Creating Value for the World

50 Years of Excellence
Doosan Heavy Industries & Construction

Doosan Heavy Industries & Construction

The Journey from Privatization to Global Player

The year 2012 marks the 50th anniversary of Doosan Heavy Industries & Construction, a company that has played an instrumental role in the development of Korea's machinery industry. Established on September 20, 1962 as Hyundai Yanghaeng, the company pioneered the machinery industry at a time when Korea was a virtual industrial wasteland. In step with the government's Heavy-Chemical Industry Development Policy unveiled in 1976, the company embarked on an ambitious project to build the Changwon plant. Despite challenges due to the oil crisis of the late 1970s and poor business performance, that project would have a huge impact on the company's five-decade history.

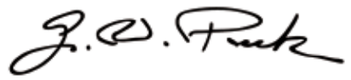
Nationalized in 1980, the companythen known as Korea Heavy Industries & Construction or "Hanjung"entered the power equipment business in earnest. With limited technical know-how of its own, the company dispatched engineers and technicians to industry leaders such as GE for training. From those humble beginnings, the company's power equipment technology and expertise grew rapidly. By the mid 1990s, it was capable of building power plants on its own. Backed by a growing technology portfolio, it began to export power generation equipment to overseas markets such. The company also excelled in the global seawater desalination field, a business it entered in the late 1970s, securing proprietary technologies and world-class competitiveness by the mid 1990s.

The onset of the 1997 Asian financial crisis rekindled momentum for Hanjung's privatization. It was at that time that the company met the Doosan Group, a century-old group that had successfully completed its own restructuring before the crisis hit and was looking for a new engine to power its second century of growth. On the eve of the new millennium on December 12, 2000, the Doosan Group was selected the preferred bidder to acquire Hanjung, opening a new page in the company's history.

The newly privatized and renamed Doosan Heavy Industries & Construction focused on developing its capabilities in core businesses such as power, water, and castings and forgings. Following a successful turnaround just four years after privatization in 2004, the company accelerated the pace of growth in the mid 2000s with an aggressive push into overseas markets. This, combined with a string of strategic acquisitions that included Mitsui Babcock Energynow Doosan Babcockof the UK in 2006 and koda Power of the Czech Republic in 2009, enabled Doosan to emerge as a global player in power markets with a technology and project portfolio spanning boilers, turbines, and generators.

Since privatization, Doosan's financial metrics have also steadily improved. Revenues grew more than three-fold from KRW 2.4 trillion in 2000 to KRW 8.5 trillion in 2011. EBIT increased seven-fold from KRW 83 billion in 2000 to KRW 570 billion in 2011. Market cap rose from KRW 400 billion in 2000 to roughly KRW 7 trillion in 2011, a nearly 20-fold increase. These results are the reason Doosan is widely regarded as Korea's most successful privatization to date.

Today, it is our privilege and pleasure to present this volume chronicling Doosan's remarkable journey over the past 50 years. We would like to express our deep gratitude for the dedication, hard work, support, and encouragement of all who have helped make the company the remarkable success it is today and lay the foundation for even greater success tomorrow. We hope you'll join us for the journey ahead as we create even greater value for the world as a global leader in power and water.



Geewon Park

Chairman & Chief Executive Officer
Doosan Heavy Industries & Construction
September 20, 2012

theDoosanWay

Our story, Our vision.

Doosan Credo

theDoosanWay

Our story, Our vision.

Our Vision

We aspire to be a Proud Global Doosan – a leading innovator of products and services that improve the quality of life for people and communities around the world.
We will achieve this by living the Doosan Credo.
Guided by our Credo, we will drive our second 100 years of growth.

theDoosanWay

Our story, Our vision.

Core Values

Doosan's people are our greatest asset and the key to our future.
They are at the heart of all our achievements.
Our continued and distinguished success will only be possible
through developing and cultivating our talent.
Our people possess great capacity, willingness and drive
to contribute to the Company.
They are relentless in enhancing their skills and capabilities.
They embrace our Core Values and demonstrate these beliefs and principles
in their daily behaviors.

Cultivating people is our highest priority and a shared responsibility.
Attracting and recruiting the right talent, who understand and embrace our values,
will be the foundation for developing our people.
We believe people develop and grow through performance at work
and we give them the authority and responsibility that best match their capabilities.
Through experience, people develop to their maximum potential.
Fair and immediate feedback and recognition are offered
as we believe this is central to self-development.
Our people are given the opportunity to develop their strengths
and address areas for improvement. As a result, Doosan people are proud of who they are
and respected as business professionals.

Integrity and transparency are fundamental Doosan strengths.
We make profit by creating value through fair and transparent activities.
We acknowledge our mistakes and keep our promises.
We never compromise our principles.

Inhwa best expresses who we are and provides us with a unique competitive edge.
We define Inhwa as teamwork in the truest sense of the word,
grounded upon fairness and camaraderie.
By carefully following these virtues we have created One Doosan;
a collective strength built on the contribution of a wide diversity of individuals.
Inhwa means we maximize our organizational strength and potential
through true teamwork built on defined, transparent rules of fair play.
Selfish rivalries between individuals or departments have no place at Doosan
and discrimination of any kind is not tolerated.
Inhwa means each individual contributes to the success of their colleagues and team,
resulting in both excellent team and individual performances.
Inhwa also means we are open; Doosan welcomes proactive ideas
and constructive criticism from everyone, regardless of seniority or position.
Our unique practice of Inhwa extends beyond the internal organization and embraces the
entire Doosan community from our families to our shareholders, affiliates and partners.

theDoosanWay

Our story, Our vision.

Our customers are the reason Doosan exists.
The true measure of Doosan's success is our customers' satisfaction and respect.
Our goal is to always deliver superior value than our competitors.
We achieve this by understanding our customers' needs
and meeting or exceeding their expectations.

Embracing world-class technology and innovation is vital to our survival.
Tomorrow drives today at Doosan; we always look to the future instead of the past.
We strive to understand, and stay ahead of, change.
We continuously seek to improve our business model, products, services and methods.
We celebrate and properly reward successful risk-taking,
while also respecting valuable attempts that fail.
Doosan applauds the spirit of challenge over complacency.
Our future success will be driven by seeking breakthrough ideas, knowledge,
technologies and resources regardless of their origin, either internal or external.

Profit measures our success and drives our growth.
Our profit must exceed our capital cost
and be sufficient to fuel our continuous growth and investment.
Our people understand how the work they do contributes to Doosan's profit.
We recognize that long-term success is built by respecting the rights of our suppliers,
distributors and partners to earn fair profits.

Creating a socially responsible enterprise is our duty to society.
We see business and society as a close partnership and an opportunity for mutual growth.
Doosan will be proactive in this partnership,
contributing the time and resources required for success.
Our goal is to develop and grow alongside society, as a trusted and trustworthy partner.
Wherever we operate, we do so transparently and lawfully.
We aim to contribute to the development of talent in society.
Our community service activities promote both corporate and social development.

We provide clean and safe working environments.
Doosan maintains all our facilities to the highest possible standards.
This is the basis for superior productivity as well as being our responsibility to our people,
their families, our customers and shareholders.
Environmental protection is our duty and obligation
to every community where Doosan does business.
We know this ultimately results in greater value creation.

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1962~2000

Spearheading the Development of Korea's Machinery Industry

1976 First Power Equipment Order and Changwon Plant Groundbreaking

Won first heat-recovery steam generator (HRSG) orders from US-based CE for cogeneration plants in Gunsan and Yeongweol, Korea. The company also broke ground for the Changwon plant, signaling the start of a new era in its history.

1978 First Seawater Desalination Plant Equipment Order

Won order for the Farasan (0.15 MIGD) multi-stage flash (MSF) desalination project from Saline Water Conversion Corporation (SWCC) in Saudi Arabia, the company's first desalination project.

1979 First Turnkey Thermal Plant Order

Won order for Samcheonpo Units 1~2 (560 MWe x 2), Korea's largest coal-fired thermal project at the time. The order covered all project aspects, including manufacturing of major equipment such as boilers and turbine gensets as well as installation and construction. The project was officially completed on February 24, 1984.

1979 First Nuclear Equipment Order

Won order for plant components for Yonggwang 1~2 (1,000 MWe x 2), Korea's first nuclear project to be supplied by local firms.

1985 First Turnkey Seawater Desalination Plant Order

Won order in January for the Assir Phase 1 (21 MIGD) desalination project in Saudi Arabia. The project gave the company the core technologies needed to succeed in this new field.

1982 Changwon Plant Completion

Completed one of the world's largest integrated manufacturing plants at the time. Finished six years after the groundbreaking in 1976, the Changwon plant opened a new chapter in Korea's industrial plant sector as the engine behind the company's growth.

1987 First OPR1000 Nuclear Equipment Order

Won order for the major equipment for Yonggwang 3~4 (1,000 MWe x 2), Korea's first nuclear project to adopt the OPR1000 standard plant design. The project helped the localization ratio reach up to 72%, marking a key turning point for the domestic nuclear power industry.

1993

First Large-Scale Turnkey Desalination Plant Order

Won EPC order for the Shuaibah Phase 2 (100 MIGD) desalination project from Saline Water Conversion Corporation (SWCC) in Saudi Arabia, the world's largest desalination project at the time.

1994 First Korea-Standard Thermal Plant Completed

Served as the prime contractor and main equipment supplier for Boryeong 3~6 (500 MWe × 4), Korea's first 500 MWe coal-fired thermal project to adopt the standardized design used for all 500 MWe plants built since.

1995 First Overseas Manufacturing Plant Established

Set up Han-Viet Heavy Industry Corporation (Hanvico) in Vietnam.

1996 First 800 MWe Thermal Plant Equipment Order

Won order for the major equipment for Yeongheung 1~2 (800 MWe x 2), Korea's first 800 MWe coal-fired thermal project. The units were completed in July and December 2004, respectively.

1997 First Overseas Nuclear Equipment Order

Won order for two 700 MWe steam generators for the Qinshan Phase III nuclear project in China from China National Nuclear Corporation (CNNC), the company's first overseas nuclear equipment order.

1999 First US Nuclear Equipment Order

Won order for four 1,200 MWe replacement steam generators for the Sequoyah 1 nuclear project in Tennessee, marking the company's first export to the birthplace of nuclear power just 30 years after Korea's first adoption of nuclear plant technology.

2001~2012

Challenge and Innovation to be a Global Leader

2001 First Hybrid Desalination Plant Order

Won EPC order in the UAE for the Fujairah Hybrid (100 MIGD) desalination project, the world's first hybrid desalination project. This order propelled the company to the top of the global thermal desalination market in 2001.

2003 Change Vision Announcement

Announced vision at the Change Vision Workshop in May to become a No. 1 global company in the industrial plant field by 2010, aiming to deliver superior value through world-class technology and cost competitiveness.

2003 Global HRSG Leadership

Ranked the world's top supplier of heat-recovery steam generators (HRSG) for the first time after delivering 64 units in 2003.

2004
First India Supercritical Thermal Plant Order

Won USD 370 million turnkey order to provide four boiler islands for the Sipat Stage-I project, India's first supercritical thermal power plant.

2004 Major Port of Singapore Crane Order

Won USD 46 million order for 42 rubber-tired gantry cranes from PSA International in Singapore. The company has shipped some 250 cranes to this customer to date, including 45 in 1993, 80 in 2005, and 79 in 2008.

2005 New R&D Center Establishment in Korea

Opened the Future Business Technology Development Center in Daedeok Science Town in Daejeon, Korea to focus on emerging energy technologies such as wind power, fuel cells, and gas turbines.

2005 194 MIGD Desalination Plant Order

Won USD 850 million IWPP EPC order for the Shuaibah Phase 3 (194 MIGD) desalination project in Saudi Arabia. The world's largest desalination project at the time capable of meeting the daily water needs of 3 million people.

2005 Doosan Hydro Technology Establishment

Launched the US-based subsidiary in Tampa, Florida on October 3 following the acquisition of the North American reverse osmosis desalination and water treatment businesses of AES.

2006 Kvaerner IMGB Acquisition

Acquired a 99.76% interest in Romania's largest casting and forging manufacturer, giving the company a strategic manufacturing presence in the European market.

2006 Mitsui Babcock Energy Acquisition

Acquired the UK-based boiler OEM and energy services company for JPY 20 billion, gaining access to the century of expertise of one of the world leaders in the power equipment field. The acquisition fulfilled a long-cherished dream of securing proprietary boiler technology that dated back to the company's start in the business in the 1970s.

2006 First APR1400® Nuclear Equipment Order

Won order for the major equipment for Shin-Kori 3~4 (1,400 MWe x 2), Korea's first nuclear units to adopt the APR1400® design. This new third generation design offers dramatically improved safety and efficiency over the previous OPR1000 design.

2006 Overseas Water R&D Center Establishment

Opened R&D centers in Dubai, UAE and Tampa, Florida, USA to accelerate development of next-generation desalination technologies and solidify the company's position as the global leader in desalination.

2007 China AP1000™ Nuclear Equipment Order

Won order from Westinghouse for the major equipment for AP1000™ nuclear units for the Sanmen and Haiyang projects, China's first third generation nuclear plants.

2007 First RO Desalination Plant Order

Won the Shuaibah Phase 3 Expansion RO (33 MIGD) project in Saudi Arabia, the company's first stand-alone reverse osmosis (RO) project. The company followed up this project by winning the Shuwaikh RO (30 MIGD) project in Kuwait in March 2008 and the Jeddah Phase 3 RO (52.8 MIGD) project in Saudi Arabia in December 2008.

2007 Overseas Power Plant Upgrade Order

Won turbine upgrade order for the Eraring thermal project in Australia, followed by a boiler upgrade order in 2009.

2007 First KRW 7 Trillion Order Performance

Surpassed orders of KRW 7 trillion for the first time thanks to a banner year in the EPC power plant business with strong orders from the Middle East, India, and Southeast Asia. Key project wins included the Jebel Ali M combined-cycle power project in Dubai and Mundra thermal project in India.

2008 "Global Leader in Power & Water" Vision Announcement

Incoming President and CEO Geewon Park announced a new vision that aims to make the company a global leader in power and water. After achieving business targets set in 2003 two years ahead of schedule in 2007, the company set its sights on joining the ranks of the world's top-500 companies with revenues of KRW 17 trillion by 2015.

2008 US AP1000™ Nuclear Equipment Orders

Won three major equipment orders from Westinghouse for AP1000™ nuclear units for the V.C. Summer, Vogtle, and Levy County projects, the first new nuclear reactors to be built in the US in more than 30 years.

2008 UAE 100 MIGD Desalination Plant Order

Won USD 800 million IWPP EPC order from the Abu Dhabi Water & Electricity Authority (ADWEA) for the Shuweihat S2 (100 MIGD) desalination project in the UAE, a plant capable of meeting the daily water needs of 1.5 million people.

2008 APR1400® Nuclear Equipment Order

Won order for the major equipment for Shin-Uljin 1~2 (1,400 MWe × 2) in Korea. This project also marks the first time Korean nuclear units are produced entirely with domestic technology, including the man-machine interface system (MMIS) and reactor cooling pumps (RCP).

2008 Doosan Engineering & Services Establishment in US

Forged strategic alliance with Burns and Roe that now shares technical capabilities with the company through an engineering center in New Jersey.

2008 Carbon Capture and Storage Investment

Partnered with subsidiary Doosan Babcock to purchase a 15% equity stake in Canada-based HTC Purenergy, a global leader in CCS technology.

2009 UK Oxyfuel Test Facility Opening

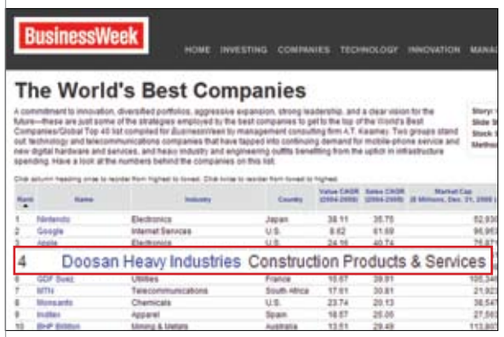
Subsidiary Doosan Babcock opened a 40 MW oxyfuel combustion test facility-the world's largest to date-in the UK. The facility successfully demonstrated OxyCoal™ technology, which uses pure oxygen combustion to facilitate carbon capture and storage.

2009 Škoda Power Acquisition

Acquired this Czech-based turbine manufacturer for EUR 451.6 million on September 14. The company is now a global player with core technologies in all three primary power generation equipment fields-boilers, turbines, and generators.

2009
Doosan Vina Plant Completion

Opened the USD 300 million Doosan Vina manufacturing plant-the largest manufacturing plant investment in central Vietnam to date-in May. Composed of five factories and dedicated port facilities on a 110-hectare site in Vietnam's Dung Quat Economic Zone, the plant produces boilers, HRSGs, desalination equipment, and material handling systems for projects worldwide.



2009 BusinessWeek and Boston Consulting Group Recognition

Ranked No. 4 out of 40 on the BusinessWeek World's Best Companies list, the top ranking by a Korean firm. The company was also ranked No. 2 out of 694 firms on the Boston Consulting Group's annual Value Creators list.

2010 Doosan Power Systems Established

Launched in February, Doosan Power Systems was formed to coordinate the operations of Doosan Babcock of the UK and Škoda Power of the Czech Republic-providing total power solutions to customers in the Americas and Europe.

2010 APR1400® Nuclear Equipment Order in the UAE

Participated in a consortium led by Korea Electric Power Corporation (KEPCO) that won the USD 40 billion Braka 1~4 (1,400 MWe x 4) project in the UAE. The company will supply major equipment for four APR1400® nuclear units in its largest nuclear plant project to date.

2010 Vietnam Thermal Plant Technical Partnership

Signed a framework agreement with the government of Vietnam to serve as the sole technical partner for a national project to localize equipment production for 600 MWe coal-fired thermal plants. The company also won a USD 1.3 billion EPC order for the Mong Duong II thermal project in Vietnam from AES-VCM Mong Duong Power Company.

2010 First Over USD 10 Billion Order Performance

Set a new order record of over USD 10 billion led by two major projects in Saudi Arabia. The wins included the Rabigh 2 (700 MWe x 4) EPC power project, the company's largest overseas thermal plant project to date, and the Ras Al Khair Phase 1 (228 MIGD) EPC desalination project, the world's largest desalination project to date.

2010 CEO Leadership Recognition

Chairman & CEO Geewon Park received the prestigious Gold Tower Order of Industrial Service Merit at the 1st Atomic Energy Day ceremony held on December 27, 2010 in recognition of his contributions to the successful win of the Braka nuclear project in the UAE. Park, who spearheaded Doosan's successful privatization and transformation into a global company, also received the top award at the CEO Grand Prix Awards in 2009.

2011 First Major MED Desalination Plant Order

Won the Yanbu Phase 2 Expansion (15 MIGD) EPC desalination project from Saline Water Conversion Corporation (SWCC) in Saudi Arabia featuring the world's largest MED distiller to date. This made the company the first in the global water industry to secure a project and technology portfolio spanning the top-three major desalination technologies- multi-effect distillation (MED), multi-stage flash (MSF), and reverse osmosis (RO).

2011 First 3MW Wind Turbine International Certification

The WinDS3000™ wind turbine became Korea's first 3 MW offshore system to win international type certification. The certification from DEWI-OCC of Germany has paved the way for overseas sales.

2011 Chennai Works and Lentjes Acquisitions

Acquired India-based boilermaker Chennai Works in February, gaining a competitive edge in the world's largest emerging market for coal-fired thermal power plants. Subsidiary Doosan Power Systems acquired Germany-based Lentjes in November, gaining access to eco-friendly technologies.

2011 First IGCC Demonstration Plant Order

Won order on November 15 for the 300 MWe Taean IGCC project, Korea's first coal syngas-fired integrated-gasification combined-cycle demonstration plant.

2011 Global Top-5 Market Share Recognition

Received the "World-Class Product of Korea" designation for achieving a global top-5 market share in nuclear reactors, oil-fired boilers, and turbine-generator rotor shafts. The company has won the designation in a total of 11 products categories since 2001, including seawater desalination plants, marine engine crankshafts, heat-recovery steam generators, and low-pressure turbine rotor shafts.

2012 India Thermal Plant Boiler Orders

Subsidiary Doosan Chennai Works won orders from India's state-owned power utility NTPC, including three 800 MWe boilers for the Kudgi project in Karnataka and two additional 800 MWe boilers for the Lara project in Chhattisgarh.

THE MAKING OF A GLOBAL COMPANY

Part 01

1962~1980

Born at the Dawn of Korea's Machinery Industry

01

From Simple Producer to Heavy Manufacturer

"We will build a plant that can make anything needed regardless of size, material quality, or degree of precision. Whether for nuclear power plants or integrated steelworks, we will strive to ensure that, as with advanced industrial powers like the United States, Japan, and Europe, there is no equipment or machinery we cannot make."

- Changwon plant founding address

Established on September 20, 1962, Doosan Heavy Industries & Construction-then known as Hyundai Yanghaeng-started out as a trading firm before expanding into light manufacturing and ultimately machinery as its capabilities grew. In early November 1976, the company broke ground for a massive new manufacturing facility known as the Changwon plant. Although excessive investment and business challenges resulted in its nationalization in 1980, the company laid the groundwork for the development of Korea's machinery industry.

Born at the Dawn of Korea's Machinery Industry

Doosan was established on September 20, 1962. Known as Hyundai Yanghaeng at the time, the company that started out as a trading firm would go on to undertake the construction of the Changwon plant, a remarkable achievement that would have a huge impact on Doosan Heavy's five-decade history.

The year 1962 also marked the start of the first five-year economic development plan pushed by Korean President Park Chung-hee. In addition to driving rapid economic development during this period, the Park administration paid special attention to the development of the machinery industry. As a result, plants that were capable of producing 3,000 diesel engines, 2,600 compact cars, and 4,000 tons of cable each year as well as countless telephones, exchange equipment, electric motors and transformers were built.

Hyundai Yanghaeng started out as a trading company, importing raw materials and equipment for manufacturing and construction as well as exporting cement, fluorite, and other materials. However in 1964, it entered the manufacturing sector with the opening of the Anyang plant in Gyeonggi Province. In 1969, the plant was expanded to produce engine radiators, side frames, and other auto parts and components. The plant continued to grow into a major manufacturing base, completing a multi-product production line in 1973.

The Anyang plant's auto part production line was originally built to produce parts for 30,000 vehicles annually. By 1978, the rapid growth of the Korean auto industry had seen the plant more than triple its capacity to make parts for 100,000 vehicles annually as it played a leadership role in the industry through the early 1980s.

In 1970, Hyundai Yanghaeng set up a steel casting shop in Gunpo, also in Gyeonggi Province,

Anyang Plant, Built in 1964

Gunpo Plant, Built in 1973

adding a machinery shop in 1972 and forging shop in 1973, giving it the ability to produce heavy construction equipment as well as laying the foundation for growth as a machinery and heavy manufacturing company. In 1975, the company completed a USD 30 million investment to expand the Gunpo plant, positioning itself as a general machinery manufacturer.

Started out as a casting shop, the Gunpo plant expanded its product portfolio to include machinery and related components, heavy construction equipment, and other products. Ultimately expanding to cover 99,000 square meters of a 264,000 square meter site, the plant emerged as an integrated machinery plant capable of producing everything from raw materials to finished products by the late 1970s. The plant produced a wide range of machine tools, air conditioners, cement plant facilities, textile machinery, material handling equipment, and other products.

Hyundai Yanghaeng grew rapidly as it entered the 1970s thanks to the Gunpo plant. Between 1970 and 1976, the company recorded phenomenal revenue growth averaging 94.5% annually. This growth was the result of focused facilities investment that grew at an annual average of 101.8% during the same period. The decisive adoption of advanced technologies from overseas suppliers in more than 50 fields also provided a foundation for growth.

This phenomenal revenue growth-more than double the industry average-continued to accelerate even after surpassing the KRW 10 billion milestone in 1975, averaging 104.3% annually. Prior to 1975, auto parts manufactured in the Anyang plant accounted for half of the company's annual revenues. That changed starting in 1976 when the Gunpo plant began full-scale operations, surpassing the Anyang plant in revenues as sales of heavy construction equipment and industrial plant machinery increased.

Despite Hyundai Yanghaeng's expansion of the Gunpo plant, it was unable to keep up with growing orders. This led to the historic decision to build the Changwon plant.

Changwon: The mecca of Korea's machinery industry

In early November 1976, Hyundai Yanghaeng embarked on a massive undertaking to build the Changwon plant. This large-scale heavy manufacturing plant was designed to produce power plant equipment, iron and steel making equipment, petrochemical plant equipment, and heavy construction equipment.

The original plant master plan called for 422,400 square meters of production space on a 3,234,000 square meter site and a workforce of just over 10,000 workers. Groundbreaking was slated for 1976, followed by completion in December 1978 and full operations beginning in 1982. Of the total construction cost of KRW 91,282 million, foreign and domestic capital were pegged at KRW 45,980 million and KRW 45,302 million, respectively.

In terms of site size, the Changwon plant was similar in size to the island of Yeouido in Seoul, often called Korea's "Manhattan". In terms of cost, the project's KRW 91 billion cost would run into the trillions at current rates. The large-scale project also attracted keen attention from business and financial circles.

Economic conditions and government policy at the time both had a major impact on this large-scale industrial project. As the Korean economy was cruising along in November 1972, President Park Chung-hee unveiled a rosy blueprint and long-term economic targets that envisioned a continued 25% average annual growth in exports that would easily push exports to USD 10 billion by 1980, ushering in the USD 1,000 per-capita income era in 1981.

Government authorities set about formulating strategies to achieve the vision President Park had laid out. The first area of focus was on fostering the nation's heavy and chemical industries. A special planning committee was established in 1971 and began operations in earnest in 1973. On January 12, 1973, President Park announced the Heavy-Chemical Industry Development Policy in his first press conference of the year.

In February 1973, the Presidential Commission for the Promotion of the Heavy and Chemical Industries was formed. Headed by the prime minister, the commission included ministers from related ministries such as Finance, Commerce and Industry, Construction, Education, and Science and Technology as well as specialists in the field appointed by the prime minister. A task force headed by the senior secretary to the president for economic affairs and staffed by directors from the Machine Industry Bureau of the Ministry of Commerce and Industry and related government departments was

Bird's eye view of Changwon Machinery Industry Base, 1973

President Park's Changwon plant visit, 1979

also established.

In June 1973, the task force unveiled a plan to foster Korea's heavy and chemical industries. Known as the Heavy-Chemical Industry Drive (HCI Drive), the plan included development and promotion plans, strategy, industrial base plans, manpower development, and funding. The plan called for these industries to rise from 35.2% of industrial output in 1971 to 51.0% in 1981, with exports rising from 19.1% of the total in 1971 to over 60% during the same period.

The HCI Drive focused on six strategic industries, including iron and steel, chemicals, non-ferrous metals, machinery, shipbuilding, and electronics. A national land development plan was proposed to ensure that locations and resources were efficiently utilized. The Nakdong River estuary would become the nation's second steelmaking base. Yeosu and Gwangyang would become chemical bases. Changwon would become a machinery base, Geojae Island a shipbuilding base, and Gumi an electronics base.

Following Changwon's selection as Korea's machinery manufacturing base, construction got underway in earnest on September 19, 1973 at the direction of President Park. The groundbreaking ceremony for this project that would transform the city's future was held on November 9, 1973.

The Korean government encouraged major manufacturers to locate their operations in the Changwon complex. In a visit to the complex site on April 10, 1975, President Park strongly signaled his intention to accelerate development of the machinery industry, promising active government support. As director of the Heavy-Chemical Industry Drive Task Force, a Senior Presidential Secretary for Economic Affairs, Oh Won-cheol aggressively solicited corporate investment in the project. His efforts resulted in the decisions by the Hyosung and Daewoo Groups to set up operations in the complex in 1975, followed by Hyundai Yanghaeng and Samsung Heavy Industries in 1976. Secretary Oh was the architect and builder with tremendous passion and dedication to the project, while President Park provided the basic blueprint for the Changwon complex.

Carving mountains and reclaiming shoreline to create a small city

The coastal location of Changwon's Gwigok-dong area made it an ideal site for a machinery plant. Among the many factors considered when selecting sites for heavy manufacturing plants, access to transport for raw materials and finished products ranks first. While ground and air transport have emerged as key transport modes, nothing compares to ocean transport when it comes to moving large cargos. Considering that raw materials are sourced from overseas and finished products are sold overseas, that consideration becomes even more important. In the industrial plant industry where huge equipment or modules must be produced and assembled or installed on-site, having port access and dedicated pier facilities is a key competitive advantage.

In early November 1976, the Changwon plant project finally began its grand journey. A construction site office was built and site survey work got underway. During the survey period, the engineering contracts were awarded to Ingersoll of the United States and Terni of Italy and technical licensing agreements were signed with Combustion Engineering and General Electric of the United States. Contracts to secure the core technologies required to operate the plant were also signed with leading international firms from the United States and Europe.

While ground was broken for the Changwon plant in November 1976, actual construction work didn't get fully underway until February 1977. Surrounded by mountains, the Gwigok site presented an ongoing series of site preparation challenges. The biggest ones came from work in the area of the boiler and nuclear shops and bedrock removal from the eastern slope of Mt. Gwi and the mountain slope adjacent to the casting shop and training center. During site preparation work, the area around the present headquarters building had to be lowered by more than 15 meters, requiring the removal of a formidable amount of solid bedrock. Some 200 boxes of dynamite were used in the process.

As the sound of bedrock blasting echoed constantly across the site, land was steadily reclaimed from the bay as dump trucks made countless trips ferrying dirt and rock carved from the mountain slopes to fill in the mud flats and bay below. The quick and cost-effective "paper drain" method was used to reclaim the mud flats and a new shorefront rising 6.9 meters above sea level gradually began to take shape.

The Changwon plant construction project was a race against time. The builders had to overcome inadequate site conditions lacking basic infrastructure or amenities to prepare the site and

Gwigokdong area of Changwon, 1976

Construction of the Headquarters building, 1979

build the plant on a tight schedule. The process of building the plant as well as roads, port facilities, and employee housing and welfare facilities on a vast site reclaimed from the sea was very much like building a small city.

By July 1977, the plant was approximately 25% complete. Some 1,056,000 square meters of the 1,686,000 square meter site had been leveled, 297,000 square meters of 529,000 square meters had been reclaimed from the bay, and 90 of 243 residential buildings had been completed.

Construction of the plant moved forward while shoreline reclamation and site preparation work were still underway. Ground was broken for the boiler shop in June 1977, followed by the heavy fabrication shop in September, the heavy equipment shop in October, the machinery shop in November, and the heavy machinery shop in March 1978. The boiler shop was the first to launch operations in September 1978, followed by portions of the machinery shop in December. As construction proceeded, the Changwon Business Division completed its relocation from Gunpo to Changwon in 1978, and the plant finally began to ramp up production and come to life.

Power equipment production gets underway

There were good reasons behind the rush to build the boiler shop before site preparation work was completely finished. Hyundai Yanghaeng had already been selected to manufacture the boiler for Korea's Nam-Jeju thermal power plant by Combustion Engineering. It also had orders to produce boilers for domestic thermal power plants in Seohae (currently Seocheon) and Samcheonpo as well as equipment for the Jizan cement plant, the company's first overseas order from Saudi Arabia.

Following its completion on an accelerated timetable, the boiler shop delivered its first products for Nam-Jeju project: the drum and super heater for boiler No. 2. The machinery shop was the second shop completed, and its first deliveries included stud valve casings for the Samcheonpo thermal power project as well as components for the boiler shop.

Although the boiler and machinery shops had been completed, securing the manpower to operate them wasn't an easy task. At the beginning, company executives that had completed technical training overseas taught the new recruits how to operate the facilities as they manufactured equipment. Throughout the end of 1979, a total of 207 Hyundai Yanghaeng employees completed overseas training at technical partners or equipment suppliers in seven countries including the United States, Germany, Italy, Sweden, Japan and Australia.

In 1978, the company had a total of 516 employees, including 201 of which had previous experience, working at the Changwon plant and Jizan cement plant site in Saudi Arabia. On July 15, 1978, training got underway in earnest with the opening of a vocational training center at the Changwon plant. Equipped with state-of-the-art training facilities, the new center had the educational system and dormitory space to accommodate 500 trainees, giving the company the capability to fully meet its technical manpower requirements. A majority of the first group of 214 trainees were hired after completing a six-month course covering seven technical specialties that included lathing, design and drafting, and welding.

Construction work on the forging shop and casting shop got underway much later in April and November 1978, respectively. The work on those shops was halted after piling work was completed. They were ultimately completed in 1981. The consulting and technical guidance provided by Combustion Engineering of the United States and Terni of Italy both played key roles in the successful completion of the Changwon plant project.

Hyundai Yanghaeng's full-scale advance into the power generation field started in the mid- 1970s. In September 1976, the company participated in the supply of heat recovery steam generators (HRSGs), gas turbine components, generators, and other equipment for combined-cycle power projects in Yeongweol (300 MW x 2) and Gunsan. The momentum increased with the Seocheon and Samcheonpo (560 MW x 2)

Kori-1 Nuclear Power Plant Completion Ceremony, 1978

Nam-Jeju Thermal Power Plant #2 Drum, Manufactured at Changwon Plant (July 15th, 1979)

thermal power projects. The latter project was particularly meaningful as the company's first turnkey power plant project.

The establishment of Korea's Act on Special Cases Concerning Electric Source Development in December 1978 made it easier for Hyundai Yanghaeng to participate in the domestic power generation equipment field, enabling the company to step up its advance. The act rejected the traditional turnkey model which relied on outside technology and equipment with overseas companies taking the lead in domestic power plant projects, enabling domestic firms to take the lead in projects to promote technical expertise acquisition and equipment localization.

In April 1978, the nuclear power age dawned in Korea when Kori 1, the nation's first nuclear plant, began commercial operations.

Overseas conditions were nearly as favorable as those in Korea. The 1973 oil crisis made Middle East countries with large oil reserves wealthy. With huge annual petrodollar revenues of over USD 100 billion piling up, countries in the region launched development and infrastructure construction projects. In deserts where only sandstorms had blown, major construction projects began to mushroom as project tenders ranging from USD 30 to 50 billion were awarded each year.

In 1975, Korea's Overseas Construction Promotion Act paved the way for local construction firms to pursue overseas projects, triggering a Middle East rush that saw annual orders from the region surpass USD 8 billion in 1978.

The Middle East rush was also an opportunity for Hyundai Yanghaeng. The Jizan cement plant project in Saudi Arabia marked the company's debut in the region. The major USD 313.5 million project included the construction of a 1.5 million-ton-per-year cement plant and supporting facilities. The company began working on the tender in January 1976 and received a letter of intent on August 14, 1977. The Jizan project was also historically significant because it was Korea's first overseas plant order as well as the nation's first overseas turnkey order.

Challenged by a management crisis and industry consolidation

The construction of the Changwon plant also played a role in aggravating a management crisis at Hyundai Yanghaeng. The company's original plan was to complete plant construction and launch overall operations by end of 1979. However in the late 1978, signs of an impending crisis that would shake the company's foundations began to appear. As the global and local economies deteriorated due to the 1979 oil crisis, securing funding became increasingly difficult. Business conditions worsened as sales and orders slumped and construction costs soared, fanning the financial difficulties. It was inevitable that the plant project schedule would face a setback.

The government designated the power equipment industry as a top priority for localization in the five-year machine industry promotion plan announced in 1976, promising a wide range of support measures. Domestic businesses showed great interest in the industry because of the sophistication of the equipment and opportunities to secure technology. More importantly, Hyundai Engineering & Construction and Daewoo Heavy Industries won a series of thermal power plant orders as part of Korea Electric Power Corporation's localization policy, spurring Hyundai Yanghaeng, Samsung Heavy Industries, and many other companies to jump into the field.

On February 8, 1978, the new minister of Commerce and Industry convened a briefing for the nine major industry players. Each company presented their business plans, announcing similar product lines and facility investments. In the power equipment field alone, a total of 12.7 gigawatts of annual production capacity was announced. Hyundai Yanghaeng and Daewoo Heavy Industries announced they would produce four 500 MW power plants each. Samsung Heavy Industries said it would produce one 600 MW plant. Hyundai Heavy Industries said it would produce two 600 MW

thermal plants and five 1.2 GW nuclear plants. Kangwon Industry and Hyosung announced facilities totaling 450 MW and 150 MW, respectively. Given that Korea's annual power demand was only 1 GW in the early 1980s, it's clear how seriously redundant these investment plans were.

As the Korea's power equipment production capacity surpassed 8 GW, competition for orders intensified. In the tender for units 1 and 2 of the Boryeong thermal power plant project in March 1979, a fierce battle ensued between the four bidding companies, delaying the process. In the face of this overheated competition, the government delayed the selection process and labored to find a way to resolve the fundamental competition issue.

On April 13, 1979, the Korean government finally announced an economic stabilization policy. A revised investment plan for the power equipment field was approved on May 25. These measures were directly related to the situation the domestic industry faced at the time.

The essence of the power equipment industry restructuring plan was that the industry would be consolidated into two groups. The first group would include Hyundai Heavy Industries and Hyundai Yanghaeng, while the second group would include Samsung and Daewoo. In the first group, Hyundai Yanghaeng would be merged into Hyundai Heavy Industries and Hyundai Chairman Chung Ju-yung would take responsibility for the construction and operation of Hyundai Yanghaeng's Changwon plant. In the second group, Samsung and Daewoo would form a joint venture or merge.

There was a clause in the government's restructuring plan that would transfer operational control of plant-related shops at the Changwon plant to Hyundai Heavy Industries. This also meant that the company would take over equipment produced for the Samcheonpo thermal power plant project as well as Halla Construction, Halla Engineering, Halla Architectural Firm and the power generation equipment division's Changwon plant.

As the business transfer progressed, plant construction came to a standstill. By August 1979, the construction contractor had completely pulled out of the site. At the end of September, Hyundai Yanghaeng's manpower, technical materials, and order book were transferred to the Ulsan plant of Hyundai Heavy Industries. Thus all construction was halted, and the Changwon plant was shut down. Plant construction was 72% complete at the time, and about 35% of plant equipment had been installed.

After about three months on hold, Hyundai Heavy Industries resumed construction work on January 5, 1980. The assassination of President Park in the interim on October 26, 1979 cast a dark cloud over the political situation, while the global economy remained trapped in a tunnel of uncertainty.

Ultimately, the new military government put the Special Committee for National Security Measures in charge and pushed a policy that would give Daewoo a monopoly in power generation equipment in August 1980. Immediately after taking over management of Hyundai Yanghaeng on September 23, Daewoo changed the company name to Korea Heavy Industries and Construction and announced that it would invest KRW 100 billion to normalize business operations. However, Daewoo requested that the government provide the company's remaining capital requirements and that it be exempted from interest payments on existing bank loans. At this point, the government determined that direct investment would be preferable and decided to nationalize the company.

On October 28, 1980, the government approved the basic framework to normalize operations at Korea Heavy Industries & Construction in a joint policy meeting with related agencies, finalizing the company's transition to a state-owned corporation.

1981~2000

The Journey to Nationalization and Back

01

The Transformation from Mediocrity to Success

"Equipped with a massive machinery plant with modern facilities that are second-to-none in the world and excellent technical personnel, our Hanjung has established the industrial plant industry in our country. As the export era opens in earnest, we must reaffirm our sense of duty that we must contribute to the national economy."

- Excerpt from 1987 inaugural address of President Byung-hwa Ahn

The construction of the Changwon plant that ran from the latter part of the 1970s through the early 1980s was the most difficult period in Doosan Heavy's history. The Korean political situation was engulfed in a maelstrom and the global economy had entered a downturn.

The Changwon plant-the world's largest heavy manufacturing plant at the time-changed owners several times virtually overnight as government policy waxed and waned. The plant that was supposed to be a strong pillar of the Korean economy was like a ship that had lost its captain, drifting aimlessly with tattered sails in stormy seas. Although the sign hanging by the door had changed from Hyundai Yanghaeng to Korea Heavy Industries & Construction, the fresh start was off to shaky beginning.

A nation mired in a tunnel of uncertainty

The year 1980 was a period when the Korean economy and politics went through a whirlwind of change. The nation's political scene was shaken in the aftermath of the assassination of President Park Chung-hee in 1979, while the 1979 oil crisis poured cold water on the fledgling economy. The Republic of Korea was engulfed in a heavy fog of uncertainty where neither the government nor citizens could seem to find the way forward as the situation slid into chaos.

For the first time since economic development got underway, the Korean economy experienced negative growth. GDP was KRW 13,843 billion, 6.2% off the previous year. Wholesale prices rose as much as 38.9%. Rapidly rising international oil prices due to the 1979 oil crisis fueled inflation and rising exchange rates.

Although the Korean government responded by lowering interest rates and announcing economic stimulus and export promotion policies, the contracting market showed no signs of life and corporate investment continued to decline. The economic recession of 1980 fully exposed the harmful effects of the inflexible economic management practices of the past. Economists attributed this to inflation due to expansion-centric policies and weakened economic health due to state-sponsored import controls and intensifying monopolies and oligopolies, ultimately resulting in the paralysis of the market function.

At this juncture, the Korean government carried out radical policy "surgery". Recognizing the limits of state-led economic growth and the need to shift to a private sector-led economy, it

restructured the nation's economic order according to free-market principles. Business circles warmly welcomed this change in direction to respect the independent investment activities of private enterprise, deregulate the financial industry, and guarantee equal access to capital.

Facing a destiny without options

On October 28, 1980, related government departments and organizations held a policy meeting to discuss the normalization of operations of Korea Heavy Industries & Construction, better known by its abbreviated Korean name "Hanjung". The decision was made to directly invest KRW 360 billion in the company through 1981 and announced the following day. It was the announcement of Hanjung's nationalization.

Despite the government's aggressive investment plan, it was difficult to expect things to go smoothly. The company's obstacles included KRW 400 billion of debt and the need for additional investment to complete construction of the Changwon plant. Even more challenging was a fundamental lack of orders necessary to keep the plant running profitably and strong opposition from state-run Korea Electric Power Corporation or "KEPCO", which held a monopoly on Korea's domestic power generation market.

Hanjung's nationalization was a harbinger of the great changes to come. On December 4, 1980, Korean President Chun Doo-hwan appointed KEPCO President Kim Young-joon to concurrently serve as president of Hanjung. Wanting to wrap up Hanjung's nagging problems as quickly as possible, the government passed them off to President Kim.

In 1981, President Kim set about normalizing management at Hanjung. His business plans for the year included completing construction of the Changwon plant at an early date, restoring the company's credibility, bolstering sales activities, establishing a faithful and diligent attitude among employees, and putting national gain ahead of corporate gain as he rushed to minimize the management vacuum and get the company back on track.

The most pressing task Hanjung faced was the completion of the Changwon plant. Although there were more than a few challenges to restarting work on a project that had been suspended since Hyundai Heavy Industries & Construction had pulled out, the forced march to meet the tight completion schedule continued. At the end of June 1981, the first phase of site preparation was completed. The forging shop, the final shop scheduled for completion, was finished in November, and a 1,600-ton press was installed on December 30. As the foundry's 100-ton electric arc furnace began melting operations on January 8, 1982, the Changwon plant came roaring to life.

While work to complete the plant construction project was underway, Hanjung was preparing to launch a new organizational structure. President Kim Young-joon and Executive Vice President Kim Jong-su were appointed co-CEOs at an extraordinary general meeting in 1981. The company also adopted a budgeting system under which it prepared a budget proposal that included management's plans to achieve the company's business goals for presentation to creditor organizations.

The adoption of a budgeting system made management planning more concrete, playing a clear role in systematic execution as well as clarifying goal-setting, responsibility, and authority. It also brought a sense of balance to corporate management and fostered the adoption of systematic management techniques that had a major impact in reducing budgets. In addition to fostering organizational stability, the company commissioned a comprehensive review of management focusing on long-term business development to the Korea Industrial Development Institute (KID). World-class power and energy project EPC and operations and maintenance specialist Burns & Roe of the United States and industrial solutions consultant Agiplan of Germany both played key roles in this review.

Although the Korean government had a normalization plan for Hanjung, revenues from 1981 through 1983 fell far short of the break-even point, making major losses unavoidable. Urgent improvements to sales strategy were needed to normalize operations, as were favorable borrowing terms to reduce the company's financial cost burden. It was amid these mounting challenges that the Changwon plant was completed. As the capacity utilization ratio of the massive new plant continued to rise, a new challenge arose.

Korea Industrial Development (KID) Researchers Visit for Status Debriefing (Jan 28th, 1982)

Laying the foundation for survival

At an extraordinary general meeting held on January 15, 1982, Park Jung-gi was appointed Hanjung president. A graduate of the Korea Military Academy, President Park was the right man to help extract the company from its situation with political rather than economic savvy.

Although a year had passed since the company's nationalization, there were no signs that Hanjung would emerge from its tunnel of red ink. While weak orders were an issue, instilling a can-do attitude among the Hanjung workforce was even more essential. President Park launched a 100-day crash program to improve productivity. The program's goal was to achieve the sales targets for each

business for the current year, establish discipline, and sharpen administrative agility. Each department created their own slogans, which they shouted in unison at the beginning and end of their work shifts as they steeled their determination. While this military-style management mentally toughened the workforce, improved quality, and cut costs, it didn't translate into productivity gains. The company only achieved 86% of its KRW 58.3 billion annual production goal with revenues of KRW 50.1 billion. One of the major reasons for this shortfall was a conspicuous lack of overseas orders.

The best and only way for Hanjung to staunch its losses was to expand overseas sales. In 1982, the company put special emphasis on building its order base. It established overseas branches, strengthened relationships with overseas customers, and expanded public relations activities to build its corporate image.

As a result, the company won the USD 200 million Perak cement plant project order in Malaysia on December 27, 1982. Designed to produce 1.2 million tons of cement annually, the Perak project was particularly notable because it was a turnkey deal that included every aspect of the project from engineering, manufacturing, and construction to commissioning and local workforce training.

The year 1982 was an especially significant year for Hanjung for multiple reasons. In addition to marking the 20th anniversary of the company's founding as Hyundai Yanghaeng, it was also a year that laid the foundation for its future growth as Doosan.

The first major development was the relocation of the company's headquarters from Seoul to the Changwon plant in April. The relocation decision was made to streamline management and normalize operations as quickly as possible. The choice of the primary production base for the new headquarters put the company's focus squarely on worksite-centric management and production activities. The meticulously planned move began with the relocation of the technology division and was completed over the course of a month.

Two months after the headquarters relocation, Hanjung marked the historic completion of the Changwon plant on June 29. At the end of birthing pains that saw the company change ownership numerous times from Hyundai Yanghaeng to Hyundai Heavy Industries, Daewoo, KEPCO, and finally state-run Korea Heavy Industries & Construction, the employees that had participated in the construction of the plant were filled with incomparable emotion and joy.

The completion ceremony was attended by Korean President Chun Doo-hwan, Deputy Prime Minister for Economic Affairs and Minister of the Economic Planning Board Kim Joon-seong, Vice Minister of Commerce and Industry Keum Jin-ho, and over 500 members of the Hanjung family. This "dream plant" that vied to be the world's largest integrated manufacturing plant at the time and boasted state-of-the-art production facilities that gave it the ability to produce everything from basic materials to finished products was finally a reality.

Following the completion of the Changwon plant, the utility of the Gunpo plant fell. In September 1982, President Park made the sudden announcement that the operations of the Gunpo plant would be absorbed by the new plant. Given that the production facilities and product lineup of the plants were similar and the fact that keeping the Gunpo plant open would unnecessarily increase expenses by KRW 20 billion annually, the Gunpo plant liquidation was an inevitable part of the company's ongoing business consolidation measures.

Hanjung took great pride in the equipment and facilities of the Changwon plant. Following the completion ceremony, the media ran stories with titles like "The Plant that Makes Plants" and "The World's Largest Machinery Department Store" that conveyed a sense of the plant's massive scale.

Completed over a five-year, eight-month period at a total cost of KRW 381 billion-an astronomical investment at the time-the Changwon plant facilities covered 537,900 square meters of the 5.28 million square meter site. The world's largest integrated machinery plant included seven massive specialized shops for machinery, heavy machinery, heavy boiler, boiler, casting, forging, heavy equipment and a variety of supporting facilities.

The Changwon plant's product portfolio included major power generation equipment such as nuclear reactors, turbine gensets, and boilers, large-scale industrial equipment for ironmaking, steelmaking, and petrochemicals, and construction equipment such as bulldozers and loaders. Capable of producing everything from raw materials to finished products, this impressive integrated heavy manufacturing plant was a world leader in terms of both scale and investment. The completion of this plant that was capable of manufacturing and assembling power generation equipment marked Korea's arrival as an advanced industrial nation.

The completion of the Changwon plant also had a far-reaching impact on Korean business and industry. First, the plant elevated the nation's power generation equipment manufacturing capability. Korea was now capable of producing equipment for all power generation technologies, including hydro, thermal, nuclear, and cogeneration. With an annual production capacity of 2,000 MW, it was more than capable of meeting Korea's entire domestic demand, paving the way for a whole new category of exports.

The plant also heightened expectations for industrial plant exports. In addition to cement plant facilities, the Changwon plant was capable of producing and exporting a wide range of industrial facilities including iron and steel mills and petrochemical plants. Before the plant was completed, it delivered a turnkey 1.5 million ton annual capacity cement plant to Saudi Arabia. All major equipment used in that project was produced at the plant, so its production technology was already proven.

The Changwon plant also played a role as an advanced base for technical training and technology development. Power generation equipment such as turbine gensets, boilers, and nuclear reactors require advanced technology and exceptional precision. The completion of the plant enabled Hanjung to learn advanced technologies, laying the foundation for technical innovation and depth.

Pursuing growth and technical independence

The completion and start-up of operations at the Changwon plant provided an opportunity for Hanjung to turn around operations that had been losing money since its Hyundai Yanghaeng days. However, the plant's capacity utilization ratio only reached 43.2% in 1982 due to difficulties in securing orders, increasing the plant's operating loss by KRW 15 billion to KRW 35.4 billion. The company needed a breakthrough to turn the situation around.

At an extraordinary general meeting held on March 30, 1983, KEPCO President Sung Rak-jung and Hanjung President Park Jung-gi switched positions. This unprecedented step reflected the Korean government's belief that, with his recognized skills as a professional manager, President Sung could speed Hanjung's return to profitability. At the same time, President Park's unparalleled understanding of Hanjung's situation could enable him to support the company's normalization from his new position at KEPCO.

Unfortunately, the results failed to meet expectations. Structural issues such as a worsening economic situation, difficulty in securing overseas orders, and high fixed costs for both labor and operations hampered the company's efforts to grow order volume. In 1983, the plant capacity utilization ratio was only 35.4% as sales shrank approximately KRW 15 billion to KRW 240.8 billion.

Historical Changwon Plant Completion Ceremony (June 29th, 1982)

13,000 Tonne Press Operation Ceremony, Changwon Plant (December 14th, 1982)

Fortunately, the market picked up in 1984, helping boost capacity utilization to 51%.

At the same time this was happening, Hanjung was petitioning the government to introduce consolidation measures in the power equipment manufacturing industry as it continued its own search for ways to survive. The company received tax benefits as a beneficiary of the Act on Regulation of Tax Reduction and Exemption. It was selected as the prime contractor for major equipment and installation projects when KEPCO built new power plants. Mandatory purchase clauses for auxiliary equipment in nuclear plant projects also helped clear the way for order growth.

The push for business diversification

In the 1980s, Korea's power plant construction plans were scaled back due to an oversupply of electricity and the aftermath of the 1979 oil crisis. As even Middle East economies cooled, Hanjung went on emergency alert to secure the orders needed to keep the Changwon plant running. The company found a breakthrough in marine diesel engines. The Korean shipbuilding industry was in the midst of a boom and had secured enough orders to keep it busy through 1985. This meant ample demand for marine engines, and analysts were forecasting greater growth beyond 1985. Ignoring opposition from other engine manufacturers, the Korean government granted Hanjung a duopoly in the industry together with Hyundai Engine on August 19, 1983 to aid in the company's turnaround.

On September 8, 1983, Hanjung signed a technical license agreement with MAN B&W Diesel of Denmark covering two-stroke marine engines. The company also launched construction of a 5,600 square meter engine shop at the heavy machinery plant, a project that was officially completed on June 26, 1984.

In its first year of engine manufacturing in 1984, the company booked orders for 28 engines, increasing overall sales by KRW 42 billion. As engine orders built momentum, the company entered a technical partnership with world-renowned engine maker Sulzer Brothers of Switzerland, accelerating efforts to improve its engine manufacturing technology.

After winning major orders in 1986, the engine business gradually found its stride. Hanjung signed a USD 35 million contract with technical partner Sulzer

57,000 Horsepower APL #1 Engine Operation Ceremony (October 6th, 1987)

for five 57,000 bhp engines measuring 14.7 meters high, 4.5 meters wide, and 22.6 meters long and weighing 1,710 tons each. The fact that this order was the world's largest marine engine at the time made it even more significant. When the final engine in the order was delivered 16 months later on March 9, 1988, the company achieved a localization ratio of 82% and its annual two-stroke engine production capacity reached 600,000 bhp.

In Korea, a country reliant on imports for the bulk of its energy resources, source diversification and efficient utilization were key tasks. The mainstream adoption of cogeneration and district heating and cooling plants centering in Europe and Japan in the latter half of the 1970s served as a good model. The government actively promoted this and Hanjung enthusiastically jumped into the business.

On December 28, 1984, the company won its first order in this new business with the signing of the contract for the Mok-dong-Sinjeong-dong cogeneration project in Seoul. In 1985, it supplied cogeneration equipment to Shinpoong Paper and delivered and installed a coal-fired boiler for a cogeneration project at Tongyang Nylon's Ulsan plant. More cogeneration orders were to follow. Business in the Korean market continued to grow as the company booked plant orders for the Banweol Industrial Complex in 1986 and Posco Pohang Works and Gumi Industrial Complex in 1987.

The offshore facilities business was another area of interest Hanjung tried its hand at, but a lack of experience in related fields hampered its efforts to break into the field. In 1985, the company made its debut in the business when it was invited by Samsung Heavy Industries to manufacture two offshore platforms for India's state-run Oil and Natural Gas Corporation (ONGC). The company signed the contracts with ONGC in March 1986 and July 1987 and projects got underway in earnest. Although these major projects were worth USD 15 million and USD 17 million respectively, the company ultimately took losses on them due to insufficient project management expertise and repeated trial and error. The fundamental reasons for the losses were low-ball bids and project schedules that didn't take into account the unique circumstances of offshore projects, resulting in project delays. After carrying out a number of offshore projects that generated losses rather than profits, the company abandoned its rosy plans for diversification in the field and made the decision to exit the business.

Taking on big challenges beyond Korea's shores

In the mid 1980s, Hanjung secured two major overseas construction projects as it toiled to break into international markets. They were the company's third and fourth overseas projects after the Jizan and Perak cement plant projects in Saudi Arabia and Malaysia. In May 1984, the company won the USD 127.8 million Assir desalination project in Saudi Arabia, followed by the USD 131.4 million Jebel Ali cogeneration and desalination project in the United Arab Emirates.

While these projects were monumental milestones in the company's ambitious overseas advance plans, they also turned out to be cautionary lessons about the dangers involved in that pursuit.

The Assir project had originally been won by a consortium led by Hitachi of Japan and Westinghouse of the United States with a bid of USD 544 million. The scope of the project was gradually reduced, resulting in Hanjung's winning bid of USD 127.8 million in the fourth round of the project tender. The contract contained a number of unfavorable provisions. More than 30% of the contract amount had to be subcontracted to local Saudi Arabian firms. Local materials and equipment were given priority, but if they were imported, it had to be through a local agent.

Producing its first water on November 13, 1988, the Assir project was completed on schedule and recognized as a successful project. The project was highly significant in that it was Hanjung's first desalination project that would lay the groundwork for the company's rapid emergence as the world's leading thermal desalination plant builder in the following years. Another point of pride for the project was the fact that the evaporators, the most important part of desalination plant, were built entirely in-house.

Each of the four evaporators produced for the Assir project measured 23.6 meters wide, 69.2 meters long, and 7.5 meters tall, weighing 2,700 tons. Manufacturing them required 18 months and 130,000 man-days. Although it's now an ordinary event at the Changwon plant, the images of two 600-ton, eight 150-ton, and four 100-ton transporters working in unison to move the evaporators to the pier for shipment were broadcast and published in the mass media, capturing the public's attention.

The ripple effects of the Assir project were significant. During the 28 months the project

Shipment of Assir Desalination Plant Evaporator to South Arabia
(January 10th, 1987)

SWCC Inspection of Assir Desalination Plant Production and Materials

was underway, the capacity utilization ratio of the Changwon plant rose by 17 percentage points and employment increased by over 1,000 jobs. Beyond this external growth, the project enabled Hanjung to accumulate valuable technical expertise in both engineering and manufacturing, paving the way for the company to participate in international desalination tenders. The successful completion of this high-profile overseas project also boosted employee pride and the company's reputation at home and abroad.

The Jebel Ali project that followed also lost a significant amount of money. Hanjung had won the 227 MW cogeneration power plant and 24 MIGD desalination project tendered by the Dubai Electricity & Water Authority (DEWA) with a dramatically lower bid. Taking a loss was the only way the company could beat the prominent competitors it faced from the United States, Japan, and West Germany. It also couldn't resist the temptation to low-ball the bid for what would be its first major power plant export project. Another reason winning the project was attractive was for the symbolism that the company was no longer a subcontractor but the leader of a consortium.

The problems appeared almost immediately. With the project owner in charge of engineering, Hanjung discovered that the project scope had increased over its original estimates, causing costs to snowball. Although the company requested a renegotiation of the contract on February 10, 1988, no progress was made through eight months of tedious negotiations. That November, work at the construction site came to a halt and the company and DEWA became locked in a bitter tug-of-war. On August 2, 1990, the Gulf War broke out. Five months later in early 1991, the two parties reached an overall agreement that raised the contract price by USD 14 million with no penalty for construction delays.

Despite the fact that the vast majority of foreign firms had pulled out of the region due to the Gulf War, Hanjung pressed forward with the project, completing installation of the first two desalination units in August 1991 and the latter two in November. When the final accounting was done, the company had spent USD 264.7 million in the project, taking a USD 120 million loss.

Even when considering the fact that this was a desperate attempt to lay a foundation for Hanjung's Middle East advance given the company's non-existent brand reputation in the region, this loss was far too immense. It was the result of blindly accommodating the unreasonable demands of the project owner to win the tender. But the great reason was an insufficient evaluation of the project scope, leading to an unreasonably optimistic estimate of 32 months for a project that would actually take 69. The Jebel Ali project was an extremely expensive lesson about the importance of meticulous preparation in international tenders. The only "profit" that would come from the project would be from the experience gained.

A total commitment to technical independence

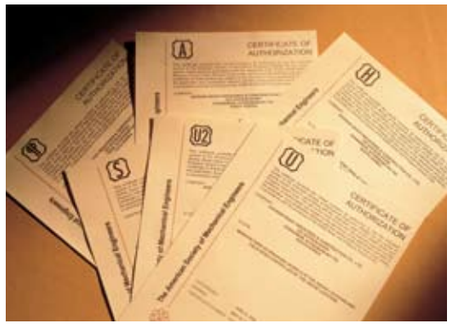
Up until the mid 1980s, the vast majority of power plants, steel mills, chemical plants, and other major industrial facilities in Korea were either manufactured or engineered overseas. The completion of the Changwon plant increased the nation's ability to manufacture plant facilities as well as giving Hanjung the ability to enhance its engineering capabilities.

Hanjung delivered nuclear plant equipment like the generator shaft for Ulchin 2, steel mill equipment such as mill housings, cold press work rolls, and blast furnace facilities, and hydroelectric plant equipment like runners entirely with in-house technology from materials to finished products. The company also produced nuclear plant equipment such as reactor vessels, steam generators, and turbine gensets, thermal plant equipment such as turbine gensets, heat exchangers, and auxiliary boilers, hydro plant equipment such as turbine gensets and spiral casings, and port cargo-handling equipment for sale at home and abroad.

The company earned nine stamps and MM and MS certifications from the American Society of Mechanical Engineers (ASME) in recognition of the quality of its power equipment and broad range of industrial plant equipment.

After establishing an in-house technology R&D center in 1985, Hanjung set a five-year technology development roadmap covering the 1986 to 1990 period, stepping up its drive to localize plant equipment production. During this time, the company identified the development of engineering and manufacturing technology for 200 MW and larger steam turbine gensets and 16 other R&D projects in pursuit of technical independence.

After signing a technical partnership with CE, the company sent technicians to the United States for training. It also invited foreign supervisors to visit to conduct technical training and pushed forward with in-house R&D. Between 1986 and 1990, the company invested nearly KRW 3.67 billion, elevating its technical independence to 55.5% in turbines and 67% in generators, setting the goal of achieving complete technical independence in those fields by the year 2000.



Certification from ASME

A dramatic turnaround from red to black

Hanjung's business woes caused by a lack of work in the early 1980s continued through the middle of the decade. Fortunately, KEPCO began expanding greenfield power plant orders in 1987 in response to soaring electricity demand in Korea, giving the company some breathing room. KEPCO orders provided a huge boost, reaching KRW 560 billion or roughly 63% of the KRW 887 billion total for the year. However, strategic overseas projects continued to record losses one after another, reigniting the company's difficulties. Although 1988 sales fell 25% over the previous year, aggravating the financial situation, power plant orders picked up dramatically in 1989 as the company recorded orders of KRW 921.9 billion, the best performance in its history.

The year 1991 will be remembered as a very special year for Hanjung as it shook off the disgrace of being a perennial money-loser and recorded its first operating profit in the 11th year following its nationalization.

Hanjung announced its first quarterly operating profit just ahead of the parliamentary inspection on September 26, 1991. At the end of August, company revenues were up 75% to KRW 534 billion. At the end of June, company operating profit was KRW 28 billion in the black. Although the company expected to turn a net profit in 1991 after recording orders of KRW 1,416 billion, revenues of KRW 612 billion, and a net loss of KRW 2.2 billion in 1990, the entire Hanjung family was thrilled when the formal announcement of the profit actually came.

The factors behind Hanjung's return to profitability were many, including strong management support for innovation, the restructuring of a lax organization, a mood of reconciliation between labor and management, cost-reduction efforts, and improvements in productivity. The company also expanded investment, investing KRW 52 billion in facilities and KRW 21.9 billion in R&D in 1991. The company proactively responded to the government's electric resources development plan by raising the bar further in 1992, investing KRW 61.6 billion in facilities and KRW 43.5 billion in R&D, boosting annual power equipment production capacity to 3.3 GW and pushing plant capacity utilization to the 90% level.

National Assembly Inspection of the Administration following Profit Posting in 1991 (September 26th, 1991)

After recording a net profit of KRW 78.6 billion in 1991, Hanjung continued the streak with a KRW 134.9 billion profit in 1992, and a KRW 247 billion profit in 1993, the year Lee Su-gang was appointed president. In the first half of 1994, the company's cumulative net profit finally exceeded its cumulative losses, laying the groundwork for true profitability going forward.

As mentioned before, many factors contributed to the company's return to profitability. These included bold innovations in management and a change in mindset, initiatives to improve productivity, the embrace of early bird commuting, innovations in quality and lower defect ratios, business diversification, technical development, and rising investment. However, the factor that stood above the rest was the company's advance into overseas markets which allowed it to secure stable work backlogs.

Absolutely reliant on KEPCO for orders, Hanjung set out to expand overseas orders, securing a new growth engine as its efforts bore results. The company's full focus was on transforming the entire organization into a sales organization in pursuit of its KRW 2 trillion order target with a balanced 50:50 split between domestic and overseas orders.

Finding new momentum overseas

Overseas orders enjoyed impressive growth after 1991, exploding to reach KRW 831 billion in 1993, a remarkable four-fold increase over 1992 and a staggering eight-fold increase over 1991.

The Shuaibah desalination project owned by Saline Water Conversion Corporation (SWCC) of Saudi Arabia was the highest profile project won in 1993. The USD 561 million power and water project included a 100 MIGD thermal desalination plant handled exclusively by the company and a 500 MW thermal power plant won in consortium with Bechtel and ABB.

On June 18, 1993, the company received a USD 50 million order from the Guam Power Authority for the Cabras power plant, a turnkey diesel power project scheduled to be completed in 21 months.

In addition to these desalination and power orders, the company also signed a USD 37 million contract to produce and install 34 ship-to-shore gantry cranes at

Shuaibah Desalination Plant Construction Contract Signing Ceremony, Saudi Arabia (November 2nd, 1993)

the Port of Singapore on May 11, 1993. The massive cranes to be supplied were the most advanced available with fully automated operations and monitoring and a handling capacity of 7 columns and 8 rows, superior to the 4 columes and 6 rows of standard cranes.

Hanjung signed its first overseas ship-to-shore crane order for eight units worth USD 8.4 million with the Port of Dalian in China in December 1990. Delivery was completed in September 1992, and crane orders continued to grow.

Completion Ceremony of Port of Dailan's Ship-to-Shore Crane, the First Export of Cranes (September 2nd, 1992)

On April 24, 1993, the company became Korea's first firm to export plant facilities to South Africa by signing a letter of intent with Davy McKee of the United Kingdom covering a USD 25 million order for cold and hot rolling mill facilities for Columbus Stainless. Began producing rolling mill facilities in 1983, Hanjung had supplied domestic customers such as Posco's Gwangyang Works.

Investing in the future

According to KEPCO's power plant tender plans, a total of 12 nuclear units, 21 thermal units, and 6 hydro units were projected to be built between 1993 and 2004. In anticipation of rising demand, Hanjung began investing in production facilities, spending KRW 41.9 billion in 1990, KRW 51.9 billion in 1991, KRW 50.6 billion in 1992, KRW 36.5 billion in 1993, and 37.0 billion in 1994 for a five-year total of KRW 220 billion.

The company also boosted investment in R&D, spending KRW 76.6 billion between 1990 and 1992. It approved detailed plans to simultaneously pursue in-house technical development and continuous investment in facilities.

With advanced technical materials and training, the company secured technical professionals and a technical support system, and built independent engineering capabilities by acquiring engineering and production experience. Between 1987 and 1992, the company invested a total of KRW 25.3 billion toward technical independence in field of engineering, KRW 23.3 billion of which was spent on technology licensing.

In 1993, Hanjung's technical development efforts focused on nuclear plant construction technology, turbine genset engineering automation, and technical independence in instrumentation and control. A total of 82 projects were planned, including major power equipment localization, auxiliary power equipment localization, and nuclear waste casks and lead casting technology development and patent registration. Focusing on technical independence in nuclear power plant construction, these efforts were divided into engineering and manufacturing areas to foster technical development.

The technology R&D center was expanded with laboratory and research buildings to provide the necessary facilities. In addition to ongoing recruitment of quality personnel, a specialist system was put in place to cultivate top talent as the R&D organization grew.

As the company focused on preparing to enter new businesses with the consolidation of the power equipment industry, it was also working to diversify into new businesses. It added gas turbines, crankshafts, and construction to its existing business portfolio while looking for opportunities to enter emerging growth businesses such as desulfurization equipment and incinerators.

The primary focus of the company's diversification efforts was the gas turbine business. As high-value-added products, gas turbines would help boost revenues and profits. The technical knowledge gained regarding advanced materials would improve technical competitiveness in related fields. Last, but not least, it was a business where localization would have a huge import-substitution effect due to Korea's complete reliance on imports.

Gas turbines were used in cogeneration plants, a new type of power plant with significantly lower construction lead times and costs compared to coal-fired thermal and nuclear plants. This virtually pollution-free high-output power generation technology also had a clear advantage over other technologies in terms of operating availability as well as cooling water and site size requirements.

In terms of new businesses, development of crankshafts for massive two-stroke marine engines was a top priority for Hanjung. Following a feasibility study in March 1990, the company set up a taskforce under the casting and forging division and signed a technical partnership with Japan Steel Works (JSW) of Japan. Between November 1990 and May 1992, JSW dispatched a total of eight training teams with a total of 41 technical specialists, enabling the company to begin crankshaft production in 1992.

On January 29, 1993, the company marked the official completion of the new crankshaft shop and launched full-scale production. A total of 8 marine engine crankshafts were produced during the first year, and production targets were set at 15 units for 1994 and 25 units for 1995. The company's entrance into the crankshaft business was projected to have an import-substitution effect of KRW 30 billion annually, paving the way for it to compete in international markets in the years ahead.

A transformation in labor relations and employee welfare

Three solid years of profitability had changed the entire dynamic at Hanjung. It gave the employees pride and confidence. The negativity disappeared and a sense of ownership took root.

The foundation of this transformation began with labor-management relations. The heated labor problems of the 1980s began to decline as the company entered the 1990s. Beginning in 1987, labor strikes were an annuall occurrence until 1992. The biggest reason for the frequent labor problems that began shortly after a union was established was a perception gap between the two sides. However, that gap was narrowed in 1993 and 1994, collective bargaining negotiations went smoothly, and an atmosphere of reconciliation took hold.

As labor relations stabilized, Hanjung began to focus on improving employee welfare. In 1993, it established a KRW 1 billion employee welfare fund, contributing an additional KRW 5 billion to an internal labor welfare fund which provided housing and emergency loans to employees. The company also built 1,040 apartment units in Changwon's Palyong-dong neighborhood for employees who didn't own their own homes. The KRW 40 billion project included 79 square meter units organized in 9 buildings on a 33,000 square meter site. By the end of October 1993, the complex was fully occupied.

Improving the workplace environment was another area of focus. The company systematically carried out safety training to help prevent accidents and environmental pollution as well as minimize life and property losses. As part of efforts to create a pollution-free environment, it installed a dust collection system at the electric arc furnace-the primary source of air pollution-and planted 76,817 tree and plant saplings around the plant grounds. It also planted 66,000 square meters of lawn and set up small rest areas around the plant to create a more park-like setting.

1993 Korea Quality Management Awards (November 18th, 1993)

The company also launched number of programs and activities to instill and inspire a sense of connection and pride in the Hanjung family. Sports days, festivals, themed essay contests, painting contests, photo contests, holiday gifts, couple incentive holidays, and other programs all brought employees and their families closer together.

As profits rose and the work environment improved, the company won the Grand Prize for Quality Management-Korea's highest industrial honor-in 1993 from the Korean Standards Association. It was the first time in history that the award had been won by a state-run company. Presented by Korea's president, the prize was an honor bestowed on a leading company that had made exceptional achievements in new product development, quality control, and quality and productivity advances through effective quality management. The company had previously won a silver medal at the 1991 National Quality Circle Convention held in November, improving to win gold in the same category at the 1992 convention as it continued to win acclaim for its efforts in quality assurance.

02

The limits of growth, big deals, and privatization

"The best way to overcome sluggish growth is to get a new management system. As the driving force behind that leap, the prescription of "privatization" was not a bad choice. Hanjung's growth in the 1980s and 1990s deserves applause. However, new change is needed to cope in the new millennium era. A change in direction demanded by the new era-that's what progress is."

- Former Korea President Dae-jung Kim

As overseas project orders boomed, the Hanjung order backlog mounted and revenues grew. With the return to profitability, the pace of technical development also quickened. The company racked up remarkable achievements in the power and water fields. As the company's customer base that had relied entirely on KEPCO orders went through a transformation, the company gained the strength it needed to find its own path to survival. It also had numerous accomplishments in the nuclear power field, emerging as a specialized maker of major equipment. However, the unexpected onset of the 1997 Asian financial crisis would ultimately lead the company down the path to privatization.

Business booms in the mid 1990s

With Hanjung's strengthening business structure following the transition to profitability in the mid 1990s, the company began to methodically prepare for its next leap forward. In 1995, the company surpassed its revenue target of KRW 1,953.9 billion to reach KRW 2,074.3 billion, the first time in its history that revenues had passed the KRW 2 trillion mark. Revenues soared as the company supplied and installed nuclear and thermal power equipment for power plant projects in Uljin, Yonggwang, Dangjin, Samcheonpo, and Hadong as well as major facilities for overseas industrial plant projects such as the Shuaibah desalination plant in Saudi Arabia and Nusantara cement plant in Indonesia.

The shipment of the nuclear reactor for Uljin 3 on March 26, 1995-a project symbolic as Korea's first OPR1000 reactor-as well as nuclear inspections in North Korea and the agreement to build a light-water reactor there attracted major domestic and foreign news coverage. The successful manufactureing of the first OPR1000 reactor reconfirmed that Hanjung was capable of supplying major equipment for the Korean Peninsula Energy Development Organization (KEDO) project in North Korea as well as shortening construction lead times for domestic projects and significantly reducing foreign currency project costs. The company also made Korea the second country in the world to localize production of a 700 MW CANDU heavy-water reactor on December 15. These developments enabled Hanjung to emerge as a world-class power equipment manufacturer capable of producing both light- and heavy-water reactors, a capability that was instrumental in the company's entrance into the Chinese market with the win of its first overseas major nuclear equipment order for the Qinshan project in 1996.

The Korean power generation market also tendered a number of significant projects during

Shipment of Uljin-3 Nuclear Power Plant Reactor (March 26th, 1995)

Panorama of Hadong Thermal Power Plant

this period. On July 6, 1995, Hanjung signed contracts for boilers, turbine gensets, and other major equipment for the Hadong 5~6 and Dangjin 3~4 thermal projects. The company also won orders for the Yonggwang 5~6 nuclear and Donghae thermal projects during the year. On November 19, 1996, the company won the major equipment order for the Yeongheung 1~2 project, Korea's first 800 MW ultra-supercritical thermal plant project. This project win was a culmination of the company's more than three decades of experience and expertise in technical development and quality control. Through the construction of tens of power plants, the company had acquired advanced production management capabilities, giving it a proven competitive edge in both price and project execution capabilities.

Power equipment industry consolidation

As the transition to profitability was putting Hanjung on a solid footing, the Uruguay Round multilateral trade negotiations wrapped up in 1994, followed by the launch of the World Trade Organization in 1995. With plans to open the Korean power equipment market and allow independent power plant projects underway, the Korean government suddenly rescinded the company's monopoly on the power equipment market as part of its new five-year economic plan.

This development opened the door for Hyundai Heavy Industries, Samsung Heavy Industries, and other companies with technologies and experience in the power equipment field to freely enter the market. Each of these companies launched facilities investment projects spanning all fields from nuclear to thermal and hydro generation, leading to overheated competition that resulted in contracts being awarded for as low as 60% of cost.

At the time, Hanjung's annual power equipment production capacity was 5.8 GW, exceeding Korea's average annual orders of 2.5 GW by roughly 57% or 3.3 GW. After maintaining a plant capacity utilization ratio of over 90% following the granting of a monopoly in the field due to the same oversupply reasons, the company saw that ratio fall to 80% in 1997 before dropping to around 40% in 1998. Lacking the technical capabilities to compete on their own, new players in the Korean industry forged technical alliances with global industry leaders to survive, relegating themselves to merely being manufacturing and installation contractors, a situation that did nothing to improve the competitiveness of the domestic industry.

These industry latecomers were now at the adoption phase for technologies that Hanjung already had mastered. Each one sourced technologies from different sources, turning the Korean power equipment market into a competition area for equipment from around the world. Moreover, they were overpaying for the technologies that they were fighting to adopt and the wide variety of technologies adopted were hampering standardization, raising concerns that power plant maintenance costs would increase.

It was at this time that the 1997 Asian financial crisis hit. Led by the Federation of Korean Industries (FKI), a consensus began to form that industry consolidation and restructuring through "big deals" by the nation's largest groups were needed. In September 1998, the FKI announced a business restructuring plan aimed at eliminating redundant investment, restructuring businesses with a focus on core capabilities and industries, promoting international competitiveness, and fostering companies capable of leading their global industries within 5 years. It was a voluntary restructuring plan designed to synergistically improve the competitiveness and profitability of every participating company.

In the power equipment industry, Hyundai Heavy Industries and Hanjung agreed to merge their power equipment operations with the details to be worked out at a later date. Samsung Heavy Industries also agreed to transfer its boiler equipment and marine engine businesses to Hanjung in a separate deal.

Though the consolidation of the power generation equipment industry and domestic market under Hanjung, it became possible to bring together the nation's accumulated manufacturing expertise, aiding the company in securing international competitiveness. In addition to helping improve the weak financial structure of power equipment makers who had an average debt ratio of 474% in 1997, it was expected to minimize cutthroat competition in overseas markets and national losses due to the adoption of redundant technologies. This was necessary because major multinationals such as GE, ABB, and Siemens dominated global markets by maintaining their monopoly positions through mergers and strategic alliances.

Hanjung and Samsung Heavy Industries signed a memorandum of understanding on the business transfer on October 1, 1998, followed by the final agreement on December 4. On February 22, 1999, an agreement on the appraised value of the transfer was signed, followed on June 28 by an agreement on the scope of the power equipment and marine engine businesses to be transferred. The scope of the transfer was adjusted on July 4 and the final agreement was signed on November 30, with the business transfer taking place shortly after.

The deal with Hyundai Heavy Industries followed a similar path. On October 7, 1998, the companies announced a revised plan for the transfer, followed on October 19 by a decision to complete the transfer as quickly as possible with the goal of wrapping up the scope, appraisal, and payment details by the end of November. On February 22, 1999, the companies agreed on the appraisal value, followed on November 9 by the signing of an agreement to restructure their power plant businesses. The final transfer agreement was signed on November 30.

Conflicts slow the momentum

Despite an economic slump in Korea and the country's request for emergency funds from the International Monetary Fund (IMF) prompted by the Asian financial crisis, Hanjung achieved remarkable results in 1997. Booming overseas sales helped orders surpass KRW 4 trillion and sales surpassed KRW 3 trillion for the first time. The company booked its largest number of overseas orders to date with orders for the Ramagundam thermal project and other thermal and diesel power projects in India, major equipment for the Qinshan nuclear project in China, and a diesel power project in Papua New Guinea. In addition to its overseas sales efforts, the company aggressively moved ahead with plans to build overseas production bases. Ceylon Heavy Industries & Construction (Chico) was established in Sri Lanka, Han-Viet Heavy Industries & Construction (Hanvico) completed a plant in Vietnam, and a boiler plant was established in Lampung, Indonesia to support the company's ambition to be a global player.

While business was booming, new challenges were just over the horizon. The "wind" of privatization battered and buffeted Hanjung in 1998. The workforce became highly agitated, leading to a 48-day strike that lasted from November 10 to December 27, 1999, preventing the company from meeting its business targets as well as striking a serious blow to its creditworthiness. All told, the strike caused revenue losses of KRW 198.9 billion and direct losses of approximately KRW 46.9 billion through the end of December 1999 in addition to negatively impacting a number of project negotiations then in progress.

While the strike was underway, it was impossible to ship products scheduled for delivery. Since products and materials couldn't be shipped or received via the main gate, late-delivery claims filed by customers began to pile up. The inability to ship orders related to an outsourcing contract with GE worth USD 150 million annually and stern and rudder castings for Daewoo Shipbuilding & Marine Engineering caused serious difficulties for those customers and greatly damaged the company's reputation.

The road to privatization - The rush to failure

The debate regarding the privatization of Hanjung started in January 1988 at a meeting between Hyundai Group Chairman Chung Ju-yung and Korean President Chun Doo-hwan. Chairman Chung was seeking a debt settlement and pre-emptive rights in Hanjung, proposing an acquisition of the company through a debt-for-equity swap.

With only one month left in his term, President Chun met with ministers from the relevant government ministries on January 12, 1988 where they decided to confirm the privatization plan before the president left office and leave the implementation details to the next administration. This last-minute decision led to problems, resulting in two years of pain and confusion characterized by sharp divisions of opinion both for and against privatization, two failed tenders, and the ultimate decision to maintain the status quo.

In the first privatization discussions, the primary issue regarded was the question of justification. Although the original target for completing privatization was by the end of 1988, strong disagreements about the pros and cons of the process made it impossible to reach a consensus on whether or not to proceed. It wasn't until a director-level meeting of the relevant government ministries on April 10, 1989 that an agreement was reached on the privatization plan.

Unfortunately, conflicting interests between the ministries led to strong disagreements. While the Ministry of Commerce and Industry actively advocated for privatization, Deputy Prime Minister Cho Soon was against it. On the political front, the Peace & Democracy Party and Democratic Party raised concerns about possible favoritism to Korea's conglomerates and set out to oppose privatization. However, the government was convinced that privatization was the right course. Deputy Prime Minister Cho and Minister of Commerce and Industry Han Seung-soo agreed in principle to the process on July 28, 1989. The final decision was reached at a minister-level meeting of the relevant ministries on August 3 and the privatization plan was officially announced.

In the meantime, the controversy over Hyundai's participation in the tender became the focus of attention. On August 2, 1988, Hyundai filed suit seeking to reclaim ownership of Hanjung's Youngdong headquarters building, filing a second suit on September 10 seeking payment for

receivables amounting to KRW 103.9 billion, further complicating the privatization process. As the government urged Hyundai to drop the lawsuits, threatening to disqualify it from participation in the tender, the Hanjung union also launched a campaign opposing a possible Hyundai takeover.

Hyundai ultimately proceeded with its lawsuits and qualified to bid on the Hanjung privatization tender. Following public notice of the stock sale on November 3, 1989, registration for the tender closed on November 14 with Hyundai Group, Samsung Group, and Korea Chemical Company submitting applications. However, Korea Chemical's application was rejected due to the fact that Chairman Chung Sang-yung of that firm was the younger brother of Hyundai Chairman Chung Ju-yung.

While the tender was reduced to a two-way battle between Samsung and Hyundai, it would fail to decide Hanjung's new owner. This was because when only Hyundai showed up for the tender bid at the Korea Development Bank at 2 pm on November 17, 1989, the tender was automatically declared invalid for failing to satisfy the minimum two-bidder requirement. With Samsung's no-show, the battle for Hanjung ended with a whimper.

With the failure of the first tender, the government decided to try again, announcing that a second privatization tender would be held on January 24, 1990. However, this time only a single bidder?Kia Industries?submitted an application by the January 20 registration deadline, so the second tender failed as well. Finally, at a press conference held on January 22, the government announced that plans would be made to normalize the business operations of Hanjung while maintaining its status as a state-owned enterprise. The first privatization discussions were back to where they had started, leaving only two years of scars and social and economic losses to show for the effort.

The road to privatization - A report sparks a second look

Five years after the controversy over the first privatization plan came to a close, the embers of privatization roared to life again in 1995 sparked by an August 7 report from the Korea Institute for Industrial Economics and Trade. The report presented eight proposals, including a privatization plan centered around a controlling shareholder and a conversion to a professional management system to achieve decentralized ownership, having a far-reaching effect on the debate.

Lead researcher Song Gi-jae presented his personal opinion in the fifth of the eight proposals, calling for the allocation of up to 10% of equity for an employee stock ownership program before the initial public offering. After the public offering, a portion of equity would be sold to a company aspiring to be the controlling shareholder, with the remainder being sold through a public offering or to institutional, private, or foreign investors. This reasonable proposal was in fact identical to the privatization process that Hanjung would later successfully go through.

Following the Korea Institute for Industrial Economics and Trade report, the Ministry of Finance and Economy's interest in privatization was rekindled. In December 1995, it announced that the Hanjung privatization plan was expected to be confirmed in 1996, pushing off the privatization to the next year.

Despite this positive momentum, the actual timing of the privatization was unclear. First of all, the research team at the Korea Institute for Industrial Economics and Trade and Ministry of Foreign Affairs and Trade were both of the opinion that privatization would be impossible during administration of Korean President Kim Young-sam. Another obstacle to privatization was the battle over ownership of Hanjung's Youngdong headquarters and two other lawsuits involving claims of KRW 400~500 billion, which would be difficult to wrap up within 1996. This meant that the earliest the sale could get underway would be 1997 if it was held after the initial public offering.

Practically speaking, this meant that actual privatization would be possible after 1998 because the sale would take at least one year after the IPO. While it would be simpler to sell Hanjung without taking the company public, it wouldn't be an easy choice due to the high possibility of serious accusations of favoritism regarding asset valuations.

The process of privatizing Hanjung wasn't simple due to the company's size and large number of stakeholders as well as the huge impact it would have on the stock and capital markets. Ultimately, the second privatization discussions also made little headway, continuing to stir controversy as the project languished.

Korea Heavy Industries' Youngdong Building, Seoul

The road to privatization - The right time and consortium

When President Kim Dae-jung took office in 1998 with the heavy responsibility of turning the nation around after the 1997 Asian financial crisis, the dormant discussion on privatization took on new urgency. In 1998, the Kim administration selected 11 state-owned enterprises for privatization. On July 3, 1998, the government announced its privatization plan to sell Hanjung and four other state-owned enterprises to domestic and international investors. The privatizations began with the National Textbook Company in November 1998, followed by Korea Technology Banking in January 1999, Daehan Oil Pipeline in April 2000, and Pohang Iron & Steel between December 1998 and October 2000. Hanjung's turn was next.

Hanjung had consistently been a candidate for privatization since 1988. Although earlier privatization plans had failed, the company had gone to tender before and there was less opposition to the plan this time than for any other privatization candidate. The government announced that it would proceed with a full privatization, selling 51% of company equity. The public notice of the sale was scheduled to take place in late 1998 or early 1999, with privatization being completed during the first half of 1999.

As privatization got underway, there was some significant internal resistance. The management team headed off employee unrest by emphasizing that rather than getting upset about the privatization discussions, the important thing was to strategically prepare to ensure that they would benefit from the process. The team also emphasized that the wisest approach would be to strengthen competitiveness through strategic alliances with leading power equipment makers and focus on efforts to build a sound and reliable company.

The problems of state-owned enterprises were raised in the media as well as internally and many of these same sources also argued in favor of privatization. The case was made that the company needed absolute independence to secure growth and strengthen competitiveness. There was virtually no worries or concerns about privatization among the company's business partners.

Finally on December 12, 2000, the Doosan consortium outbid the Speco consortium with a bid of KRW 305.7 billion, representing KRW 8,150 per share, securing a 36% equity stake in the company. On December 19, the Doosan consortium secured voting rights representing 51.7% of Hanjung's equity with the signing of contracts to acquire the 36% stake owned by Korea Development Bank and KEPCO as well as a separate contract giving it the first right of refusal on an additional 15.7% stake held by Korea Exchange Bank.

On December 13 and 16, top management held privatization briefing sessions for employees in Changwon and Seoul. Welcoming the completion of privatization, the sessions focused on the fact that privatization was a desirable process that would maintain the company's basic direction and should be considered an opportunity for Hanjung to cultivate its core capabilities and remake itself as a globally competitive company.

Prior to privatization, Hanjung sold a 24% equity stake in September 2000 through a direct public offering, transferred a 10% stake to an employee stock ownership program, and offered an additional 14% stake divided between private and institutional investors. On October 25, 2000, the company was listed and began trading on the Korea Stock Exchange under the ticker number 34020.

The First Meeting of Crown Corporation Privatization Team (July 20th, 1998)

001~2012

Growing Success,
Global Aspirations

01

Erasing the vestiges of public enterprise

"As restructuring got started in 1995 just a year shy of the group's 100th anniversary, I thought about what I had inherited from my late father as well as what I would bequeath in the future. It wasn't a brand called OB Beer or a beer brewery, but a business philosophy. If we had tried to maintain the status quo, the Doosan Group wouldn't exist today."

- Excerpt from a manager's forum address by Doosan Group Chairman Yongmaan Park

The acquisition of Hanjung by Doosan-a business group with a proud heritage stretching back over a century-is considered the most successful takeover in Korean business history.

Doosan's history began in 1896 when Park Seung-jik opened a store in downtown Seoul's Baeohgae district, an area today known as Jongro-4-ga. Following Korea's liberation from Japan at the end of World War II, his eldest son and founding Doosan Chairman Too Pyung Park took over the store in 1946 and renamed it Doosan Store, laying the cornerstone for what would become the Doosan Group. Oriental Brewery-one of Korea's most legendary companies and a Doosan flagship company-was established in 1952 and became synonymous with beer in Korea as it grew along with the Korean economy. Following Oriental Brewery's founding, Doosan found new growth opportunities in the trading business. In 1960, the group began to take shape as Doosan Construction & Engineering, Doosan Beverage, Doosan Machinary, and other companies were established. As it entered the 1970s, the group positioned itself as part of Korean life as a pacesetter in the life and culture business. In the 1980s, it expanded into publishing, advertising, and electronics businesses as well as turning its eyes overseas.

After making a name for itself as one of Korea's leading business groups in the consumer goods field, change was in the air in 1995, just one year ahead of Doosan's 100th anniversary. Korea's oldest group had a miserable year in 1995. Oriental Brewery succumbed to the onslaught by competitor Hite Brewery and lost money, rocking the entire group. Doosan's combined loss for the year was extremely serious at KRW 908 billion and its debt ratio soared to 625%, shaking the group's very foundations.

McKinsey report gives Doosan less than a year to live

With Doosan's future unclear as it approached the 100th anniversary of its founding, the executive team's concerns deepened. The psychological shock of losing the top position in Korea's beer market that it had held for 50 years to a competitor added to the sense of crisis. The reality of OB Beer's fall from No. 1 taught the lesson that even industry leaders could fall at any time. Then Doosan Chairman Yong-gon Park believed that bold and decisive restructuring was the only way forward and set up a restructuring team headed by Yongmaan Park, then director of Planning & Coordination in the group.

That decision was a crucial moment that would change the group's future.

The restructuring team decided that an impartial third-party analysis was necessary, so it entrusted the group review to the global consulting group McKinsey & Company. The "Tri-C" team composed of McKinsey consultants and group employees uncovered Doosan's problems through meticulous inspections and management consultations.

The Birthplace of Doosan Group, Park Seung-jik Store, Established in 1896

The McKinsey consulting report delivered in 1996 revealed the sobering reality that Doosan was in dire condition. While the report was complicated and extremely detailed, if it were to be summarized in two sentences, they would be "Everything has to change. If things go on like they are, a year from now the doors may be closed."

When the executive team reviewed the report, the shock they experienced was beyond imagination. Doosan Chairman Yongmaan Park, then director of Planning & Coordination in the group in charge of spearheading the reorganization, later reminisced at a lecture that chills ran down his spine the entire time he was reading the report.

Giving up a cherished possession for a greater cause

While the fear the report brought was great, the hesitation afterwards was short. Taking the report's recommendations, the executive team announced a restructuring plan that would merge subsidiaries and push forward with stock and real estate sales to complete the group's reorganization.

The executive team's decision to accomplish the changes that were required was absolute. From 1996 through the first half of 1997 before the Asian financial crisis hit, the restructuring proceeded without delay. Doosan began with the disposal of 14 properties to pay off debt, including unprofitable real estate such as subsidiary headquarters buildings and undeveloped land. It resolutely sold off equity stakes in overseas joint ventures with partners like Kodak, 3M, and Nestle that generated tens of billion of won in profits annually. It even gave up the business rights to the world's most famous brand, Coca Cola. It liquidated some of its best businesses virtually overnight. It even considered selling Oriental Brewery-the flagship company of the group-and its Ulchiro headquarters.

In early 1998, Doosan sold a 50% stake and managerial rights in Oriental Brewery-its pride and joy-to Interbrew of Belgium. While it was a decision that could shake the group's foundations, Doosan proceeded with restructuring with the attitude that a chance at a second century in business was worth the pain and sacrifice. Ultimately, 23 subsidiaries were merged into just four companies-Doosan Corporation, Doosan Construction & Engineering, Doosan Packaging Materials Manufacturing, and Oricom.

Selling off a core business that the group founder had built with his sweat and blood wasn't an easy decision. Doosan Chairman Yongmaan Park shared his feelings on that resolute decision at a manager's forum. "Doosan's restructuring was about survival. As restructuring got started in 1995 just a year shy of the group's 100th anniversary, I thought about what I had inherited from my late father as well as what I would bequeath in the future. The thing I received wasn't a brand called OB Beer, a beer brewery, or something physical, but a business philosophy. If we had tried to maintain the status quo, the Doosan Group wouldn't exist today."

Doosan's Honorary Chairman Yong-gon Park expressed his deep regrets regarding the Oriental Brewery sale in one press interview. "The most difficult part of the restructuring process was the sale of Oriental Brewery. When the Yeongdeungpo plant was sold, I felt like crying tears of blood. The employees at the time strongly opposed it because it was a business my father, the late Chairman Too Pyung Park, had poured his sweat and toil into. But I've never regretted the decision."

The grand finale of Doosan's restructuring was the sale of the group's Ulchiro headquarters building in downtown Seoul in February 1998. When the sale was announced, other major business groups expressed their regrets about Doosan's plight. However, the sale proved itself to be a wise choice that helped the group weather the crisis, providing the funds for the construction of Doosan Tower, a landmark in Seoul's Dongdaemun district that would become the new headquarters building and home to the popular Doota fashion mall.

In a press interview, Doosan Chairman Yongmaan Park shared some thoughts about the timing of the restructuring. "The group began its slim-down before the economic crisis hit, so we were less affected than other domestic groups. That fearful time and painful restructuring of 1996 was a turning point that transformed Doosan."

McKinsey's chilling report was the spark that ignited the restructuring of the Doosan Group.

Oriental Brewery Yeongdeungpo Plant

Dongdaemun Doosan Tower

That said, without the timely business diagnosis, a belief that the restructuring would work, and the fortitude to literally tear out everything from the rafters to the cornerstone and rebuild the group from the ground up, today's Doosan might not even exist.

Voluntary restructuring turns a crisis into opportunity

The Doosan Group's decision would later earn it the nickname of "Exhibit 1 for voluntary corporate restructuring" and recognition as a model for successful restructuring. Not every aspect of Korea's first voluntary restructuring project went smoothly. At a time when the term "restructuring" itself was unfamiliar, the rumors of impending bankruptcy and difficult circumstances spread. Stock prices plummeted and employee morale hit rock bottom. It wasn't easy to win the cooperation and consensus of employees, but the executive team persevered and stuck with its decision and was ultimately proven right.

The Oriental Brewery's loss and liquidity crisis in 1995 turned out to be a blessing in disguise. While other business groups struggled when the Asian financial crisis hit unexpectedly in the second half of 1997, Doosan had already been inoculated by its earlier restructuring and avoided the worst of the crisis. If the group had undertaken its business restructuring during the financial crisis, there was no guarantee that its business sales would have been successful, regardless of how successful the companies were in their fields. Even if those businesses were successful, the huge amount of assets for sale at the time would have made it impossible to get a fair price. This is the reason Doosan's restructuring was considered to be a prescient decision. If there was a god of timing, that god was on Doosan's side.

With restructuring successfully completed before the 1997 Asian financial crisis, Doosan was able to prepare for the future while other companies were fighting for their lives. As the Korea won-US dollar exchange rate soared, the group's dollar holdings from its business sale proceeds enabled it to earn a sizeable foreign exchange windfall. This gave the company the confidence to sell controlling stakes in flagship companies such as Oriental Brewery and Doosan Beverage in 1998, enabling it to secure cash liquidity and the capability to launch the new core businesses that the group's future would depend on.

Although the restructuring process was accompanied by excruciating pain, the debt ratio that had soared to 688% in 1996 fell to 159% within just three years, putting the group on a sound financial footing by 1999. As cash flow improved, Doosan recorded a solid profit of KRW 673 billion. While other companies were talking about shrinking investment during the financial crisis, the mood at Doosan began to change as opportunities to make bold investments arose.

The completion of restructuring at Doosan wasn't simply about overcoming the crisis at hand. The liquidation of core businesses had to be followed by the identification of new businesses that would become the group's new growth engines. When restructuring got underway, the group had a rough idea of where it wanted to go, leaving behind its retail-centric business portfolio of liquor, beverage, and publishing businesses for heavy manufacturing and other businesses with strong prospects for long-term growth. It was with this framework that the executive team began its long deliberations on Doosan's future direction.

Taking the capital secured through restructuring, the century-old business group selected infrastructure support businesses businesses-involved in building tomorrow's infrastructure-to lead it into its second century. Covering infrastructure such as roads, ports, railways, and airports, energy, national defense, manufacturing facilities, and distribution and transport facilities, infrastructure support businesses span a broad range of large-scale businesses that are closely tied to the development of humanity. It was at that time that a company that was a perfect fit for Doosan's new direction came on the market.

That company was Hanjung. Korean President Kim Dae-jung's administration had accelerated the privatization of state-owned enterprises to help Korea recover from the Asian financial crisis and Hanjung-a major player in the power generation and seawater desalination plant fields-was in the process of being privatized. The company had great potential after securing competitiveness through newly gained monopolies in Korea's power equipment and marine engine fields in December 1999.

While Hanjung was a perfect fit for Doosan, there were some significant challenges ahead. The company faced a very difficult business environment at home and abroad at the time of privatization

Doosan Group Chairman Yongmaan Park (on right) and Korea Development Bank Vice President Chuljo Jung (on left) at Stock Acquisition Contract Signing Ceremony

due to an overall economic downturn in Korea following the Asian financial crisis that led to delays on domestic power plant projects as well as a rapid contraction in overseas industrial plant markets. The opening of the Korean power equipment market also enabled major companies armed with technology and capital to enter the domestic market, intensifying competition and hurting profitability, leading the company to record a loss in 2000. The company's antiquated organizational structure had also become an impediment to business, and a lack of leadership was preventing it from fully utilizing its capabilities.

Marking the beginning of a new era

After being selected as the priority bidder for Hanjung on December 12, 2000, the acquisition process proceeded smoothly as expected. On March 23, 2001 at the 38th annual general shareholders' meeting-the first held after privatization-the company name was changed to Doosan Heavy Industries & Construction and the company announced its new start to the world.

The company was now at an inflection point where it needed to prepare for a new leap forward after receiving the baton from a company that had grown to become a leading force behind the development of Korea's heavy industrial sector for more than four decades. Rather than a mere change of mission or character, this was a crucial time for the company's transformation into a forward-looking organization. The top priority was to put in place a new corporate culture and eliminate the inefficiencies inherent in state-run enterprises. Erasing the dark vestiges of the company's state-owned enterprise days that had held it back from achieving results commensurate with its capabilities was the first task at hand.

At the newly privatized company's first general shareholders' meeting on March 23, 2001, the company name was changed and Chairman YS Park was appointed Chairman. At the same meeting, Hanjung's President Yoon Young-suk was appointed President and CEO and Geewon Park, then Executive Vice President, was appointed the Director of Planning and Coordination.

On May 4, key members of the executive team and over 5,000 employees attended a ceremony commemorating the symbolic new start as Doosan Heavy at the ground in the headquarters in Changwon. In his address commemorating the event, Chairman YS Park emphasized the company's new direction. "Through non-stop restructuring during the past six years, Doosan has, in the 105th year since its founding, secured a growth engine that can drive its second leap forward. That growth engine is Doosan Heavy. Doosan's restructuring wasn't a stopgap measure. It has been carried out with a direction and philosophy in mind. Even in the process of selling and liquidating numerous businesses, our core businesses have continued to expand. Since then, industrial goods have generated operating margins superior to consumer goods, and their portion will only increase with the acquisition of Doosan Heavy. We must reorganize our business structure for growth and profitability and achieve specialization and systemization."

Bird's Eye View of Doosan Heavys Changwon Plant, 2000

New Start Ceremony of Doosan Heavy Industries & Construction (May 4th, 2001)

Winds of change infuse new energy

Making a fresh start as a privatized company, Doosan was given an important mission. There were, however, lingering questions. One was whether, as one of Korea's leading heavy machinery manufacturers, the company would be able to build on its state-owned enterprise organization and successful privatization to contribute to the Korean economy. Another was about whether it could grow to become a global power equipment manufacturer through transparent and advanced management.

The challenging domestic and international business environment at the time was another concern. Following the Asian financial crisis, the overall economy was sluggish, the power generation plant market shrank, and the opening of the Korean power equipment market and ensuing rush of new competitors made the business environment even tougher. Internally, an absence of managerial responsibility and inefficient systems were contributing to the ongoing deterioration of the company's financial situation, threatening its very existence. It was in this environment that the Change Program was launched as a special measure to improve the business fundamentals and competitiveness as part of the company's survival strategy.

Chairman and CEO of Doosan Heavy, Geewon Park, the man who spearheaded the Change Program, shared these thoughts. "During two decades as a state-owned enterprise, the president changed 13 times. With just a 1- or 2-year term, the idea that you could maintain your position if you could just avoid the attention of the changing executive team was widespread in the organization. Every time a new president came in, they would launch whatever business innovations were popular at the time, but they were unable to finish what they started before they left. Due to the organizational culture at the time, projects and tasks took off, then collapsed shortly after the start. After the acquisition, the first message we sent to employees was that the executive team wouldn't be changing. When we start something, we'll see it through to the end until we get results."

During the Hanjung days, the company had launched a variety of improvement programs, but they were frequently abandoned after a short time when the anticipated results failed to materialize. The frequent turnovers in management made it difficult to continue programs, resulting in the incoming management team pursuing unrealistic business strategies. The new management team's message was a warning to employees who were used to the trial-and-error routine that things would be different from the past.

Doosan established its vision, set target standards to achieve that vision, and defined "change activities" as any activity aimed at overcoming the company's present situation. Before the Change Program could be adopted, the management paradigm had to change first. Setting the vision clarified corporate objectives and return on invested capital, cash flow, and other new value-driven management techniques were adopted. Management focused on core businesses like power generation and seawater desalination and decisively exited underperforming ones. A results-oriented culture took root through the adoption of the business group and team organizational structures and a variety of supporting systems. The launch of manpower training programs also started to dramatically improve the organizational infrastructure. Building on this foundation, operational improvement initiatives aimed at cutting costs and strengthening competitiveness were carried out across the entire value chain, enhancing sales, engineering, purchasing, manufacturing, and project management. The way the company worked had to change as well, focusing on timely decision-making and the elimination of inefficiencies. Even lifestyles were transformed by improving employee welfare and cultural opportunities to build new kind of workplace environment.

Reorganizing to enhance authority and responsibility

On October 8, 2001, a major organizational restructuring project was launched focusing on the divisional structure. The former function-centric structure was transitioned to a business group structure where sales, project management, and production functions were integrated, clarifying the source of profits and losses and putting in place the foundation for transparent and responsible management.

Under the business group structure, the department and section organization was replaced with the team system in all areas with the exception of manufacturing part. This system was chosen to streamline the approval process, reducing unnecessary time waste as well as facilitating timely decision-making and elevating efficiency. The expected effect on management was also substantial, with the company anticipating managerial responsibility to take root as well as improvements in transparency, market focus, and efficiency.

With this reorganization the company went from one office, four divisions, and nine departments to one office, three divisions, and seven business groups. The difference between the former and new systems was that each business group was an independent unit with its own balance sheet, income statement, and cash flow. The objective was to build a results-oriented organizational structure with clear lines of authority and responsibility with independent financial statement responsibility supported by integrated sales, project management, engineering, and production functions. In other words, it secured transparency in evaluation standards and put in place an independent decision-making system for each business group. Another difference from the previous organizational structure was that it aimed for centralized control by strengthening the single management system and project risk management.

The new organization also emphasized the authority and responsibility of the CEO of each business group (BG). The CEO of each BG was now responsible for formulating strategy and planning as well as executing it. In other words, the CEO had authority and responsibility covering all decision-making in the course of the business group's normal operations including planning, sales, engineering, production, service, and even manpower training. This authority would be later expanded in phases to include decision-making for specialized procurement (excluding joint-procurement items), component procurement, and other areas.

Doosan Heavy's Changwon Headquarters

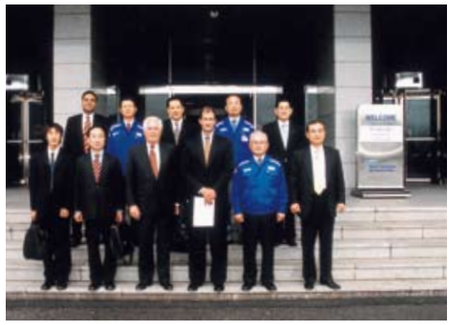
The adoption of a team system was another major part in the reorganization. The team system was adopted to strengthen the company's organizational competitiveness to enable it to actively adapt to changes in the domestic and international business environments, speed decision-making, and put in place a merit-based personnel system. The primary goals were to flatten the organizational structure to speed decision-making and enhance flexibility, separate position and duty for merit-based personnel management, and take full advantage of the specialized skills of mid-level managers.

One of the primary objectives of the team system adoption was to speed decision-making by flattening the organization. The adoption reduced the approval process from a maximum of seven stages to four, making the team leader's role critical. The team leader redesigned the work scope of each team member. One of the things that had to be clearly decided early in the team system implementation process was what matters needed to go through the job leader and which did not. The team leader played decision-making and mediating roles in his team and was responsible for achieving the team's targets and budget management. Team members were responsible for carrying out their assigned roles and tasks as well as the results of their work performance, laying the foundation for a merit-based culture.

Expanding into global power and water markets

One of the key components in achieving Doosan's long-term objectives was to prepare an aggressive business strategy aimed at making inroads into overseas markets and strengthen core capabilities in the power and water fields.

Prior to its privatization, the company had been actively executing an overseas market diversification strategy since 1998. As a result, major project orders began to rise in 1999 and 2000 as the company won power and water projects in the United Arab Emirates and Kuwait totaling over USD 2.1 billion as well as USD 600 million long-term power equipment supply agreement with General Electric. To achieve this, the sales team was reorganized, unifying the previously independent sales departments for each



General Electric Executive Visit to Changwon Headquarters, 2001

product to enhance synergy. Specialized regional sales teams for the Americas, the Middle East, Europe, and other regions were also set up. At a time when many Korean companies were closing their overseas offices, the company set up offices in Dubai and Taipei as it expanded the sales network that would enable it to make inroads into global markets.

Immediately following privatization, Doosan focused on enhancing its capabilities in core businesses such as power generation, desalination, and castings and forgings while shuttering its iron and steel mill, chemical plant, cement plant and other underperforming businesses. The company established subsidiaries in Shanghai, New Delhi, and Kuwait to bolster its local marketing capabilities and took aim at new markets such as Spain, Qatar, and Oman. These efforts enabled the company to grow orders by 9.5% to KRW 3,628.7 billion in 2001-the first year following its privatization-with the order backlog surpassing KRW 8 trillion. Revenues rose 4% to KRW 2,468.6 billion. Despite a one-time non-operating charge of KRW 38 billion for early retirement packages, higher revenues and lower non-operating expenses enabled the company to achieve a KRW 24.8 billion net profit in 2001.

Looking at major projects won in 2001, the USD 800 million Fujairah desalination project in the United Arab Emirates won on June 30 led the way. Capable of producing 100 million imperial gallons of water a day-the world's highest capacity at the time-and generating 660 MW of power, the turnkey project was handled entirely in-house from engineering and manufacturing to installation and commissioning. New orders from General Electric also played a big role. Previously focusing on piecemeal components, GE expanded its orders to include major plant equipment such as steam turbines and generator sets, increasing total orders to USD 570 million for the year. Heat-recovery steam generators or HRSGs also continued to deliver steady growth, rising from USD 120 million in 2000 to over USD 200 million in 2001. A total of 29 HRSGs were ordered, expanding the company's market base and increasing revenue prospects in markets like Taiwan, Southeast Asian markets like Malaysia and Vietnam, and markets in the Middle East.

The growing pains of privatization

It was inevitable that there would be some growing pains following privatization. During the rapid process of change and innovation to transform the company's state-owned enterprise organization, many employees turned over a new leaf and conflict between labor and management emerged starting in 2001. The labor union set out to put the brakes on the various post-privatization Change Program initiatives launched. Used to the customary "union strikes, company yields" labor relations from its state-owned enterprise days, the union chose a path of confrontation rather than communication and compromise.

But the new management team was not about to yield. It responded to the labor strike by adopting "no work, no pay" and other regulations and policies. The result of this was two consecutive years of extended strikes lasting 41 days in 2001 and 47 days in 2002.

Then Doosan Heavy's Executive Vice President Geewon Park shared this recollection of the labor conflict. "As expected, it wasn't easy to change the state-owned enterprise organization and business didn't go smoothly. The union used strikes as a weapon to pressure the management team. However, we made it clear that we would stand firm to the end on the "no work, no pay" principle and amply conveyed that this was a necessary measure for corporate survival."

The labor strike of 2002 was particularly serious. The union blocked all entrances to the Changwon plant, preventing management-level employees from reporting to work. It also shut down production and took over the headquarters building. Later, the dormitories were closed and product shipments were blocked as the situation deteriorated into violence. The 47-day illegal strike cost the company KRW 280 billion in lost revenues and KRW 96 billion in direct losses. Despite the huge losses incurred, the sight of the company sticking to its principles was a clear departure from its state-owned enterprise days. Through this painful process, labor and management relations were able to move beyond conflict and mistrust as a new culture based on communication and compromise as well as mutual benefit and collaboration began to take root.

02

A Global Company Emerges

"After the Change Program adoption and the announcement of the company vision, the core strategies to achieve it, and a new organizational culture, we wanted to let each individual employee know what kind of changes and benefits to expect when these plans are achieved. The Change Vision isn't just for one part of the organization. It's our future that we all must pursue together."

- Excerpt from Change Vision Workshop address by President Dae-jung Kim

The early days following the company's privatization in December 2000 brought plenty of pain as Doosan struggled to break habits formed during its 20 years as a state-owned enterprise. However, the company achieved a rapid turnaround in 2004 through the Change Program, which transformed its state-owned enterprise DNA, and strengthened core capabilities. After entering the overseas power plant EPC business in 2004, the company won a steady stream of major projects across the Middle East, India, and Southeast Asia, ultimately achieving its best business performance to date in 2007. The company also embarked on an aggressive overseas acquisition strategy in 2005, securing core proprietary technologies as it took aim at becoming a truly global company.

A Home-Grown CEO Leads the Change

In March, 2003, Dae-jung Kim, one of the most competent professional managers of the Doosan Group, was inaugurated as the 16th president and CEO of Doosan Heavy. His inauguration was significant because it meant that the company had succeeded in making a soft landing with a CEO from the pre-privatization era and that it was time for the company to take the next step forward under a genuine Doosan management style.

As the executive largely in charge of the Group's liquor business, President Kim was known as a uniter and leader. Later, he would be evaluated as a CEO that brought about positive changes in Doosan Heavy's state-owned enterprise DNA while overhauling the work environment and attitudes of the organization. His inauguration indicated that change was in the air. Above all, President Kim was the right person to put an end to labor strikes that had afflicted the company for two years and provide more aggressive leadership. As he assumed leadership, the company initiated a reorganization that saw the appointment of new business group heads, as well as changes to streamline the organization and improve business synergy.

The Plant Construction Business Group was merged into the Construction Business Group due to the similar nature of the businesses. The Industrial Business Group was dissolved. The Material Handling Business Unit was absorbed by the Thermal Power Plant Business Group, the Special Project Business Group by the Castings and Forgings Business Group, and the Chemicals Business Group by the Desalination Business Group. To promote the development of new technologies and secure proprietary technologies more efficiently, the company put the Technology R&D center

under direct control of the CEO and expanded it. To strengthen marketing capabilities and increase overseas orders, the company assigned an executive director for the Americas and established the Architect-Engineering Center. To improve work efficiency and speed decision-making, the company reduced its executive levels from five-assistant vice president, vice president, senior vice president, executive vice president, president-to four by eliminating the assistant vice president level.

As he assumed his new position, President Kim identified four tasks to reform the company: a new labor-management relationship based on trust and cooperation, aggressive investment and hard work to secure technological competitiveness, the creation of a new corporate culture, and hard work to achieve order targets. The fact that a new labor-management relationship topped the list was evidence of how seriously the company had suffered from during the two-year labor-management conflict.

Inauguration of 16th Chief Executive Officer, Dae-jung Kim (March 24th, 2003)

A New Vision Takes Flight

Doosan announced its new vision at the Change Vision Workshop held on May 20, 2003. The new vision was to become a global leader in the industrial plant business by delivering the best value with world-class technologies and price competitiveness. The company also set a number of specific business targets, including orders of KRW 4 trillion, revenues of KRW 4 trillion, an operating margin of 10.7%, a return on invested capital of 18.1%, and a three-fold increase in market cap within five years. “Change, the challenge to be No. 1” was the catchphrase.

Doosan also announced four new strategies at the workshop: maximizing management efficiency, strengthening sales capabilities, securing proprietary technologies, and upgrading the business portfolio.

To maximize management efficiency, the company would launch programs to reduce costs and improve performance while strengthening its project management capabilities by elevating cost competitiveness and project risk management.

To strengthen sales capabilities, the company would expand its geographical order pool, bolster its domestic and overseas sales infrastructure, build market-tailored sales capabilities, and actively foster sales specialists.

To secure proprietary technologies, the company would implement a system to systematically manage and protect its technologies as well as increase investment in new technologies.

To upgrade its business portfolio, the company would pursue strategic alliances with global leaders to strengthen core capabilities in the power and desalination business, advance into the power plant service market both at home and abroad, and target new overseas markets.

To effectively promote the four strategies mentioned above, Doosan put in place a number of systems to instill a performance-based culture, foster human resources, enhance mutual trust, and encourage individual initiative. The company promised to invest KRW 35 billion over three years to create a working environment that would rival the best in the nation to give employees a sense of pride as well as continue to support overseas backpacking trips. The company would generously reward employees for exceptional performance. The company also launched a program to identify and foster key talent for future leadership roles.

Commenting on the vision announcement, President Dae-jung Kim said, “In addition to elevating the pride of being an employee of a global No.1 company, we will make this a place that promises you and your family a bright future. We will continue to improve the fundamentals of Doosan Heavy to improve customer satisfaction and enterprise value. This vision and the strategies to achieve it are designed from that perspective.”

Commenting on the significance of the Change Vision announcement, President Kim added, “After the Change Program adoption and the announcement of the company vision, the core strategies to achieve it, and a new organizational culture, we wanted to let each individual employee know what kind of changes and benefits to expect when these plans are achieved. The Change Vision isn't just for one part of the organization. It's our future that we all must pursue together.”

Change Vision Workshop (May 20th, 2003)

Finding Answers to Growth Overseas

Doosan began to invest more energy in opening overseas markets following the announcement of the Change Vision. The company aggressively pursued overseas business, inviting potential customers to the Changwon plant to give them the opportunity to see its world-class manufacturing facilities and technologies.

The first good news came from Amman, Jordan in July 2003 when Doosan won a USD 86 million contract from Jordanian Electric Power Company (JEPCO) to supply the main equipment for the 100 MW Rehab combined-cycle power plant, including heat-recovery steam generators (HRSGs) and a steam turbine genset produced entirely with in-house technology.

Just two days later, more good news arrived from Iran. The company signed a EUR 240 million contract with Mapna to convert gas turbine power plants in eight regions into more economical combined-cycle power plants. The contract was the world's largest for combined-cycle power plants at the time.

The back-to-back orders electrified the company atmosphere. The joy was multiplied because Doosan had secured a strong foothold in the Middle East market through these projects in Jordan and Iran. There was also encouraging news about the company's growing chances to participate in post-war Iraq projects. Propelled by these two Middle East projects, the company secured orders for 64 HRSG in 2003, emerging as the world's No. 1 supplier. According to industry authority McCoy Power Reports, the company secured orders for 58 HRSGs totaling 3,664 MW between January and September 2003. Just 10 years after it began producing HRSGs with in-house technologies in 1993, the company captured 27% of the total global market share. It was nothing short of a miracle.

Rehab Cogeneration Power Plant EPC Project Contract Signing Ceremony, Jordan (July 6th, 2003)

MAPNA Cogeneration Power Plant Project Contract Signing Ceremony, Iran (July 9th, 2003)

Commenting on the Mapna project, Chairman and CEO Geewon Park said, "The Mapna project is an extremely meaningful order in that it will without a doubt engrave the name of Doosan Heavy Industries & Construction not only in Iran but in power equipment markets across the Middle East."

Thanks to these efforts to expand its overseas presence in 2003 under new leadership, Doosan grabbed the top position in the global HRSG market in addition to leading thermal seawater desalination market. It was a clear sign that Doosan was now poised to emerge as a global player.

Expanding into Global Power Equipment Markets

Following its success in 2003, Doosan power equipment orders continued to gain momentum in 2004. On April 16, the company won the USD 370 million Sipat Stage-I coal-fired thermal power plant order in India, the world's largest power generation market. The order from NTPC for three 660 MW units for the project in Chhattisgarh was India's largest power plant project to date. The Sipat project was even more meaningful because of the Indian government's plans to make it the model for future thermal power plants.

With the win of this turnkey order covering engineering, manufacturing, installation and commissioning of the entire power plant, Doosan had seized the opportunity to set the standard for future Indian supercritical power plants, opening the door for future opportunities in India and Southeast Asian markets.

Thanks to this boom in overseas power plant orders in 2004, the company threw a party on May 10, 2004 to celebrate overseas orders surpassing the KRW 1 trillion milestone and thank employees for their hard work.

Sipat Plant, the Largest Coal-Fired Thermal Power Plant in India, was Awarded to Doosan in 2004.

A Turnaround Unlocks Value

In 2004, Doosan orders set a new record of KRW 4.01 trillion, a huge 43% increase from the previous year. The order backlog reached KRW 8,095.4 billion, indicating smooth sailing ahead. Revenues reached KRW 2,455.5 billion and the operating profit was KRW 207.6 billion with the operating margin rising to 8%, up from 3% just before privatization in 2000. Net income reached KRW

166.5 billion, a huge 512% increase over the previous year. More importantly, return on invested capital exceeded the weighted average cost of capital, marking the company's successful turnaround. As a result, the company's enterprise value also rose sharply as the stock broke out of the KRW 5,000~6,000 price range in early 2004 to set a high of KRW 14,000 during the year.

Securities analysts touted the stock, issuing "buy" recommendations and saying that Doosan was entering a growth phase. Others said that the stock outlook was very positive due to an attractive price compared to its enterprise value, large order backlog, and favorable order prospects. Still others said that growing orders and advances from customers were increasing current assets while debt continued to be paid back, leading to interest income exceeding interest expense. The market reacted even more positively, pushing the stock beyond the target price.

Garden Party Celebrating KRW 1 Trillion Overseas Sales (May 10th, 2004)

Commenting on the situation, Chairman Geewon Park said, "Since privatization, we have strengthened our core capabilities in power and desalination, following a select-and-focus strategy to grow into a world-class heavy manufacturer. Through the Change Program, we have continuously carried out the key management innovation initiatives that have produced these major achievements."

Gearing up for EPC Success

Doosan began to learn power plant equipment technology from foreign companies in the latter half of 1970s. By the mid 1990s, the company was capable of building power plants on its own and exporting major plant equipment overseas. However, around the time of its privatization in 2000, the company's focus was on the Korean market with overseas orders accounting for less than 30% of the total. If the company was going to move beyond the limited domestic market and grow into a global company, it was essential to significantly expand its overseas presence.

It was at this point that Doosan chose to focus on the power plant engineering-procuremnet-construction (EPC) business, taking responsibility for the complete project from engineering and manufacturing to installation and commissioning. While EPC projects carried a high degree of risk with projects ranging from hundreds of billions of won to trillions of won, winning large EPC projects was expected to play a major role in company growth. The company's power equipment manufacturing capabilities had reached the point where they were fully capable of supplying overseas markets. The company's Changwon plant itself was capable of manufacturing everything needed for power plants from components to finished facilities. In every respect, it was capable of competing against industry leaders from Japan, Europe, and the United States. The company also had a unique advantage in that it was capable of handling both power and seawater desalination plants thanks to its success on numerous projects in the Middle East where it was common for those plants to be built together.

With the strategic goal of upgrading its business portfolio, Doosan moved beyond simply being a supplier of power plant equipment focused on the domestic market as it set out to remake itself into an EPC player equipped with strong design and engineering capabilities. To enhance its EPC project execution capabilities, the company invested a significant amount of its resources on R&D, hiring top-class engineers at home and abroad as well as creating a chief technology officer position.

The company also went all-out to let the world know about Doosan through marketing at international trade shows.

Beginning with Power-Gen Asia, the company actively participated in Power-Gen Middle East, Power-Gen International, and other power industry shows. In 2004, Doosan Heavy Chairman YS Park joined over 60 executives and staff at Power-Gen International held from November 30 to December 2. The company launched a variety of marketing activities at the conference to demonstrate the level of sophistication of technology it had secured, showcasing its major contract awards and promoting the Doosan brand. In the years since, this presence at such international trade shows and conferences has become a powerful global business showcase for the company, playing a significant role in elevating its global profile.

Leadership Changes but the Innovation Continues

On November 3, 2005, Doosan initiated a major organizational restructuring to more aggressively pursue opportunities in Middle Eastern markets in the process of expanding their power and water infrastructure due to rising oil prices as well as infrastructure markets in fast-growing economies such as China, India, and Southeast Asia.

Up to this time, Doosan's power plant business organization was organized around boilers, turbine gensets, and other major equipment. In keeping with the global industry trend toward EPC project tenders, the company integrated its Thermal Power Plant and Turbine Generator Business Groups into the Power Plant Business Group. The sales and project management, architect-

engineering and service activities previously carried out by each business group were consolidated and the support organization was expanded. The focus of the reorganization was to transform the company organization to execute EPC projects efficiently and responsibly around the globe, giving it a competitive edge in the intense battle for orders with the global leaders.

Commenting on the background behind the reorganization, Chairman Geewon Park explained, "In order to lay the groundwork for our leap forward to become a No. 1 global company with revenues of KRW 10 trillion by 2015, we have reorganized our operations, moving beyond our equipment-manufacturing-centric business model to a business structure appropriate for EPC projects that is capable of effectively utilizing our intangible engineering and construction assets. Our goal is to be able to effectively execute EPC projects to drive the company's future growth."

In 2006, President Dae-jung Kim, the man who had led the company successfully through the tumultuous years immediately following privatization, was promoted to vice chairman and left day-to-day management of the company. His replacement, Namdu Lee, was appointed president on March 2, 2006. President Lee presented three principles in his inaugural address: workplace-centered management, vision and strategy execution, and harmonious labor-management relations.

With the arrival of a new leader, the company also launched the Winning Meeting program, a new Change Program aimed at transforming the corporate culture.

Winning Meeting was modeled after GE's Work-Out "town meetings", which played a key role in establishing an empowering and results-driven organizational culture at that leading global company. GE's Work-Out is often cited as the prime example of a successful organizational innovation. Since its adoption by GE in the late 1980s, Work-Out has transformed the entire organizational culture as well as the employee perspectives and methods of working.

Winning Meeting Announcement (April 24th, 2006)

At Doosan, Winning Meeting played a critical role in the rapid reform and growth process following privatization, invigorating an organizational culture that had started to show signs of fatigue as well as putting in place an empowering and results-driven culture.

Barka Phase Two Power and Desalination Plant Project Contract Signing Ceremony, Oman (December 15th, 2006)

The World's Largest, Mundra Power Plant Construction Contract Signing Ceremony, India (May 16th, 2007)

Power Plant EPC Orders Soar

Doosan's focus on EPC projects paid off quickly. The company began to see orders take off at the end of 2006. Doosan signed contracts for the Barka Phase II independent water and power (IWPP) project in Oman and the Al Taweelah A10 combined-cycle thermal power project in the UAE. As 2007 got underway, EPC orders began to boom.

Doosan's 2007 results were dazzling. The company won major projects worth upwards of KRW 1 trillion such as the Jebel Ali M combined-cycle power project in the UAE and the Mundra thermal power project. Other orders included the Glow CFB project in Thailand-the company's first to use a circulating fluidized-bed boiler-as well as the Daharki combined-cycle power project in Pakistan, the Amman East combined-cycle power project in Jordan, the Qatalum combined-cycle power project in Qatar, the Cirebon thermal power project in Indonesia, and the Cebu CFB thermal project in the Philippines.

It was as if a dam had burst as new EPC projects kept rushing in. Geographically, the new projects covered a huge swath of the planet, stretching across the Middle East to India and Southeast Asia. In 2007 alone, Doosan booked orders of KRW 7.023 trillion, its best performance to date. The EPC business had clearly emerged as one of the company's key businesses and growth drivers.

Proving Global Competitiveness at Home

While Doosan was concentrating on making inroads in overseas markets, the company recognized the necessity of guarding its domestic market share that had turned into a no-holds-

barred battleground. On February 2, 2004, Korea South-East Power selected the company in an international tender over Mitsubishi and Babcock-Hitachi of Japan as the preferred bidder for units 3 and 4 of the Yeongheung thermal power project. As Korea's largest thermal plant to date at 1,740 MW (870 MW × 2), the KRW 200 billion contract had generated intense interest at home and abroad. Having previously out-bid Japanese competitors for units 5 and 6 of the Dangjin thermal power project and units 7 and 8 of the Taean thermal power project, the company's win of the Yeongheung project proved without a doubt its superior technical and price competitiveness.

Doosan continued to prove its competitiveness in the domestic market throughout 2004. On May 18, the company signed a KRW 100 billion contract for units 3 and 4 of the Nam-Jeju thermal plant project. On June 14, it was awarded a contract to supply Korea Midland Power with 500 MW boilers and turbine gensets for units 7 and 8 of the Boryeong thermal power project. For the Boryeong project, the company supplied Korean-standard once-through supercritical boilers, turbine gensets, and all auxiliary facilities built exclusively with in-house technology. These successes over leading international makers proved the company's international technical and price competitiveness, solidifying its leadership in the local market.

On March 31, 2005, Doosan signed a KRW 435 billion contract with Korea Southern Power to supply and install the 1,000 MW (500 MW × 2) boilers and turbine gensets for units 7 and 8 of the Hadong thermal plant. The largest thermal plant project in Korea to date, the Hadong project did not follow the local custom of awarding separate contracts for equipment manufacturing and installation. For the first time in the domestic market, the client adopted the "island" EPC contract common in international tenders. The size of the project attracted bids from Mitsubishi of Japan and Ansaldo of Italy, but Doosan emerged as the ultimate winner. The victory served as an opportunity to reaffirm that, even after the opening of the Korean power equipment market, the company's ongoing efforts to strengthen technical and price competitiveness had given it a competitive edge over major European and Japanese players.

Leading in Desalination Through Diversification

In the seawater desalination field, Doosan continued to prove its global leadership. In 2004, the company won the bid for Sabiya desalination project in Kuwait, followed by Sohar IWPP project in Oman and the Ras Laffan "B" IWPP project in Qatar, completing a perfect sweep of the Middle East thermal desalination market. The company also won several smaller desalination projects around this time, including the Benghazi North multi-effect distillation (MED) project in Libya in 2004 and the Zawia MED project in Libya in 2005.

In April 2005, Doosan succeeded in its bid for the Sabiya Phase 3 project in Kuwait. At the end of the year, the company was awarded the world's largest desalination plant to date, the USD 850 million Shuaibah Phase 3 IWPP project in Saudi Arabia, a project designed to meet the daily water needs of 3 million people.

Having achieved global success in the multi-stage flash (MSF) desalination market, Doosan made the decision to advance into the reverse osmosis (RO) market to expand and diversify its seawater desalination business. In December 2005, the company acquired the North American reverse osmosis water treatment business of American Engineering Services and established Doosan Hydro Technology, securing access to proprietary technologies in the RO field. In

Hadong #7 and #8 Thermal Power Plant EPC Project Contract Signing Ceremony (March 31st, 2005)

Taean #7 and #8 Thermal Power Plant Groundbreaking Ceremony (November 7th, 2011)

The Kuwait's Largest, Sabiya Desalination Plant Construction Contract Signing Ceremony (May 8th, 2004)

Panorama of Shuaibah Desalination Plant, Saudi Arabia

December 2006, the company set up water R&D centers in Dubai, the UAE and Tampa, the US to accelerate development of next-generation high-capacity desalination technologies as well as target opportunities in small- and medium-scale seawater desalination and water treatment.

As a result of the above efforts, Doosan booked its first RO seawater desalination project just two years after entering the new field. In December 2007, the company won the USD 180 million Shuaibah Phase 3 Expansion RO project in Saudi Arabia. The 33 MIGD project was launched by royal order to help resolve a critical shortage of water in the Jeddah region.

Commenting on the project, Water Business Group CEO Seokwon Yoon said, “Doosan was able to win the Shuaibah RO project because of the company’s reputation and technical competitiveness in the global seawater desalination plant market. This order is a turning point in our advance into the RO market and emergence as a global leader.” The company would go on to win two RO projects in the Middle East the following year in 2008, proving itself to be a formidable player in the field.

Moving Full Speed Ahead in Nuclear Power

On August 28, 2006, Doosan won the bid for units 3 and 4 of the Shin-Kori nuclear plant project, the first units to adopt the new Generation III APR14002™ reactor design developed in Korea entirely with domestic technology. Compared to the previous 1,000 MW OPR1000 design, the 1,400 MW APR14002™ design offers significant advances in both generating capacity and safety features. A few months prior in March 2006, the company won a contract to supply replacement steam generators for the Sequoyah 1 plant in the US, a recongnition of the company's technological capabilities from the country that brought the world nuclear power.

During this period, the global nuclear power industry was also keenly watching to see who would win the tender for China’s first Generation III nuclear power plants in Sanmen and Haiyang. China had announced plans to build thirty-one 1,000 MW nuclear power plants valued at KRW 50 trillion through 2020, making it by far the world's largest nuclear power market. The global nuclear powers?the US, Europe, and Japan?all flexed all their diplomatic clout to help their local contractors win these important first contracts. Although Doosan was on the same technological level as its competitors, it failed to qualify for the tender due to interference by some of its peers. However, the company was ultimately able to win the contract to manufacture the major equipment for the AP1000™ reactor design thanks to its close relationship with Westinghouse of the US, the winning contractor. In July 2007, Minister of Commerce, Industry and Energy Young-joo Kim and other Korean government officials joined President Namdu Lee and other Doosan executives for the contract signing ceremony in China.

Shipment of Haiyang Nuclear Power Plant’s AP1000 Reactor to China
(November 4th, 2011)

Shin-Kori-3 and -4 Nuclear Reactor Contract Signing Ceremony
(August, 28th, 2006)

Commenting at the time, then Nuclear Power Plant Business Group CEO Tae-woo Kim said, “Due to the virtual halt in nuclear power plant construction worldwide over the past three decades, the number of nuclear equipment manufacturers has significantly declined. At the same time, Doosan has continued to accumulate extensive technologies and experience through domestic nuclear plant projects. Globally, Doosan is virtually the only company with its own nuclear materials supply capability and major materials technologies, giving it world-class competitiveness.”

The cooperation with Westinghouse continued into 2008, when Doosan was awarded contracts to supply six AP1000™ units for new nuclear power plants to be built in three US states.

Other Businesses Contribute to Growth

On July 19, 2004, Doosan won a USD 46 million contract for 42 container handling gantry cranes to be installed at the Port of Singapore. The company had previously won bids from the port for 11 cranes in 1993 and 34 cranes in 1995, so this order brought the total supplied to 87. This success in Singapore paved the way for the company to expand its influence in the Southeast Asian market where port construction was underway to meet growing container shipping volumes. It was also a reminder that the company's competitiveness wasn't just limited to the power generation and desalination fields.

On June 9, 2005, Doosan once again beat out competitors from China, Singapore, and Germany to win a USD 42 million international tender to supply and install 40 container handling cranes for the Port of Singapore Authority (PSA). This contract increased the number of Doosan cranes

supplied to the port to 167.

As the largest container port in the world with steadily growing demand for container handling equipment, the Port of Singapore attracted the attention of the world's top equipment makers. Doosan's string of successes over a multi-year period in fiercely competitive tenders testified to world-class technology and competitiveness in the field.

Doosan also demonstrated that it was competitive in construction projects during this period. In January 2005, the company joined a consortium with five other local companies to win a KRW 847 billion contract to build a highway between West Suwon and Pyeongtaek in Korea. The build-transfer-operate (BTO) project called for the construction of a 38.5 km highway with four to six lanes between the two cities. Doosan's 25% stake in the consortium was the largest, and the company played a leading role in the project with a KRW 286 billion contract.

Acquiring a Whole New Future

Although it was ultimately unsuccessful, Doosan's first acquisition attempt took place in 2005 when the company jumped into the battle to acquire global nuclear power technology leader Westinghouse of the US. While the global nuclear power industry was busy strategizing on how to win the acquisition battle, Doosan submitted a letter of intent in July 2005. Rothschild, the investment bank running the auction, selected Doosan as one of the qualified bidders. It is believed that about 15 global companies participated in the auction, including GE and Mitsubishi. Simply qualifying to bid in the Westinghouse auction elevated Doosan's profile in the global nuclear power industry.

Over the years, Westinghouse has supplied its proprietary technologies to roughly half of the world's nuclear power plants as a supplier of nuclear fuel services, technology, plant design, and equipment. It was the original supplier of proprietary technologies for Korea's nuclear power program, and had shared those technologies with Doosan in the 1970s when it participated in the construction of the country's first nuclear power plant. At the beginning of 2005, the two companies had agreed to collaborate on nuclear power plant projects in China, another sign of their close relationship. Although Doosan's acquisition attempt was ultimately eclipsed by Toshiba's more aggressive approach, the collaborative relationship between the two companies has continued unchanged, expanding Doosan's opportunities to participate in US nuclear power plant projects.

A few months after the Westinghouse auction, Doosan made its first acquisition. On October 31, 2005, the company acquired the North American reverse osmosis (RO) water treatment business of American Engineering Services (AES) in the US. Shortly after, it established Doosan Hydro Technology to take over those operations. The acquisition brought Doosan proprietary technologies in the area of RO and water treatment, a national sales network and a project portfolio that included more than 80 desalination plants and more than 100 RO-based public water and sewage facilities in the US and Latin America.

With the acquisition of AES and launch of Doosan Hydro Technology, Doosan had become a total water solution company with proprietary technologies spanning the three major seawater desalination fields.

Doosan was now capable of expanding beyond its core Middle East market into seawater desalination markets in the US, Europe, Southeast Asia, and beyond, opening up a global market valued at KRW 4 trillion annually. As the company's MSF business continues to lead the global thermal desalination market with a market share approaching 40%, it has also leveraged its RO business to develop more cost-effective hybrid and next-generation desalination solutions, laying the foundation for greater synergy in the field. The acquisition of RO technologies has also opened the door to new opportunities in the closely related water, sewage, and wastewater treatment fields, a global market valued at over KRW 2 trillion annually.

American Engineering Services Inc. (AES)

A Streak of Acquisitions Sparks Synergy

As 2006 rolled around, Doosan became more aggressive in its acquisition strategy. On June 26, the company signed a contract in Seoul with Kvaerner IMGB, Romania's largest casting and forging company, to take over a 99.75% stake for about KRW 14.5 billion.

Kvaerner IMGB started out as a state-owned general machinery maker in communist Romania. At the time of its privatization in 1998, it was acquired by Kvaerner of Norway. Doosan's counterpart in the deal was TH Global, a holding company which owned Kvaerner IMGB. Like Doosan, Kvaerner IMGB had a 13,000-ton press, the largest made in the world. It produced 140,000 tons of products a year. It also had assets of about USD 70 million, an annual turnover of USD 45 million, and a workforce of over 600.

Today, Doosan IMGB's main focus is on manufacturing equipment for hydroelectric power plants-a field that accounts for 75% of its sales-exporting primarily to markets in Europe, the

Americas, and Asia, including China. Through the acquisition, Doosan secured a second component manufacturing base that complements its casting and forging operations in Changwon, Korea. At the time of acquisition, the global casting and forging field was growing around 4.1% annually. Demand for large cast and forged products significantly outstripped supply, indicating high potential for growth.

The acquisition of Kvaerner IMGB increased Doosan's casting and forging capacity by more than 70%. The company's goal of becoming the world's largest supplier of castings and forgings with annual revenues of USD 900 million by 2015?more than double its revenues at the time-was now within reach. The acquisition was also expected to directly benefit other businesses, helping eliminate chronic component shortages in the power equipment and shipbuilding fields.

Commenting on the acquisition he spearheaded, Casting & Forging Business Group CEO Young-chun Choi said, "Focusing on Europe, Kvaerner IMGB has had a wealth of exchanges with world-class power plant manufacturers for more than 40 years. We will combine this experience with Doosan's power equipment manufacturing technology to maximize the synergy of this acquisition."

Doosan's most famous acquisition took place on November 6, 2006. The objective was to secure proprietary technologies for boilers, a core component of every thermal power plant. The acquisition target was Mitsui Babcock Energy, a British engineering company with proprietary technologies in boiler design and engineering. Doosan purchased a 100% stake in the British company owned by Mitsui Shipbuilding of Japan for JPY 20 billion, equivalent to KRW 160 billion at the time.

Commenting on the acquisition, Chairman Park said, "Securing proprietary boiler technologies has been our long-held desire since entering the power plant equipment business in 1976. For the past three years, we have considered a multitude of ways to secure them. Our conclusion was to acquire a company that had those technologies. Through this acquisition, we have secured proprietary technologies that would difficult to develop given even 20 or 30 years."

Share Purchase Agreement Ceremony of Kvaerner IMGB, Romania
(June 26th, 2006)

Share Purchase Agreement Ceremony of Mutsui Babcock Energy
(November 6th, 2006)

Doosan's lightening-fast acquisition of Mitsui Babcock was a seminal event for the Korean power equipment industry. A core component of every thermal power plant, boilers are used to produce the high-temperature, high-pressure steam that turns the turbine genset. Globally, there were only four companies with proprietary boiler technologies: B&W and Foster Wheeler of the US, Alstom of France, and Mitsui Babcock. With the acquisition of Mitsui Babcock, Doosan joined that exclusive group, laying a foundation that would enable it to enter literally any market on the planet.

Mitsui Babcock had the world's most advanced boiler engineering technologies, particularly in the field of combustion technology. It was also highly competitive in the power plant services field. Combined with Doosan's boiler manufacturing and marketing capabilities, the prospects for the company's boiler business were brighter than ever. Through the acquisition, Doosan also laid a foundation for close cooperation with major power utilities in China, a market that is expected to see explosive growth in the power plant services field. The acquisition also paved the way for Doosan to aggressively pursue new power plant services projects from its existing customer network across the UK and European markets.

Doosan Babcock began to generate synergy almost immediately. On June 25, 2007, just seven months after the takeover, Doosan Babcock signed a partnership agreement with British Energy, the UK's largest power utility and producer of one-sixth of the country's total electrical power. Under the GBP 550 million agreement, Doosan Babcock is now providing technical, engineering, and operational support for nine British Energy power plants across the UK for a period of seven years. Running through 2014, the agreement also covers engineering, mechanical technology services, maintenance, performance improvement, and nondestructive testing services at British Energy's 8 nuclear plants and 1 coal-fired thermal plant.

The British Energy services agreement was the largest in Doosan Babcock history. Commenting on the agreement, Chairman Geewon Park said, "I want to place special significance on the

Doosan Babcock - British Energy, Mechanical Engineering and Technology Services Contract Signing Ceremony (June 25th, 2007)

fact that this great achievement came just seven months after the Doosan Babcock acquisition. Going forward, we will combine the marketing capabilities of Doosan Heavy with the power plant services technologies of Doosan Babcock as we target global markets with high value-added services."

The task of expanding the company's business horizons previously limited to the Middle East and Asia to other continents was the first step toward becoming a truly global company.

Establishing a Global Production System

Doosan's firm position in Southeast Asia was showcased by the groundbreaking ceremony on February 7, 2007 for a planned manufacturing base known as Doosan Heavy Industries Vietnam (Doosan Vina) in the Dung Quat Economic Zone on the coast of central Vietnam. Scheduled for completion in late 2008, Doosan Vina-the company's "second heart"-was to be built on a 110-hectare site with 123,000 m2 of production space, manufacturing facilities, port facilities, a headquarters building, and dormitories.

Following groundbreaking, site preparation work got underway. On October 16, 2007, construction got underway in earnest with a ceremony to mark the installation of the first column of the boiler shop. Doosan Heavy Chairman YS Park and President Namdu Lee attended the ceremony to encourage the construction project team. As they fastened the first bolt of the first column of the boiler shop, all were reminded of the significance of the company's first overseas manufacturing base.

When the plant was completed and reached normal operations, Doosan Vina would be able to achieve roughly the same level of productivity as the Changwon plant, producing 6 boilers, 8 desalination evaporators, 18 heat-recovery steam generators, 10 rail-mounted quayside cranes, 50 rubber-tired quayside cranes and 42,000 tons of chemical process equipment annually. With its investment in highly productive facilities and closer proximity to overseas construction sites, Doosan Vina could be Doosan Heavy's frontline base for overseas construction markets. At the same time, it was also clear that it could be a stepping-stone into Vietnam's power and infrastructure development fields.

Doosan Heavy Industries Vietnam Co. Groundbreaking Ceremony
(February 7th, 2007)

Staking the Future on R&D

Technical development is an extremely important aspect of corporate competitiveness that determines a company's future competitiveness. With revenues and sales on the right track, Doosan redoubled its commitment to R&D, making 2005 the beginning a new era focused on R&D.

In addition to its existing Technical Institute at the Changwon plant, Doosan established new satellite R&D centers in the Korean cities of Daejeon and Yongin. On June 10, 2005, the company held ceremonies to mark the opening of the new centers and affirm its commitment to R&D. The Technology Development Center for Future Business in Daedeok Research Center in Daejeon focuses on emerging energy technologies such as wind power systems, molten carbonate fuel cells, IGCC (Integrated Gasification Combined Cycle) and small gas turbines. If successful, these new technologies could be commercialized and help add value to existing businesses. The Industrial Plant Control System Development Center located within the Doosan Technology Center in Yongin focuses on localizing man-machine interface system (MMIS) and distributed control system (DCS) for Korean nuclear power plant with the goal of enhancing plant equipment manufacturing and delivering solutions that add value.

Participating in National Research Projects

In August 2006, Doosan was selected by the Korean government to head a national project to develop a 3 MW offshore wind turbine system. The great potential of the offshore wind power market attracted fierce competition, with consortiums from Doosan, Hyosung, and STX-Hyundai Heavy Industries vying to lead the project. The three-year agreement with the Korea Energy Management Corporation (KEMCO) covered turbine system development, including engineering, manufacturing, and testing.

On December 22, 2006, Doosan was selected by Korea's Ministry of Commerce, Industry and Energy and KEMCO to head the development of a national project to develop integrated-gasification combined-cycle plant (IGCC) technologies. The agreement with KEMCO covered coal gasification plant engineering and key technology development.

In October 2007, Doosan was once again selected by Korea's Ministry of Commerce, Industry and Energy to head a national project to develop fuel cells for a 300 kW power generator. The company partnered with the Korea Institute of Science and Technology, Korea Institute of Energy Research, and Korea Midland Power on the KRW 51 billion joint research project. The company had previously secured proprietary technologies in the field by developing Korea's first 25 kW fuel cell stack in April 2007. Leveraging those technologies and a 46,000 m2 lab building, it set a goal of

Yongin Suji Doosan Research and Development Center (June 10th, 2005)

Announcement of Fuel Cells Development Project for 300kW Power Generator (May 25th, 2010)

developing a fuel cell system by 2008 and commercializing a 300 kW fuel cell for power generation by 2012. Fuel cells for power generation produce electricity through a chemical reaction between oxygen and hydrogen. Their high energy efficiency and zero emissions make them an ideal candidate to replace fossil fuels as a next-generation energy source.

Already the global leader in the thermal seawater desalination field, Doosan set out to make its mark in the reverse osmosis market. The company began developing technologies for the world's largest RO seawater desalination facility. On October 24, 2007, it was selected by Korea's Ministry of Construction and Transportation to head a national project to engineer and develop construction technologies for a high-capacity seawater desalination plant. This project is a core task of the 'Seawater Desalination Plant Project' managed by the Gwangju Institute of Science and Technology as well as one of the Ministry of Construction and Transportation's ten "value creator" (VC-10) projects.

A Rising Global Brand

Doosan's competitiveness comes from customers, quality, innovation, and people. From this perspective, diversification into new overseas markets and major project orders have enhanced the company's competitiveness as well as its reputation. Between 2005 and 2007, the company saw its credibility and brand value skyrocket in international markets.

On September 26, 2005, Doosan was named Korea's top company in the general machinery sector at the Korea Top Company Awards hosted by the Korea CEO Association. Korea Top Company awardees are chosen based on their scores in five areas, including growth potential and profitability, based on a detailed survey of the over 1,500 local companies listed on the Korea Stock Exchange (KOSPI) and Korea Securities Dealers Automated Quotation (KOSDAQ).

In 2006, the Changwon headquarters and Changwon plant began to take on a more global look. In February, the corporate information center-the "face" of the headquarters?opened its doors. The center is a window into the company for visiting VIPs as well as the starting point for the plant tour program. Covering roughly 1,000 m2 on the first floor of the Changwon headquarters, the center has an information desk, a waiting room, a multi-purpose room, and an exhibition zone.

On April 4, 2006, Doosan opened a new dormitory. A second home for some executives and employees, the new dormitory was constructed right across from the headquarters. Completed at a cost of KRW 19 billion over an 18-month period, the 15-story building has one underground floor and a total floor area of 15,600 m2. The modern facility boasts 457 single rooms, a restaurant, a convenience store, a DVD room, a fitness center, a recreation hall, and a business center.

On January 24, 2007, Doosan opened the Doosan Guest House, a five-star luxury hotel located close to the Changwon headquarters. In 2005, the company decided to replace the previous 27-year guesthouse. Completed in only 15 months at a cost of KRW 21.4 billion, the new four-story building has one underground floor and a total floor area of 7,800 m2. The facility features an elegant design and a splendid view. It has 80 guest rooms modeled after five-star hotel rooms, a restaurant, a conference room, a business center, and a fitness center. It also has five-star housekeeping and guest services.

On August 10, 2007, Doosan labor and management signed the 2007 wage bargaining agreement, marking its second straight year without a labor dispute as well as completing the agreement in record time, opening a new chapter in labor relations. A total of 16 negotiation meetings were held starting on May 31. The final agreement included a 5% wage increase, a KRW 4 million incentive for meeting productivity targets, a KRW 300,000 incentive for setting a new order record, KRW 300 million for condo time-shares, welfare facility expansion, and a target-achievement bonus of between 50% and 200%.

After weathering the "typhoon" of three years of illegal strikes immediately following privatization, this was a symbolic event that signaled that the era of peace and cooperation had finally dawned. Sticking to their principles, the executive team approached the union and employees from the heart, and their efforts were rewarded.

On December 28, 2007 in the waning days of the year, Doosan carried out a significant change in management. Then Executive Vice President Geewon Park, the man who had spearheaded the company's drive to be a global company, was promoted to president and CEO. The appointment of a top executive with ownership in the company signaled new changes ahead.

03

The Path to Global Leadership

"The company's newly adopted vision is to be a global leader in power and water." This literally represents our commitment to becoming a leading company in the global power and water desalination markets. As we consolidate our position as a global leader in all aspects, including world-class independently developed technology, cost competitiveness, quality, revenues, profitability, human resources training, and corporate culture, we will lead technology trends and marketing in the global market as well as market transformation. We aim to become a global leader that can stand shoulder-to-shoulder with companies like GE, Siemens, and Alstom."

- Excerpt from the inaugural speech of Chairman and CEO Geewon Park

When Doosan achieved its 2009 business goals set back in 2004 ahead of schedule in 2007, management and employee morale soared to new heights. On December 28, 2007, the architect of the firm's emergence as a global company-Executive Vice President Geewon Park-was promoted to President and CEO, opening a new era of management accountability.

A New Vision of Accountability

The inaugural ceremony for President and CEO Geewon Park held on January 2, 2008 doubled as the kick-off meeting for the new year. Presenting his vision and business targets, President Park said, "We have achieved our 2009 order target of KRW 6.9 trillion set in 2004 two years ahead of schedule. We also have largely achieved other long-term objectives, including the transition to an EPC-centric business model, the securing of our leadership position in the Middle East and Indian power markets, entry into the North America and European markets through our overseas subsidiaries, acquisition of proprietary boiler technology, and development of an overseas manufacturing base. Accordingly, we are upgrading our corporate vision and business objectives originally set in 2004 and announcing a new vision and business targets as we aim to become a leading global company."

Doosan's new vision was to be a global leader in power and water, and its new business targets were sales of KRW 17 trillion and operating margin of 10% by 2015, a performance aimed at earning the company a place on the Fortune Global 500. Leveraging proprietary technologies secured through overseas acquisitions, expertise in overseas markets, and global manufacturing and sales networks, the company has generated annual revenue growth in excess of 15%, positioning itself to emerge as a global leader in power and water.

Following his inauguration, Chairman & CEO Park visited the Changwon plant and a string of major construction sites at home and abroad, encouraging employees and challenging them to work together to achieve the new vision and business targets. Executives and staff warmly welcomed the new leader who had spearheaded the company's transformation and growth since its privatization. On January 16, 2008, the company undertook a reorganization to bolster its execution capabilities to achieve the new vision and targets. The Power Business Group was reorganized into product-based business units to secure cost competitiveness in EPC projects and enhance profitability, resulting in the establishment of the Boiler and Turbine/Generator Business Units. The Nuclear Power Plant Business

Inauguration of 18th President & CEO, Geewon Park (January 2nd, 2008)

Plant Visit of CEO Park, Following the Inauguration in 2008

Group spun off the overseas project management department and expanded it as an executive-led organization amidst the growing volume of overseas orders for major equipment for nuclear power plants in China and the US. The Technology Institute expanded(or raised) the Materials Technology Development Team into the Materials Technology Development Center in order to secure platform technology that would be suitable for an EPC player. At the same time, a large-scale personnel reshuffle that promoted executives en masse was also conducted to boost the morale of organizational members. Meanwhile, President Park sent an email to executives and employees soon after the general shareholders' meeting on March 21, commending them on the 2007 business performance. A special KRW 1 million incentive bonus was also paid to each employee on the same day.

Accelerating Three Major Strategies for Global Leadership

Soon after the company's privatization, Chairman Park began consistently pushing three core strategies, focused on upgrading its business portfolio, technological capabilities, and business system. As the major business goals pursued under these strategies were achieved, the company was transformed into a global enterprise and achieved its mid- and long-term goals ahead of schedule. The company needed to adjust and refine its three core strategies to take the next step toward becoming a global leader. The tasks Chair Park presented at his inaugural speech were linked to the company's new vision.

First, with regard to upgrading its business portfolio, Doosan had to strengthen its position in existing markets and enter new ones to expand its market coverage. Chairman Park said the company should continue to create a business structure that strikes a balance between growth, profitability, and stability by attaining growth through the expansion of major EPC projects; increasing the portion of service businesses that can reap high returns, including power plant performance improvement projects; and constantly discovering and developing highly-profitable water projects. In other words, he emphasized that in order for Doosan to become a global leader, the company should continue to create a business structure that helps constantly increase sales and that is stable in terms of securing profitability.

Secondly, Chairman Park emphasized that in order for Doosan to upgrade its technological capabilities, the company needed to secure eco-friendly coal-based power generation technologies such as oxyfuel combustion and post-combustion carbon capture (PCC); develop next-generation power plant equipment; upgrade materials technologies that allow it to generate stable, high profits; and boost technological capacities in future energy fields, including fuel cells. This represents the company's commitment to discover future growth engines through the development of technology for eco-friendly coal-fired power plants that are in tune with global environmental regulations, and the development of future energy technologies backed by confidence gained from the proprietary boiler technologies secured through the acquisition of Doosan Babcock.

Third, in order to upgrade the business system, Chairman Park stressed that the company needed to boost its global support network, including the construction of overseas operations centers to promptly respond to customers and minimize risks and the integration and expansion of the Indian engineering center. He also noted that the company must achieve the optimization of its global capacity to ensure the expansion of new orders and secure as many market opportunities as possible. In order for Doosan to become a global leader, the company needed to advance and optimize its operations in the areas of quality, customer satisfaction, and operations as well as in its global production system.

An Order Boom Follows a Smooth Start

The three strategies Chairman Geewon Park emphasized in his inaugural speech were smoothly implemented. From a market expansion and business portfolio perspective, the company saw orders continue to increase in 2008. New strategies also enabled the company to advance into new markets as well as secure new business opportunities.

In the power field, Doosan won the Gheco One coal-fired thermal project, the largest plant of its kind in Thailand at the time. It also ranked first in the global HRSG market for a second consecutive year. While Doosan Babcock won the Pecem coal-fired thermal project in Brazil, the company's HRSG business entered new markets such as Russia. With the signing of a contract to supply the major equipment for the Yeongwol combined-cycle thermal project, the company also secured the

opportunity to supply gas turbines in Korea, another major accomplishment.

In the seawater desalination field, Doosan won the huge Shuweihat S2 MSF project in Abu Dhabi, UAE and swept two major RO projects ordered in Kuwait and Saudi Arabia, further consolidating its position as the world leader in the field. With these orders, the company emerged as a leader in the RO as well as MSF markets.

The order for six AP1000™ reactors for all three new nuclear power plants ordered in the US was a significant achievement that followed orders for two AP1000™ reactors for China's first third-generation nuclear power plants. With nuclear power plants having emerged as a practical alternative to replace fossil fuel plant amid increasing regulation of greenhouse gas emissions, the acquisition of successive orders in China and the US has made Doosan the biggest beneficiary of the nuclear renaissance.

Attempts were also made to significantly enhance the company's capacity in design and engineering through strategic alliances with leading companies. On September 6, 2008, the company formed a strategic alliance with US-based Burns & Roe, a world-renowned power plant engineering firm. Under this alliance, the company established Doosan Engineering & Services, a specialized engineering firm in New Jersey. In addition to gaining engineering technology and expertise from Burns & Roe, engineers from that company participated in Doosan projects around the world.

The partnership with Burns & Roe enabled Doosan to address problems with securing engineering capacity and manpower, both of which were needed to effectively carry out multiple major projects at once. Through the formation of the partnership, Doosan was now able to stand on equal footing with the world's best engineering firms and poised for greater success in winning new orders. At the signing ceremony, Chairman Park said, "Due to the alliance, the company expects to secure optimized, high-efficiency design capabilities for thermal power plants and diverse additional design data, which will lead to new orders and greater profitability. Through the reinforcement of our engineering capacity, we have laid a foundation for growth that will enable the company to not only take a leap forward in becoming a world-class power company but also contribute to Korea's export of power plants to foreign markets through enhanced capacity."

Two days earlier on September 2, 2008, Doosan signed a technology licensing agreement with Loesche, a German-based specialized maker of pulverizing mills, securing the technology to design and produce pulverizing mills for power plants. Pulverizing mills have a significant effect on boiler performance. Their primary function is to grind coal into fine particles that are smaller than flour and remove foreign substances so that the coal can be easily combusted in the boiler. Through this alliance, Doosan secured the ability to manufacture and supply pulverizing mills for projects in Korea and overseas, resulting in an estimated annual cost savings of about KRW 70 billion.

Desalination Evaporator for Shuweihat S2 in Abu Dhabi, UAE

Strategic Alliance Partnership Formation Ceremony with U.S. based Burns and Roe (September 6th, 2008)

On December 4, the company signed a technology agreement with US-based water treatment engineering firm Carollo, laying the foundation to enter the water treatment field. The alliance was a move for the company to expand its portfolio to the water treatment business and to diversify its markets beyond the Middle East in order to become a total water solutions provider, building on its competitiveness as the world leader in thermal seawater desalination.

Earlier on September 4, 2008, the company signed a technology licensing agreement with and purchased a 15% equity stake in HTC Purenergy of Canada, a leader in power plant carbon capture and storage (CCS) technology. There are three primary types of CCS technology: pre-combustion, oxyfuel combustion, and post-combustion. HTC is considered a leader in post-combustion technology.

Commenting on the acquisition, Chairman Park said, "With our investment stake in HTC, both Doosan Heavy and Doosan Babcock have secured the capability to freely enter the global CCS market for power plants without any restrictions. The strong market potential of HTC's CCS technology will give us an upper hand over our overseas rivals."

Proactive Marketing and Growing Brand Awareness

In 2008, Doosan launched the annual Doosan Match Play Championship, the sole match-play tournament on the Korea Ladies Professional Golf Association (KLPGA) schedule. The company and KLPGA held a signing ceremony on February 29 and agreed to hold the inaugural Doosan Match Play Championship during May 22~24, 2008. The match-play format is not used during regular ladies professional golf tournaments in the US and Japan. Consisting of six rounds of single-hole match play, the championship offers golf fans a chance to enjoy a new style of golf competition.

The first event of the new championship teed off at the Ladena Golf Club in Chuncheon, Korea. With a total of KRW 400 million in prize money at stake, including KRW 100 million for the winner, the championship brought together 64 professional golfers from the KLPGA who vied for the title. At the event, rookie golfer Kim Bo-kyung made a splash by winning the title. Starting with the rise of Kim Bo-kyung, the Doosan Match Play Championship has displayed thrilling competitions and generated unexpected results every year, becoming one of the highlights of the KLPGA tour. Billed as the world's only single-hole match-play competition on a ladies professional golf tour, the first event was a resounding success. The event also achieved success in terms of popularity due to the participation by world-class players, including Grace Park and Shin Ji-ae. The value of the media exposure for the Doosan brand the event generated was estimated to have exceeded KRW 10 billion.

Since 2005, Doosan has conducted a TV ad campaign aimed at recruiting top talent, drawing keen public attention. In addition to playing a major role in increasing public awareness and enhancing the Doosan corporate image, the campaign received a string of advertising awards in 2008. On March 19, the campaign received the “Good Advertisement Prize” at the 16th Best Advertisements Selected by Consumers presented by the Korea Advertisers' Association. One of Korea's most prestigious advertising awards, the award is a special honor since the winners are picked by consumers. In October, the campaign also clinched the Grand Prize in the JoongAng Sunday category of the 44th JoongAng Advertisement Awards hosted by the JoongAng Ilbo daily. Earlier, the company’s corporate PR film won the bronze prize in the promotional video category of the 2008 Mercury Awards, an international ad competition held in New York.

In 2008, Doosan ranked 17th out of the 30 All Star firms of the “Most Admired Companies of Korea 2008,” which elevated its internal and external stature significantly. The companies were selected through a survey of opinion leaders and consumers conducted by Korea Management Association Consulting. However, in September 2008, the company suffered an unexpected setback to this momentum with the onset of the global financial crisis. The company had no choice but to change its trajectory to effectively cope with a dramatically different environment.

The First KLPGA Doosan Match Play Championshi

Overcoming a Global Financial Crisis

Due to the spread of the financial crisis into the real economy and a widening concern over a protracted economic recession, some industrial projects were delayed or cancelled. Amidst this economic slump, Korean heavy manufacturers set their sights on the power and seawater desalination markets to diversify their business portfolios, while Korean construction companies began to enter foreign EPC markets. Global EPC companies had to take losses due to rising raw materials prices and delivery schedule delays. Doosan also faced escalating costs on its EPC projects and project schedule delays due to a lack of resources. This forced the company to focus on operational excellence, pursuing business activities that maximized cash flow. The company also had to internally reinforce its business structure and improve systems to prepare for a period of market recovery rather than maintaining a low profile.

The sense of crisis in the wake of the global financial crisis was confirmed in Chairman Geewon Park’s new year’s speech. “The company is facing unexpected difficulties in its internal and external management environment due to the financial crisis that started in September 2008. We have a situation where some of the projects led by independent power producers in the Middle East are being delayed. We must build a management system to cope with a protracted crisis and focus on cash-generating business activities. Accordingly, our 2009 management plan should be implemented in a way that maximizes cash flow by enhancing operational efficiency to cope with the global financial crisis. At the same time, we must strengthen our business organization and secure growth engines to prepare for global economic recovery.”

Strengthening EPC and Sales Capabilities

On January 22, 2009, Doosan conducted a major reorganization to bolster its EPC and project management capabilities. In order to enhance its risk management capabilities, the company transferred its EPC organization from the Construction Business Group to the Power Plant Business Group. In the Nuclear Business Group, the company divided AP1000™ project management into separate regional teams for China and the US and established an outsourcing team in consideration of order growth and business capabilities. For business units, the integrated sales and project management teams were separated into individual teams. A new wind power technical team was established to accelerate technical development in that clean energy field. The integrated commissioning team and power construction technical team were renamed the EPC project management team and EPC process management team, respectively.

From July 23 to 25, 2009, Doosan held a three-day marketing strategy meeting for the second half

of 2009 with more than 130 executives in attendance, including Chairman Geewon Park, the heads of regional operations and overseas branches, domestic and overseas sales executives, and overseas subsidiary executives. At the meeting, Chairman Park said, “I feel that the company lacks the methods of systematically and scientifically approaching markets. When we examine projects the company has submitted bids for, we find that the company has passively followed market demand in most cases. In order for us to address this problem and approach markets one step ahead of our rivals, we must systematically establish a full-pledged marketing strategy before approaching markets.” He was proposing a proactive marketing strategy where the company would identify customer needs first and then approach them.

Based on this marketing strategy, Doosan conducted a reorganization aimed at strengthening the marketing capacities of the power and water EPC businesses. The key components of the reorganization were the deployment of the sales organizations of the Power Plant and Water Business Groups to the frontlines at overseas branches and the transfer control of overseas branches involved in EPC sales to the respective business group. The Water Business Group also established a Santiago branch to target opportunities in the Latin American market. To bolster EPC project management capabilities, a “projectized project management” (PPM) organization was established within the Power Plant and Water Business Groups and overseas power and water EPC projects handled by the Construction Business Group were transferred to the respective business group. At a dinner with related executives following the reorganization, Chairman Park urged them to pursue marketing more aggressively and proactively on the ground in their target markets.

Marketing Strategy Meeting at Doosan Vina (July 23rd, 2009)

Delivering Remarkable Achievements in Challenging Times

Despite a tough market environment, Doosan posted an outstanding performance in Korea and overseas in 2009. Major project wins included the high-profile Braka nuclear power project in the UAE, the Qurayyah combined-cycle thermal power project in Saudi Arabia, and the Shin-Ulchin 1~2 nuclear power project in Korea.

Doosan also achieved remarkable results in the green energy field. The company completed construction of a 3 MW offshore wind turbine demonstration project on Korea’s Jeju Island. Doosan Babcock successfully demonstrated its OxyCoal™ technology at the world's first 40 MW oxyfuel combustion test facility in the UK as well as an engineering project from a US power utility for the world's largest CCS facility to date.

Doosan Vina in Vietnam successfully shipped power plant and seawater desalination equipment in 2009, positioning itself as a global manufacturing base. Doosan also reorganized its global business system, transitioning to a projectized project management (PPM) organization to improve EPC project management while deploying sales personnel to the frontlines to establish a proactive marketing system.

Improving the Global Business System

Doosan also started to adjust and gradually improve elements of its global business system, an area that was overlooked during the company’s robust expansion. It established the Middle East Operations Center to provide support for major projects in that core market. Tasked with providing systematic support, the center provided worksite engineering and global outsourcing support for multiple projects following the company’s explosive order growth in 2007. The company also established a standard schedule for projects to minimize delivery schedule risk on EPC projects and merged its Indian engineering operations with those of Doosan Babcock to create a single engineering firm.

On May 15, 2009, Doosan held a completion ceremony for the Doosan Vina manufacturing

Doosan VINA Manufacturing Plant Completion Ceremony (May 15th, 2009)

Doosan VINA Manufacturing

plant in Vietnam, a project launched back in 2007. The Doosan Vina plant, which was in partial operation prior to completion, marked its first product shipment on February 23, 2009. The plant hired workers during the construction period and trained them so it would be able to start production immediately upon completion. As a result, Doosan Vina shipped its first boiler on September 30, 2009, just four months after the completion of construction, demonstrating the plant's rapid manufacturing ramp up.

Revving Up the Gas Turbine Business

On November 15, 2009, Doosan shipped its first gas turbine, a 180 MW unit delivered as part of an EPC order from Korea Southern Power for the Yeongwol combined-cycle thermal power project. Gas turbines were one of the company's dream areas from the beginning of its power equipment business. Striving for technical independence through countless successes and failures, the company's successful production of its first gas turbine moved it a step closer to being a global leader in the power equipment field.

Driven by high-temperature, high-pressure combustion gas, gas turbines spin at high speeds, providing the rotational force to drive generators and produce electricity. Gas turbine technology is considered the most difficult power plant equipment technology to master. Only a handful of leading companies have the ability to design and manufacture turbines. The more than 100 gas turbines that have been installed at combined-cycle power plants in Korea to date have all been imported.

In April 2007, Doosan formed a technology alliance with Mitsubishi Heavy Industries (MHI) of Japan and pushed forward with the gas turbine technology transfer. Using the experience gained from the Yeongwol combined-cycle thermal power plant project, the company is now currently in the process localizing every aspect of gas turbine production technology. With new orders for gas turbines expected to total roughly 40 GW per year through 2030 due to ongoing power plant construction, the company has also established an integrated production system covering four large gas turbine models in technical partnership with MHI as it aims to secure a competitive edge in combined-cycle thermal power markets at home and abroad.

Yeongwol Cogeneration Thermal Power Plant Gas Turbine

Completing the Power Plant Equipment

In 2009, Doosan inked another major acquisition deal that opened a new chapter in its history. On September 14 when the world was still reeling from the global economic crisis, the company signed a EUR 450 million contract to acquire a 100% stake in ?koda Power, a specialized power plant equipment manufacturer based in the Czech Republic. The acquisition gave the company access to proprietary technology for steam turbines, a key component of thermal and nuclear power plants.

Founded in 1859, the ?koda Group is the Czech Republic's best-known business group with a distinguished 150-year history. ?koda Power was a major group subsidiary and a world leader with proprietary technologies in the steam turbine field. The company has supplying more than 450 turbines to 62 countries worldwide since starting turbine production in 1904.

After securing proprietary technology for boilers through the acquisition of Doosan Babcock in 2006, Doosan's acquisition of Skoda Power and the proprietary technology for steam turbines that it brought marked the achievement of the company's long-cherished goal of technical independence in power generation equipment envisioned more than 30 years earlier. Doosan was now a global O&M with proprietary technologies in all three core power equipment areas?boilers, turbines, and generators-putting it on an equal footing with leading power equipment companies such as GE, Siemens, and Alstom with a solid foundation to emerge as a global market leader.

Turbine production is a high-tech industry that requires highly advanced technology. The presence or lack of proprietary technology in this field has a significant impact on a company's prospects in the power industry. With its acquisition of proprietary technology for turbines, Doosan expected to boost not only its technological competitiveness but to drastically elevate its overall competitiveness and expand business opportunities in the power equipment field. The company has secured the capability to compete on an equal footing with the industry leaders across the entire power equipment value chain from design, engineering and major equipment manufacturing to power plant retrofit and other value-added services.

Where Doosan previously had to purchase turbines for its EPC power plant projects, the company is now able to manufacture and deliver its own turbines. With a full lineup of boiler, turbine, and generator (BTG) products, the company is also able to compete in the more profitable BTG package market. The company is also now able to enter the 50 Hz steam turbine market, which accounts for 85% of the global market, as well as target opportunities in major power markets in Europe and the US where proprietary technologies are virtually mandatory for market entrance. With the notable exception of China, the company now effectively has the ability to serve customers anywhere around the globe.

Commenting on the acquisition, Chairman Geewon Park said, "The strategic value of the ?koda

Power acquisition is the synergy effect that is expected to boost revenues by KRW 5.3 trillion annually in 2020. Backed by ?koda Power and Doosan Babcock, we will aggressively target Europe, the US, and other developed markets in the coming years."

In February 2010, Doosan established Doosan Power Systems (DPS) by integrating Doosan Babcock and Skoda Power in preparation to enter the European and US power markets in earnest. DPS is a holding company that has an integrated project management system capable of handling power plant marketing and sales, engineering and production, project execution, maintenance and repairs, and performance improvement project. DPS brings together the capabilities of proprietary boiler technology holder Doosan Babcock and proprietary turbine technology holder Skoda Power to serve as a beachhead to enter the European and North American BTG package markets.

Share Purchase Agreement Ceremony of Skoda Power A.S., Czech Republic (September 14th, 2009)

Commenting on the strategy, Chairman Park said, "Going forward, Doosan will refocus on its existing core markets in the Middle East, India, and Southeast Asia, while DPS will focus on the European and North American markets. Our goal is to become a global leader by targeting power equipment markets around the world."

Winning International Recognition for Value Creation

While Doosan had enjoyed praise for its stellar performance since its privatization, it got wonderful news in early October 2009 when it was ranked fourth on the BusinessWeek annual World's Best Companies list.

Commissioned by BusinessWeek, the 2009 World's Best Companies list compiled by global management consulting firm A.T. Kearney, the survey singled out companies with more than USD 10 billion in sales and who earned at least 25% of their total sales from overseas markets in 2008 from 2,500 listed companies worldwide. A.T. Kearney ranked the firms based on sales for the previous five-year period and the compound annual growth rate. In the survey, Nintendo of Japan, and Google and Apple of the US ranked first to third, respectively, while Doosan Heavy and Hyundai Heavy Industries & Construction of Korea ranked fourth and fifth, respectively. Due to the characteristics of the survey, firms that posted constant growth over the past five years from among global enterprises with extensive overseas operations topped the list.

Doosan Heavy posted sales of USD 15.269 billion in 2008, with overseas sales accounting for 70% of the total. It recorded a 34% annual average sales growth and a 26% annual average growth in value creation from 2004 to 2008. The company ranked sixth in sales growth from among the 40 companies, but had the third highest growth rate in value creation as it achieved both quantitative and qualitative expansion. BusinessWeek cited Doosan Heavy as an example of firms that successfully coped with the economic crisis, and pointed to the company's ability to predict the future and agility as the keys to its success. The magazine singled out the company's successful acquisitions of technology and companies, its performance-focused corporate culture, and its business diversification into areas with high growth potential such as nuclear power and seawater desalination as factors behind its growth. A.T. Kearney Korea Partner Myounghoon Jang commented, "Doosan received high marks not only for its financial achievements but also for Chairman Geewon Park's strong leadership, its global management system, and the successful settlement of a corporate culture, and hence will have huge growth potential in the future."

In late October 2009, more exciting news came. Doosan had been ranked second on the Boston Consulting Group's 2009 Value Creators list, which ranked 694 companies in 14 industry groups worldwide based on total shareholder return (TSR). According to the BCG report, the company posted a TSR of 58.5%, ranking second after OCI (73.7%), another Korean enterprise. A high TSR indicates a high potential for long-term growth. TSR is a measure of shareholder value creation and is calculated by combining gains in share prices and dividend rates. Value Creators are firms that are expected to have a higher value in the future than at present.

Doosan Heavy Ranked Fourth by the BusinessWeek annual World's Best Companies List

Leadership in the Spotlight

The leadership of President Geewon Park, who successfully spearheaded the privatization and transformation of the company into a global enterprise, has received high marks not only in the business community but also from academia, media, and the government.

On December 10, 2009, President Park was presented with the Korea CEO Grand Prix at the Korea CEO Research Forum attended by over 130 people from the business community and academia. The winner of the Korea CEO Grand Prix is selected by the Korea CEO Research Forum, which is comprised of some 40 experts, including scholars in economics and management, CEO researchers, certified public accountants, and legal experts. The CEO Research Forum evaluates three-year financial statements and managerial achievements of the CEOs of listed manufacturing companies and financial institutions in Korea based on a CEO performance criterion developed jointly with Seoul National University's Institute of Management Research. President Park was credited for his contributions to the development of the Korean industry by opening an era of KRW 8 trillion in new orders for the company in 2008 with the expansion of new orders through overseas EPC projects. He also drew keen attention due to the acquisition of proprietary technologies through overseas acquisitions beginning in 2006 and the construction of Doosan Vina, a major overseas manufacturing base, among other achievements.

Several days later on December 18, 2009, President Park received the human resources management grand prize of the 2009 Korea CEO Awards jointly hosted by the Korea Economic Daily and the Open Management Research Institute. He was honored for his leadership in spearheading the development of the company into a global enterprise through the development of quality human resources.

In late 2010, President Park was honored with the Gold Tower Order of Industrial Service Merit at the 1st Atomic Energy Day ceremony held at Korea Electric Power Corporation headquarters in Samseong-dong, Seoul on December 27. The Gold Tower Order of Industrial Service Merit is an order presented by the Korean government to citizens who have made major contributions to the development of the nation's industry. It is the highest honor bestowed to entrepreneurs in the industrial sector. President Park played an important role in the first export of a Korean nuclear power plant for the Braka project in the UAE, a project won by a Korean consortium in December 2009. He was also recognized for making major contributions to the construction of nuclear power plants in Korea, the domestic development of nuclear technology, and the export Korean nuclear power equipment.

CEO Park was honored with the Gold Tower Order of Industrial Service Merit at the 1st Atomic Energy Day (December 27th, 2010)

CEO Park was presented with the Korea CEO Grand Prix at the Korea CEO Research Forum (December 10th, 2009)

04

Aiming for the Global Top Tier

"The year 2012, the 50th anniversary of Doosan Heavy Industries & Construction, is a very important year. We must achieve organic growth as we diversify our business portfolio in order to secure new growth engines while we simultaneously maintain our global top-tier competitiveness in our existing businesses."

- Excerpt from 2012 new year's message from Chairman Geewon Park

After wisely weathering 2009, Doosan saw overseas orders once again peak in 2010, a trend that continued into 2011. In 2010, consolidated orders reached a staggering KRW 13 trillion for the first time. In 2011, orders exceeded KRW 10 trillion for a second straight year. The company booked major power and water projects across core markets in the Middle East, India, and Southeast Asia, including the Rabigh thermal and Ras Al Khair desalination projects in Saudi Arabia, the Raipur coal-fired thermal power project and bulk boiler orders in India, and the Mong Duong coal-fired thermal power project in Vietnam. The company also booked major equipment orders for the Braka nuclear project in the UAE and secured the first order for the WinDS3000™ wind turbine system as every business delivered significant results.

Preparing for a Record-Breaking Performance

After delivering solid growth despite the fallout from the global financial crisis, Doosan couldn't hide its expectations for 2010. This is also clearly evident in the 2010 strategic tasks Chairman Park revealed in his new year's address along with a review of the previous year's highlights. "With the acquisition of Skoda Power in 2009, the company secured the long-desired proprietary technology for turbines, putting in place an important foundation for our leap into the ranks of global leaders in the power equipment field. The green energy field also had remarkable results, including the completion of an offshore wind turbine demonstration unit and the successful demonstration of oxyfuel combustion. With production in full-swing, Doosan Vina successfully shipped its first power and water equipment orders, taking its place as a global manufacturing base."

The first strategic task was a focus on improving the company's operating margin, elevating the profitability of the EPC business by effectively completing core improvement tasks and meeting cost targets and shipping schedules.

The second strategic task was improving both order volumes and profit margins through proactive marketing to achieve the best order performance to date by targeting new customers in India, Latin America, and China with the sales organization moved overseas to the frontlines in 2009 and expanding the market base in the EPC and boiler-turbine-generator (BTG) fields.

The third strategic task was putting in place the Doosan Power Systems organization to make inroads into the European and North American BTG markets and maximize synergy from the

acquisition of Skoda Power.

The fourth and final task was accelerating efforts to develop and bring to market renewable energy technologies in the wind power and fuel cell fields in response to increasingly strict CO_2 emissions standards coming into force around the world as well as staking out a leadership position in the carbon capture and storage market.

Combined, these strategic tasks outlined by Chairman Park would pave the way for explosive order growth in 2010 and 2011.

Winning Major Projects in Core Markets

On January 22, 2010, the first good news of the year arrived from Bangalore, India. Doosan signed a KRW 1.2 trillion EPC contract for the Raipur-Chhattisgarh coal-fired thermal power project. The power plant to be constructed in Raipur in the state of Chhattisgarh would have a power generation capacity of 1,370 MW (685 MW × 2 units). The company was in charge of the entire project, from the design of major equipment, including boilers and turbine gensets, to manufacturing, installation, and commissioning.

Commenting on the Raipur project, Power Plant Business Group CEO Dongsoo Suh said, "This project, unlike earlier projects where we only supplied boilers, is the first where we will supply all major equipment, including the turbine gensets. By supplying major equipment produced with Doosan technology, we will make this plant a landmark power station in India." Using this project as a stepping-stone, the company has positioned itself to accelerate its advance into the fast growing Indian power market, which is expected to place orders for new coal-fired thermal power plant projects amounting to 160 GW over the next 10 years.

In February 2010, Doosan signed a contract with the Egyptian government to supply and install two 650 MW boilers for the USD 330 million El-Ain El-Sokhna thermal power project, successfully booking its first power project in the Egyptian market.

In April 2010, the company won its first contract in the South Pacific, signing a USD 120 million contract with Swiss-based mining company Xstrata to build a power plant for a nickel mine in Koniambo, New Caledonia, a location famous for its nickel production as well as its resorts.

In September 2010, Doosan received a letter confirming the award of a KRW 4 trillion EPC project to build the Rabigh 6 thermal power project from Saudi Electricity Company (SEC). With the contract award, the company surpassed KRW 10 trillion in orders for the first time in its history. The Rabigh 6 project was the largest overseas contract for a single power plant won by a Korean contractor. The 2,800 MW (700 MW × 4) expansion project is located some 150 km north of Jeddah, Saudi Arabia's second largest city.

Commenting on the Rabigh project, Power Plant Business Group CEO Dongsoo Suh said, "Amidst global economic instability, we have acquired ample new orders, securing solid growth engine going forward and elevating our position as a global EPC player."

On September 12, 2010, Doosan signed a contract with Israel Electric Corporation (IEC) to supply sulfur dioxide scrubbers for units 1 and 2 of the Rutenberg thermal power plant, Israel. The contract followed another contract from IEC in the first half of the year to supply sulfur dioxide scrubbers for units 5 and 6 of the Orot Rabin plant in Israel. Totaling KRW 200 billion, the orders were significant both for their value as well as the company's first export of wet scrubbers.

On December 10, 2010, Doosan was awarded a USD 1.3 billion contract to build the 1,200 MW (600 MW x 2) Mong Duong II coal-fired thermal power project in Vietnam. Located in Quang Ninh, 160 km northeast of the capital of Hanoi, the power plant would feature industry leading combustion technology from UK-based subsidiary Doosan Babcock to allow the use of local anthracite coal. The project attracted fierce competition from major firms in Japan and China because it was considered to be a stepping-stone to the huge Vietnamese power generation market, which was estimated to be worth roughly USD 17.7 billion with projects representing 23 GW of new generating capacity expected to be tendered through 2015.

A week later on December 17, the Vietnamese government selected Doosan as the technical partner for its coal-fired thermal power plant localization project. The company signed a basic agreement to construct the Quynh Lap I (600 MW × 2) and the Long Phu II (600 MW × 2) coal-fired power plants in consortium with leading Vietnamese construction firm Lilama and the National

Raipur - Chhattisgarh Thermal Power Plant Project Contract Signing Ceremony, India (January 22nd, 2010)

Rabigh II Thermal Power Plant Construction Site, Saudi Arabia

Research Institute of Mechanical Engineering (Narime).

This basic agreement is expected to give Doosan an upper hand in future coal-fired power plant projects in Vietnam. Commenting on the agreement, Chairman Geewon Park said, “Doosan’s selection as Vietnam’s partner has been made possible because the company, since its move into the Vietnamese market in 1995, has been contributing to the development of the Vietnamese economy through projects such as the opening of the Doosan Vina plant. It is our hope that the signing of the basic agreement will contribute not only to the development of Vietnam’s power industry, but also to the promotion of Korea-Vietnam ties and the national interests of both nations.”

On December 29, Doosan signed a KRW 400 billion contract with Korea South East Power to supply boilers for units 5 and 6 of the Yeongheung thermal power project. The 870 MW boilers are the largest in Korea to date along with those installed in units 3 and 4. The company outbid Japanese contractors in the international project tender.

Expanding the Power Equipment Business

In 2011, Doosan secured significantly more orders for power generation equipment such as boilers, turbines, and HRSGs as well as EPC projects than the previous year. This performance was closely related to the company’s reorganization on May 1 and synergies from the new organization. The company integrated the EPC organizations of the Power Plant and Construction Business Groups into the EPC Business Group and established the Power Business Group to promote its equipment businesses?boilers, turbine gensets, HRSG, material handling equipment?as well as service and green energy businesses.

Through the reorganization, the company aimed to create greater synergy between the EPC power plant and equipment business while pursuing the expansion of its equipment business as well as profitable growth. The EPC Business Group, which inherited the plant construction capabilities of the former Construction Business Group, is aiming to maximize the synergies between its organization capabilities, expand the EPC business, and achieve industry-leading profitability. The Power Business Group is aiming to diversify its overseas markets and develop the best products in the business to rapidly respond to the marketplace as well as bringing together the core proprietary boiler and turbine technologies of Doosan Babcock and ?koda Power to make inroads in global markets.

As a result of this reorganization, Doosan won a steady stream of power equipment orders. Starting in May, the company won overseas orders for the Yanbu II thermal power project in Saudi Arabia and Sabarmati thermal project in India as well as domestic orders for the Pocheon combined-cycle power project, Yangju cogeneration project, and Sejong City combined-cycle project.

Opening Up the Indian Market

On January 30, 2011, Doosan acquired AE&E Chennai Works, a boiler supplier for coal-fired thermal power plants, based in Chennai, India from the creditor group of Austria-based AE&E for EUR 20.5 million.

To support the development of the local power industry, the Indian government restricted foreign businesses with no investment in India from participating in local bids. The company's acquisition of AE&E Chennai Works was made in response to this policy and to increase the company’s competitiveness in India. Commenting on the acquisition, Power Plant Business Group CEO Dongsoo Suh said, “We have considered a variety of ways to effectively make inroads into the Indian power market since 2010, including investment methods such as building a new factory, establishing a joint venture company, and taking over an existing equipment maker. Through the acquisition, we have in a short period secured basic infrastructure such as manufacturing facilities and a skilled workforce as well as tender competitiveness.”

Backed by the acquisition of the Chennai Works, Doosan won a power plant upgrade and retrofit contract for the Sabarmati thermal project from Torrent Power Limited, a leading private power company in India, for KRW 60 billion on July 6, 2011. It was the first contract won by a Korean company in the Indian power equipment service sector.

Excluding China, India accounts for 40% of the global power market. India is the largest market for coal-fired power plants in the world and is expected to tender 25 GW of new power projects valued at USD 25 billion every year for the foreseeable future. The value of the acquisition of the Chennai Works was proven once again in February 2012 when the newly renamed Doosan Chennai Works through aggressive localized marketing won contracts valued at KRW 1.5 trillion to supply five 800 MW boilers to NTPC, India's largest state-owned power utility, including three for the Kudgi thermal project in the state of Karnataka in Southwestern India and two for the Lara Power Plant in the state of Chhattisgarh in central India.

On April 7, 2012, Doosan signed a KRW 120 billion contract with West Bengal Power Development Corporation Limited (WBPDCL) for the upgrading of the Bandel thermal power plant. Constructed

Acquisition of AE&E Chennai Works, India (January 30th, 2011)

in 1982, the plant performance had deteriorated over three decades of operations. Scheduled for completion by May 2014, the project will upgrade turbine output by more than 5 MW and boiler efficiency by more than 10% as well as install the latest instrumentation and control systems.

Leading the Desalination Market in Multiple Technologies

In 2009, Doosan did not have many new orders in the area of desalination. However, on September 1, 2010, it was awarded the KRW 1.7 trillion Ras Al Khair seawater desalination project?the world's largest desalination project to date in both value and capacity-by Saline Water Conversion Corporation (SWCC) in Saudi Arabia, reaffirming its global leadership position in market. The daily production capacity of the project will be 228 MIGD, sufficient to meet the water needs of 3.5 million people. Although a competing consortium submitted a lower bid, SWCC selected Doosan as the project contractor based on the company's highly regarded technical and project management capabilities.

On February 7, 2011, Doosan signed another contract with SWCC for a USD 124 million multi-effect distillation (MED) seawater desalination facility project in Yanbu, located 350 km north of Jeddah. The capacity of the distiller will be 15 MIGD, making it the largest single-unit MED desalination facility in the world to date.

The global seawater desalination market is dominated by three major makers: Doosan of Korea, Fisia of Italy, and Sidem of France. Doosan and Fisia lead in the multi-stage flash (MSF) field, while Sidem leads in the multi-effect distillation (MED) field. With the Yanbu MED project, Doosan has proven that it also has the technical and cost competitiveness to succeed in the MED field.

On September 13, 2011, Doosan was awarded a USD 80 million MED seawater desalination project from Marafiq, a state-owned power and water utility. The back-to-back wins provided further evidence of the company's world-class technical competitiveness in the MED desalination field.

Doosan is currently the only company in the world to have both technologies and project experience in all three fields of seawater desalination: MSF, MED, and RO (reverse osmosis).

Marafiq Multi-Effect Desalination Plant Contract Signing Ceremony, Saudi Arabia (September 13th, 2011)

Changing the World Nuclear Power Map

On June 30, 2010, Doosan signed a KRW 4.7 trillion contract with Korea Electric Power Corporation (Kepco) to supply major equipment for the Braka nuclear power project in the UAE. The Braka project includes the construction of four 1,400 MW APR14002™ Generation III nuclear reactors developed in Korea near Abu Dhabi for Emirates Nuclear Energy Corporation (ENEC). Doosan will provide major equipment for the project including the reactors, steam generators, and turbines, all designed and manufactured entirely with in-house technology.

Commenting on the project, Chairman Geewon Park said, "The Korean government and local nuclear industry must join hands to develop the nuclear power generation as a strategic export industry. We will successfully carry out this first export of Korea's standard nuclear power plant and actively contribute to national efforts to expand nuclear plant exports."

Starting with Yonggwang 1, which began commercial operations in 1986, Doosan has supplied or is in the process of fabricating equipment for 23 nuclear power plants in Korea. In the latter half of the 1990s, the company began to make inroads into the Chinese and US nuclear power plant markets. In 2007, it won its first contract to supply AP1000™ reactors developed by Westinghouse for the Sanmen and Haiyang projects, China's first Generation III nuclear plants. In 2008, the company won a contract to supply all six AP1000™ reactors to Westinghouse for the nuclear projects in the US.

Today, Doosan has emerged as a leading global supplier of major equipment and facilities for nuclear power plants by winning competitions against global powerhouses in Europe and the US. The company is now investing to meet rising demand for nuclear plants, upgrading its major equipment manufacturing capabilities from 3.5 units at present to 5 units annually by the end of 2012.

Changwon Nuclear Reactor Manufacturing Plant

Bringing Clean, Green Energy to Life

Doosan began to accelerate efforts to develop and commercialize eco-friendly green energy solutions. On July 24, 2009, Doosan Babcock successfully demonstrated oxyfuel combustion with a utility-scale 40 MW boiler at its headquarters in Renfrew, Scotland. The successful demonstration

paved the way for the construction of green thermal power plants with zero carbon dioxide emissions. The company's OxyCoal™ combustion technology burns coal in pure oxygen rather than air. After combustion, only carbon dioxide and water remain, making it possible to completely capture and store the former, the most common greenhouse gas. Doosan Babcock began development of this technology in 1992. The company successfully developed and built the 40 MW oxyfuel combustion facility with an investment of KRW 30 billion as part of a national research project supported by the British government in 2007.

Low-carbon power generation technology is expected to be required for the operation of power plants in developed countries with the post-Kyoto Protocol coming into effect in 2013. Oxyfuel combustion is a core technology in carbon capture and storage. Although global leaders such as Alstom of France and B&W of the US have been focusing on the development of this technology, Doosan Babcock was the first to successfully demonstrate a utility-scale 40 MW boiler.

Commenting on the achievement, Chairman Geewon Park said, “Research on low-carbon power generation technology has been actively underway around the world, but Doosan Babcock is the first to develop technology that can immediately be put into commercial use. Looking forward, this technical foundation in oxyfuel combustion is expected to give us an upper hand in the low-carbon power generation market.” The low-carbon power generation market is projected to reach KRW 50~60 trillion a year from 2013 and beyond.

Doosan has also made remarkable progress in the wind power business in recent years. The company began development of a 3 MW offshore wind turbine in 2006. Following completion in 2009, a demonstration turbine was built in on Korea's Jeju Island, the first 3 MW wind power plant to be built with domestic technology. Following a demonstration period of about one year where the WinDS3000™ turbine succeeded in consistently producing more than its 3 MW rating, the company acquired international type certification from DEWI-OCC of Germany on March 15, 2011. While the WinDS3000™ was the first Korean offshore turbine to win international type approval, the fact that it was tested onshore left uncertainty about how it would perform in an actual offshore environment. In late 2011, the company began construction of a second demonstration turbine offshore from Jeju Island's Woljeong-ri area. The plant was successfully completed in approximately six months and began operations on June 10, 2012.

Offshore wind turbine systems with capacities of 3 MW and up are major facilities that require a high level of expertise. Only a handful of makers such as Vestas of Denmark and Siemens of Germany complete in the field. The fact that Doosan has succeeded in obtaining international type certification and successfully operated an offshore turbine signifies that the company has secured an important beachhead for its advance into the global wind power market.

In a situation where the Korean market is dominated by turbines from international makers, Doosan's success in securing certification of its proprietary technologies to lay a solid foundation in this new green energy business is particularly meaningful. Since the end of 2010, the company has supplied WinDS3000™ wind turbines to a number of domestic wind farm projects, including the Shinan, Yeongheung, and Tamna projects, as it accelerates preparations to enter the global wind power market.

Doosan also began development of integrated-gasification combined-cycle (IGCC) technology in 2006. With the technology ready for commercialization in 2011, the company signed an EPC contract with Korea Western Power in November to construct Korea’s first IGCC demonstration power plant. IGCC power plants are powered by synthetic gas consisting primarily of hydrogen and carbon monoxide extracted from coal. The gasification technique is so advanced that there are only five demonstration plants in operation worldwide.

Coal is widely available around the world. It is cheaper than crude oil. The world has estimated coal reserves of over 150 years opposed to estimated crude oil reserves of 40 years. For these reasons, developed countries are paying close attention to coal gasification power plants. Globally, the coal gasification market is an untapped industry that is projected to grow into a 400 GW market worth around KRW 1,200 trillion by 2030. In Korea, 15 coal gasification plants producing 10 GW are expected to be constructed by 2020.

For the Taean IGCC demonstration project, Doosan is responsible for the entire gasification plant, including gasifier and syngas cooling equipment manufacturing. The project is scheduled to begin operations in late 2015. Commenting on the project Power Plant Business Group CEO Dongsoo Suh said, “If the Taean IGCC demonstration project proves successful, we expect to build subsequent gasification power plants in Korea as well as export to foreign markets. We are also cultivating offshore wind turbines and fuel cells for power plants as next-generation growth engines.”

Jeju 3MW Offshore Wind Power Generation System, South Korea

Securing Proprietary Technologies for Eco-Friendly Boilers

On November 27, 2011, UK-based subsidiary Doosan Power Systems (DPS), acquired German power equipment company AE&E Lentjes GmbH for KRW 87 billion.

Established in Ratingen, Germany in 1928, AE&E is a global leader in plant engineering and component manufacturing with a significant number of eco-friendly proprietary technologies such as circulating fluidized-bed (CFB) combustion boilers and desulfurization facilities. Unlike traditional pulverized coal boilers, CFB boilers operate at a constant 850°C, a combustion temperature that minimizes the production of pollutants such as nitrogen oxide and sulfur oxide.

At present, the global market for CFB boilers is estimated to be around 4 GW. CFB-based thermal plants are particularly popular in countries that have large reserves of low-grade coals because they support a wider choice of fuels and are economical to operate. Through the acquisition, Doosan Power Systems is now able to tap into developed markets in the US and Europe, both of which are strengthening their environmental regulations, as well as being able to tap into the markets in developing countries that want to make the best use of their low-grade coals.

Panorama of AE&E Lentjes, Germany

Doosan expects to see significant synergies between the CFB boiler technology owned by Doosan Lentjes and the proprietary pulverized coal boiler technology owned by Doosan Babcock, enabling it to offer its clients a full range of efficient thermal power solutions as well as open up new markets such as biomass-fired power generation.

Growing in Stature as a Global Leader

On October 11, 2011, a survey result meaningful to Doosan was announced. The Hankuk Daehak Sinmun (“University News Network”) reported that Korean university students had selected Doosan as their favorite heavy manufacturing company. It was the first time the company had taken the top position since the survey began in 2004. A total of 2,187 college and university students across the nation participated in the survey, the nation’s most respected of its kind.

On October 21, 2011, Doosan was awarded the best Corporate PR award at the 48th Chosun Ilbo Advertising Awards, one of the most prestigious creative ad awards in Korea. The Doosan corporate image ads were previously awarded the Consumers’ Choice Advertising Award by the Korea Advertisers Association in 2008 and 2011. These awards are indications that the company's brand image and corporate value continue to rapidly rise.

On May 23, 2012, Doosan won the Grand Prix at the 10th New Quality Convention hosted by the New Quality Forum and the Korea Economic Daily for its outstanding technical and construction capabilities at home and abroad particularly in the areas of nuclear, thermal, and hydro power plant as well as seawater desalination and water treatment plants.

On July 16, 2012, Doosan was awarded the Excellent Climate Change Competitiveness Company Certificate in the machinery industry category from Korea's Ministry of Knowledge Economy and the Korea Chamber of Commerce.

Today, Doosan is emerging as a global leader not just in sales and profits, but in a range of other areas such as brand awareness, quality, environment, health, and safety, human resources, labor-management relations, employee welfare, partner support, and corporate social responsibility.

Received “2012 New Quality Convention” Grand Prize

Cultivating Work and Life Balance

Doosan has been Korea's fastest growing company over the past 10 years, not only in orders and sales, but also in corporate value. The company has also grown into a truly global company during the past decade. Overseas employees now account for over half of the total, and more than 70% of orders come from overseas markets. As the company prepares to make the next push to top-tier leadership in global power and water markets, employee work habits need to rise to the same level.

With this background, Doosan launched its Smart Office initiative at the beginning of 2011 under the motto “Personal and corporate growth through work-life balance”. This starts with improving work processes to remove inefficiencies and waste, freeing up time that can be invested in leisure and self-improvement, leading to personal growth as well as greater job satisfaction. The initiative has three major components.

The capability development component focuses on creating and executing a systematic development roadmap for each individual based on a comprehensive evaluation of their strengths and weaknesses.

The inefficiency elimination component focuses on streamlining work processes with a focus on work that truly adds value, freeing up at least 20% of each day for leisure time that can be invested in recreation and self-improvement.

The workforce management and system improvement component focuses on creating more efficient working conditions, adopting both core work hour and flexible work hour systems to boost work efficiency.

Doosan also implemented a number measures in 2011 to help the Smart Office initiative take off, including a two-week summer vacation, a shortening of the work day from 8 am to 5 pm, and a five-day winter vacation.

Unleashing the Potential of Production Personnel

On October 1, 2011, the Doosan human resources system underwent a significant overhaul. The company virtually eliminated the titles that had been only applied to blue-collar production personnel and introduced new titles that were almost identical to those for white-collar administrative personnel. Previously, production personnel were classified as employees (Level 6), supervisors (Level 4, 5), and jikjang and gijang, or roughly "experts" (Levels 2, 3). After the overhaul, their titles were the same as administrative personnel with the addition of the term "technical" at the beginning of the title, including technical deputy section chief, technical section chief, technical assistant manager, technical head assistant manager, and technical manager.

Major Korean companies still use titles such as gijeong, gigam, and gijang or jojang, jikjang and gongjang for their production personnel at domestic production sites. These titles are different from those used for administrative personnel and unfamiliar to the general public. Doosan has eliminated this invisible discriminatory wall by unifying titles for all personnel, fostering a sense of pride in production personnel as well as workforce harmony.

Erected in 2011, "Wall of Maestro" was the first of such among Korean corporations." "* Confirmed by picture on page 164, second book"

Not satisfied with just these title changes, Doosan also adopted a career development program for production personnel, enabling them to choose from three career tracks depending on their personal expertise, aptitude, and aspirations. The three career tracks are field manager, technical specialist managerial, and technical specialist. The field manager track is the most common path for production personnel who would like to continue to work on the frontlines. The technical specialist managerial track trains technicians as administrators to help them become production section chiefs, shop managers, and production executives. The technical specialist track helps those who excel in their area of expertise to become "technical masters".

The above changes have succeeded in helping break down social prejudice against blue-collar workers, raise their self-esteem, and eliminate the wall separating them from their white-collar counterparts. Doosan is a pioneer on the path to a fair and equitable society in Korea. Beyond fostering the pride and capabilities of production personnel, the company is also improving their compensation in the belief that these efforts will ultimately result in improved corporate competitiveness.

Changing the Labor Relations Paradigm

In 2012, Doosan marked its seventh consecutive year of labor peace since 2006, a testimony to the transformation of the labor-management relationship that was previously defined by continuous conflict and confrontation. Notably, in 2010, the union and management agreed to comply with the new labor law and recognize the new limit to union leaders' exemption from work. They agreed to actively participate in corporate social responsibility activities to fulfill their respective social responsibilities and earn the public trust. They also agreed to join forces to improve relations with company suppliers to ensure mutual survival and shared growth.

In 2011, the union and management succeeded in concluding collective bargaining negotiations before summer vacation started at the end of July through dialog based on mutual trust. In 2012, they concluded the collective bargaining agreement for 2013 before the end of June, the earliest conclusion of annual negotiations since the company's privatization at the end of 2000. In the agreement, they reached a consensus on extending the retirement age from 56 to 58 with the adoption of a wage-peak system, meaning that employee wages do not increase after the age of 56.

Taking Good Care of Overseas Employees and Their Families

In 2011, Doosan launched Family Doo, a support program for the families of employees dispatched overseas. The program covers support for a wide range of areas such as education, vacations, counseling, and family events.

The program allows employees' children to study English at Yonsei Language Institute at Yonsei

University?one of Korea's top English language schools-every summer and winter vacation. Families can visit employees at overseas worksites and share a vacation at a nearby resort once a year at the time of their choosing. Children can receive counseling for their studies and careers from Wise Mentor, a professional study mentoring firm in Korea. Families can also get psychological counseling from Duo Life, a professional life-counseling firm.

The program also includes celebrations of employee's parents and spouse birthdays as well as employees' wedding anniversaries. The program also operates a 24-hour hotline to take family members to the hospital at any time as well as assist in other urgent matters that may come up.

In January 2012, the company launched the FamilyDoo.com website for employees' families and began offering a variety of services mentioned above.

Doosan has also upgraded the working and living conditions of employees stationed overseas to a level reflecting its position as a global company. Starting with overseas offices opening in 2011, the company now provides the same quality working environment as at the Changwon headquarters. Employees have private accommodations as well as access to a variety of leisure amenities such as "screen golf" golf simulators and table tennis.

Commenting on the Family Doo program, Chairman Geewon Park said, "The number of employees working overseas and living apart from their families has sharply increased with our recent global business expansion....With a commitment to taking care of the families of employees working overseas, the company has adopted a number of thoughtful, lifestyle-tailored support programs."

2012 Collective Bargaining Agreement Signing Ceremony

At present, approximately 800 employees of the 6,000-strong Doosan workforce are working at overseas construction sites in India, the Middle East, and Southeast Asia. Tailored through meetings with employees and spouses, this new family support program is expected to help reduce the emotional burden and difficulties that come from extended family separations.

Libyian Evacuation Spotlights EHS Excellence

In 2011, Doosan faced a critical situation overseas. On January 13, anti-government rallies against the 42-year Gaddafi regime in Libya started in Benghazi and swept across the nation, eventually plunging the country into a civil war. As the situation deteriorated, the company went into crisis mode. It was building the Al Khalij power plant in Sirte, the last coastal stronghold loyal to Muammar Gaddafi about 500 km from the capital of Tripoli.

From the moment anti-Gaddafi forces began to gain momentum, Doosan began methodical preparations for the evacuation of its employees and project workers. As the situation worsened, the company decided to put the evacuation plan into action. However, the planned airlift turned out to be close to impossible under the circumstances. EgyptAir refused to fly charter flights to Libya because of the Egyptian government's opposition and the deteriorating situation on the ground. The safety of Doosan employees and workers hung in the balance.

While persuading the airlines and the Egyptian government, Doosan asked the Korean government for help in mobilizing all diplomatic channels to influence the Egyptian side. With this assistance, the charter flight was finally arranged. The evacuees left Sirte Airport at 4:15 am on February 27 on an EgyptAir charter flight, arriving at Cairo Airport at 6:50 am local time.

From the moment the charter plane landed at Sirte Airport all the way to takeoff, every step of the evacuation was fraught with tension and danger. The Korean government, Korean embassies to Libya and Egypt, Doosan, and Libyan government officials all collaborated in the safe exit. The evacuation was highly regarded as a model of public-private collaboration for evacuation operations. The company's evacuation of foreign workers and local subcontractor employees in addition to its own employees on the same plane also earned it praise for its focus on safety and preserving life.

On March 24, 2011, Doosan presented a plaque of appreciation to the Ministry of Foreign Affairs and Trade for its full support in the evacuation operation. In his comments while accepting the plaque, Vice Minister Dong-seok Min said, "Doosan demonstrated the decency of a responsible global company by evacuating the staff and employees of its subcontractors, foreign workers, and even some Japanese nationals on the charter flight that it paid for in full."

As a result of this experience, Doosan took the opportunity to put in place even stronger employee safety measures at construction sites in areas of conflict to ensure top priority will be given to the safety of staff and workers in future evacuation situations.

On June 28, 2011, Executive Vice President and Head of Human Resources Myung-woo Kim was awarded the Industrial Service Medal at the 2012 Global Green Management Excellence Awards co-hosted by Korea's Ministry of Knowledge Economy and Ministry of Environment. Doosan

Emergency Evacuation of Doosan and Affiliate Personnel from Lybia (February 27th, 2011)

Executive Vice President Myung Woo Kim (Middle) was awarded the Industrial Service Medal at the 2011 Global Green Management Excellence Awards

increased its environment, health, and safety (EHS) staff from around 60 in 2007 to over 130 in 2010 and assigned an executive to oversee the organization. Originally starting out as a single team, the EHS organization now has seven teams, including one for each business group. All domestic construction sites, of which there are currently 30, are required to have an on-site EHS supervisor. To facilitate timely decision-making on environmental issues, the company established the Greenhouse Gas Management Council in 2009 as well as mid- and long-term greenhouse gas reduction targets under the slogan “Green Growth, Green Technology.”

Commenting on the company's environmental commitment, Executive Vice President and Head of Human Resources Myung-woo Kim said, “We apply stricter criteria than global standards when it comes to the environment. We strive to strengthen and keep air and water pollution emissions to less than 30% of the legally allowed standards.”

Sponsoring Excellence in Sports

Doosan began sponsoring the Doosan Match Play Championship in 2008. The popular KLPGA match-play tournament has become one of Korea's most popular golf events as well as major publicity vehicle. In 2010, the company became one of the five patrons of the British Open, the oldest and most prestigious of the world’s four major golf tournaments. This ongoing sponsorship has significantly increased awareness of the Doosan brand in the United States and Europe.

The British Open marked its 150th anniversary in 2010 at the Royal and Ancient Golf Club of St. Andrews. Approximately 250,000 people attended the event, which was broadcast in an estimated 163 countries on BBC and ESPN. Doosan was one of five global companies including Rolex and Lexus who were chosen as the patrons. It was the first opportunity for a Korea-based company to support and promote its brand worldwide through the tournament.

In 2011, Doosan was the title sponsor of the 1st Asian Dream Cup Championship held in Vietnam on June 15 under the auspices of the JS Foundation, a non-profit organization established and run by Korean footballer and Premier League star Ji-sung Park. Commenting on the sponsorship, Chairman Geewon Park said, “The Vietnamese love football. This is basically a charity event designed to help develop youth football in the region. As the largest company in central Vietnam, it’s a pleasure to sponsor the event.” Speaking before the event, Ji-sung Park commented, “It’s an honor to have an excellent global company like Doosan Heavy in the Doosan Asian Dream Cup as the title sponsor of this international charity football match. I will do my best to host a successful event.”

In addition to local football fans, the match between Ji-sung Park’s team of international footballers and NaviBank Saigon was attended by Doosan clients, government officials, and Doosan Vina employees. All had a great time cheering on their teams and enjoying the camaraderie and festive atmosphere.

Pursuing Shared Growth with Suppliers

Establishing “virtuous circle partnerships” with suppliers is the core principle of Doosan's shared growth initiative that aims to strengthen the global competitiveness of both the company and its suppliers over the long term.

Under the “virtuous circle partnership” system, the company will integrate all suppliers into a unified system encompassing technology, quality, and management, enabling them to benefit from ongoing internal programs to strengthen technical capabilities and upgrade business systems. Moving beyond the traditional buyer-seller or contractor-subcontractor relationships, the company and its suppliers are now closely collaborating through an integrated production and supply chain, enhancing the competitiveness of the entire system while generating profits that are shared with suppliers to build even stronger partnerships.

On April 27, 2011, Doosan launched the Doosan Heavy Industries & Construction Cooperation Council, an organization dedicated to shared growth and fostering 200 small suppliers into globally competitive firms, at an inaugural general meeting attended by Doosan Group Chairman Y.H. Park, top executives, and CEOs from the 200 selected suppliers. The company will provide strategic support to these 200 long-term strategic partners through the council, ensuring a broad range of support to help them emerge as strong, globally competitive companies. The company

The Establishment of Doosan Heavy Cooperation Council (April 27th, 2011)

Changwon Community Support Agreement Signing Ceremony (May 23rd, 2011)

set up a taskforce consisting of 72 inside and outside experts in fields such as quality assurance, productivity improvement, and design improvement. Starting in March 2011, the taskforce launched a careful review of supplier capabilities and devised tailored support measures to strengthen their competitiveness. In one instance, the company underwrote the cost of acquiring American Society of Mechanical Engineers (ASME) certification for nuclear component suppliers. The company also underwrote the cost of management consulting firms to help suppliers adopt cost reduction and other business innovation methods to create a system that helps companies sharpen their own competitiveness.

In addition to the above, Doosan promised participating suppliers that it would expand financial support by raising the proportion of cash payments, increasing grants, creating a fund to share growth, and guaranteeing access to credit. In the area of technical support, the company promised to provide advance notice of new orders as well as promote joint technological development and localization. It also promised to support programs in the area of education and training as well as visits to Doosan overseas construction sites to help suppliers expand their global perspective. All told, the company plans to invest KRW 100 billion through 2014 to promote its shared growth initiative.

Making a Difference Locally and Globally

Although Doosan's “Great Love” volunteer service organization had played an active role in the Changwon region since 1995, some argued that the lack of a systematic community outreach program meant that the company wasn't living up to its social obligations as the region's leading corporate citizen.

In 2010, the Doosan Group marked the 100th birthday of the late Founding Chairman Too Pyung Park by establishing a CSR organization and announcing its intention to step up its engagement with local communities. Under the motto "Growth and Self-reliance of People", the group chose to support underprivileged children as its core focus. That same year Doosan Heavy followed the group's lead, setting up a CSR team and embarking on its own community outreach programs. At a ceremony held at Changwon Headquarters on May 23, 2011 attended by Changwon Mayor Wan-su Park and Chairman Geewon Park, the company signed an agreement with the city of Changwon to support community priorities, formally announcing the launch of a number of community initiatives to serve the greater Changwon region.

Doosan’s community service initiatives focus on four general areas, including support for disadvantaged children and youth, educating and training a high-quality workforce, job creation for the young unemployed, and support for city-selected projects. The Great Love service organization was also replaced by the Doosan Volunteer Group composed of over 6,000 employees to better meet the needs of the local community.

Focusing on disadvantaged children and youth, Doosan has pledged to support all 62 children’s daycare centers and 6 orphanages in Changwon, providing annual funding of KRW 500 million to be distributed on a monthly basis to each facility. In addition to this financial support, company volunteers visit the facilities regularly to help children with their studies, take them on field trips, and share a variety of other activities. In 2011, the company helped 300 young students from disadvantaged families with their institute tutoring fees and provided daily necessities to 2,000 households through the Community Chest of Korea and the Korean Red Cross.

Focusing on educating and training a high-quality workforce, Doosan has pledged to provide scholarships of KRW 1 million and KRW 1.6 million, respectively, to 100 middle school and 150 high school students from low-income households in Changwon each year who have demonstrated academic excellence. The company has also pledged to provide scholarships to Changwon Science High School, which opened its doors in March 2011, as well as Changwon Mechanical Technical High School.

Focusing on city-selected projects, Doosan has pledged to actively support projects that will improve quality of life while keeping in character with the company's business portfolio. Commenting on the company's community outreach, Chairman Geewon Park said, “As the Changwon region's leading company, Doosan will offer a wide variety of support and volunteer services for the

disadvantaged. We consider 2011 to be the starting point for our community service initiatives as we aim to become an even more respected and loved corporate member of the community."

Doosan is also hard at work to make a difference in overseas communities. In conjunction with the formal opening of the Doosan Vina manufacturing plant in May 2009, Doosan Vina signed an MOU with Quang Ngai Province and Chung-Ang University Medical Center to offer medical services each year in Vietnam and Korea.

In 2010, a number of Vietnamese children received free cleft lip and palate surgeries, while several adults received free cataract surgeries in 2011. More than 1,000 local residents as well as local hospitals have benefitted from these and other free medical services and donations to date.

Doosan Vina has also awarded scholarships to students majoring in Korean Studies in local universities in Vietnam as well as actively participating in typhoon recovery efforts. In 2011, the company was recognized by Vietnam's Ministry of Planning and Investment for excellence in corporate social responsibility.

An Bihn Island Desalination Plant Support MOU Exchange Ceremony (August 30th, 2011)

In August 2011, Doosan Vina signed an MOU to provide a desalination plant to An Binh Island, an island located 30 km off the coast of Quang Ngai in central Vietnam. The project kicked off on May 4, 2012 and was handed over on August 31, 2012.

The Quest for Organic Growth

While the world was still recovering from the global financial crisis that originated in the US in late 2008, a sovereign debt crisis began in Greece in 2010, spreading across the Eurozone and plunging the global economy into recession once again. Some said that a double-dip recession was very likely because of the lingering impact of the 2008 financial crisis, predicting an extended global recession. Although the power and water industries were expected to grow steadily over the long term, the challenge was to find a way to survive in a global economy where the short-term outlook was uncertain.

In his 2012 new year's address, Chairman President Geewon Park presented a new direction for the company on the occasion of its 50th anniversary. "We must achieve organic growth by diversifying our business portfolio to secure new growth engines while simultaneously maintaining competitiveness in existing businesses."

Chairman Park identified four key tasks in the pursuit of organic growth. First, Doosan will continue to push forward with key corporate-wide long-term initiatives to generate new growth momentum by steadily diversifying its business portfolio. The company will focus on identifying and securing the businesses and core capabilities capable of driving future growth in power, water, materials, and other core fields. Regular Technology Council meetings will play a key role in this.

Second, Doosan will continue to maintain competitiveness in products and technologies in existing core businesses. As it works to secure the growth engines that will drive continued growth, the company will back that up by pursuing organic growth in existing businesses. Given the projected near-term growth slowdown due to the unfolding Eurozone financial crisis and other factors, it is imperative to make inroads in markets dominated by global top-tier players. This is only possible if Doosan products and technologies are on par with or better than industry leaders like GE and Siemens. Toward this end, the company is now fast-tracking an ambitious technical development roadmap to achieve this goal within five years.

Third, Doosan will strive to maximize synergy with overseas subsidiaries by optimizing its global operations. While the company has successfully secured proprietary technologies through the acquisition of a number of quality overseas subsidiaries over the past few years, efforts to generate synergy by sharing those technologies and expanding into new markets have come up short in some cases. Going forward, the goal is to systemize the sharing of proprietary technologies spread across each subsidiary and then use them to develop products optimized for each region so the company can cover literally any global market.

Fourth, Doosan will continue to expand the Smart Office initiative and systematic personnel training programs as the company pursues the Doosan "2G" strategy-Growth of business by Growth of People philosophy of corporate growth through personal growth. The Smart Office initiative will elevate work efficiency, freeing up time that Doosan people can invest in leisure and self-improvement, ultimately creating a better work-life balance. Training programs will be expanded and upgraded to systematically meet the training needs of employees at all levels and stages of their careers. For managers, leadership training will equip them to lead the company and effectively coach their team members. For young, lower-level employees, training will focus on job and management skills.

President Geewon Park Promoted to Chairman

On May 24, 2012, the Doosan Heavy's Board of Directors appointed President & CEO Geewon Park to the chairmanship of both the company and board. Chairman Park joined Doosan Heavy at the beginning of 2001. He successfully led the company through its transition from a state-owned enterprise to a performance- and efficiency-driven private company. His leadership was instrumental in securing a number of proprietary technologies through aggressive overseas acquisitions as well as a remarkable overseas business expansion that has helped the company emerge as a global leader in power and water. Since being appointed president and CEO in 2008, he has presented a new vision and management objectives. His leadership has spurred the company's global leadership strategy, resulting in back-to-back order performances surpassing KRW 10 trillion in 2010 and 2011. As Doosan Heavy marks its 50th anniversary in 2012, Chairman Park has initiated a number of tasks focusing on making the company a global top-tier player from a global operations and corporate culture perspective as well as a growth engine and business perspective.

On May 21, 2012, the company carried out a reorganization to establish a quality management system, strengthen leadership in the Indian market, expand the power equipment business, improve sales capabilities, and strengthen global financial management.

The "Doosan Way" Points the Way for the Next 100 Years

From May 7 to 9, 2012, the Doosan Group held a three-day Doosan Way Workshop at the Shilla Hotel in Jeju, Korea with Doosan Group Chairman Yongmaan Park, Doosan Heavy Chairman Geewon Park, CEOs from all Doosan subsidiaries, business group CEOs, and division heads in attendance. The workshop was convened to introduce the Doosan Way to the leaders of the company, build consensus, and commit to top-down change. The Doosan Way is the values and philosophy that has sustained the Doosan Group for more than ten decades and will guide it through the next.

The workshop placed special emphasis on the Doosan Credo, the set of values at the heart of the Doosan Way and the inherent characteristics of "Proud Doosan People" who put those values into action. Discussion and case studies followed. The workshop concluded with a pledge ceremony where the participants promised to change themselves and play the role of vanguards for corporate change. Doosan Chairman Yongmaan Park presented the participants with 3-minute hourglasses as gifts, encouraging them to cherish every minute they have.

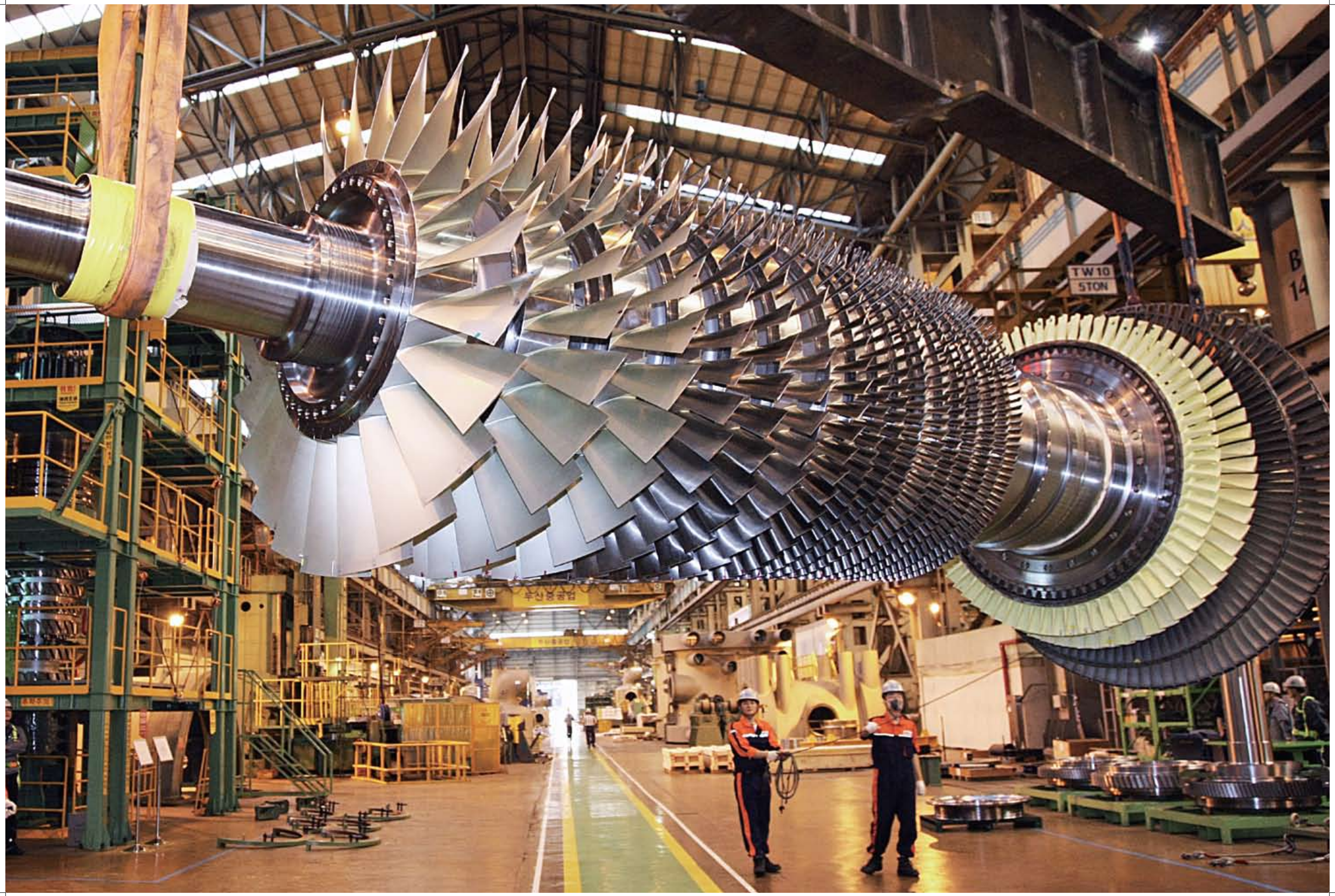
Doosan Way Workshops were held for executives in May and June 2012 before being expanded to group subsidiaries.

Doosan Way Workshop

Part 02

THE ELEMENTS OF A GLOBAL VALUE CREATOR

POWER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DOOSAN
DOOSAN

POWER

THERMAL POWER

Growth to EPC Player from the Ground up

"Doosan Heavy Industries & Construction is a company specializing in power generation, which is one of the key industries for Korea. Doosan has built Korea's energy infrastructure through the consolidation of innovative energy generation technology. Members of Doosan's Power Business Group take great pride in the rapid growth into a global leader in power generation. At the core of Doosan's global competitiveness is its organizational strength and ability to swiftly adapt to new conditions. Catching up to the rest of the world necessitated the development of key advantages that the competition lacked. With its swift but prudent decision-making and efficient organizational structure, Doosan has surprised global competitors by rapidly adapting to the world's needs and surpassing all expectations in record time. Clients are repeatedly amazed by Doosan's ability to bring to meetings new insight pertaining to issues discussed just the previous day. As a newcomer to the industry, Doosan was able to overcome the competitive gap with its flexibility, and being able to make quick key decisions has proven to be a major advantage in marketing and sales. Since the privatization, Doosan's focus on human resources development, well-timed investments and aggressive M&As have allowed the development of a unique strength that we can call our own. These are the factors behind our success.

- Excerpt from an interview with Dongsoo Suh, CEO of the Power Business Group

The Birth of the Company
- Starting From Scratch

Doosan has been in the power generation business since the 1970's, when no one in Korea knew how to build a power plant. Since then, the company has been contributing to the growth of the power generation industry by building most of the nuclear and thermal power plants in the country. Through the development of proprietary technology, Doosan has built power systems for both domestic use and for foreign export. After years of competing with global industry leaders in foreign markets, today, Doosan stands shoulder to shoulder with them.

Doosan's First Project (1976)

Doosan first started building power systems in 1976 by manufacturing heat recovery boilers for the Gunsan and Yeongwol Combined Cycle Power Plants with technology provided by CE. Since Doosan lacked the technology and experience, CE provided both technology and assistance to help Doosan get on its feet. Through much painstaking effort, Doosan finally managed to successfully build their first boiler, an experience that would be the first of many.

After learning the basic boiler manufacturing technology, Doosan worked its way towards obtaining quality certification from ASME (American Society for Mechanical Engineers). In September of 1977, it managed to obtain ASME Quality Certification for six different categories, all necessary for manufacturing boilers and auxiliary facilities. They were Doosan's first international certifications for power systems, and were achieved in a relatively short period of time.

Doosan's boiler technology was rudimentary at best and required a relatively simple manufacturing process. Doosan would manufacture steam drums, superheaters, evaporators, and economizer headers, assemble them into steam drums and headers, which were then fit together with fin tubes supplied by CE.

However, Doosan wanted to do more than just manufacture and assemble components, and so on February 15, 1977, it signed a boiler technology transfer agreement with CE, through which it established a basis for manufacturing power plant systems. In 1978, Doosan built a boiler

production facility at Changwon plant. However, despite obtaining the technology, Doosan lacked the human resources and the intellectual knowledge base to understand the technology. The few experienced people that Doosan did have only knew how to operate boilers, and not how to design and manufacture them. In the end, they realized that the only way to close the gap was to send their people to CE and have them learn the necessary skills hands-on.

On July 20, 1978, Doosan received an order from KEPCO for the procurement and installation of boilers and auxiliary facilities for the Nam-Jeju Thermal Power Plant Units 1 & 2. It was Doosan's opportunity to become the first in Korea to build power plant boilers. So right after signing the contract, the company notified CE of the project and asked them for their assistance in the technology transfer. Due to certain circumstances in the U.S., CE instead issued a subcontract to their technical partner, Japan's Mitsubishi, for engineering and production of certain boiler parts. So Doosan ultimately gained experience in the production of boiler parts with the help of Mitsubishi, while also learning the operation and characteristics of all the manufacturing facilities of the boiler factory at Changwon plant. After that, Doosan signed a contract to supply the main thermal systems for the Seocheon Thermal Power Plant Units 1 & 2, the first large-scale non-turnkey project in Korea. Doosan signed another contract to manufacture and supply turbine generators and auxiliary boiler systems for the Samcheonpo Thermal Power Plant Units 1 & 2. It was the perfect opportunity for Doosan to build experience in building power plant systems. The Samcheonpo Units 1 & 2 were the largest thermal power stations (560MW X 2 Units) in Korea, and it was an EPC (Engineering, Procurement and Construction) project in which Doosan carried out in its entirety.

Obtaining Fundamental Technology

In 1981, having become competitive in boiler manufacturing, Doosan was ready and eager to develop fundamental technology to compete in the global market. To bolster manufacturing, Doosan's Boiler Business Unit organized a team dedicated to obtaining additional ASME Quality Certifications. With assiduous research and practice, the team managed to obtain 5 more certifications by May of 1982. From 1982 to 1985, Doosan continued to obtain technology from leading OEMs. During these years, the company's engineers learned every aspect of the design, engineering and performance of drum-boilers. At the time, Doosan had not yet experienced building large power stations, but was nonetheless able to develop it by applying and modifying the technology and experience obtained while producing small to medium-sized industrial and cogeneration boilers. During the early 1980s, KEPCO did not build additional power plants, and so Doosan's focus shifted to the power generation projects of private companies. Starting from the boilers for Lucky Corporation's Naju Factory in September of 1984, Doosan won many contracts, including a few contracts from Korea Energy Management Corporation to build a total of five boilers for the CHP (Combined Heat and Power) Plants in Mok-dong and Sinjeong-dong in December 1984. In April of 1985, Doosan demonstrated its technical stability by supplying boilers to the CHP Plant of Shinpoong Paper. In August 1985, Doosan was awarded a contract from Dongyang Nylon to supply coal-fired boilers to their CHP plant. It was the company's first attempt to build a coal-fired boiler from scratch by using its own technology.

By executing these projects, Doosan significantly upgraded its technology in the areas of manufacturing and engineering, to the point that it could manufacture pulverizers, coal burners, oil burners, sludge burners, and auxiliary equipment with its own technology. In the area of engineering, Doosan acquired capabilities in boiler performance designs, basic designs for steel boiler structures, and basic designs for combustors. Doosan was even able to successfully commission a coal-fired boiler, despite its employees' lack of knowledge in coal-fired boiler operation. Most encouragingly, with the ability to carry out entire turnkey boiler projects, Doosan had established a strong footing to enter foreign power plant markets.

Mokdong - Sinjeongdong Cogeneration Project Completion Ceremony (November 28th, 1987)

Technological Independence
- Made in Korea and Domestic Market Domination

Doosan has continued to obtain technical data and send its engineers overseas for technical training with the cooperation of technical partners since the mid 1980s. Doosan's ambition for technological independence was realized in the area of boiler production. The company showed that it was capable of building boilers for combined heat and power plants as well as drum-boilers for Samcheonpo Units 3 & 4, and also proceeded to import manufacturing technology for once-through boilers through a technical partnership with Sulzer of Switzerland in 1989. The once-through boilers were to be used for the first time at the Korean standard Boryeong Thermal Power Plant Units 3 & 4. With this, Doosan had the boiler engineering technology for making just about every type of boiler, ranging from industrial boilers to heat recovery boilers, drum-boilers, and once-through boilers.

Boiler Export

After being recognized for having accumulated technology through years of designing and manufacturing power plants and industrial boilers in Korea, Doosan was awarded a contract from CE of USA to make boiler pressurizers for the Honolulu Project assigned by Hawaiian Electric Company on January 31, 1986. One month later, Doosan found itself exporting more boilers by winning a contract with the Dubai Water & Electricity Authority of the UAE to make heat recovery boilers for the Jebel Ali Power Plant. In May of 1987, Doosan received a contract from CE to build pressurizers for CFB (Circulating Fluidized Bed) boilers ordered by North Eastern Power USA. It was a great opportunity for the company to learn about CFB boilers.

In 1984, when people started paying attention to pollution, CFB boilers became the most popular type of boiler worldwide due to its drastically reduced carbon dioxide and air pollutant emissions. Therefore, Doosan joined the race to build the more environmentally friendly CFB boilers by signing a CFB technology transfer agreement with Lurgi of Germany on September 23, 1987, and its team of engineers managed to learn the basics of the technology through a technical training session that took place in Germany in early 1988. Doosan started taking interest in CFB boilers after receiving orders to build pressurizers for such boilers. And by August of 1989, the company signed a CFB supply contract with Korea Zinc since it was fully capable of building CFB boilers after a year of technology implementation and overseas technical training of engineers.

In November of 1993, Doosan was awarded a contract by SWCC (Saline Water Conversion Corporation) of Saudi Arabia to supply boilers to the Shuaibah Power Plant. Bechtel of USA (auxiliary facilities, construction, and installation), ABB of Switzerland (turbines), and Doosan (boiler) formed a consortium to join the bid, and were chosen over Mitsubishi of Japan and Alstom of France to build a 565MW power plant boiler and desalination facility. By carrying out this project, Doosan joined others in leaving a mark in the history of power generation.

At the time, Doosan formed a separate consortium for building boilers to participate in the Shuaibah Project, and carried out every process, including estimation, contract binding, manufacturing, test run, and performance assurance. Doosan made full use of the opportunity to secure boiler technology, and increased its chances to export boilers in the global market.

Shuaibah Desalination Plant Construction Contract Signing Ceremony, Saudi Arabia (November 2nd, 1993)

Building Korean Standard Thermal Power Plants

Doosan could not have exported power plant equipment in the early 1990s without having built experience by carrying out a number of major power plant construction projects in the late 1980s. Not a single thermal power plant was built for 10 years since Boryeong Units 1 & 2 were equipped with main equipment in September of 1979. And it wasn't until March of 1989 when a contract was signed to supply power equipment to the Boryeong Thermal Power Plant Units 3 & 4.

Doosan was awarded a turnkey contract to build the first Korean standard thermal power stations, Boryeong Units 3 & 4. As a result of research and discussions with KEPCO, once-through boilers were chosen as a Korean standard as well as for Boryeong Units 3 & 4 in 1985. After choosing the type of boiler to be used, Doosan signed a technical partnership agreement with Sulzer Brothers of Switzerland for proprietary technology transfer in August of 1989. It was yet another challenge for

Doosan since it did not have any experience designing and building once-through boilers. Despite it being a different type, Doosan was able to adapt its top-notch fundamental technology with relative ease.

In November of 1989, when the construction of Boryeong Units 3 & 4 was ongoing, Doosan signed another contract to build drum-boilers for Samcheonpo Units 3 & 4. Just as in the case of Boryeong Units 3 & 4, Doosan had enough technology to design and manufacture all boiler parts and auxiliary facilities from scratch for Samcheonpo Units 3 & 4. In the project, Doosan came up with the first Korean standard coal-fired boiler. Doosan continued to invest in the development of manufacturing and engineering technology. As a result, the company was able to manufacture all the thermal power plant equipment except the control systems and a few other parts.

Boryung #3 and #4 Thermal Power Project Contract Signing Ceremony (April 15th, 1989)

Since then, Doosan has kept supplying domestic power plant equipment, such as heat recovery boilers for Boryeong Thermal Power Plant Units 5 & 6 and Seo-Incheon Combined Heat & Power Plant in May 1990. It continued to win more supply contracts for Taean Thermal Power Plant Units 1 & 2 in September 1991, Taean Units 3 & 4 in March 1993, and Hadong Units 1 & 2 in October 1993. The market for Korean standard thermal power systems was booming.

Implementation of Turbine Generator Technology

Developing turbine generators had always been on the agenda for Doosan, since it is one of the main power plant equipments along with the boilers. Doosan signed a technology transfer agreement with GE in November of 1976 so it could adopt the technology and learn to manufacture turbine generators. Since then, Doosan has been making preparations to manufacture turbine generators, one of which was to form the Turbine Team and Generator Team.

In 1979, Doosan signed a contract with KEPCO to supply Samcheonpo Units 1 & 2 with turbine generators. Doosan engineers did not have any knowledge in making turbine generators when they started learning the skills from GE, and so they began by building oil tanks. Although they had enough practice in building turbine generators, particularly after supplying them to the thermal power stations on the west coast, they could not even dream of making the main power systems. As a testament to this fact, only 20.3% of the Samcheonpo Units 1 & 2 and 27.8% of the West Coast Stations were built in-house.

Doosan later signed as a subcontractor to Westinghouse, for the supply of the LP roter casing, MSR, and oil tank for the turbine generators to be fit at Yeonggwang Units 1 & 2, but the core technology was still off limits to Doosan. It wasn't until 1981 when Doosan finally had the chance to learn how to design a turbine generator. It was a subcontract with Alstom, which was the main contractor in charge of supplying turbine generators to the Uljin Nuclear Power Plant Units 1 & 2, since the contract included a design training program. Unfortunately, the deal was limited to learning how to design parts and not the whole generator. Still, the experience of building turbine generator parts for Uljin Units 1 & 2 helped Doosan greatly in improving turbine generator technology, as 40% of the turbine generator was now designed and built by Doosan.

Developing Independence in Turbine Generator Technology

In January of 1985, Doosan signed a TAA (Technical Assistance Agreement) with GE for manufacturing main power generation systems, including turbine generators, and its team of engineers was sent to GE for a engineering training program in May of 1986. In the program, 25 engineers of 21 different areas of turbine generator engineering were trained by GE engineers on the designing process, method, and related theories for a period between three and 12 months.

With the assistance of GE engineers, those Doosan engineers who took the training program at GE were able to test their newly acquired skills in the Yeonggwang Units 3 & 4 Project awarded by KEPCO in 1987. The engineers also took a mock test from 1989 to 1990 to prove their engineering skills. After many trials and errors, they came up with the final drawing and took the company a step closer to obtaining the capability to design turbine generators on its own. Their efforts aimed at gaining technological independence finally bore fruit in the Uljin Nuclear Power Plant Units 3 & 4 Project for which the contract was signed in 1991. Uljin Units 3 & 4 were the first nuclear power stations to be equipped with the first turbine generators ever designed by Doosan. Doosan was able to design the generators based on the experience, technology, and data gained through participating in the Yeonggwang Units 3 & 4 Engineering Project. The company even had one of GE's engineers as a full-time engineering consultant resided at the Changwon plant for two years. Doosan kept a close relationship with GE so it could learn more advanced engineering skills, all the while sending more of its engineers overseas to get trained and receive various engineering data and programs. As a result, Doosan finally was able to design turbine generators on its own by the mid 1990s.

Doosan continued to carry out its plan to make all turbine parts including the turbine rotor and bucket, for which the technology had not been accessible to them because foreign companies refused to transfer their technology. The company implemented the project one step at a time, starting from Yeonggwang Units 3 & 4. Doosan was able to improve its skills by winning turbine generator contracts for the Boryeong Thermal Power Plant Units 3, 4, 5, and 6, Samcheonpo Thermal Power Plant Units 3 & 4, and Wolseong Nuclear Power Plant Unit 2. In particular, in the project of building a turbine for Boryeong Unit 4, Doosan enhanced its competitiveness in turbine engineering by successfully accomplishing the precision finishing of a high pressure turbine rotor and assembly. With this, Doosan was now at the stage where it could carry out all the processes of manufacturing turbine generators with all the parts, and established a system for manufacturing and testing of all the turbine parts with the completion of the Balancing Factory in 1994.

Technological Independence and Privatization

By the early 1990s, Doosan was superlative to other Korean companies in the construction of thermal power plants. After Boryeong Units 3 & 4, Units 5 & 6 were commissioned. While Boryeong Units 5 & 6 showed strong operating performance, Doosan also built Taean Thermal Power Plant Units 1, 2, 3, and 4 and won the Dangjin Thermal Power Plant Units 1 & 2 Project. By this time, Doosan had the ability to build all thermal power plant equipment, except for the control systems. In 1996, Doosan demonstrated its technological prowess once again by completing the 500MW Korean standard thermal power stations, Taean Units 1 & 2.

In November of 1996, Doosan won the contract to construct Korea's first 800MW thermal power plant, Yeongheung Units 1 & 2, based on their technology and price competitiveness. Winning the Yeongheung Thermal Power Plant Project was regarded as the result of Hanjung's 30 years of technology accumulation and quality management. It was also proof that the company was very capable of managing projects, particularly since it had already built dozens of power stations, and it was also highly competitive in terms of price and project implementation.

Yeongheung #1 and #2 Thermal Power Project Construction Site

The year 1999 saw the completion of a number of small and large power plants in which Doosan played a major part. The highlight was Hadong Units 3 & 4, the 500MW Korean standard coal-fired thermal power stations for which Hanjung supplied main materials and system installation services. Equipped with high-tech, highly effective, and a safe pollution prevention system along with others made with the latest technology, Hadong Units 3 & 4 were recognized as environmentally-friendly power stations.

After the privatization, Doosan set up effective management strategies to become a global company and improve competitiveness in the main business of building power plants.

Domestic Power Market Domination Strategy

Right after its privatization, Doosan was put to the test in the area of power plant construction. After the establishment of the WTO in 1996, the Korean power generation market was open to the world and the method of bidding for thermal power plant construction projects changed from private to open international bidding. Furthermore, the Korean government divided KEPCO into six different power companies in accordance with the power industry privatization policy. As a result, the method of marketing also changed so that each of the companies could set up its own sales organization and cope with a wide range of technical standards of its preference.

As for Doosan, it chose the strategy of maximizing its strong points according to the changing environment. In the bidding process, Doosan had its Marketing Team focus on collecting relavent data by using its network and had its Technical Team draw up measures to ensure price competitiveness for each project. Doosan also had them find a suitable purchasing price in order to cut down the cost, therefore achieving good results from the bidding. Efforts were poured into cutting down the cost and secure competitive price advantages. In particular, aggressive operational improvement (OI) activities such as DTC (Design to Cost) and PSM (Purchasing & Supply Management) carried out since privatization had greatly helped in cost reduction.

As a result of such efforts, Doosan was awarded a number of contracts, starting from the Dangjin Thermal Power Plant Units 5 & 6 to Taean Units 7 & 8 and Dangjin Units 7 & 8. Doosan ended up dominating the domestic power plant market by winning most of the power plant contracts issued in Korea, delivering boilers and other power plant equipment for Yeongheung Units 3 & 4 and Hadong Units 7 & 8.

Globalization
- Power Plant EPC, the Growth Engine

Despite the opening of the domestic power plant market, Doosan still managed to compete and win against leading foreign companies, and dominated the domestic market in the process. It was around this time when Doosan predicted that the domestic power plant market would be saturated after 2005, so they began to expand their reach in the global market. For Doosan, the driving force behind globalization and explosive business growth and the key to building a reputation in the global market among leaders in power plant systems were EPC projects. EPC projects was Doosan's powerful growth engine, particularly in the area of building power plants.

Chairman and CEO Geewon Park said, "We had to move out of the saturated domestic market and focus our energy on winning the overseas EPC projects in which the contractor is expected to provide everything from design to engineering and system production/ installation/commissioning. As a result, the ratio of our overseas projects rose from 30% in 2001 to around 70% in 2008. Clients preferred issuing EPC contracts. In the case of the Middle East, they often issued contracts in which the contractor was required to build both power and desalination plants simultaneously, and Doosan was the only company in the world that could build power and desalination plants simultaneously." He added that winning the EPC contracts played a pivotal role in becoming a global company.

A Powerful Growth Strategy for Power Plant EPC

Exports accounted for only 30% of total sales for a few years after privatization, so Doosan needed a new growth strategy in order to increase exports. The management board took notice of the EPC (Engineering, Procurement and Construction) contracts, according to which the contractor was required to carry out every aspect of the project including designing, manufacturing, installing, and testing the systems. The EPC was the preferred form of contract for clients, particularly those in the Middle East, since they often issued power and desalination contracts concurrently. With a large production plant in Changwon and over 30 years of experience under its belt in the production of power and desalination systems, putting effort into winnng EPC contracts was the best strategy. Although the EPC projects came with a big risk, most of them were of large scale. Thus they would surely help the business grow.

Since 2004, Doosan had the strategic goal to "improve the business portfolio", and has been trying to become an EPC contractor instead of simply manufacturing and supplying unit products mostly for the Korean market. To improve its EPC capabilities, Doosan hired some of the most skilled engineers in Korea and overseas and also created a new position called CTO (Chief Technology Officer). As such was the case, Doosan focused on technology development and vowed to develop the capabilities necessary to build both power and desalination plants.

When they were awarded a USD370 million 'Boiler Island' contract by the NTPC (National Thermal Power Corporation) India in April 2004 to build the Sipat Thermal Power Plant, Doosan knew they were in for smooth sailing. In the open bid, Doosan had to compete with a number of leading power plant builders from the US, Japan, and Europe. Of note, it was to be the first thermal power plant in India to be equipped with a supercritical boiler, for which the global demand was increasing due to its cost effectiveness and stability in operating the power plant. But the problem was that it was the latest model, and therefore only a handful of companies in the world had the technology to build it.

Sipat Thermal Power Plant Project Contract Signing Ceremony
(April 16th, 2004)

Becoming an EPC Contractor

Doosan went through a reorganization and management reshuffle in May of 2005 in order to facilitate more proactive global marketing. Thanks to the hike in oil price, Middle Eastern countries launched more SOC projects particularly in the areas of power generation and desalination, while China, India, and the Southeast Asian countries focused on economic development and infrastructure expansion. So Doosan consolidated its Thermal Power Business Group and TG Business Group into the Power Plant Business Group, giving the business group more power to tap into these markets. Doosan also integrated sales, business management, A/E, and services into one division for a more

comprehensive management of power plant business marketing and management. The HRSG team was also reorganized into the HRSG Business Unit to become more specialized. In addition, the domestic marketing and service teams were also combined into one.

The main goal of the 2005 reorganization was to grow out of the business model focused on system production and implement an EPC business structure in which intangible assets such as engineering and construction are effectively utilized.

Furthermore, Doosan was well aware that the EPC projects were not something that could be carried out by a single business group, but required the concerted effort of all business groups. Therefore Doosan needed all of its business groups and units to work as a team in order to carry out the EPC projects successfully through overall optimization of the process. In the past, the marketing team would take the lead in carrying out a project with the support of A/E. This had to change. Management, construction, and commissioning now participated in the project early in the process of project to minimize risk. At the same time, Doosan also improved its decision making process in the course of reorganizing the company. Other goals of reorganization were that project managers would play a bigger role with more authority throughout a project and strengthen the capabilities of commissioning the plants built in other countries by improving the management of subcontractors and organizing a commissioning team.

Development of Proprietary Boiler Technology and EPC Business

While a corporate-wide effort was being made with the aim to start a power plant EPC business, Doosan acquired a large company in the second half of 2006, greatly increasing Doosan's position in the global power plant market.

In September of 2006, Doosan took over Mitsui Babcock of the UK, along with proprietary technology in boiler engineering. Right after making the first step in the power plant market in 1976, Doosan sent its engineers to GE to learn skills. 30 years have passed since, during which Doosan has gained knowledge and developed manufacturing technology through many trials and errors. Nevertheless, Doosan was still far from obtaining proprietary technology in boilers. The M&A was a solution to this problem. The acquisition of Babcock gave impetus to Doosan's overseas EPC projects. Doosan was already well recognized for its manufacturing and marketing in the global market, while Babcock was a leading player in the areas of engineering and power plant services. The combination of the two companies was sure to bring a substantial synergy effect.

Becoming an EPC Market Leader

Starting from the end of 2006, Doosan started winning a number of large EPC projects soon after the full implementation of the EPC system and amid the expansion of the power plant industry in the Middle East and Asia.

Orders started pouring in from December 2006, starting from a USD500 million contract to build a private desalination plant in the second phase of a project in Barka, Oman and a USD170 million project to build the Al Taweelah Combined Cycle Power Plant A10 for the UAE. In January of 2007, Doosan received a USD160 million order from Thailand to build a coal-fired power plant in Glow, followed by two more in February: the Amman East Combined Cycle Power Plant with a contract value of USD200 million placed by the government of Jordan and a USD150 million project to build a combined cycle power plant in Daharki, Pakistan. In March, the Dubai Water and Electricity Authority of the UAE issued a USD1.14 billion contract to build the Jebel Ali M Phase 1 combined cycle power plant with an output of 1,330MW. It was the largest power plant ever to be built by a Korean company in a foreign country. Jebel Ali, a port town located southwest of the city of Dubai, is where an array of power stations have been built one after another since the 1980s to meet the rapidly increasing demand for more electricity in Dubai as a result of its rapid economic growth. It was the single largest power plant ever ordered by Dubai, and also the last combined cycle power plant to be built in the town.

Doosan continued to sign more contracts with a value of over KRW 1 trillion. One of them was the contract issued by India in May to build the world's largest coal-fired power plant in Mundra for a total of USD1.22 billion. The Mundra Coal-Fired Thermal Power Plant was to have a total output of 4,000MW (800MW × 5 Units), and it was the largest contract Doosan ever signed in corporate history. This meant that the company's record was replaced in just two months, since the Jebel Ali was the largest project prior to this. Until then, the world had never seen a 4,000MW thermal power plant that called for the simultaneous construction of five 800MW power stations. Doosan was awarded the Mundra Power Plant Project mostly because of its experience of having built a 800MW thermal power plant in Korea, along with the technology and project management capabilities it had demonstrated in the course of building India's first supercritical thermal power plant.

Other major contracts included the USD500 million project to build a 700MW coal-fired power plant in Cirebon, Indonesia, for which the contract was signed on September 18, 2007. In 2007, Doosan's sales reached over KRW 8 trillion, a figure the company wished to achieve in 2009, as stated in its mid-term goal set in 2005.

The Booming Market for Power Plant Services, at Home and Abroad

Power plant retrofit services have always been a highly lucrative business, but only for those global players with proprietary technology in boilers, turbines, and other main power equipment. Although Doosan had been supplying main equipment to most of major power plants in Korea for decades, it was not until 2002 that it actually started providing retrofit services. Starting with the coil replacement work for the Uljin Nuclear Power Plant Units 1 & 2, Doosan started building experience in this field by providing turbine generator refurbishment services for the Gori Nuclear Power Plant Unit 1, Boryeong Thermal Units 1 & 2, Seocheon Thermal Units 1 & 2, Seo-Incheon Combined Cycle Power Plant Units 3~8, and Ulsan Thermal Power Plant Unit 5.

After years of experience providing such services, Doosan was awarded the Boryeong Units 1 & 2 Project, which was the first 500MW power plant retrofit project in Korea. And in December of 2007, Doosan also won an overseas contract to retrofit the Eraring Power Plant in Australia, which marked the beginning of the company's overseas power plant retrofit business. Doosan continued to repair and refurbish power plant equipment, such as the low-pressure turbines for Uljin Units 1 & 2 in 2008 and Yeonggwang Units 1 & 2 in 2010. Its overseas marketing efforts paid off as well, when Doosan became the first Korean company to provide power plant retrofit services for India in July of 2011. In June 2011, Doosan also signed a 5-year O&M (Operation & Management) contract with Daelim Industries for the operation and maintenace of the Pocheon Combined Cycle Power Station from 2014.

Eraring Energy Boiler Upgrade Project Contract Signing Ceremony, Australia (January 20th, 2009)

Enhanced Competiveness in EPC

A flood of orders for overseas EPC projects was seen in 2007. Accordingly, Doosan saw the necessity to dramatically improve its capabilities in design and engineering, which could also be said to be the very basis of the EPC business. Doosan needed more technology and knowledge in this area, so it established a strategic alliance with the US-based Burns and Roe, one of the leading power plant engineering companies in the world, in September 2008. It was a strategic partnership, which enabled Doosan to use their engineers when necessary. Burns and Roe was a global player in power plant engineering that provided services to a total of 175 power plants around the globe responsible for producing about 70GW of electricity all together. It was the same engineering consulting firm that provided services to Korea's first Koran standard thermal power plant, Boryeong Units 3 & 4.

Thanks to the partnership, Doosan acquired the engineering capabilities and manpower necessary to effectively carry out large power plant projects. Doosan even set up an engineering company in New Jersey, USA so it could facilitate the transfer of technology from Burns and Roe. Geewon Park, Chairman and CEO of Doosan Heavy, said, "Through the recently established technical partnership, we were able to gain access to high-efficiency engineering capabilities and data optimized for thermal power plants in addition to what we already have. I expect this will also improve our profitability. Enhancing engineering capabilities is like laying a healthier basis for growth on which to become a global power plant services provider."

Strategic Alliance Partnership Formation Ceremony with U.S. based Burns and Roe (September 6th, 2008)

Proactive Marketing

The financial crisis of 2008 was bad news for EPC contractors. There were no EPC orders placed besides the one for the GHECO-One Coal-Fired Power Plant in Thailand in 2008 and Qurayyah Combined Cycle Power Plant in Saudi Arabia in 2009. So Doosan implemented a corporate reorganization in September of 2009 with the goal of sending its marketing people to overseas offices. It was the launch of the so-called 'Proactive Marketing' system.

Prior to the reorganization, Geewon Park, Chairman and CEO of Doosan Heavy, said in a workshop in July 2009, "We were negligent of some details while carrying out marketing activities in the market, particularly in terms of methods for taking more systematic and scientific approaches. We were so busy trying to meet the market demands, that we remained either passive or reactive, and the project details for the bids we have participated in prove this point. We've been trying to draw up preemptive measures as a strategy to meet market demands since 2008". Doosan set to analyze its competitors' marketing strategies and perform a case study to identify the advantages and disadvantages of their marketing tactics, and held lengthy meetings to decide how to deal with clients

and what strategies to use in the future. In the end, the company settled on reorganizing the company and launching a proactive marketing campaign.

In a proactive market, the aim is to increase the chance of winning a contract by understanding the needs of a client before the client issues a project, and propose a more aggressive solution. To make proactive marketing possible, both sales and marketing teams must be at the site. As a result, Doosan moved some of the Power Plant and Water Business Group's sales teams to overseas branches, and had its overseas EPC-related branches report to the Business Groups. Chairman and CEO Geewon Park told the sales and marketing representatives of their duties and roles by saying: "Reactive marketing, in which we collect information on certain projects and react to the client after a project is issued, is an old way of doing business. We are relocating our sales and marketing teams to overseas branches because we need to take a wholly new approach. Ultimately, we need to have strong ties with our overseas clients just as we do with the subsidiaries of KEPCO in Korea, and provide them what they might want before they even figure out what they want themselves."

Rise to a Global Player

Doosan took over Skoda Power of the Czech Republic in September of 2009, for its proprietary technology in turbine engineering. It was Doosan's second time to surprise the global market, after the acquisition of Babcock.

By taking over Skoda Power, Doosan now had proprietary technologies in boilers, turbines, and generators, which are the three main components of a power plant. This gave the company an edge over its global competitors since it created a value chain with which to start providing high value added services such as retrofitting in addition to simple manufacturing of such systems. It dramatically enhanced its competiveness in the power plant business by acquiring proprietary technology in turbine engineering, which was the most important factor of competitiveness for most power plant builders, since improved competitiveness means more business opportunities. For instance, Doosan was now able to supply turbines for EPC projects carried out in Korea and overseas, and enter the 'BTG (Boiler-Turbine-Generator)' package market that's accessible to only a handful of global companies. Doosan could also sell its products and services to Europe and the U.S., where proprietary technology was often an absolute necessity in winning a bid. This meant that Doosan now had access to markets of all countries except China.

Share Purchase Agreement Ceremony of ?koda Power A.S., Czech Republic (September 14th, 2009)

First Step Towards Manufacturing Large-scale Gas Turbine, the Core of Power Generation

As its power plant EPC business finally bore fruit, Doosan had one more thing to celebrate in November of 2009. It was the successful production and shipping of its first gas turbine, the most important component of a power station. It was a large, 180MW gas turbine for the Yeongwol Combined-Cycle Power Plant operated by Korea Southern Power. It was going to be the largest gas turbine ever manufactured by a Korean company. The Yeongwol Combined-Cycle Power Plant has a total output capacity of 900MW generated by three gas turbines, all of which were supplied by Doosan in early 2010, starting from the first delivered in the previous year.

Prior to this feat, Doosan had to sign a license agreement with Japan's MHI in April of 2007 in order to learn how to manufacture a gas turbine (100MW and up). It was based on this that Doosan was able to win the contract to build three 501F (185MW) units for the Yeongwol Combined-Cycle Power Plant in June of 2008. While acquiring the license was an important factor in winning the trust of the client, Doosan's experience of having built small and medium sized gas turbines since the 1990s had also played an important role. After the successful production of gas turbines for the Yeongwol Combined-Cycle Power Plant, Doosan continued to win contracts from a number of combined cycle and cogeneration power plants in Korea, including the Pocheon Combined-Cycle Power, Yangju Heat & Power , Sejong Combined-Cycle Power, and Hanam Combined Cycle Power Plants.

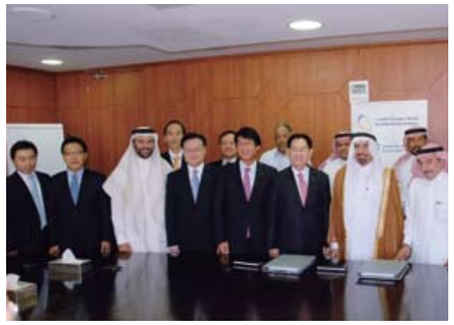
A Series of Large-Scale Projects in Major Markets

Doosan had a rush of orders from overseas again in 2010, after the global economic recession of 2009. It was all the more meaningful because the orders came from its major markets such as the Middle East, India, and Vietnam.

The first was the USD1.1 billion contract to build a 1370MW coal-fired power plant in Raipur, Chhattisgarh, India in January of 2010. The Raipur Project was the first power plant EPC contract Doosan ever won from India, and it was a package deal that included turbine generators and all other main systems. It was the result of India's trust in Doosan's capabilities in construction as well as in engineering and manufacturing. The Raipur Project was a great opportunity for Doosan to establish its position as an EPC contractor in India.

In September of the same year, Doosan was also awarded a KRW 4 trillion contract to build the world's largest thermal power plant in Rabigh, Saudi Arabia. The power plant with a total output capacity of 2,800MW, or four 700MW units, was to be built in Rabigh, an ancient town located about 150km north of Jeddah, the second largest city in Saudi Arabia. Being such a big project, there was fierce competition between many global power plant EPC contractors. This and other reasons led to a rebid, in which Doosan managed to win over other companies. It was not just the sheer scale of the project that people at Doosan were thrilled about, but also being the first to carry out a power plant EPC contract in Saudi Arabia. The victory was more sweet particularly because it was the result of its so-called 'Proactive Marketing' that was implemented in 2009 by sending its sales and marketing teams to each of the overseas branches.

Just as their excitement was about to dwindle, Doosan won yet another bid: the USD1.3 billion Mong Duong 2 Coal-Fired Power Plant Project in December of 2010. The Mon Duong 2 Thermal Power Plant was to be built in Quang Ninh, a large province located about 160km northeast of Hanoi. Due to the fact they needed to utilize large quantities of low-grade anthracite mined in Vietnam, the Vietnamese government chose Doosan Babcock over others for its combustion technology, which was regarded as the best in the world.



Rabigh II Thermal Power Plant Contract Signing Ceremony, Saudi Arabia (September 28th, 2010)

In 2010 alone, Doosan set a new sales record by bringing home KRW 1.3 trillion by signing a number of big supply contracts for large thermal and nuclear power plants with the UAE, as well as one of the world's largest desalination projects in Ras Az Zawr, Saudi Arabia.

Global Top Tier Aspirations

Doosan underwent a large-scale reorganization in May of 2011 in order to more effectively cope with the changes in the global market for power generation systems, such as the expansion of the power plant materials market and improve its power plant business competitiveness. The company separated power plant EPC business from its Power Plant Business Group and organized a new division called the Power Business Group to take control of power plant materials such as boilers, turbine generators, and HRSGs, as well as the power plant business, bulk handling and alternative energy. In addition to this, the former EPC business and Construction Business Group were combined to form the EPC Business Group. The aim was to create synergy between power plant EPC and other related businesses dealing with materials, while also expanding its materials business to promote business growth in this area and achieving "profitable growth" by maintaining balance between growth and profit.

In the face of the prolonged global economic depression and the European financial crisis in 2012, Doosan also started focusing on realizing "sustainable growth" by developing a new growth engine through portfolio diversification and enhancing its competitiveness to enter the global top tier. To achieve all this, Doosan needed to improve the quality of its products and technology before anything. To ensure sustainable growth, Doosan needed to have a new growth engine backed by the "sustainable growth" of existing businesses. Furthermore, the company also needed to sell more products in the market occupied by global top tier companies to keep up with the growth spurt, particularly since low market growth was expected due to the European financial crisis. This would be possible only when its products and technology are better than its competitors. These were the reasons why Doosan came up with a new roadmap for technology development aimed at developing products and technology suitable for the global top tier within five years.

Dongsoo Suh, CEO of Power Business Group, was confident about realizing sustainable growth. He said, "After we have reorganized our team, we're reaching the strategic goals one after another according to the roadmap. However, technology is undoubtedly the most important for the Power Business Group. The lifecycle of our products is relatively long, but we still need to be fast in coping with market changes. From now on, we will try to narrow the technological gap between us and our competitors by being more aggressive in R&D, come up with five-year term strategic plans, and implement a roadmap for the development of each product. If we choose the research objectives through collaboration between the industry, academia, and research institutes based on a global network, there is no reason we cannot compete with the global leaders."

Heon-tak Kim, CEO of EPC Business Group also said, "We have created a new business group for EPC in 2011 with the goal of making a fresh start as an EPC contractor that brings more profit." The increasing number of EPC projects since the USD4 billion Rabigh Project in 2010 called for the immediate organization of the EPC Business Group. The EPC Business Group is in charge of maintaining balance between projects and providing services to meet the specific needs of each client. Although Doosan had some difficulties in the early stage of carrying out EPC projects, it was now on the road to success after the reorganization. Our mid and long-term plan is to improve the profitability and competitiveness of our EPC business and enhance overseas project management capabilities, so we can lay the groundwork on which to become the world's best EPC contractor."

Doosan Sweeps the Global HRSG Market

Doosan's HRSG (Heat Recovery Steam Generator) was chosen as a "World Class Product" in 2003, and the company takes pride in it. But becoming the world's best in HRSG wasn't easy by any means, as there were many obstacles to overcome.

The Beginning of HRSG Production

The rapidly increasing demand for combined cycle power plants had resulted in the competitive development of the HRSGs. HRSG made its debut in 1985. As for Doosan, the first HRSG contract was the three 250-ton units for Jebel Ali Power Plant in the UAE. At that time, Doosan didn't have the technology to design, but only to manufacture. Doosan saw that HRSG had good marketability, and started developing HRSG technology for the first time in Korea after gaining some experience in the course of carrying out the Seo-Incheon Combined Cycle Power Plant Project in Korea. Its first goal was to provide the Seo-Incheon Combined Cycle Power Plant with HRSGs. However, since the company had neither the technology nor experience in building HRSGs, it had to resort to receiving design plans from Alstom of France in exchange for royalties, since it had proprietary technology in the area.

MAPNA Cogeneration Power Plant Project Contract Signing Ceremony, Iran (July 9th, 2003)

After that, Doosan's engineers started manufacturing HRSGs based on the design plans provided and by reading all related records. They made one part after another by exhaustively studying the design and manuals. Just like when they first learned to make other power plant systems, endurance and patience were their biggest assets. After some time, the HRSGs for the Seo-Incheon Combined Cycle Power Plant Units 1 & 2 began to take shape. But just when the project was nearly complete, they had a catastrophic accident: The pin tube, one of the most important parts, collapsed. So they kept experimenting to the last detail, and the HRSGs for the Seo-Incheon Combined Cycle Power Plant were completed in December of 1992. They were the first HRSGs Doosan ever manufactured, and the company was satisfied by the fact that it had finally finished the project.

After the Seo-Incheon Project, Doosan received a contract to build four HRSG units for the Pyeongtaek Combined Cycle Power Plant in July of 1992. By this time, Doosan had the manufacturing technology to carry out all the processes from engineering to installation. At the time, Doosan sent its engineers to get trained at CE in the US from the end of 1992 to early 1993, during which time its engineers at home also made significant progress in the development of industrial, drum, and once-through boilers.

Going Global

After its success in Korea, Doosan shifted its position to the outside world. The 515MW Essar combined cycle power plant on the southwest coast of India was the first project Doosan ever performed. Doosan opened a construction site office in April of 1995, before beginning construction. They were required to apply every single standard according to the notoriously strict 'Indian Boiler Protocol'. The protocol has been revised dozens of times since it was first written around 1950, but the revised version was not yet fully completed. So they had no choice but to gather all the pages of the modified version and design according to the protocol. A local company started installing the systems under the direct supervision of Doosan, and the Essar Power Plant was finally completed in November of 1995. The name Doosan became well-known in India after the successful completion of the Essar Project. As a result, the company was awarded the Kondapalli Project to build power stations with a daily output of 355MW. Doosan continued to expand its market in the Philippines, Taiwan, and Malaysia. Doosan's next goal was Spain, where a leading HRSG manufacturer called

'Postilla' holds the largest market share. The Gibraltar Project of Spain started at the end of 2001. Doosan was able to win the contract after promising that it would finish the project within five months when it usually takes eight. As if it was not challenging enough, local subcontractors were too proud and uncooperative, and Doosan employees had a hard time dealing with the airport immigration office. The Spanish government didn't issue work permits to Doosan employees, so Doosan employees were forced to view the construction and give orders from a distance. To make up for lost time, Doosan shipped out half assembled systems to be fitted to the power plant by using the C-Section method, which allows for on-site installation. After seeing how Doosan had successfully completed the project despite such difficulties, the Spaniards awarded Doosan with a few more power plant projects in Castejon and Palos. As a result, Doosan became the number one supplier of power systems in Spain over the leading company in the country. For Doosan, it was a miracle in every aspect.

The Birth of 'D-Top' Model and Global Market Dominance

However, it was a mission half accomplished. Without proprietary technology, Doosan still had to pay royalties to foreign companies for the designs of core components. It left Doosan with one choice: develop technology on its own. So in July of 2002, Doosan set up an engineering task force team composed of its top 16 HRSG experts. In a period of four to five months, they came up with nearly 400 different development ideas, and 100 of them were actually applied in the development of the HRSG. They ended up developing an independent model code-named 'D-Top'. It was a great feat for Doosan, particularly because it was the first model it had ever developed after being in the HRSG manufacturing business for 13 years. And in July of 2003, Doosan set out to conquer the market by winning the Mapna Project with a record-breaking scale.

Doosan's Unique "D-Top" Model Enabled the Company's Dominant Market Share in Global HRSG Market

The Mapna Project was a great turning point in the history of HRSG for Doosan. There was symbolic importance because it meant Doosan beat its European competitors, solved the problem of technology transfer, and finally became the leading company in the HRSG. But those at Doosan gave themselves more credit for overcoming the difficulties subsequent to the contract rather than just winning the contract. At first, creating data was a problem in itself, since Doosan had no experience transferring technology to others. The designing process was delayed because Doosan engineers were not provided with basic data promptly, and without the design plan, there was no work to be done by local companies. Doosan had to go through many trials and errors in correcting the processes, but also came up with just as many ideas for preventing delays and meeting the deadline. Doosan was eventually recognized by the client for its capabilities in project management. As a result, Doosan was awarded four additional contracts to build a total of eight more HRSGs in Iran between 2007 and 2009.

POWER

NUCLEAR POWER

Thirty Years of Nuclear Mastery Opens Global Doors

"I think countries around the globe will likely postpone the construction of new nuclear power plants at least for the moment since they have been scrambling to perform safety inspections on their existing plants and take necessary measures to improve nuclear safety since the Fukushima accident. However, in the long run, they'll have no other choice but to build more nuclear power plants because, in particular, quantitative impacts of new and renewable energy sources are still minimal at best, hence there are no definite alternative plans to replace nuclear power plants. This is why the future is bright for Doosan's nuclear power plant business, which now stands as a global leader in the industry.

The Nuclear Power Plant Business Group has years of experience in building nuclear power plants in Korea and overseas. It has the technology to design and build a wide range of nuclear power systems. As a member of the 'Korea Team' that will export the APR1400, while also continuing to build more power plants in Korea, Doosan will continue to gain more influence in the Middle East and Asia by playing a pivotal role in exporting Korean standard nuclear power systems. In addition, countries wishing to implement nuclear energy also wish to build nuclear power plants on their own through the transfer of technology just as Korea had done. Doosan will become a leader in manufacturing nuclear power systems and help other countries develop their own technology."

- Excerpt from an interview with Habang Kim, CEO of Nuclear Power Plant Business Group

Korea's Biggest Overseas Nuclear Project to Date

This was the headline on one of the major Korean newspapers sent by its reporter from the United Arab Emirates on December 28, 2009. Many Koreans were shocked by the news because it was a monumental achievement they never thought possible, not only because the contract value totaled USD40 billion but also because it was the first time Korean nuclear power was exported. To them, it seemed like a gift set full of goodies. Even the Korean President flew out to the site to set up diplomatic relations with the country's leader.

For Korea, it was the biggest single nuclear contract ever and gave Koreans a reason to celebrate because they never thought it would be possible for a Korean company to export nuclear power plants. As for Doosan, in a consortium with the Korea Electric Power Corporation (KEPCO), it was a feat to be remembered forever as it was the single largest contract Doosan has ever won in the past 30 years since going into the nuclear power generation business. The heated diplomatic battle over the project drew worldwide attention, so winning the contract had the added bonus of enhancing the brand image of not only the company but also the country.

The UAE nuclear power project involved the engineering and construction of four 1,400MW Korean standard nuclear power plants as well as the supply of fuel rods and construction of the infrastructure around the site. Korea built its first nuclear power plant with the help of another country in 1978. In other words, it only took 30 years for the country to move from being dependent on foreign technology to becoming a major exporter of nuclear power plants.

Doosan, as a part of the Korean Consortium led by KEPCO, signed a USD40 billion contract with the UAE in July 2010 to build, supply, and install main power systems such as nuclear reactors, steam generators, and turbines.

Doosan Heavy's Chairman & CEO Geewon Park emphasized the significance of the achievement by saying, "The future of Doosan depends on nuclear power generation. Although thermal power generation will continue to be a necessity for humanity for the next few decades, more emphasis will be given to nuclear power generation particularly in terms of reducing carbon dioxide emission. In this aspect, signing the big nuclear power contract with the UAE will serve as a turning point for Doosan, and it will change the company's future."

From Ground Up to Become the World's 6th Highest Nuclear Energy Producer

The Obninsk Nuclear Power Plant of the former USSR became the world's first to produce nuclear power on June 26, 1954. Over a period of 60 years since then, the world continued to build nuclear power plants. As of March 1, 2012, there were a total of 436 stations operating in 31 different

countries and 63 more on the way in 15 countries according to the calculation of the International Atomic Energy Agency (IAEA). There are a total of 104 nuclear power plants in the US, 58 in France, 50 in Japan, 50 in Russia, 21 in South Korea, and 20 in India. Along with these top nuclear power producing countries, China has only 16 plants currently in operation, but 26 are under construction and will soon stand shoulder to shoulder with Russia, which is building 10 more at the moment.

During the first oil shock in 1973, there were 147 nuclear power plants in the world, which accounted for merely 0.8% of the total energy consumption. But by 2010, the world had 436 plants accounting for about 14% of the world energy consumption and producing over 370,000,000kW. The IAEA estimates that global nuclear power generation will grow by an average of 3.6% annually until 2030 with twice as many plants as there currently are.

While still struggling to heal the scars of war, South Korea signed a nuclear power agreement with the US in 1956 to lay the foundation for technology development and industrialization. In the 1960's, the demand for electricity grew dramatically as the late former South Korean President Park Chung-hee's five-year economic development plan bore fruit. And after going through two oil shocks, Koreans began addressing the need for fossil fuel replacement and alternative energy development as well as to build nuclear power plants. Korea started launching nuclear power research projects as soon as the research reactor for TRIGA Mark-II went into operation for the first time in 1962. As a result, the Korean government chose Kori, Yangsan-gun, Gyeongsangbuk-do as the site for their first nuclear power plant in 1968. With the Korea Electric Power Corporation as the project leader, the government announced the construction of their first nuclear power plant using pressurized light water reactors and named it Kori No. 1 at the ground-breaking ceremony on March 19, 1971. In 1973, it started the construction of Wolseong No. 1 using pressurized heavy water reactors. At the time, Korea had no experience whatsoever in building nuclear power plants, so the country was completely dependent on foreign technology.

For their first nuclear power plant named Kori No. 1 producing 587MW of electricity, US-based Westinghouse was in charge of construction and the initial supply of fuel cells while UK-based GEC was in charge of supplying turbines and generator systems as well as civil engineering. Korean construction companies participated in the project only as subcontractors. It was the largest single project in the history of Korea with a total foreign investment of USD173.9 million and domestic investment of KRW71.7 billion. Since then, the Korean government, nuclear power experts, and academic professionals have been making concerted efforts with the single goal of developing proprietary technology. First, the government had foreign contract bids for separate contracts for Kori Units 3 and 4 so that Korean companies could participate in the projects as a subcontractor and allowed Korean companies to participate in the construction of Yeonggwang Units 3 and 4 as major contractors in charge of the overall project management.

In the 1990's, Korean companies succeeded in designing and building Uljin Units 3 and 4 using the Korean standard nuclear reactor, OPR1000, which was an improved and modified version designed to suit the needs of Korea. After the 2000's, Korea built more Korean standard nuclear power plants, specifically Shin-Kori Units 1 and 2 and Shin-Wolseong Units 1 and 2. It's now building Shin-Kori Units 3 and 4 by using APR1400, a new independent light water reactor with improved safety and capacity. And in 2009, Korean companies signed the country's biggest export contract to build four APR1400 nuclear power plants for the United Arab Emirates, showing the world their capabilities. Korea later launched a new project titled the Nu-Tech 2012 with the goal of enhancing the level of its nuclear power technology and gaining technology independence by 2012.

As of June 2012, with a total 21 nuclear power plants in four different sites including Kori, Wosleong, Yeonggwang, and Uljin, Korea ranked the sixth in the world by producing 18,716MW of nuclear power, which accounted for 32.7% of nation's total energy production. As of 2012, Korea has 19 pressurized light water reactors and 4 pressurized heavy water reactors. Korea is currently building a total of five nuclear power plants and plans to build six more in the near future. Through these endeavors, Korea plans to increase its total nuclear power production by 59% and have it account for up to 41% of the total national power production by 2030.

Exporting Back to the Country that Transferred Nuclear Technology

Nuclear power generation systems largely consist of a nuclear steam supply system, turbine generators, and auxiliary facilities. Only a small number of companies in the world are capable of making nuclear power systems, particularly the main systems because they require an extensive investment in facilities, extremely advanced technology, and perfect quality assurance.

Doosan has been participating in a number of power plant construction projects ever since building its first general machinery factory in Changwon in 1982. Today, it designs and supplies most of the main nuclear power generation systems such as reactor vessels, steam generators, pressurizers, cooling water tubes, turbines, and generators. In particular, Doosan is now capable of carrying out turnkey projects that involves designing, manufacturing, installation, and post-management. Doosan has made significant contributions to Korea's realizing import replacement by reducing the level of Korea's dependence on foreign technology. Today, Doosan is competing with other major players in the global market.

Doosan has participated in the construction of a total of 15 nuclear power plants including

Yeonggwang Units No. 1, 2, 3, 4, 5, 6, Uljin Units No. 1, 2, 3, 4, 5, 6, and Wolseong Units 2, 3, 4 (pressurized heavy water reactor) and successfully manufactured and delivered main power generation systems to the stations. It has recently completed the construction of main systems for Shin-Kori Units 1, 2, 3, 4 and Shin-Wolseong Units 1 and 2, and Shin-Uljin Units 1 and 2. Doosan has also participated in a number of power rehabilitation projects by manufacturing a replacement steam generator for Kori Unit 1 in 1997 and two of the same to Uljin Units 1 and 2, for which the contract was signed in 2008 and completed in January 2012. Doosan is also building a reactor head for Kori Unit 1 after receiving the replacement contract in 2009 and won another contract in June 2012 to replace the existing steam generators of Uljin Units 3 and 4 with an OPR1000 for the first time ever in the industry.

Doosan has been playing a leading role in the development of proprietary technology for nuclear as well as being a pioneer in the global nuclear power market.

Starting with the signing of a contract for the third phase construction project for Qinshan Nuclear Power Plant Units 1 and 2 in 1997, Doosan also won the second phase project for Qinshan. In 1999, Doosan started exporting nuclear power generation systems to the US, the foremost player in the industry, by winning a contract to replace the steam generator for the Sequoyah Nuclear Power Plant Unit 1. At the end of 2009, Doosan also participated in the Korean Consortium and played an important role in winning the UAE Nuclear Power Plant at the end of 2009.

Reactor Shipment to Qinshan -3, China

Implementation of Technology
- A Passion for Clean Energy

Doosan entered the business of nuclear power generation starting with the construction of its Changwon plant in 1976 and supplied power plant systems to Uljin Nuclear Power Plant Units 1 and 2 until 1986. The period between the two events is known as the 'Technology Implementation Stage' for the company. It was during this time when the company first introduced and implemented the new technology for building nuclear power generation systems and laid the foundation for building such systems by setting up a quality assurance system for nuclear power generation.

Starting Business with Simple Manufacturing Contracts

The Korean government started implementing heavy and chemical industries from the 1970's and decided to encourage companies to develop proprietary power plant technology as one of the main goals of the Fourth Economic Development Plan, which was carried out from 1977 to 1981. Doosan started building its Changwon plant in November 1976 and implemented core technologies for designing and manufacturing the main systems for nuclear, hydro, and thermal power plants while also sending its employees abroad to study advanced technologies. As a result, it has established itself as a company specializing in power plant systems.

Top priority is placed on stringent quality assurance and utility design to ensure a high level of safety in building nuclear power systems. As a result, only a handful of international companies with the capability to supply nuclear power systems existed. This was the situation when Doosan first tapped into the market.

As for Kori Nuclear Power Plant Units 1, 2, 3, and 4 and Wolseong Unit 1 built in 1970, their systems were designed, built, and managed in the form of a turnkey project, so there wasn't enough room for Korean companies to participate in such projects. In particular, they could not even dream of building a main nuclear power generation system. Korean companies couldn't even build auxiliary facilities because they didn't have the technology nor the production facilities. They were just glad to be able to supply facilities and materials that had nothing to do with safety.

Efforts in Proprietary Technology Development

Doosan as well as other Korean companies were finally able to fully participate in building nuclear power plants for the Yeonggwang Units 1 and 2, for which construction began in 1980. While foreign companies played a leading role in the projects, they were given the task of designing and supplying some of the materials needed for the project. This was in part due to nuclear power plants beginning to be built as private projects and policies being implemented to favor Korean-made materials over foreign-made material. As a result, Korean companies were able to start supplying materials.

Doosan obtained the N-Stamp and NPT-Stamp, which are required in building nuclear power generation systems, from the ASME (American Society of Mechanical Engineers in November 1981. The company didn't stop there. It also obtained the MM and MS Stamps for nuclear power plant materials. In November 1984, the company obtained more stamps that allowed for it to build nuclear power plant systems not only in the factory, but also at construction sites. With this, the company was fully qualified to manufacture, supply, and install all power plant systems.

Korean-made power systems accounted for 35% of the power systems at Yeonggwang Units 1 & 2 and 40% for Uljin Units 1 & 2, both of which were built in the 1980's, indicating that a significantly higher portion of the power plants were designed and built by Korean companies, compared to the 8~10% used at the Kori Nuclear Power Plant.

Doosan played a particularly significant role in building Yeonggwang Units 1 & 2 and Uljin Units 1 & 2. The company welded pressurizers and steam generators and manufactured the ASME Section III pressurizers and heat exchangers. As for the Uljin Units, Doosan imported half-finished reactors, steam generators, pressurizers, main cooling tubes, and other main systems and successfully assembled them. This experience greatly helped the company improve its manufacturing capabilities. However, Doosan failed to grasp the core technology for making such systems because it still didn't have the ability to design, and foreign companies were very hesitant about transferring their technology. But the situation changed when Doosan participated in the Uljin Units 1 & 2 Project, where the company succeeded in developing proprietary technology in all the power plant systems except for reactors vessel internal, CRDM (Control Rod Drive Mechanism), reactor coolant pumps/control systems.

Advancement of Technology
- Absorption of Advanced Technology

Doosan was able to accumulate experience through technology transfer and by carrying out projects after being selected as the main contractor for supplying nuclear steam supply systems for Yeonggwang Units 3 & 4 in 1987. By that time, Doosan already had enough production facilities to develop the main systems. This brought about a significant advancement in the design and production of materials and systems. In addition, by carrying out the Uljin Units 3 & 4 Project in 1991, Doosan was in the stage of technological advancement for its nuclear power business. Doosan began to independently design Uljin Units 3 & 4 based on the experience it gained by carrying out the Yeonggwang Units 3 & 4 Project and sent its engineers overseas to receive training in the areas of production where it lacked the technology as part of its plan to enhance its capabilities in nuclear power technology.

Yeonggwang Units 3 & 4 Open to the World of Nuclear Power Generation

Korean nuclear power companies were able to build a strong background for technological assets and basis through technology transfer and participation in a number of nuclear power plant construction projects as a subcontractor for major foreign companies. It's largely attributed to a special government policy implemented in 1984 with the aim to establish a foundation on which domestic companies can develop proprietary nuclear power technology.

The main aim of the government policy was to help domestic companies achieve technological independence in the course of carrying out the Yeonggwang Units 3 & 4 Project, set up a division-of-labor system so that each of the participating companies can develop original technology, develop standard designs, and build the same nuclear power models repeatedly so that the companies can gain experience and have a higher chance in developing proprietary technology. In order to cope with the government policy and build technological capabilities, Doosan set a goal and a detailed action plan to "have the technological capability to design, manufacture, and build 95%" of a nuclear power plant of the same model as Yeonggwang Units 3 & 4 within the deadline and budget, while also

meeting the quality requirements." In addition, Doosan participated in the project with the main goal of becoming a self-reliant company by importing technology from a number of foreign companies through technical cooperation.

The new goal in the Yeonggwang Units 3 & 4 Project also changed the project implementation system. With the system in action, Korean companies were selected as main contractors and foreign companies as subcontractors. This meant that items for which Korean companies lacked the technology to design and construct were ordered from foreign subcontractors so that they could learn the technology much easier. After being selected as the main contractor in charge of supplying nuclear steam supply systems, Doosan chose the Korea Atomic Energy Research Institute and the US-based ABB-CE as its subcontractors in designing and manufacturing the nuclear steam supply system. Doosan was put in charge of everything from design to materials and finished products and became responsible for ensuring quality and meeting the deadline.

With the mission to make materials and systems with domestic technology, Doosan focused on only one thing: Stop importing all supply systems and start making them internally. For instance, core shells are made of ring forging large ingots or bending back-up rolls. While Doosan had all the facilities necessary for ring forging, it still had to import reactor core cells because it lacked the capability to perform high-precision calculations.

For this reason, Doosan's first goal in the Yeonggwang Units 3 & 4 Project was to be able to make core shells in Korea. Doosan sent its engineers to Terni, an Italy-based company with the core shell production capabilities for technology transfer. After acquiring the technology, Doosan combined it with its outstanding casting and forging technology and successfully completed the pilot production of the main system in 1988. It was through these endeavors that Doosan was finally able to make and test all the main materials and equipment for the NSSS (Nuclear Steam Supply Systems), including reactors, steam generators, pressurizers, and main cooling water tubes. They were delivered and fitted at the construction site of Yeonggwang Units 3 & 4 at the end of 1991.

Yonggwang #3 Generator Production Completion Ceremony
(April 29th, 1992)

Thanks to its efforts, 72% of the parts that were fit at Yeonggwang Units 3 & 4 parts were made in Korea, compared to the past production of only 35% fit in the case of Yeonggwang Units 1 & 2. It was a significant achievement for Korea when considering that it had only been 20 years since Korea first started using nuclear power and a brilliant achievement for Doosan because the company had been in the industry for only 10 years.

In terms of technological independence, under the full responsibility of Doosan, a greater portion of materials and half-finished products were manufactured and ordered from Korean companies rather than foreign manufacturers. Doosan also secured manufacturing and inspection procedures as well as technical data on production and applied them after testing, thus upgrading its production facilities by adding larger and more industry-specific equipment to its factories. On top of that, Doosan fully utilized the benefits of overseas training and technical consultation services to further develop its employees' skills while also making multilateral efforts to identify problems in the production of pilot and actual products.

Acquiring Engineering Technology through Overseas Training

Doosan also made significant progress in the area of engineering. After being selected as the main contractor of the Yeonggwang Units 3 & 4 Project, the company sent a large group of engineers to CE (today's WEC) to learn the skills necessary as design engineers were among those that were sent.

In the past, Doosan used engineering reports and blueprints provided by foreign companies, but all this changed after the Yeonggwang Units 3 & 4 Project, for which the company signed a technology transfer contract aside from the main contract. This enabled them to send its engineers to train at CE and have a team of its own engineers to join the CE engineering team in the designing of Yeonggwang Units 3 & 4.

For Doosan, development of human resources was the main principle in acquiring advanced technology. It was achieved by having its own engineers participate in every stage of mechanical engineering by foreign suppliers, so that they could gain experience and technological expertise. As a result, Doosan engineers received basic training necessary to carry out the designing process prior to the construction of Yeonggwang Units 3 & 4, and the participants of the program were able to design the nuclear steam supply systems with engineers from foreign suppliers. It was a new chapter in the history of developing engineering technology.

After returning home, the trained Korean engineers tested their skills by designing a mock system and turned them into assets. In addition to human resources, designing nuclear power systems also required design data, facilities, computer programs, and computers. That's why Doosan

made sure that it was provided with all sorts of design data and computer programs by foreign companies according to the technology transfer contract. These resources played a pivotal role in designing the first Korean-standard nuclear power plant, Uljin Units 3 & 4.

Yonggwang Nuclear Power Plant

By implementing this additional plan for obtaining technological independence while also carrying out the Yeonggwang Units 3 & 4 Project, Doosan was able to design and manufacture all the main reactor systems excluding reactor vessel internal, control rod drive mechanism, reactor coolant pumps, and control systems. With these systems in hand, Doosan now had the capability to design and manufacture nuclear power systems of the same model as Yeonggwang Units 3 & 4.

Doosan Proposes Standards for Uljin Units 3 & 4

Doosan not only built Yeonggwang Units 3 & 4 but also gained confidence during the process. This allowed the company to enhance its capacity in nuclear power plant construction during the Uljin Units 3 & 4. Uljin Units 3 & 4, whose construction began in May 1992 and ended in December 1999, were the first Korean standard nuclear power stations designed to suit the particular needs of Korea. Doosan also performed electric construction for the Uljin project, and that's why the company is praised for opening a new chapter for nuclear power technology in Korea.

While building Uljin Units 3 & 4, Doosan provided the basic design of the main systems, and only a small portion of the design was reviewed by a technical partner. As for system production, Doosan sent its engineers to the partner company to receive training on designing and manufacturing reactor vessel internal and CRDM (Control Rod Drive Mechanism), which were not yet possible by Korean companies at the time of building Yeonggwang Units 3 & 4.

Although Yeonggwang Units 3 & 4 and Uljin Units 3 & 4 had the same output capacity, Doosan cut down the total project time by 11 months. All the processes were carried out in exactly the same fashion as in Yeonggwang Units 3 & 4, but the project time was reduced nonetheless by applying standard technology.

Making the Three Major Rods in Korea

It was also during this time that Doosan obtained the technology for making pressurized heavy water reactors. The contracts for building Wolseong Unit 2 were signed in December of 1990 and Units 3 and 4 in September of 1992. They used a pressurized heavy water reactor, and the main contractor was Canada-based AECL.

Doosan manufactured and installed the steam generators and pressurizers for the AECL as a subcontractor. For Wolseong Unit 2, it manufactured only the top portion of the steam generator, and assembled it with the bottom portion that was manufactured in Canada before being shipped to Korea. Although there are big differences from design concept to materials, shape, and production technology used between heavy and light water reactors, but Doosan managed to overcome the differences based on the experience it gained in the Yeonggwang Units 3 & 4 Project. The company was also successful in manufacturing steam generators since it had already built half of it and assembled them for Wolseong Unit 2. Afterwards, the company also started making light and heavy water reactors in 1995, followed by light water steam generators, main control mechanism for ash handling system, heavy water feeder header, and fuel rods in 1996.

Nightscape of Uljin Nuclear Power Plant

Technological Independence
- Reversal from Importer to Exporter

After its successful completion of Uljin Units 3 & 4, Doosan realized its dream of having the technology to design and manufacture main nuclear power systems. Along with this, Doosan also signed a steam generator supply contract for China's Qinshan Units 1 & 2 (3rd phase) in 1997. The company was eventually recognized by the global market for its technological prowess by exporting main nuclear power systems to China and then to the US. This marked the beginning of Doosan's technological independence. After that, the company proceeded to also develop the RCP and MMIS technology while carrying out Korea's Nu-Tech 2012 Project.

Standardization of Nuclear Power Plant Construction and Making Main Nuclear Power Systems in Korea

In 1999, Doosan had successfully standardized and digitized construction data based on 20 years of experience in building nuclear power plants. The standard construction manual for 1,000MW power plants is comprised of a total of eight parts and the follow-up procedure including construction management, processes, civil engineering, machine, pipe laying, pilot operation, and quality management. The manual book has a whopping 129 pages in total.

Of note, this standard manual includes a collection of all the data and photos necessary for building a nuclear power plant, such as blueprints, documents, number of installations, required manpower, necessary equipment and tools, necessary materials, construction methods and order, and construction costs.

The standardization of nuclear power technology had significantly strengthened Doosan's competitiveness since it was made possible to come up with more accurate estimates in less time, and the numbers are in turn used as basic data for the construction of next-generation nuclear power plants according to the global market trend for nuclear power.

In 2000, Doosan established a basis for manufacturing all the main nuclear power systems on its own, by developing the technology needed to export reactors, steam generators, and pressurizers in the form of a single package.

The package mainly includes the RVI (Reactor Vessel Internals) and the CEDM (Control Element Drive Mechanism). With a diameter of 4 meters, height of 12 meters, and weight of 198 tons, the RVI is an enormous structure designed to support 177 fuel bundles. This stainless steel cylinder body is a core reactor system that allows the cooling water to flow between the fuel cells. Up until recently, only a few foreign companies were able to supply this mechanism because it requires advanced manufacturing technology, particularly because improper welding can distort the shape.

Each reactor is installed with a total of 73 CEDM sets, which are designed to move the reactor control rods up and down to control the speed of the reaction. Doosan established a basis for building these CEDMs on its own by sending its engineers overseas to learn the design, manufacturing, and quality management technology in 1992, and started making CEDMs in 1996. The CEDM is the only moving part in a reactor. Special surface treatment is employed to make this chrome plated, plasma coated device. Just about every process of making a set of CEDM is highly complex, from welding to assembling and performance testing, thus all the CEDMs were imported from Westinghouse (formerly CE) up until recently.

Control Element Drive Mechanism (CEDM) Unit

Challenge Towards the APR 1400

The APR 1400 (Advanced Power Reactor 1400) was a bold move Doosan took in 1995 to build a growth engine for the future. It was an extremely difficult mission to achieve. One of the employees who took part in the development project tells just how difficult it was.

"In 1995, soon after achieving technological independence and before the first Korean standard nuclear power stations Uljin Units 3 & 4 were completed, we joined the KNDG (Korea Nuclear Developing Group) to participate in the development of the APR1400, which would be safer and more economical than the Korean standard nuclear reactor. Equipment engineering and productivity review that Doosan was supposed to conduct started later than the general power plant engineering or system engineering. In other words, they used up most of the development budget by the time

it was our turn to sign the contract. So we were left with no choice but to carry out the project with whatever money was left. At the time of developing the APR1400, someone suggested during the process of reviewing the supply potential of cast and forged metal for the main systems that we shouldn't develop anything that will require more cast and forged metal than Doosan could create."

- Research Fellow, Nuclear Power Business Group -

The development of new light water APR1400 began in 1995. Its design was completed in 1999, but the project was completed in 2002 only after obtaining a standard design approval for it in 2001. In the course of developing the APR1400, a new concept technology had to be implemented to improve safety, cost effectiveness, operation, and convenience of maintenance based on the experience and technology gained through designing, building, operating, and maintaining the OPR1000. The power output was drastically increased from 1,000MW to 1,400MW, and the power plant lifetime was extended from 40 years to 60, which in turn, dramatically improved the cost effectiveness and efficiency.

The price of building an APR1400 was USD2,300 per kW. It's the most cost-effective reactor among third-generation reactors of the same class made by France, Japan, and the US. As for safety, it uses the Hybrid Safety System, which is regarded as the safest since it combines the advantages of both the Active Safety System of France and the Passive Safety System adopted by the US. The Korean standard APR1400 was installed at Shin-Kori Units 3 & 4 and Shin-Uljin Units 1 & 2.

Shin-Kori -3 and -4 Major Equipment Contract Signing Ceremony
(August 28th, 2006)

Overseas Marketing: China, US, UAE

Uljin Unit 3, the first Korean standard nuclear power station that marked the beginning of Korea's technological independence in nuclear power generation, held an opening ceremony on September 11, 1998. It was a monumental event for Korea since the power station was proof that its nuclear power technology had improved.

Doosan has been transferring technology from Westinghouse (former ABB-CE) starting from Yeonggwang Units 3 & 4. However, from Uljin Units 3 & 4, Doosan started making all the reactor steam supply systems on its own, except for the reactor vessel internal, control rod drive mechanism, and reactor coolant pump. By the time Yeonggwang Units 5 & 6 were built, Doosan was also able to make reactor vessel internal and the control rod drive mechanism by using Korean technology. This left only the reactor coolant pump that Doosan could not design and manufacture, among all the reactor steam supply systems.

It was based on these capabilities that Doosan was able to win the steam generator contract for the third phase of China's Qinshan Nuclear Power Plant Units 1 & 2 Project in 1997. Doosan won a contract from the CNNN (China National Nuclear Corporation) to build a 600MW pressurized light water reactor for the 2nd phase of the Qinshan Unit 3 Project in August 2005 and received a follow-up project to build an AP1000 for China's first next-generation nuclear power plant in 2007.

In 1999, Doosan began exporting nuclear systems to the US, the undisputed industry leader, by successfully supplying a replacement steam generator to Sequoyah Unit 1 in the US. It was followed by the supply of a steam generator for Watts Bar Unit 1 in 2002 and reactor heads for the nuclear stations in Entergy and Palo Verde in 2005. In 2008, Doosan proceeded to sign more contracts to supply V.C. Summer Units 2 & 3, Vogtle Units 3 & 4, and Levy County Units 1 & 2 in the US, which stopped building nuclear power plants 30 years ago.

And at the end of 2009, Doosan also provided the UAE with the APR1400, the last piece of a nuclear power station, as it finally had the capabilities to build and export all nuclear power systems.

Shipment of Steam Generator to Watts Bar Nuclear Power Plant Project, U.S.
(September 23rd, 2005)

2012: Today, and Tomorrow

Since the Fukushima disaster in 2011, countries around the globe have been taking added safety measures for their nuclear power plants, and South Korea is no exception. Relevant government agencies performed safety inspections on every nuclear power station in the country and decided to take every necessary measure such as flood prevention of the main systems that are vulnerable to natural disasters. Doosan is also making multilateral efforts to increase the level of nuclear power safety through stringent production and quality management by applying global

quality standards that it achieved in the course of building main nuclear power systems for the past 30 years.

Habang Kim, CEO of the Nuclear Power Plant Business Group said, “The biggest issue at hand for Doosan Nuclear Power Plant Business Group is to manufacture and deliver the main AP1000 systems to China and the US on time and successfully complete the performance test on Shin-Kori Units 3 & 4 where the APR1400 will be installed for the first time. These are the prerequisites to gaining trust from the UAE in nuclear power technology and ensuring the successful completion of the Shin-Uljin Units 1 & 2 Project where RCP and MMIS will be applied for the first time. To achieve these goals, we must all work towards realizing the highest level of quality through the ‘No-Fault Innovation Activities’ in every stage of production management. At the actual production site, we’re trying to prevent problems with quality by conducting thorough preliminary inspections not only on the actual production site, but every step of the designing, technical, and manufacturing process.” In the short run, Doosan’s nuclear power business seems to have low growth potential in the wake of the Fukushima crisis as many countries are scrambling to perform safety inspections on their nuclear power plants and postpone the construction of new nuclear power plants. However, quantitative impacts of new and renewable energy sources are still minimal at best; hence, there are no definite alternative plans to replace nuclear power plants. These are the basis on which to presume countries will continue to build nuclear power plants, allowing for the nuclear industry to continually grow and develop. This is the optimistic view of the company, and that’s why the company is still gearing up for the future. The future of Doosan's nuclear power plant business is bright because of the following reasons:

Reactor Shipment to Qinshan -3, China

“Doosan has years of experience in building nuclear power plants in Korea and overseas. It has the technology to design and build a wide range of nuclear power systems. As a member of the ‘Korea Team’ that will export the APR1400 while also continuing to build more power plants in Korea, Doosan will also play a key role in exporting Korean standard nuclear power systems to the Middle East and Asia. Furthermore, most countries wishing to import nuclear power systems believe local contents will serve as their KSF (Key Success Factor) for building more nuclear power plants. Doosan will help these countries develop their own technology, and Doosan will have a higher chance of becoming an industry leader in nuclear power production” Habang Kim, CEO of Nuclear Power Business Group expected.

POWER

GREEN ENERGY

Technology to Enhance the Future Value of Doosan

"In 2003 and 2004, a specially organized task force team discovered the new growth engines which will be sustainable even in 20 to 30 years.
Out of more than 200 ideas, we finally chose the candidates for future businesses including wind power energy and fuel cells, which the synergy with the existing power plant technologies is expected, in terms of connectivity, marketability, and economic feasibility. The ratio of renewable energy in global energy market is expected to soar as the Kyoto Protocol took effect. Our R&D team consisted of top talents at home and abroad has been working on to develop the renewable energy technologies such as wind power, fuel cells, and IGCC. For commercialization of the renewable energy, we need to enhance the level of technologies and competitiveness through demonstrations in Korea. Building on the success in domestic market, we will have to move forward to global market and ultimately make a contribution to the national economy."

- Excerpt from the interview with CTO, Seungjoo Choe

Since the mid 2000's, interest in clean energy technologies has been increasing as restrictions on greenhouse gas emissions are getting strict and fossil fuels are depleting.

With the official implementation of the Kyoto Protocol on February 16, 2005, Doosan reviewed the impact the Protocol would bring to the company's businesses and countermeasurements to minimize any negative effects. The company concluded that it would not be able to remain competitive unless it secures solutions that would meet the new environmental regulations. There are three main approaches in reducing the emission of carbon dioxide from electricity generation. The first solution is to increase efficiency of thermal power plant systems and reduce fossil fuel usage. The second approach is to utilize the CCS (Carbon Capture & Storage) technology used to capture and store carbon dioxide emitted from thermal power plants. The last approach is to develop the renewable energy technology for natural energy sources such as wind and solar power, or to invent new energy sources such as fuel cells. Doosan currently develops relevant technologies throughout all three approaches.

USC - High-efficiency Power Generation System

In 2008, Doosan succeeded in developing its proprietary technology needed to design and manufacture the main equipment for the world's top-level environment-friendly, highly-efficient 1000MW-grade Ultra Super Critical (USC) power generation system.

A USC power generation system maximizes the power generation efficiency by using steams at pressures exceeding 246㎏/㎠ and temperatures exceeding 593℃. Doosan's proprietary USC system uses steams at pressures and temperatures of 265㎏/㎠ and 610/621℃, superior to the systems developed by its European and Japanese competitors. Compared to the other systems, the Doosan's system is expected to reduce CO_2 emission by approximately 320,000 tons a year. Doosan is now promoting the commercialization of its USC power generation system by applying it to domestic power plants.

Meanwhile, Doosan plans to develop Hyper Super Critical power generation technology that increases the steam temperature to more than 700℃ on the back of its latest technological success.

IGCC - Coal Attracts Renewed Attention

In November 2011, Doosan signed a contract with Korea Western Power Co., Ltd. to build Korea's first IGCC (Integrated Gasification Combined Cycle) demnstration plant. Doosan is executing the project on a turn-key basis, from design, fabrication to installation and commissioning of core facilities of the plant including the gasifier and the syngas cooler on its own. The estimated completion date is set for the end of 2015.

IGCC is a clean, integrated power generation technology: It turns coal into synthesis gas (syngas) at both high temperature and pressure, and then removes impurities from the gas before it is combusted. It then runs gas turbines with CO and H_2 in syngas and runs steam turbines with the heat from the exhaust gas produced during the process. The use of this technology raises the power generation efficiency of a traditional coal-fired thermal power plant from 39% to a maximum of 45%. It is also environmentally friendly as it reduces the emission of SOx (sulfur oxides) and NO (nitrogen oxide). It can use a variety of fuels including coal, biomass, wastes, and heavy petroleum.

Globally, only 5 IGCC demonstration plants are in operation in the U.S., Japan, and the Netherlands, and the technology has not been commercialized. With the technology, the cost of capturing CO2 is only 30~50% of a typical coal-fired thermal power plant, and it can minimize the emission of pollutants such as sulfur oxides and particles produced by a coal-fired thermal power plant. Since the IGCC plants increase efficiency in power generation, both coal consumption and CO2 emission drop, as well as the emission of carbon dioxide.

IGCC is more economical as well. The CCS treatment facility used in an IGCC plant is smaller than in a traditional thermal power plant because it separates CO_2 before it burns the syngas. Above all else, coal is more cost effective than oil and it is widely accessible in abundance.

Coal has been envisioned to be sustainable for the next 150 years, whereas oil is anticipated to be completely depleted in just 40 years. For these reasons, many countries are paying keen attention to the IGCC power generation plant.

In Korea, Korea Western Power Co., Ltd. and Doosan have tried to develop the technology as part of the new and renewable energy research and development project supported by the Ministry of Knowledge Economy since 2006. The global IGCC market is expected to grow to 400GW or KRW120 billion by 2030. In Korea, 15 IGCC plants providing 10GW of energy are expected to be built by 2020.

Taean IGCC Project Contract Signing Ceremony (November 15th, 2011)

CCS - CO2 Capture Solutions

The world's major power generation facility manufacturers are virtually at war against CO_2. In the post-Kyoto period from 2013 to 2017, about 50% of the new global contracts for coal and gas thermal power plants, approximately 80~100GW or KRW5~6 trillion annually, are expected to call for the adoption of the CCS (Carbon Capture and Storage) technology wholly or partially. The market thus deserves to be called the golden business opportunity. In short, the CCS technology is absolutely critical in future thermal power plant business in the face of environmental restrictions being strengthened across the world. In line with the trend, Doosan has been trying to secure the CCS technology since 2006.

In September 2008, Doosan and Doosan Babcock, its European subsidiary, signed a contract with HTC in Canada,

Doosan Babcock Carbon Capture and Storage (CCS) Equipments

which possessed proprietary CCS technology, for equity investment and technological cooperation. HTC Canada had long engaged in R&D of PCC (Post-Combustion Capture) technology required to separate and capture CO_2 from the exhaust gas and had secured the world-class PCC knowledge. The PCC technology separates and captures only CO_2 from exhaust gas emitted from thermal power plants, which contains nitrogen, CO_2, H_2O and O_2. Its tremendous market potential comes from the fact that just the installation of a facility to a traditional coal-fired thermal power plant is the only requirement to need.

In July of 2009, Doosan Babcock succeeded in pure oxygen combustion of a boiler burner for a 40MW-grade coal-fired thermal power plant for the first time in the world. The pure oxygen combustion technology makes the capture of CO_2 easier. Instead of the air, the technology injects only oxygen into burning coals in a thermal power plant. Thus, only CO_2 and water are generated by the combustion. Although there had been some successful small-scale pure oxygen combustion experiments, Doosan Babcock succeeded in the world's first 40MW-grade pure oxygen combustion experiment, which was significant in that, the 40MW-grade could be commercialized promptly. Doosan Babcock began to work on the development of pure oxygen boiler technology in 1992. The development of a 40MW-grade pure oxygen combustion facility was designated as one of Britain's national projects in 2007, with a budget of KRW30 billion.

Small-scale Gas Turbines using Biogas

Doosan has engaged in the development of a 5MW-grade biogas cogeneration system since May of 2009, partnering with Korea East West Power Co., Ltd. Unlike fuel cells and wind power generation which must be based on commercialized technology, the biogas turbine only involves an additional application of combustion technology of lower level caloric value fuel to an existing gas turbine. Therefore, it requires relatively a small amount of investment in technology development. The market for the technology continues to expand in line with the global trend to develop environment-friendly energy resources. So the ripple effects of the technical development are expected to be considerable.

5MW Small Gas Turbine Engine Sectional View

Korea has not seen the successful set-up of a biogas cogeneration plant using a small-scale gas turbine engine. The development of a standardized small-scale gas turbine engine using biogas or landfill gas is urgently required. Doosan is in the process of developing the package of a 5MW-grade biogas burner and turbine. Partnering with Korea East and West Power Co., Ltd., it plans on setting up a biogas cogeneration plant in a landfill area of the metropolitan area and completing its demonstration operation by 2013.

Leading countries including E.U. are actively promoting the development of biogas power generation in an effort to use new and renewable energy as much as possible. As China, in particular, produces a tremendous amount of biogas, and is expected to have huge market potential for the new technology.

Offshore Wind Power Generation System

Doosan completed the trial run of its 3MW-grade offshore wind power generation system installed just outside of Woljeong-ri, Jeju-do and succeeded in the 3MW nominal power generation

3MW offshore wind power generation system

in June of 2012. The success took the company six years after it embarked on the development of the technology in 2006.

There are just a few companies that have developed a 3MW or greater offshore wind power generation system and had a successful operation. Vestas of Denmark and Siemens of Germany are examples of the rare occurrence. Therefore, Doosan has happened to secure a very important foothold, not just for the domestic market, but also for the overseas markets with great market potential.

Doosan completed the development of a 3MW offshore wind power system in about three years after it began the project which was designated as the national project by the Ministry of Knowledge Economy in 2006. In October 2009, Doosan set up an onshore demonstration plant in Gimnyeong, Jeju-do and ran demonstration operations for about a year. In March 2011, the company obtained international accreditation from DEWI-OCC, Germany, a prestigious international accreditation agency. It was the first international accreditation that a Korean company received for a 3MW-grade wind power system.

The global wind power market is anticipated to grow by an annual rate of 30% and the total installed capacity is expected to increase from 4GW in 2011 to 99GW in 2025. Anticipating a dramatic rise in the global offshore wind power generation, the government and the industry have joined forces to secure offshore wind power system technology and to foster the local industry.

Towards the end of 2010, Doosan was awarded a contract to supply three wind power generators in Sinan Wind Power Complex in South Jeolla Province. Since then, the company has secured contracts for 15 wind power generators in total, which it is currently manufacturing or installing. Doosan is also working on the development of an improved model wind power system. It is pushing for the supply of 2.5GW offshore wind power facilities off the southern and western coast of the country. Doosan aims to advance into major overseas markets such as Europe, the United States, and Asia.

Fuel Cells used for Power Generation

Fuel cells for power generation are a low-pollution, high-efficiency power generation system producing electrical energy, heat, and water, through the combination of hydrogen and oxygen.

Compared to traditional thermal power generation, the new method ensures greater efficiency, while emitting almost no pollutants and reducing CO_2 emission by approximately 22%. It is a future-oriented power generation technology. The fuel cells for power generation use natural gas, biogas, or waste gas as their source of fuel. Hydrogen is anticipated to also be used as fuel. When the era of the hydrogen economy finally arrives, fuel cells will most likely become the source of the industry.

Doosan succeeded in the development of a 25kW-grade MCFC (Molton Carbonate Fuel Cell) in April of 2007 for the first time in Korea. The company is working on the development of a 300kW-grade stack and its peripherals. Doosan plans to complete the demonstration project of a 300kW-grade initial product, produced through 100% domestic technologies, and commercialize it by the end of 2012.

The global market for fuel cells designed for power generation is currently estimated to be 42MW, but is expected to grow more than 1,000 times to 42GW by 2030.

Fuel Cells for Power Plants

WATER







WATER

Conquering the Ultimate "Blue Ocean"

"Doosan became the global leader in seawater desalination industry, thanks to the power of technology. Doosan has proprietary technology for all of the three methods of desalination, namely MSF (Multi-Stage Flash), MED (Multi-Effect Distillation), and RO (Reverse Osmosis), and it's the only company in the world that is capable of carrying out a project by using all three of these at the same time. The company has R&D centers in Dubai, Changwon, and Tampa, Florida in the USA, to get a closer view of the global technology trends and to ensure its top-tier global market position.

Additionally, Doosan is one of the best manufacturers in the world. It was the world's first company to develop the one-module block method, which enhances the assembly and transportation of evaporators that could be the size of a soccer field. It's now regarded as the core manufacturing technique that enables the company to build a desalination plant faster than anyone else in the world. Doosan derives its power from top quality products manufactured from the Changwon plant in Korea, which is the world's largest production plant, as well as Doosan Vina in Vietnam."

- Excerpt from an interview with the CEO of Water Business Group

Global Leader in Desalination: 30 Years of Challenges and Glory

Doosan Heavy Industries & Construction holds the global market leadership in the seawater desalination industry. But that doesn't mean there are no strong competitors, such as Fisia of Italy and Sidem, Veolia and Degremont of France, that are all trying to capture a bigger share of the market. Above all, fierce competition with Sidem in the area of MED is unavoidable. Also, the competition is particularly fierce in the area of RO since there are numerous local companies specializing in this area.

An analysis of desalination projects with a capacity of over 5 MIGD per unit since 2005 shows that Doosan commands a market share of 60% in MSF, followed by Fisia of Italy with 37%. In the area of MED, however, Doosan has a market share of only 5% while Veolia and Sidem of France hold 70%. But this will most likely change since Doosan is winning more MED contracts in the Middle East. As for RO desalination, there are no strong players because of standardized technology and participation of local companies. However, Doosan has been taking a more prominent position in the market sector for large-scale RO plants since 2007.

Doosan was the first Korean company to start building desalination plants. In the early 2000's, after only about 20 years since its entry into the market, Doosan took a market share of 29% and became the global leader, beating out French, British, and Japanese companies that had formerly held a dominant position in the market. It was an amazing feat when considering that Doosan had neither the proprietary technology nor the ability to manufacture parts when it first set its foot in the market. This feat can be ascribed to the strong will, determination, and other characteristic features of Koreans. The early stage of the desalination business was a struggle to say the least. In 1978, Doosan started as a subcontractor for the Farasan Project followed by the Assir Project in Saudi Arabia through which Doosan suffered a heavy loss. The Jebel Ali Project was carried out in the middle of the Gulf War and was nothing short of a disaster for Doosan. But these failures didn't stop Doosan from battling on. Doosan continued to acquire core technologies and kept challenging itself in different areas to secure a position as a new player in the desalination market.

The successful completion of the Fujairah Desalination Project was a springboard for Doosan's rise as the number one market leader. After that, the company developed its one-module method

that enabled it to make evaporators faster than anyone else in the market and attempted a hybrid system by combining the MSF and RO methods for the first time in the world. Doosan has kept breaking records in the course of carrying out a number of projects since then, such as the Shuaibah Desalination Plant in Saudi Arabia in 2005, the Ras Al Khair Desalination Plant in 2010, and finally the world's largest unit MED project in 2011. The past 30 years of Doosan's desalination business have been a time of constant challenges and R&D efforts aimed at securing proprietary technology, a struggle to maintain its dominant position in the market.


Fujairah Desalination Plant, United Arab Emirates

With its successful trackrecord in the seawater desalination industry, Doosan continues to make its efforts to expand its footprint in the water industry, which is referred to as the "blue ocean" nowadays. It's also expanding its market share in the fields of water treatment as well as high value-added small-scale desalination systems.

Implementation
- Creating an Oasis in the Burning Desert

The early stage of the desalination business largely consisted of manufacturing evaporators, brine heaters, deaerators, pipes, and steel structures according to the specifications of the subcontract. After gaining some experience, however, Doosan became a main EPC contractor from 1985 when it won the contract to carry out the Assir Desalination Project for Saudi Arabia. But Doosan ended up paying a high price for the experience in this turnkey project as it lost around US$100 million during the execution stage.

From a Subcontractor to an Innovative Main Supplier

Doosan started its desalination business in 1983. The company set up an engineering division that was dedicated to seawater desalination and did this as a measure to diversify its business portfolio. Although Doosan had already announced that it was going to enter the desalination market, the company did not have much of a systematic engineering base for desalination, let alone possessing any technical knowledge. All that company could count on was its experience in building condensers, heat exchangers, and chemical facilities for power plants. The plan was to participate in desalination projects as a subcontractor for foreign engineering companies and to gain experience in building desalination systems in the process. The beginning is similar to that of the power plant business where Doosan created a new business from ground up.

Doosan's actual entry into the desalination market goes back several years. In the 1970's, the industry was booming in the Middle East with a market value of USD10 billion. At that time, the countries in the region were struggling to solve their severe water shortage problems. During that period, the dominant players in the region's desalination market were companies from a number of advanced countries such as Japan, France, the UK, and Italy. Doosan was a late starter by supplying materials for the Farasan Desalination Plant in Saudi Arabia in 1978. It was a daring challenge for the company. Doosan had to settle for being a subcontractor up until the 1980's because it didn't possess technical know-how and experience.

All that Korean companies could do was provide civil engineering and construction services or

make relatively simple machines for foreign contractors that were in charge of both manufacturing and installing systems since most of the Korean industries were still in their infancy at that time. This went on until a separate team dedicated to desalination was formed at Doosan in 1983.

In the early stage of its desalination business, Doosan had no choice but to focus on foreign markets since Korea didn't need any desalination plants. Therefore, Doosan had to receive orders from overseas markets and for that it had to send its marketing staff to leading desalination engineering companies based in the US, Europe, and the Middle East to promote its ability to build the necessary products. To win an order, the company participated in a bid for a desalination project initiated by the Yanbu Royal Commission in Saudi Arabia in 1983.

As a result of such efforts, Doosan finally managed to win the Assir Desalination Project in the fourth round of bidding after the first three were cancelled in January 1985. For the Assir Project, Doosan formed a consortium with a US-based desalination engineering company called ESCO. This project had a special meaning for Doosan since it was the company's first turnkey project in which it was to design, manufacture, install, build, and test all of the desalination systems and facilities. The Assir Desalination Project brought many changes to Doosan's desalination business, particularly because the company signed a technology transfer contract with ESCO that required ESCO to transfer most of its desalination technology within five years. Accordingly, Doosan was able to build a technological basis on which to start building MSF systems by 1987. Despite the fact that Doosan had to rely on the technology of a foreign company and actually lost money building the Assir Desalination Plant, the company ended up winning the Jebell Ali Desalination Project from the UAE in 1986. This helped Doosan see the potential for growth in the desalination business.

Assir Desalination Plant, Saudi Arabia

Repeated Challenges with Big Project

The Assir and Jebel Ali Projects were a great turning point for Doosan in the desalination business. By carrying out the two projects, Doosan was able to improve its image in the global market and gain the type of project experience that is required as part of bidding qualifications for most of the projects. But for Doosan, acquiring the technology and building experience by carrying out large-scale desalination projects were more important than anything else. In addition, the production of evaporators and other main desalination materials meant a higher operating rate and more jobs at its Changwon plant.

Despite both the tangible and intangible economic effects, carrying out the two projects was both painful and beneficial as it almost did more harm than good. Those at Doosan were thrilled when they won the Assir Project as they were delighted about the prospect of building the world's largest desalination plant at the time. As excited as they were, they were also fully aware that they had neither the technology nor experience to carry out the turnkey project. Even before the groundbreaking for the project, the first bad news broke out at a meeting with the Saudi clients who were in charge of the project. In the meeting, Doosan submitted a document that specified that most of the materials would be supplied by companies that were located in countries other than Korea. After seeing that, the clients pointed out that nearly 100% of the materials were supplied by companies in Japan when a Japanese companies carried out projects. In short, they had doubts about Doosan's capabilities.

In the end, the Assir Project was completed on time, and there was a ceremony at the desalination plant to celebrate the first production of water. But by no means was the process easy. According to Saudi Arabia's policy on utilizing domestic businesses, Doosan was forced to subcontract out about 30% of the work to local companies. Not only that, Doosan also had difficulties in getting the right people for the job since it was the company's first time designing a desalination plant, and Doosan even wasted time waiting for design that wasn't completed on time. During the construction phase of the project, Doosan had compatibility issues with some of the parts, which caused more delays, and a damaged steamline called for structural reinforcement. Even the pipe design arrived late, and there were mistakes in the control design. In short, Doosan had an array of issues throughout the project.

Doosan had just as many problems with the Jebel Ali Project. These issues were even more complex since the project involved the simultaneous construction of both desalination and power plants. Doosan was in charge of providing materials as well as civil engineering, installation, and testing and commissioning while AEG of Germany formed a consortium to supply gas turbines and generators. The total project value was USD131.44 million, of which Doosan's share was USD88 million. Overly anxious to establish a basis on which to start doing business in the Middle East, Doosan submitted a bid that was too low, and this posed a serious problem throughout the project. Not only that, Doosan promised to complete the project in just 32 months when a project of such

scale normally takes 48. So Doosan ended up spending twice more than it was getting paid to do the job, and it was a heavy toll on the company for carrying out the project. Doosan even had payment problems and was forced to suspend the project for 11 months. It didn't stop there as the Gulf War had both direct and indirect damaging effects on the project. Besides, there was no peace at home either since labor-management conflicts led to a strike. All of these events took place almost all at once.

The biggest problem of all came after the completion as the plant failed to produce any water during the testing and commissioning. Doosan shut down the plant for two weeks and searched for a solution. The client ended up demanding a compensation of USD540,000 if the plant still didn't produce any water in another two weeks. The engineers were at a dead end. The company completed the project despite losing money instead of making any, and now it was going to have to pay a penalty. The result was catastrophic. Despite all the efforts, no water came out of the pipes. Instead, there was a leak, and the entire plant was flooded. Doosan managed to get permission from the client to rebuild the plant and finally succeeded in producing water. But by this time, the company's credibility had plummeted.

The project was full of difficulties and problems and was a failure in every aspect. Nevertheless, the desalination part of the Jebel Ali Project was finally finished on November 4, 1991 with the completion of Unit 4, which was the last of the four units, for which Doosan had to purchase materials and even the technology from foreign companies. Some of the results included 16 months of delay and USD120 million in deficit. Nevertheless, Doosan learned lessons through these failures. In the course of solving these problems, Doosan acquired the essential technical data with which to be able to later on develop its proprietary technology.

While the Assir and Jebel Ali Projects turned out to be a very expensive lesson for Doosan, they also helped the company establish a reputation in many Middle East countries as a "company that never gives up."

When the Gulf War broke out in 1991, Doosan was busy finishing up the Jebel Ali Project and was getting ready to perform a test run. As for the Assir Project that was completed in 1990, Doosan had its employees on the site for repair work. The Middle East was going through the turmoil of war. All of the other companies that were carrying out construction projects in the Middle East had sent their employees back home just in case, and everything stopped at construction sites. The companies that fled the country included the top desalination plant builders from Italy, France, and Japan. But Doosan remained so that it could keep its promise to the clients. Doosan was the only company in the Middle East that carried on construction even during the war, and this left a lasting impression on

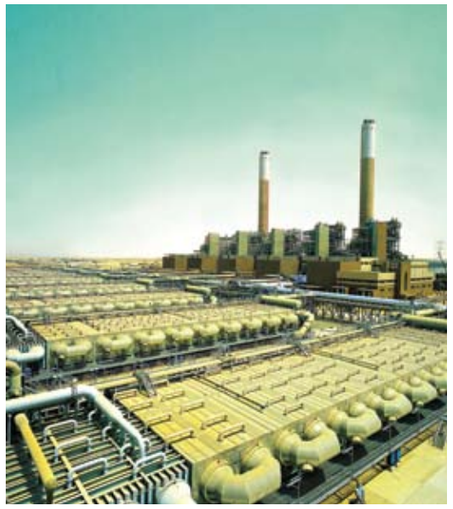
Saudi Arabia and other Middle East countries as well. It was then when those in the Middle Eastern market for desalination realized that what Doosan lacked in technology, the company made up for in its sense of responsibility. If it weren't for the strong will of the employees who stayed put even in the face of a war with the intention to overcome the disadvantage of being a late starter, Doosan couldn't have succeeded in the desalination market.

A Challenge for Proprietary Technology

After the technology transfer in 1987, Doosan bid for more projects and built a comparative analysis database of project characteristics. In the course of carrying out the Assir and Jebel Ali Projects, starting in 1990, Doosan was capable of bidding for projects without having to form a partnership. As a result, the company won the Yanbu Desalination Project from Saudi Arabia in 1990. But Doosan was soon forced to give up the project due to the unstable political situation in the Middle East, a prolonged strike in South Korea, and difficulties in carrying out the Jebel Ali Project.

Doosan was provided with an opportunity to make up for the loss in Jebel Ali and show off its desalination know-how in 1993. Saudi Arabia became the new arena of competition for every global desalination supplier after the Kingdom commissioned a project to build the world's largest desalination plant in Shuaibah. By that time, Doosan had the technology for design, manufacturing, construction, installation, and testing and commissioning. So the company bid for the project alone on a turnkey basis. In August of that year, Doosan was awarded the project as the lowest bidder and signed the contract for the 55-month project on November 2, 1995.

The construction began at last, and the project management team was as ready as ever, especially since they wanted to impress the clients at the Saline Water Conversion Corporation of Saudi Arabia. The team needed support for Doosan's technology and know-how if they ever wanted to make up for their past mistakes. Every Korean engineer participating in



Al-Shoaiba Desalination Plant, Saudi Arabia

the Shuaibah Project felt the same. Those on the project team set out to make all of the parts and materials in addition to the core components by using Korean technology. Until that time, Korean companies couldn't even make small bolts, pipes, and steel plates that could withstand saltwater, not to mention the systems with a large enough capacity to produce 450,000 tons of water a day.

So for the next two years, Doosan concentrated its efforts on research and development of desalination systems in order to fabricate products on its own. The R&D department's hard work eventually paid off. Clients' skepticism about Doosan's desalination technology began to fade away, and they began to compliment Doosan and Koreans alike for their impressive growth within such a short period of time. Behind the company's success in technology development was the reliable supply of materials from other Korean companies. Korean companies began to make salt-resistant tubes and stainless steel plates, which are some of the most crucial materials for a desalination plant, and this served as an important basis for manufacturing products on time. The successful completion of the Shuaibah Project was a demonstration of just how much growth the Korean industries had achieved.

The Growth
- Desalination Market Leadership in the Middle East

The successful completion of the Shuaibah Project elevated Doosan's position as a reliable company in the market. Doosan was now a company that could carry out a project on its own without having to form a partnership. That's how Doosan started leading the desalination market in the Middle East. The company developed the capability to carry out turnkey projects in which it provided engineering, design, manufacturing, construction, installation, and commissioning services, and it eventually worked its way up to becoming a global EPC player through continuous R&D. But this was only the beginning. Doosan was not just an EPC player but was also an innovative supplier that possessed differentiated solutions for clients.

The One-Module Method as a Time Saver

At the end of 1998 when the Shuaibah Project was coming to a successful completion, Doosan received good news from the UAE and soon found itself faced with an unprecedented challenge. The good news was that they had won the Al-Taweelah Project, which aimed at producing 230,000 tons of water a day. The problem was that the client wanted it completed much faster than normal. They wanted the plant running in just 26 months, which is 18 months less than what is normally required to build a desalination plant of similar capacity. All of the other global desalination plant suppliers refused to bid for the project, saying that it was simply impossible. But unlike the others, Doosan took on the challenge.

The short construction time meant that extraordinary measures had to be taken. The project management team at Doosan brainstormed for ways to shorten the delivery period. The idea that was chosen was something that had never been attempted in a desalination project. The idea itself was nothing special except for that the person who came up with it thought outside the box. It was the very simplicity of the idea that made it hard to implement. The concept was to fully assemble the evaporator before shipping it out since assembling it at the site took the most amount of time in building a desalination plant.

The idea of transporting equipment the size of a football field (90m x 30m x 15m) sounded good but also risky. But Doosan saw no reason not to try and become the first one to pave the path. It seemed like a crazy idea at first, but it proved to be the best one. A detailed plan was drawn up, and the idea was soon materialized.

In February 2000, a 3,500-ton evaporator made its appearance. The fully assembled evaporator was 90 meters long, 30 meters wide, and 15 meters high. It contained more than 66,500 pipes that stretched out 20 meters in length. It was a super-sized block of a desalination system. People gaped at the sight of it, particularly when it was carried by a total of 32 transporters in three rows to the Changwon plant's dock. Every news media outlet sent their reporters to take pictures of this historical sight, and the story made it to the front page of every newspaper that was in South Korea. When it arrived at the Abu Dhabi Port, local and international reporters flocked to the site to report on it. The achievement was not limited to just Doosan as it left a mark in the history of desalination.

The unprecedented attempt to deliver a fully assembled evaporator changed the impossible to the possible. As proof, the challenging project was completed within a record-breaking period of 26 months. Since then, assembling football field-sized evaporators and delivering them in one piece became a trademark of Doosan and made it possible not only to shorten the construction period but also improve quality. These factors were the driving force behind Doosan's number one position in the global desalination plant industry.

Shipment of Al Taweelah Desalination Plant Equipment to United Arab Emirates

World's First Hybrid Method

Doosan became something of a legend in the Middle East by delivering the desalination plant in the shortest period of time, but it didn't stop there. Doosan was about to make history in 2001 when it was awarded a contract to build the world's first hybrid desalination plant in Fujairah.

At the time, the project was financed by the Kuwait Fund, which is dedicated to investing in new technology development and future industries. Since it could only finance projects in these two areas, the client demanded a more advanced type of desalination plant. By that time, Doosan had already developed a hybrid-type of desalination system, which it thought to be perfect for the Fujairah Project. But the project was awarded to one of its competitors before it had the chance to mention it. Nevertheless, Doosan didn't give up. It proposed an entirely different type of desalination plant using its hybrid method. Designed to combine MSF using a thermal heat exchanger and RO, the hybrid system was perfect for the Middle East where power consumption varies greatly between summer and winter. Power plants produce more electricity in the summer because of air conditioning. More power production means more steam supply, so MSF (Multi-Stage Flash) makes for a more ideal choice for the hot season. There is relatively less electricity consumption in the winter, so less steam is generated. This makes RO (Reverse Osmosis) a better choice when it's not as hot. After reviewing Doosan's proposal, the client withdrew the original contract and signed a new one with Doosan. While Doosan was noted for providing the highest level of services by introducing the latest technology for the Fujairah Project, it made its name in perseverance. The Fujairah Project was what elevated Doosan's position as being the leader in this particular global market.

Aerial view of Fujairah Desalination Plant, United Arab Emirates

Desalination Market Dominance in the Middle East

Doosan made breakthroughs in desalination technology after winning and carrying out every desalination project commissioned in the Middle East in 2004. In 2004 alone, Doosan won four big projects including desalination plant retrofits, and it became the market leader in the Middle East. During this period, Doosan also gained some experience in MED (Multi-Effect Distillation) by carrying out its first MED projects in Benghazi and Zawia, Libya that were capable of producing 5,000 tons of water a day.

The first desalination project commissioned in the Middle East in 2004 was the one in Sabiya. Located about 100km north of Kuwait, Sabiya was to have the largest desalination plant with a daily capacity of 7,000 tons, which is enough to sustain up to 600,000 people. The KRW435 billion contract was signed on May 8. The main factor that played a significant role in winning the Sabiya Project was the successful completion of the Az Zour Desalination Plant, which had a daily production of about 130,000 tons of water, in 2002. During the project, the client was greatly impressed by Doosan's

technology. Winning the Sabiya Project helped Doosan secure a leading position as a supplier of desalination systems.

On August 31 of the same year, Doosan signed yet another contract to build a power-desalination plant in Sohar, Oman. It was an EPC contract, in which Doosan was to build both power and desalination plants at the same time, by supplying engineering, procurement, materials, production, transportation, on-site construction, and commissioning services with its own technology. The Sohar Project made Doosan the first company ever to build a power plant and desalination plant at the same time in the Middle East.

The most significant project of 2004 was the construction of a privately funded power-desalination plant in Ras Laffan, which was commissioned by Qatar Electricity & Water. The Qatari government was in a hurry to build a power-desalination plant because it had to prepare for the 2006 Asian Games. The power-desalination plant was going to be the largest one in Qatar, which is located 80km north of the capital city of Doha. The plant was to produce 270,000 tons of water and 1,025MW of electricity a day for up to 700,000 people to use.

Ras Laffan IWPP, Quartar

In 2004, Doosan achieved sales of more than USD1.5 billion in desalination alone by winning all of the large desalination projects commissioned in the Middle East that year. By this time, Doosan was recognized as the world's number one supplier of desalination systems after having built large desalination plants in the 1990's, which were worth about USD3 billion and capable of producing a total of 500 million gallons of water per day.

The Largest Global Market Share

After leading the market for large desalination plants in 2004, Doosan launched business and market diversification strategies. The first project to be awarded in 2005 was the Shuaibah Water Supply Project with a contract value of USD28 million. It was also Doosan's first time supplying water conveyance systems to the Middle East. It was very encouraging for Doosan since the company was presented with an opportunity to expand its business and become a total water solutions provider in the Middle East by providing water pump, conveyance, and purification systems through the extended application of its desalination technology. The market for water pumps and conveyance is just as large as the desalination market, so Doosan had to compete with other global leaders in the business, such as Johnston of the USA and Kubota of Japan, to win the project. So, starting the Shuaibah Water Supply Project was a great opportunity for Doosan to diversify its water business based on its position as being the world's number one supplier of desalination services.

In April 2005, Doosan signed a USD260 million contract to build the Sabiya Stage 3 Desalination Plant in Kuwait. Sabiya 3 was to be built right next to Sabiya Stages 1 and 2, both of which were built by Doosan. It was a large desalination project, which aimed at producing 227,000 tons (50 million gallons) of water per day for nearly 600,000 people to use. When all three units would be finally completed, they would have a water production of 454,000 tons per day (100 million gallons per day). They were to be Kuwait's largest desalination plants. By carrying out the Sabiya 3 Project, followed by Sabiya 1 and 2 as well as Shuaibah Retrofit, Doosan was able to secure a firm position in the Kuwaiti desalination market.

On December 29, 2005, Doosan won an USD850 million contract from Saudi Arabia to build the world's largest Shuaibah Phase 3 IWPP Desalination Plant. The Shuaibah Phase 3 Plant was to be the world's largest by far since it was going to supply drinking water to up to 3 million people every day, or twice that of the Fujairah Desalination Plant, which had the capacity to provide 1.5 million people with water. Winning the contracts to build the world's largest desalination plants one after another boosted Doosan's overall sales and contribution to water production in the Middle East as the company took home a total of USD4.5 billion and credit for producing 3.666 million tons of water per day in the region. With that, Doosan commanded a market share of 40% in the global market for desalination systems.

Nightscape of Sabiya Desalination Plant, Kuwait

The Leap
- Development of Proprietary Technology in Three Areas and Business Expansion

At the end of 2005, Doosan acquired the RO division of AES of the USA and established Doosan Hydro Technology (DHT). The acquisition was aimed at diversifying its business by including RO systems to the product line in addition to MSF systems, of which Doosan is the world's largest supplier, in order to align itself with the highly fluctuating market. Doosan also established water R&D centers in Dubai, UAE, and Tampa, Florida in the USA at the end of 2006. Such measures were taken to maintain its position as the leading market player through the development of next-generation desalination systems and the expansion of its desalination business to include small- to medium-scale desalination systems and water treatment plants.

Successful Entry into the RO Market in Just 2 Years

Doosan's efforts to diversify its business by tapping into the RO market bore fruit in just two years. On July 15, 2007, the company signed a USD180 million contract to build an RO desalination plant as an extension to the Shuaibah Phase 3 Plant in Saudi Arabia. The Shuaibah Plant expansion project was commissioned after a direct order from the Kingdom with the main objective of solving the water shortage problem in Jeddah, which is the gateway to the Holy City of Mecca, by building a desalination plant capable of producing a whopping 150,000 tons of potable water per day. After that, in March 11, 2008, Doosan also won a USD320 million contract to carry out an RO project in Shuwaikh, Kuwait. It was the first large-scale RO desalination plant to ever be built in Kuwait, but most of the companies invited to bid for the project declined to bid on the basis of the very low quality of the seawater from the Gulf. On the contrary, Doosan submitted a proposal with an advanced pretreatment process. On December 12, 2008, Doosan proceeded to sign a USD300 million deal with Saudi Arabia to build a reverse osmosis plant in Jeddah. So in just one and half years, Doosan became a leader in the RO market by winning three RO contracts back to back.

Besides these RO projects, Doosan was also awarded a USD800 million contract on August 7, 2008 by GDF Suez to build the Shuweihat S2 Desalination Plant in Abu Dhabi, UAE. The competition was fierce between the leading companies of the market, as the Shuweihat S2 Desalination Project issued by the Abu Dhabi Water & Electricity Authority had a contract value of USD2.5 billion. Since the project required the use of the MSF method, Doosan set a new sales record in both MSF and RO in 2008.

The World's Top Seller

The desalination market froze following the financial crisis of 2009, but Saline Water Conversion Corporation of Saudi Arabia broke the ice by issuing the Ras Al Khair Desalination Project on September 1, 2010. With a contract value of KRW1.7 trillion, the objective of the project was to build the world's largest desalination plant in Ras Al Khair with a capacity of 228MIGD, which would be enough water for 3.5 million people to use per day. The former largest plant was the Shuaibah Phase 3 Desalination Plant (194MIGD) in Saudi Arabia that had been built by Doosan in 2005.

The Ras Al Khair Desalination Plant is being built in a city that is located 75km northwest of the industrial city of Jubail in the eastern province of Saudi Arabia and will supply water to Riyadh, the capital city of Saudi Arabia. Under the EPC contract, Doosan is responsible for the completion of the every phase of the project, and the project is scheduled to be finished by January 2014. It's another opportunity for Doosan to show off its desalination prowess as it will be a hybrid desalination plant combining MSF (160MIGD) and RO (67.7MIGD). Doosan received credit from the client for its technical and project management capabilities. This was a clear demonstration of the company's position in the Middle East as a top-tier player.

Since 2010, the bidding method in the global desalination market has been employing the "open process," in which bidders are allowed to combine two or more different types of technology instead being restricted to just one. This meant that the ability to provide systems that are optimized to the client's demands is a determinant factor in the bid, and the Ras Al Khair is an exemplary case of this new bidding process.

Only Company with Three Methods of Desalination

Now that Doosan had become a leading supplier of MSF and RO systems, the next focus was MED (Multi-Effect Distillation). MED is one of the three primary methods of desalination along with MSF and RO. An MED plant is typically smaller than an MSF plant, but it's relatively cheaper to install and more efficient. Doosan has invested over KRW3 billion at the Changwon plant to build testing facilities with which to develop MED technology in order to enter the market while also carrying

out proactive marketing activities in Libya. As a result of these efforts, Doosan won a USD4.5 million contract in April 2004 to build an MED plant in Benghazi, Libya as well as a USD6.5 million contract to carry out the Zawia MED Project in the same country in February of the following year. Both of these projects were small-scale projects for building MED plants with a capacity of 1MIGD each, but the company decided to go after this niche market in Libya and other North African countries. After that, Doosan started developing large-scale MED systems at the Dubai Water R&D Center after establishing the center in 2006.

On February 7, 2011, Doosan finally tapped into the market for large-scale MED systems by signing a USD124 million Yanbu Phase 2 MED Desalination contract with the Saline Water Conversation Corporation of Saudi Arabia. The project involves building the world's largest MED plant with a capacity of 15MIGD (68,190 tons) per unit in Jeddah. It has nearly twice the capacity of the Fujairah II Desalination Plant in the UAE, which is formerly the world's largest MED plant with a capacity of 8.5MIGD per unit. Once completed, the Yanbu MED plant will be supplying water to over 200,000 people. By winning the contract, Doosan became one of the leading players in the MED market, as well as in the markets for MSF and RO, in terms of technology and marketing power.

After the Yanbu Phase 2 Project, Doosan signed on for another mid-sized MED project on September 13, 2011. Marafiq, which is a government-run company in Saudi Arabia, commissioned this project, which carries a contract value of USD80 million. The Marafiq Yanbu MED Project for building two 6MIGD units is taking place in the industrial city of Yanbu, which is located about 350km northwest of Jeddah, the second largest city of Saudi Arabia.

Total Water Solutions Provider

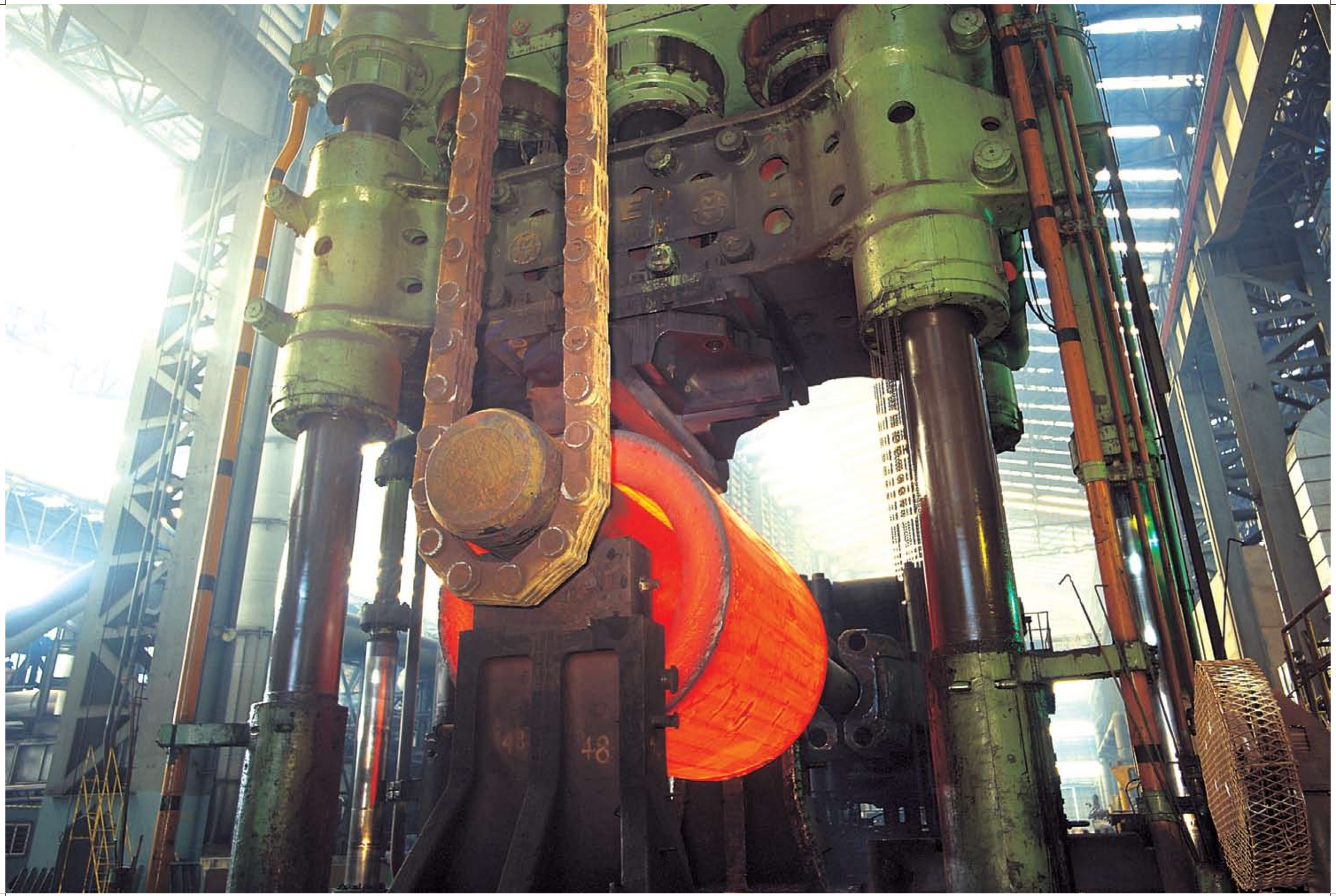
By winning and carrying out a series of projects in Saudi Arabia and the United Arab Emirates between the 1980's and 1990's, Doosan succeeded in developing proprietary technology for desalination plant engineering, which has been led by several companies from the US, Europe, and Japan. With that, Doosan became a leading supplier and eventually the world's number one supplier of desalination systems by earning the trust of clients in the course of carrying out projects. In the Middle East region, Doosan has successfully completed a total of 27 projects, which have led to an aggregate capacity of 5.8 million tons of potable water per day for more than 20 million people to use at the same time. No other companies in the world have this much hands-on experience in supplying desalination plants.

In December 2008, Doosan signed a technical agreement with Carollo, the largest water treatment services company in the US in a measure to enter the water treatment market and ultimately to expand its share in the market for water solutions. Water treatment involves purifying sewage and wastewater for industrial and household use. As of 2010, the market is estimated to be worth around USD3.3 billion with an annual growth rate of over 15%, and it is forecast to reach USD10 billion by 2015. Doosan plans to develop water treatment technology as a growth engine for the future since it's seen as an alternative solution to global environmental pollution and water shortage.

Seokwon Yun, CEO of Doosan Water Business Group, said, "In the long term, we'll elevate our position as a total water solution provider and expand not only our EPC business but also our operation and maintenance businesses so that we can become the top water solution company both in Korea and overseas."

Marafiq Multi-Effect Desalination (MED) Plant Contract Signing Ceremony, Saudi Arabia (September 13th, 2011)

CASTING & FORGING



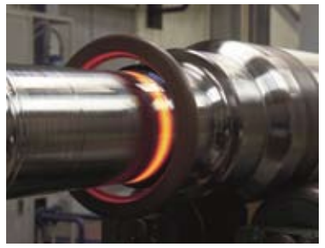
CASTING & FORGING

The Cradle of World-Class Products

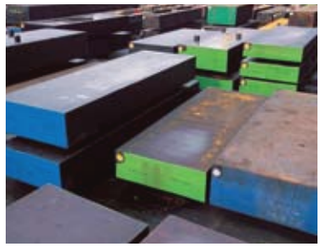
Crankshaft

Turbine Generator Rotor Shaft

Low Pressure Steam Turbine for Thermal Power Plant



Work Roll



Mold Steel

Stern Casting for Large Vessel

Cast Water Turbine


CAPA SOTON
300/600톤

CASTING & FORGING

Creating Masterpieces of Craftsmanship

"Doosan's Casting & Forging BG is globally competitive because it makes the highest quality products and has a wide product lineup. It produces top quality products for shipbuilding, thermal power plant, nuclear power plant, iron & steel making, petrochemical, and mold steel. Product diversification has made the BG less dependent on specific industries and enabled it to remain largely impervious to economic change. Continuous technical development is yet another factor why it remains a global leader in the industry. The products of BG are differentiated from those of its competitors. As proof, seven of its products were chosen as WCPs, or 'World-Class Products.' However, the most important factor in gaining competitiveness is people. Those working in other business divisions jokingly call the casting & forging factory the 'kremlins,' mainly because they do their job without complaining. Prior to the privatization of the company, the business division has been in red for nearly 20 years. Therefore, those in other divisions looked down on them, but without being deterred, they were relentless. They were passionate about their job and remained faithful to it. As a result of their relentlessness, those at the Casting & Forging BG have very strong teamwork and look after one another. They have achieved a great deal thus far, but they know they still have a long way to go to make their workplace the world's best factory in casting and forging field."

- Excerpt from an interview with CEO of Casting & Forging BG

The Birth
- Changwon Plant in Full Operation

The completion of the Changwon plant was like a fanfare of trumpets as it marked the take-off of the Doosan Casting & Forging BG. The stages between the opening of the Casting and Forging Shops in the Changwon plant and development of proprietary technology marks an important period in history on the development of the casting and forging industries. Not only that, it was also the origin of the materials industry that sparked the growth of Doosan.

Development of Casting Materials and Proprietary Technology

After years of implementing advanced technology and facilities, the steel mill started producing ingots from the 100-ton and 30-ton electric furnaces, where iron is melted at 1650℃ before being moved to the 155-ton refinery. Once moved to the refinery, the iron is turned into an ingot in the state of vacuum. In 1983, the shops succeeded in making an ingot weighing 430 tons.

Cast steel products are very important success factor for Doosan. Therefore cast steel production always held a special place in the history of the company. Not only that, it's also directly related to the development of proprietary technology in cast steel production. It's historically important because the nozzle casting from the mills was the first product that Korea ever exported. In short, Korea started producing cast-steel products after exporting a nozzle to the US. It was followed by the production of a series of large cast-steel products, particularly for power generation systems.

The casting business picked up in 1983, when the company started making casting parts for Uljin Units 1 & 2. In the project, the company signed a technical arrangement with Terni, an Italy-based casting and forging company, and started developing proprietary technology in the production of castings for power plant parts. Employees were sent to Italy to learn from the Italians, and Italian supervisors resided in the Changwon plant for technology transfer.

As for parts for the nuclear power plant, the company started producing turbine casings made of martensite stainless steel and valve casings and elbows made of Cr-Mo alloy and carbon steel for the nuclear power plants in Yeonggwang, Uljin, and Wolseong as well as those designed by

GE, an American company. In the process, the company also succeeded in developing proprietary technology for a number of steel products. Simultaneously, the company supplied turbine casings to the US-based Westinghouse and Shanghai Plant, as well as the world's largest 1,500MW turbine casings ordered by the EDF (Electricite de France).

The company has also successfully developed thermal power plant parts, which needed to withstand higher temperatures than those of a nuclear power plant, and was put in charge of supplying parts to the thermal power plants in Samcheonpo, Boryeong, Taean, Hadong, and Banwol, as well as to the combined heat and power plants in Banwol and Gumi. Needless to say, Doosan did not succeed in making all the cast steel products from the very beginning, for it had gone through many hardships.

The company has successfully made parts for hydropower plants, and started Francis runners since 1984. Doosan has been exporting Francis runners to the US since 1984, as well as for the hydraulic plants in Hwacheon and Hapcheon in Korea. It started exporting 'Francis Runners' to Japan, instead of importing them, as Korea always had before. Japanese companies such as Toshiba, Fuji, Hitachi, and MHI began importing Korean-made runners. It was based on this fact that the company was able to develop proprietary technology for most of the cast steel hydraulic power parts in 1987 and 1988.

Turbine Casing Production

It also made great strides in the production of cast steel for other industries, including large mill housing and other steel mill parts, as well as medium and large sized cast steel products made of carbon steel, low-alloy steel, and stainless steel for cement manufacturing facilities.

Implementation of Large Ingots and Forging Technology

The completion of the Changwon plant not only made cast steel production possible, but also increased the production of forged products. At first, the Casting and Forging Shops focused on producing a wide range of machine parts necessary for running other shops and factories in the Changwon plant, and eventually made the large main shafts for the Samnangjin Pumped Storage Power Plant for the first time in Korea.

The Forge Shop produced large forged products by using ingots. Its first product made of a 430-ton ingot and pressed by the 13,000-ton press, became the generator rotor shaft for the Uljin Nuclear Power Plant Unit 2. The shop has also manufactured high-temperature and high-pressure rotor shafts for the Uljin Nuclear Power Plant in the same year. In 1987, its quality was evaluated through a pilot production of a mock-up shell, one of the core components of a nuclear power station, before being assigned with the task of producing materials for the reactor vessels and steam generators to be installed at the Yeonggwang Nuclear Power Plant Units 3 & 4 in 1988.

In producing the reactor vessel, Doosan did not use the traditional method of bending the steel plate before welding the parts together. Instead, it employed a new, never attempted method of manufacturing a single-module shell so that it did not have to be welded. It was a revolutionary change in the industry of heavy manufacturing. However, it was achieved after a series of failures. The engineers could not obtain an essential property of matter, which resulted in the error of attempting to perform quenching heat treatment with a large amount of salt in order to improve the cooling performance. In another case, it took five years for Doosan to make some equipment while Westinghouse took only three years for the same equipment. Doosan went through a number of trials before establishing a reputation as a nuclear power parts manufacturer.

Besides the development of Korean standard power plant parts, Doosan also signed a technical cooperation agreement with the UK-based Sheffield Forgemaster in 1985. The technical partnership enabled Doosan to develop a back-up roll in a Korean standard, which is one of the main components of a rolling mill, and started supplying it to a number of domestic companies since 1987.

In 1984, Doosan started developing and manufacturing power plant materials, as well as ship parts, cement facilities, and steel mill parts. It also succeeded in developing cast tool steel with its own technology, and supplied various steel products such as plastic die steel and hot/cold work die steel to domestic companies. As a result of the development of tool steel, the company played a role in Korea's industrial development. Despite this, the Changwon plant barely posted an operating rate of approximately 10%.

Nuclear Reactor Core Shell Forging

Lift-Off
- Portfolio Diversification

While Doosan gained experience in the course of implementing and accumulating technology, as well as making Korean history in casting and forging, the operating and productivity rates were still very low. There was even discussion that the Casting and Forging Shops should be sold. But others remained adamant and justified the existence of the Casting and Forging Shops, saying that the future of the power plant industry would be uncertain if they didn't have the capacity to produce materials on their own. In the 1990s, they decided that the plant could not generate enough profit to be sustainable just by producing power plant parts. As a result, they were forced to diversify their product portfolio.

Tapping Into the Market for Large Ships

After the successful development of the first plastic mold steel (HP1A) in 1984, Doosan proceeded to make technical progress by introducing the next models in 1988 code-named HP4A and HP4MA. In 1991, it also developed a special type of hard die steel (HEMS) for TV cathode ray tubes for portfolio diversification. Also in 1991, Doosan used closed-die forging, or impression-die forging, to develop crankshaft manufacturing technology for low speed marine engines.

The crankshaft is the part of an engine that converts linear piston action into a rotating motion. The pistons and connecting rod deliver the explosive energy generated from the cylinder to the connecting rod and crank throws in order to continuously rotate each of the throws, which in turn deliver the propulsive force of the engine to the propeller. It is one of the most important parts of a large ship that need to be solid and precise. Doosan began gaining experience in this area by manufacturing crankshafts for low speed marine engines.

As the 1990s rolled around, more stringent design regulations were applied on double-hulled vessels globally, and this provided a great opportunity for Korean shipbuilders. The future of shipbuilding looked bright, so Doosan decided to specialize in crankshafts for large ships. But many opposed this idea, saying that they were unclear about the economic feasibility of the plan to qualify as a breakthrough, particularly when the company has been in the red for so many years.

Despite opposition from people both in and out of the company, the board of management still had high hopes for the large marine engine crankshafts, so they went ahead and built a crankshaft factory despite all the opposition. The factory was completed in April of 1993. For technology implementation, they signed a technical cooperation agreement with Japan-based JSW with the proprietary technology in this area. Doosan managed to obtain the crankshaft technology after many attempts. Today, Doosan is recognized as one of the top manufacturers of crankshafts in the world.

There are two different methods of manufacturing crankshafts: 'Casting Type' and 'Forged Type'. Doosan specializes in low speed (90~120rpm) crankshafts made of hard forged steel to make them lightweight and compact ? a reason why it has a high market share. Large crankshafts can't be made with a single piece of steel because of its size and weight, so the shrink fit, or interference fit, is employed to assemble crank throws and shaft together.

Crank Shaft for Large Vessel

Production of Large Iron & Steel Manufacturing Facilities

Despite experimental errors during the trials, the entrance into the crankshaft market was an important achievement for Doosan that gave confidence to the company in expanding into new businesses. Interested in building steel mill parts with a new set of goals, Doosan scrambled to get ready for business expansion. In 1996, Doosan entered into a technical agreement with KANTOC of Japan for the development of proprietary technology for forged steel work roll, and started making necessary preparations for the production of work rolls, which are one of the core facilities for steel mills. In the process, Doosan boasted its technological prowess in the areas of casting and forging, by successfully building the world's largest 350-ton mill housing with a single block of cast steel. It took over 10 months to build the housing after signing a supply contract with MHI, the client was more than impressed with the level of quality.

In October of 1997, after the completion of yet another factory with the capacity of producing 1,500 cold work rolls a year, Doosan began manufacturing work rolls in earnest. Attaining an even,

homogeneous surface hardness is the most important factor in making a work roll. To achieve this, Doosan needed to have the technology that would enable them to perform induction heating and cooling simultaneously. As a result, Doosan went ahead and built an array of heat treatment and processing facilities as well as another remelting furnace for re-refining, a process required for producing high-clean steel. During that time, all the cold work rolls used at the steel mills in Korea were imported from overseas. But with the construction of a work roll factory, Doosan achieved import substitution amounting to KRW 25 billion a year.

In 1998, Doosan proceeded to develop a high-depth work roll with 5% Cr. After the development, Doosan began supplying POSCO Gwangyang Steel Works, JFE of Japan, and CSC of Taiwan with high-depth work rolls. However, Doosan faced a number of problems in the early stage of work roll business, mainly in terms of profitability. Many started pointing fingers at Doosan for starting the work roll business, and some even demanded that Doosan sell the work roll factory. This also sparked renewed skepticism about the casting and forging business.

Roll Manufacturing Plant

Despite their worries, Doosan still went ahead and integrated the work roll factory, existing crankshaft production line, and forging processing line to come up with a 'Work Roll Crankshaft Factory'. It was a demonstration of their will to create a strategic growth engine for its casting and forging business with crankshafts and work rolls, and to put an end to the skepticism.

IMF: Signs of Despair and Hope

Doosan was still having difficulties due to a low operating rate and new business expansion, but kept striving toward the development of casting and forging technology.

The company obtained the KEPIC certificate in 1997 after being recognized for its manufacturing technology in the area of power generation systems, as well as a new technology certificate called KT Mark, which is given to super hard stainless molding materials. In the construction of the Gwangan Bridge, now a landmark of the city of Busan, Doosan supplied KRW 13.9 billion worth of cast and forged steel, bridge tower, truss, and girders as part of its diversification scheme.

In 1998, Doosan installed a huge vacuum tank with a diameter of seven meters at the Casting Shops for the production of large rotor shafts and the improvement of overall productivity. During the excavation of the site for the vacuum tank, the excavator pierced a water vein, flooding some parts of the Changwon plant. Despite the setback, the tank was installed and the casting and forging facilities were upgraded, thanks to the implementation of the new facility.

Doosan produced 430 tons of ingots in 1984 and tested its limit by trying to produce 530 tons of ingots in 1998. However, in the first production, an explosion took place while the vacuum was being released, injuring one worker. A new challenge is almost always accompanied by a hardship, but Doosan always overcame every obstacle and enjoyed the sweet taste of success.

The entire nation was in turmoil during the financial crisis of 1997, and Doosan's casting and forging business was no exception. One-third of the workers lost their jobs at the Changwon plant, and those at the Casting and Forging Shops sacrificed the most. The management board of Doosan saw they needed a total management overhaul, as they considered spinning off the casting and forging business.

Instead of going through the process of a mass overhaul, they continued to run the shops and invest in technology development for productivity improvement. Then they were presented with an amazing opportunity. The Korean won value was cut in half, drastically improving the company's price competitiveness in casting and forging. Doosan's cast and forged products were now suddenly better priced than those of Japan, the global leader in the industry at the time, as well as the Chinese enterprises that were disrupting the market order with low-price bids. Orders started pouring in as the competitive market environment changed, much to the delight of the workers at the Casting and Forging Shops. They had been working only on the day shift as there was not much to do at the shops. But the rush of orders forced them to hire more hands and work on the graveyard shifts as well. So it was not until 1998 that the Casting and Forging Shops started operating 24 hours a day, as this continued until the mid 2000s. For instance, the Casting Shop, which produced only about 110,000 tons of molten metal in 1997, shelled out 140,000 tons in 1999 and then 170,000 tons in 2000.

As the operating rate increased, the company developed a method of producing larger cast steel with even hardness as well as 5% Cr backup rolls, diversifying its product portfolio. But still, the Casting and Forging Shops posted a deficit.

The Growth
- The Emergence of World-Class Products

Privatization has brought about many changes in Doosan as well as the positive changes in the casting and forging business. The Casting and Forging Shops were on the brink of being sold off to another company on more than one occasion, but it started generating profits in just two years after the privatization. Under a new management system, the business started to grow. Twenty years of technology development and accumulation had finally paid off, and it even produced a number of 'World-Class Products'. Doosan Casting & Forging BG has slowly but steadily established a basis for growth, in the course of laying the cornerstone for the rapid growth of Doosan's entire business.

A Turnaround

Although the Casting & Forging BG posted growth at the end of 1990s thanks to a weak Korean won, it was always in the red until the privatization of 2001. But it was finally ready for takeoff after corporate reorganization. Following the corporate reorganization on October 8, 2001, the casting and forging divisions became an independent business group. The company's functional structure was converted into divisional structure, giving some transparency to the profit and loss of each business division. This eventually served as a basis for establishing a transparent and responsible management system.

However, it was the transparency that dragged down the Casting & Forging BG. People started talking about selling the Casting & Forging BG off, soon after the privatization in 2001, noting the consistent deficit. It was not the first time the subject was brought up, but it was for a very different reason this time because improving business efficiency was the key after privatization. There was just the voice that opposed the idea of selling off the division. Those at the Power Plant BG and Nuclear Power Plant BG were particularly against it. They reasoned that it was highly advantageous to have their own production system in order to maximize the capabilities of the Power Plant and Nuclear Power Plant businesses. So they once again dropped issue of selling the BG.

After the incident, those at the Casting & Forging BG took pains to come up with a more effective way to manage their business, and many ideas were presented and just as many attempts were made at the work site. As a result, a transition program was introduced in 2001, and an optimization program, called the 'TOP', was implemented in all areas of production. The effort to make quality products faster led to production improvement. Under the new system, the Casting & Forging BG borrowed its way to business stability and generated profit for the first time in 2002, just two years into privatization. By this time, it has been 20 years since the establishment of the Changwon plant.

After turning their deficit into profit, the Casting & Forging BG skyrocketed. Its market conditions changed, as the global market for forging and casting products saw an exponential growth in 2003. The Changwon plant started receiving back orders, since its production could not keep pace with the orders. Thanks to the booming market, the Casting & Forging BG found itself in a favorable position. They were no longer in a buyer's market, but rather a seller's market, and they were able to hand-pick their customers. Doosan revved up its production system to focus more on profitability. By that time, Doosan had already created a production program that's designed to maximize profits through production optimization soon after privatization. So the company was ready to rake in more profit, while also keeping pace with the changes in the market.

High Value-Added Products

"The market isn't always on your company's side." In early 2000s, the market conditions were favorable to Doosan Casting & Forging BG, but things were bound to change, especially in the market. So there was the need to expand the product portfolio and create high value-added products in order to stay a step ahead of the game in the market. The company needed to invest more and improve technology.

The crankshaft business was the first to bring results, largely because Doosan had been focusing on the area of technology development ever since the completion of the crankshaft shop in 1993. After 10 years of technology development and two failed attempts, Doosan was finally able to manufacture a highly economical and high performing crankshaft with its proprietary technology. Starting from steel production, forging, heat treatment, and processing to its own 'shrink fit method', Doosan had a comprehensive and seamless process. Doosan also developed an advanced method that enabled the company to process metal to an accuracy of one thousandth of a millimeter.

Its advanced technology was welcomed by the market, and the company saw immediate results. Orders poured in, and the crankshaft shop had to be in full operation day and night. It produced more than 100 units for the first time in 2001. And in 2003, some of its product items were chosen as 'World-Class Products,' as it was recognized for producing global standard products and

having a significant degree of market power. Their success in the crankshaft market was a significant turning point for those at the Casting & Forging BG, since it instilled a sense of confidence.

In 2005, Doosan set a record by producing 220 crankshafts, including the world's largest crankshaft with a length of 27 meters and weight of 414 tons.

In 2004, its mold & tool steel and cold-rolling work rolls were chosen as 'World-Class Products'. In short, Doosan's business of casting and forging metal was thriving. Mold & tool steel was the first product that Doosan produced after the completion of the Changwon plant. Through years of material development, starting from the plastic mold steel in 1984, the BG held the most diverse portfolio among other BGs. Its efforts bore fruit when their products were named the company's representative product. Built in 1997, the Work Roll Shop was the fastest growing sector in the plant. The Work Roll Shop delivered a total of 60 units in the first year, and the number rose to 1,000 in 2003 and 2004 as it claimed the largest market share all over Asia including Japan, from which Korea had imported.

In 2004, Doosan developed rotor shafts for thermal power plants producing electricity at 593℃ , based on which it developed and manufactured later versions of rotor shafts. In 2002, Doosan also developed an SHSS intermediate roll and supplied it to POSCO Gwangyang. After that, Doosan made all-out efforts to develop the base technology necessary to manufacture nuclear power plant materials and other more complex products.

Forging Shop

Casting Shop

The Leap
- Becoming a Top Class Casting & Forging Manufacturer

To many Koreans in the metal industry, Doosan is a dream company. Not only because the company has the world's largest production infrastructure, but also because it has taken all the right steps to become a global leader as it is rightfully called. In 2006, Doosan took over IMGB, a Rumanian casting and forging manufacturer once recognized as the best in Europe, to go global. It was a major turning point for Doosan Casting & Forging BG.

The IMGB Takeover and Global Marketing

The market for casting and forging products boomed in 2003, and the 'heat' of the market didn't die down until the mid 2000s. Doosan continued to invest in building production facilities, but still could not keep up with the orders. Everyone at Doosan agreed that they needed a new set of production facilities to keep pace with the incoming orders, and IMGB of Rumania popped up on the company's radar screen.

IMGB was established in 1963, just one year after Doosan set its foot in the market. It had a production plant about the same size as the Changwon plant, and even had a 12,000-ton press just like Changwon did. IMBG started off as a government-run company receiving all the government support, so it did not take long for the company to become the largest government enterprise in Rumania. But after being privatized in 1998, it was sold to a Norwegian company called Kvaerner. While it was a government enterprise receiving government assistance, it was once recognized as the best casting and forging manufacturer in the world. But after privatization, the company collapsed and failed to generate any profit. So the company had been in the red for many years. Kvaerner could no longer sustain IMGB, so it decided to sell it. And the buyer was none other than Doosan, which happened to be looking for an overseas production facility at the time.

Although IMGB was once called the best in the world in casting and forging, most of its facilities were built more than 40 years ago and its technology was seriously outdated. Even its sales network was in bad shape. By the time it was taken over, its annual production was around 20,000

tons, or just one-tenth of that of Doosan. The first thing Doosan did was to invest in building new facilities and transfer technology by sending a team of engineers to the refurbished plant. Doosan put off repairing the sales network. Doosan had no problem ensuring a certain level of operating rate for IMGB, since it had so many back orders that were about to go past due. That was what the company had in mind at the time of the takeover.

Share Purchase Agreement Ceremony of Kvaerner IMGB, Romania (June 26th, 2006)

Today, about 65% of Doosan IMGB's orders come from Doosan, and the other 35% come from its original marketing network in Europe. Its current annual output is 105,000 tons, or five times higher than the time of the M&A. The company also dug out of the deficit in 2009, three years after the takeover. It reported a small deficit in 2010, but got back into the positive side in 2011. Doosan IMGB is now once again recognized as Rumania's best heavy industries company, as well as a representative company of Rumania.

Substantial Technological Advancements

2006 was a landmark year that saw both 'external' and 'technological' turning points for Doosan. Doosan launched a project in 2006 to develop an integral head for nuclear power plants. It was also in 2006 when Doosan developed a cask used as a storage vessel for fuel rods. The company also enhanced its rotor shaft manufacturing capabilities by developing material for building rotor shafts for thermal power plants producing electricity at 621℃, as well as super large rotor shafts, turbines, and valve casings.

In 2007, Doosan's runners for hydraulic power plants and stern frame casting were selected as 'World-Class Products'. With these, Doosan now had a total of five 'World-Class Products'. Along with mold & tool steel, turbine 'runners' were some of the original products developed by the Changwon Casting & Forging BG, for which the technology development project started in 1984. By 2006, Doosan turbine runners claimed a 17% market share. Doosan started producing stern frame casting in 1982 and selling it overseas in 1985. Its market share has also been on the rise as it was recognized for its quality in the global market. As a result, Doosan recorded the world's highest production volume in stern steel in 2008 and 2011.

In 2008, Doosan made another breakthrough by developing an integral nuclear head for AP1000. Since the steam generator in a reactor vessel must withstand high temperature and pressure, its casing is made by welding cast and forged steel. While operating nuclear power plants, a non-destructive testing of welding joints must be performed to regularly assess the soundness. Hence, the less number of welding joints means less time for non-destructive tests, which consequently leads to improving operating rate and safety of the nuclear power plant. This is the reason nuclear plant operators prefer casting and forging parts to be a single module. To meet customer demands, Doosan went through a complex research and development process including a series of computer simulations and miniature models. As a result, Doosan came up with a giant block of cast and forged steel.

When Doosan started the project, there were only two companies in the world that were capable of building these types of reactor heads. Therefore, the development of a single-module head was the turning point for Doosan to gain reputation as a global casting and forging manufacturer. After the development, Doosan manufactured and supplied a single-module channel head to the Sanmen Nuclear Power Station Unit 1, making the new method applicable to the industry.

One piece of AP1000 reactor shell weighs over 100 tons. To ensure the highest level of safety, the shell weighing over 100 tons has a maximum surface roughness of less than 1mm. To minimize the number of welding joints, steam generators were also built with a single solid block of forged metal. This block of metal actually has a complex design, as more than 10,000 tubes must go through it, but Doosan still managed to make it while keeping their goal of minimizing the number of welding joints for the sake of safety. The AP 1000 is a TSP (Tube Support Plate) used to hold tubes stretching over 10 meters tightly. This solved the concern of tubes wearing out too soon, as this was important because tubes tend to have the shortest lifespan among the steam generator components.

Doosan proceeded to supply the APR1400 in 2010 and then develop a new reactor head in 2011, which made it possible to supply major equipment for the nuclear power plant in the UAE.

Shipment of Sanmen Nuclear Power Plant's AP1000 Reactor (July 23rd, 2011)

The World's Best Products in the Making

Although it hasn't been named a 'World-Class Product' yet, the plate back-up roll developed jointly with POSCO in 2009 is the most likely candidate. Doosan became the second company in the world to manufacture the 236-ton back-up rolls, and supplied a total of 10 units to POSCO Gwangyang Steel Works immediately after the development process was over. In 2011, Doosan set up an independent production line dedicated to producing back-up rolls, which was one of the most important components for a rolling mill. Doosan established a production line capable of producing 340 crankshafts a year in 2008. In 2010, the company expanded its Forging Shop and Crankshaft Factory so they could produce 425 crankshafts a year. Since Doosan began producing crankshafts in 2003, it has always posted a steady growth, until earning worldwide recognition as the best crankshaft supplier in the world.

An expansion of the Casting & Forging BG's own VBM processing facility couldn't be put off due to the global market calling for steady supply and on-time delivery of reactor shells. So in December of 2009, the management board gave the acknowledgement to the Casting & Forging BG to implement the expansion project with the goal of starting commercial operation by the end of 2011. Both the expansion of the installation factory and structural improvement for installing a 400-ton crane were carried out without any major setbacks. The foundation construction for installing new facilities such as the VBM processing equipment had to be delayed for about a month because a 300-ton back-up roll lathe also had to be installed in the same factory and it took up a large amount of space, but the entire project was completed on time and the refurbished factory was able to make a prototype in a test run in June 2012. After the VBM started commercial operation, the Casting & Forging BG was able to produce four 1400MW nuclear power units a year.

In 2009, the management gave priority to the investment in the installation of a 300-ton lathe and the final investment decision was made in September of the same year after an economic analysis and investment feasibility study. Workers had to work day and night to finish installation ahead of schedule because the precision processing of POSCO's plate back-up roll had to be performed on the new lathe. After the installation and test run of the new large lathe with the grinding function were completed in just three months, Doosan started commercial operation in July of 2011. After the high precision processing of a prototype plate back-up roll was successfully completed, Doosan held an official opening ceremony on September 5, 2011. It was a turning point for the Casting & Forging BG since it now possessed the ability to process super large products.

The Cradle of World - Class Products

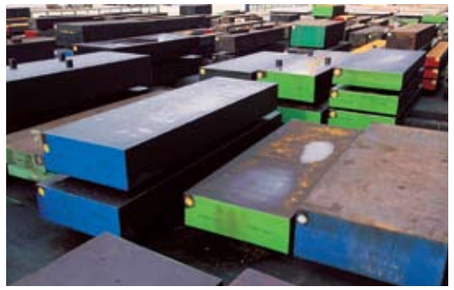
The Casting & Forging BG is the oldest business division of Doosan, and it is also the one with the highest number of 'World-Class Products'.

The 'World-Class Products' are selected once a year by the Ministry of Knowledge Economy, among the Korean products ranking fifth or higher in terms of global market share in a market scaled at more than US$50 million. In addition, the global market size must be twice the size of the Korean domestic market and the total export value of the product should be at least US$5 million. Among the cast and forged products, crankshafts were the first to be selected as a 'World-Class Product' in 2003. It was followed by rotor shafts for turbine generators in 2011. Today, the Casting & Forging BG has a total of seven 'World-Class Products'. In addition to those, Doosan has a wide range of other products that fully qualify to be selected as a 'World-Class Product'.

Crankshaft: Made of crank throws and a journal and thrust shaft, the crankshaft converts linear piston action into rotation, which in turn, turns the propellers to move the ship.

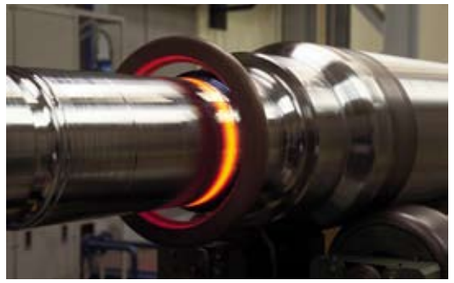
Doosan specializes in the manufacturing of forged crankshafts for low speed (90~120rpm) engine, and it has a comprehensive production system ranging from high purity ingots, forged products, 'shrink fit' assembly, and precision cutting, which are all used to manufacture over-sized crankshafts. The company has positioned itself in the world's top tier based on these outstanding facilities and manufacturing technology, and is recognized by global customers for the quality of its products.

Crank Shaft for Large Vessel



Mold Steel

Mold Steel: The development of Korean mold steel industry started in the mid 1980s with the support of the government, as it saw the need to produce mold steel in the country instead of importing it from Japan or Europe, in the wake of the rapidly increasing demand for electric/electronic products as well as automobiles. In this aspect, Hanjung was established in just the right moment in 1982. The company started developing mold steel for plastic injection for the first time in Korea. As a result, it began supplying mold steel to large domestic home appliances manufacturers and automakers in 1984, while also accumulating technology in this area. In 1999, the company also developed large mold steel with uniformity in hardness distribution and became the only company in Korea capable of producing such steel. It eventually was selected as a 'World-Class Product' in 2004, marking the second 'World-Class Product' of the Casting and Forging BG.



Work Roll

Work Roll: The work roll is a core component of a rolling mill, or roller. It directly touches the metal to be rolled to produce a cold rolled plate with the required thickness. Doosan built a work roll factory in October of 1997 to start a full-scale production of work rolls.

Turbine Runner for hydraulic power plants: Runners for hydraulic power plants are made of stainless steel. Various turbine models include Francis, Kaplan, Pelton, and Bulb. Among these, Francis runners are most widely used. They're generally composed of three different parts, including the crown, band, and blade. These cast steel parts are either welded together, or cast as one single block of steel from the beginning. The configuration is a very important factor that determines the efficiency of a hydraulic power plant, so it requires strict measurement invariance and quality.

Stern Frame Steel: Rudder horn and stern boss are the most important components for steering and propelling a ship. They're categorized as cast parts of the stern because they're generally installed in the stern. A rudder horn is used to hold and support the rudder, a device for steering a ship. It's directly connected to the rudder stock and pintle, which are made of Doosan forged steel. A stern boss supports the propeller and propeller shaft of the ship, so it enables the ship to propel forward. The stern steel requires a very complex configuration and high precision measurement since it is fitted on the hull. It is like a piece of art that requires expert hands in all stages of production, including the wooden pattern design, modeling, heat treatment, processing, and correction.

Stern Casting for Large Vessel

Rotor Shaft for Low Pressure Thermal Turbines and Rotor Shaft for Turbine Generators: The Casting and Forging BG produces forged rotors used in coal-fired thermal and nuclear power plants, and supplies them to Doosan's Power BG and overseas power generation companies. Forged rotors are largely categorized into HP/IP/LP (High/Intermediate/Low Pressure) Turbine Rotor Shaft and Generator Rotor Shafts.

Low Pressure Steam Turbine for Thermal Power Plant

Turbine Generator Rotor Shaft

These rotor shafts are made by forging an ingot from the steel making with electric arc furnace and refining with a 13,000-ton press then is sent to another shop for pre-heat treatment, processing, and quality heat treatment. The final configuration of the shaft is obtained after testing its internal quality and mechanical properties such as the UT, tensile test, and impact test. Since the internal quality requirements for a shaft are much more stringent than those for other products, producing a high quality ingot is an absolute prerequisite in manufacturing a rotor shaft. A rotor shaft can be anywhere from 2.5m to 18m long, but the mechanical property must be even throughout the whole body. So a rotor shaft requires the highest level of manufacturing technology among large forged and cast products. Doosan's LP turbine rotor shaft for thermal power and turbine generator rotor shaft were selected as a 'World-Class Product' in 2010 and 2011, respectively.

The Present and Future of Casting & Forging

The prospects are not bright for the global casting and forging market in 2012. When the market was at its peak in the mid 2000s, companies around the globe invested in facilities, particularly in China. The excessive competition came back to them like a boomerang with severe repercussions after 2010. To make things even worse, the Lehman Brothers collapse in 2008 led to a serious financial crisis. As if that was not enough, the European economic crisis in 2011 and 2012 put the casting and forging market into a deeper state of depression.

However, the slowing global market for casting and forging has not slowed down Doosan. Today, only a handful of casting and forging manufacturers are generating any profit in the world, and Doosan is one of them, with an operating rate of 100%. Despite being busy, Doosan slightly lowered its sales goal for 2012 compared to 2011. This is mainly due to declining price caused by competition with other companies in bidding for contracts. Although the aftermath of any depression is a definite factor that can stunt business growth, it's not enough to stop Doosan from generating profits.

The global market for casting and forging may be in a slump, but Doosan's Casting & Forging BG remains unaffected, thanks to its highest level of technology in the industry. The company has a diverse portfolio, which frees the business unit from the reliance on certain product and ensures business stability. Its great business stability also gives it enough room to cope with changes. Jeog Jeon, Managing Director of Doosan's Casting & Forging BG, said, "We surely can't let our guard down in the face of depression and new competitors. So we still have our focus on producing the products that others can't because we know that they can get ahead in the game if we make products that can be made by others." He added that they're making all the necessary preparations to overcome the depression and stay more competitive.

As of 2012, those at Doosan's Casting & Forging BG think that making a super large integral reactor vessel head for the nuclear power plant in the UAE and parts necessary for building main systems at Sin-Gori Nuclear Power Plant Units 5 & 6 are the most pressing matters at hand. They're also concentrating on the manufacturing of an AP1000 for Sanmen Unit 2 so they can tap into the Chinese nuclear energy market.

Simultaneously, they're focusing on developing new plant materials that can withstand deep water and extreme cold. Due to the continuous rise of demand for more industrial plants for oil mining in deep waters and extreme cold, it will create a new blue ocean that Doosan can't afford to lose sight of. Doosan's Casting & Forging BG is giving more impetus to the development of mold steel that has been in its portfolio for the longest time so it can supply high polish cast steel to high definition TV makers. It's currently carrying out a project to develop super-hard, heat-rolled mold steel.

Seok-hee Ko, Executive Vice President of Doosan's Casting & Forging BG, said, "We plan to double our sales and increase our operating profit by 2.2 times in 10 years. We'll transform our casting and forging business into high-value added business, and become the best in the metal industry. Now, even JSW of Japan sees us as one of their biggest competitors, when not too long ago, they didn't take us seriously. They are envious of us when they see our great production facilities and how we have accumulated technology, even though they are the biggest casting and forging company in the world. Doosan will grow to be a dream company not only for Koreans, but also for every metal engineer in the world." In the interview, he didn't hide his pride in Doosan, nor doubted its potential for future growth.

To become the top player in the casting and forging industry within 10 years, Doosan's Casting & Forging BG is making efforts in the development and commercialization of new products for power plants, nuclear energy, offshore plants, die casting, and steel mills. The BG has been developing a total of 15 new products a year and newly formed their own R&D Team within the business division. Furthermore, they have also reorganized their marketing team and hired more marketing professionals to bring major changes in customer service.

APPENDIX

01 Top Management

GEEWON PARK

Chairman &
Chief Executive Officer

Education

Feb. 1984	Graduated from Kyungshin High School
Feb. 1988	Graduated with BA from Yonsei University, Seoul, Korea
May 1990	Graduated with MBA from Stern School of Business, New York University, USA

Professional Experience

Feb. 1988	Joined Oriental Brewery Co., Ltd
Jan. 1992	Joined McCann-Erickson Hakuhodo (Tokyo)
May 1992	Joined McCann-Erickson World Wide (New York)
May 1993	Joined Doosan America Corporation
Jan. 1997	Appointed Director of Doosan Corporation
Dec. 1999	Appointed Vice President of Doosan Corporation
Jan. 2001	Appointed Executive Vice President of Doosan Heavy Industries & Construction
Dec. 2007	Appointed President of Doosan Heavy Industries & Construction
Mar. 2008	Appointed Chairman & Chief Executive Officer of Doosan Heavy Industries & Construction
Mar. 2009	Appointed President & COO of Doosan Corporation
May 2012	Appointed Chairman & Chief Executive Officer of Doosan Heavy Industries & Construction (present)
	Appointed Vice Chairman & Chief Operating Officer of Doosan Corporation (present)

Awards

Dec. 2009	5th Korean CEO Grand Prix Award
	2009 Korean CEO Award for HR Management
Dec. 2010	2010 Yonsei University Alumni Award for Outstanding Contribution in Commerce and Economics
	Gold Tower Order of Industrial Service Merit in 1st Atomic Energy Day

Education

Jan. 1969	Graduated from Gyeonggi High School
Feb. 1974	Graduated from College of Business Administration, Seoul National University (Korea)
Jun. 1981	Graduated from Michigan State University (USA) with MBA

Professional Experience

Sep. 1975	Passed 17th Higher Civil Service Examination
Apr. 1996	Director of Statistics and Research Dept., National Statistical Office
Jan. 1997	Director of Policy Development Bureau, Ministry of Finance and Economy
Jan. 1999	Director of Fiscal Reform Bureau, Planning and Budget Commission
Sep. 1999	Director of Budget Management Bureau, Ministry of Planning and Budget
May 2001	President and Chief Strategy Officer of Doosan Corp.
Nov. 2001	President of Neoplux
Mar. 2003	President of Doosan Techpack
	President of Samhwa Crown & Closure
	Vice-chairman of Neoplux (Present)
Apr. 2003	Chairman of Korean Association of Corporate Restructuring Companies (KACRC)
Feb. 2006	President of Doosan Construction & Engineering
May 2007	Vice-chairman of Doosan Construction & Engineering
	Vice-chairman of Korea Employers Federation (Present)
	Director of Federation of Korean Industries (Present)
	Acting Owner of the Doosan Bears baseball team (Present)
Jun. 2008	Vice-chairman of Doosan Heavy Industries & Construction (Present)
Feb. 2009	Chairman of Korea Association of Machinery Industry

Awards

Dec. 1983	Presidential Award
Dec. 1995	Hwangjogunjeong-Honor

JITAIK CHUNG

Vice Chairman

KEYSUN HAN

President &
Chief Operating Officer

Education

Feb. 1994	Graduated with MBA from Yonsei University
Feb. 1978	Graduated with Bachelor of Social Studies Education from Seoul National University

Professional Experience

Mar. 1978	Strategy Team Leader of Daewoo Group
Apr. 1988	Planning Team Leader of Jinro Group
Nov. 1995	Managing Director of Jiinro
Jul. 1998	Sales& Mktg Vice-president of Jinro& JBC
Jan. 2002	Sales Senior Vice-president of OB Company
Oct. 2004	Vice president of Doosan Liquor BG
Mar. 2005	President & CEO of Doosan Liquor BG
Mar. 2009	President & COO of Doosan Infracore
Sept. 2009	President & CEO of Doosan Infracore
Mar. 2011	President & COO of Doosan Heavy Industries & Construction (present)

02 Top team

HABANG KIM

Executive Vice President
Nuclear Power Plant Business Group

HUNTAK KIM

Executive Vice President
EPC Business Group

DONGSOO SUH

Executive Vice President
Power Business Group

SEOKWON YUN

Executive Vice President
Water Business Group

SEOKHEE KOH

Executive Vice President
Casting & Forging Business Group

MYUNGWOO KIM

Executive Vice President
Management Division

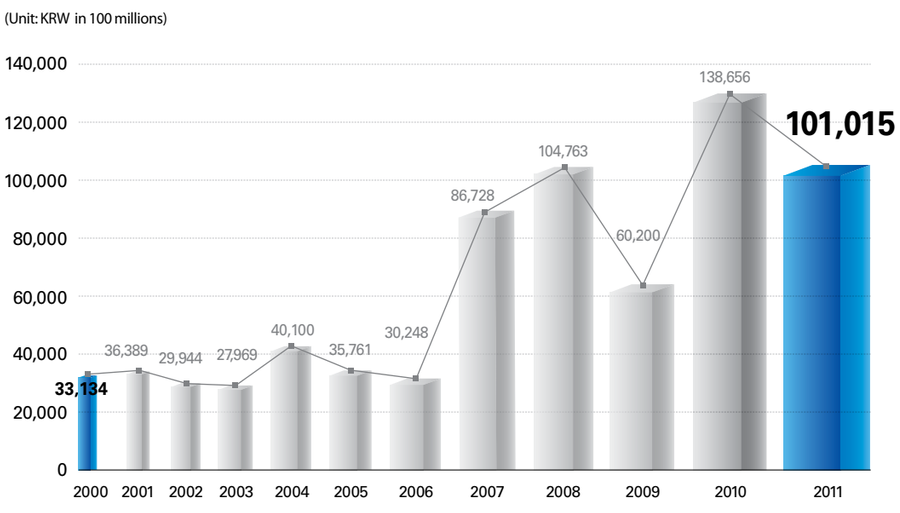
MYEONGHO JANG

Senior Vice President
CFO

SEUNGJOO CHOE

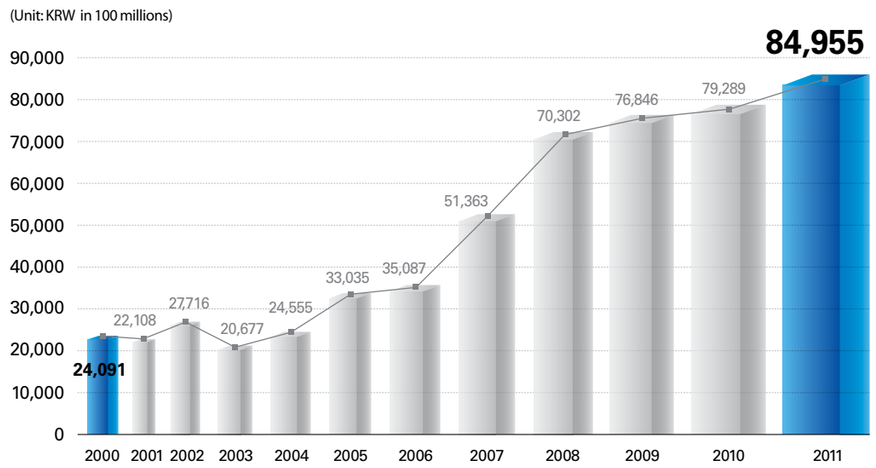
Executive Vice President
CTO

03 Orders



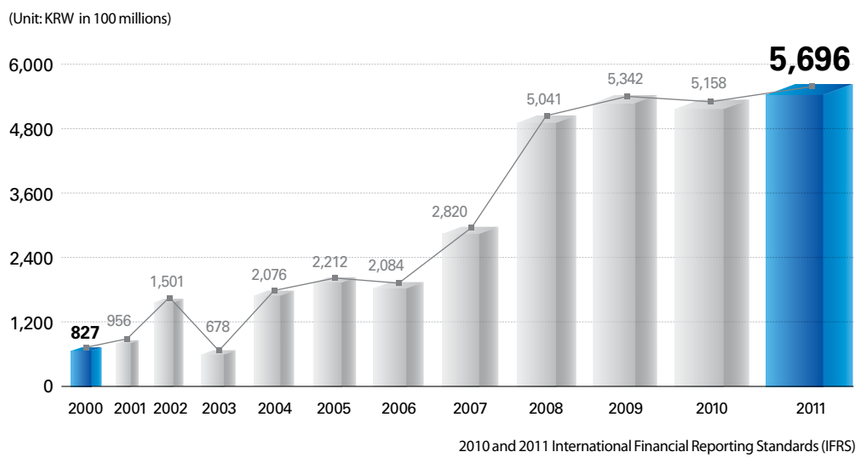
2010 and 2011 International Financial Reporting Standards (IFRS)

04 Revenue



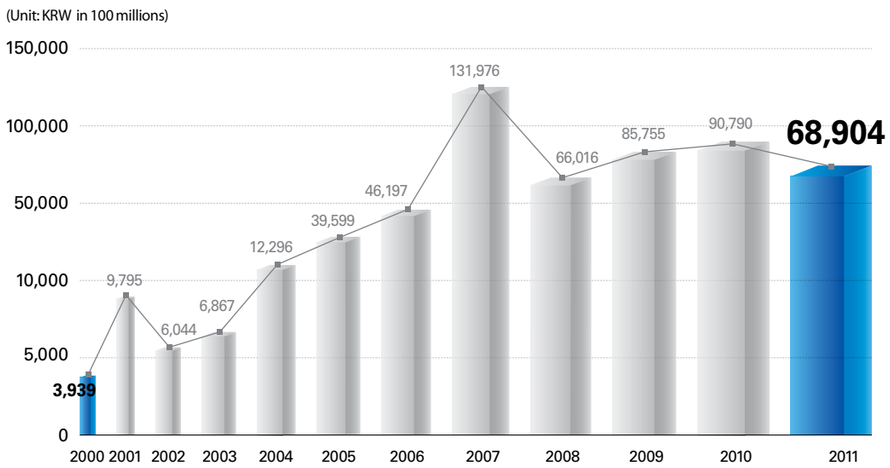
2010 and 2011 International Financial Reporting Standards (IFRS)

05 EBIT

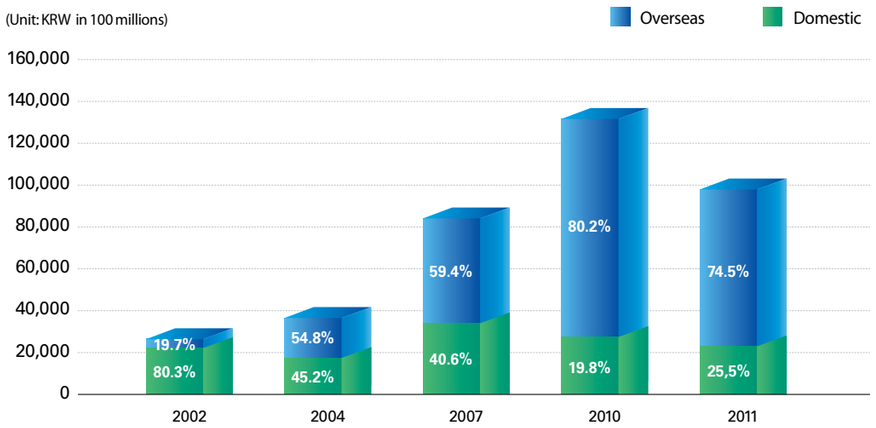


2010 and 2011 International Financial Reporting Standards (IFRS)

06 Market Capitalization

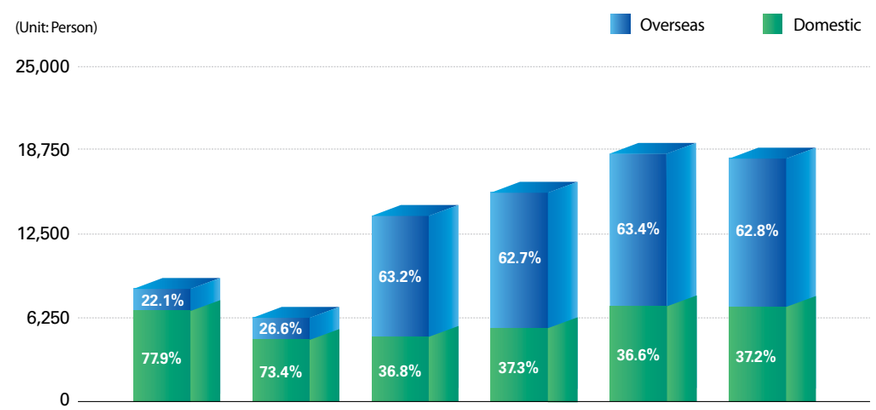


07 Domestic and Overseas Order Status



Overseas	5,893	21,986	51,503	111,183	75,283
Domestic	24,051	18,114	35,225	27,473	25,732
Total	**29,944**	**40,100**	**86,728**	**138,656**	**101,015**

08 Domestic and Overseas Employees



Overseas	1,800	1,772	8,300	9,842	11,905	11,610
Domestic	6,358	4,889	4,843	5,853	6,871	6,867
Total	**8,158**	**6,661**	**13,143**	**15,695**	**18,776**	**11,610**

09 Major Domestic and Overseas Projects

EPC

CCPP ; Combined Cycle Power Plant

no	Project	Contranct	Client	Capacity	Location
1	Qurayyah Add-on	2009.09.16	SEC(Saudi Electricity Company)	1,238㎿	Damman, Saudi
2	Barka Ph2 IWPP	2006.12.13	SMN Barka Power Company S.A.O.C	685㎿ + 26.4㎿D	Barka, Oman
3	Daharki	2007.09.10	Fauji	177㎿	Parkistan
4	Qatalum	2007.07.11	Qatalum Company	1,250㎿	Qatar
5	JBL M	2007.03.01	DEWA	1,945㎿	UAE
6	Amman East	2007.02.25	AES	370.05㎿	Jordan
7	Taweelah A10	2006.12.15	GTTPC	216㎿ CoGen	UAE
8	Fujairah Power & Water Project	2001.06.30	Union Water & Electricity Company	660㎿ + 100㎿D	Fujairah, UAE

TPP ; Thermal Power Plant

no	Project	Contranct	Client	Capacity	Location
1	Mong Duong 2	2011.08.07	AES-VCM Mong Duong Power Company	600㎿ x 2	Vietnam
2	Rabigh Stage 2	2010.09.28	SEC(Saudi Electricity Company)	700㎿ x 4	Jeddah Saudi
3	Raipur	2010.01.22	GMR Energy	685㎿ x 2	India
4	GHECO-One	2008.07.10	GHECO-One (Glow Hemaraj Energy Company Limited)	660㎿ x 1	Bangkok
5	Cirebon TPP	2008.04.30	PT. Cirebon Electric Power (Indonesia)	660㎿ x 1	Java, Indonesia
6	CEBU CFB	2007.12.10	KSPC(KEPCO+SALCON)	103㎿ x 2	Naga city, Philippines
7	Hadong 7, 8	2007.03.01	South Power Generation Co.	1,000㎿ (STG2)	Korea
8	Amman East	2007.05.01	TATA Power (CGPL)	800㎿ x 5	Gujarat, India
9	GLOW CFB	2007.02.21	Glow Energy Public Co., Ltd.	115㎿ x 1	Rayong, Thailand
10	SIPAT	2004.05.06	NTPC (Natonal Thermal Power Corporation Ltd.)	660㎿x 3	Sipat, Chattisgarh, India

Boilers

no	Project	Construction	Client	Capacity	Scope
1	Marafiq Yanbu II	2011.06 ~ 2014.01	Marafiq / Hanwha E&C	276㎿ x 3	Boiler PACKAGE
2	Raipur, INDIA	2010.01 ~ 2013.09	Progress/Westinghouse	685㎿ x 2	MAIN PLANT (BTG) PACKAGE
3	Marafiq #5,6	2009.08 ~ 2012.07	MARAFIQ	275㎿ x 2	BOILER PACKAGE
4	GHECO-One	2008.06 ~ 2011.10	GLOW HEMARAJ ENERGY COMPANY LIMITED, THAILAND	700㎿ x 1	EPC
5	FONSECA, ELSALVADOR	2008.03 ~ 2011.05	POSCO E&C KOREA	240㎿ x 1	BOILER PACKAGE
6	AL KHALIJ	2008.01 ~ 2011.12	GENERAL ELECTRICITY COMPANY OF LIBYA	350㎿ x 4	BOILER PACKAGE
7	CAMPICHE, CHILE	2008.01 ~ 2011.03	POSCO E&C KOREA	240㎿ x 1	BOILER PACKAGE
8	ANGAMOS, CHILE	2008.01 ~ 2011.03	POSCO E&C KOREA	240㎿ x 2	BOILER PACKAGE
9	CEBU POWER PLANT	2007.12 ~ 2011.05	KEPCO SPC POWER CORPORATION, PHILIPPINES	103㎿ x 2	EPC
10	CIREBON COAL FIRED POWER PLANT	2007.09 ~ 2011.11	CIREBON ELECTRIC POWER INDONESIA	695㎿ x 1	EPC
11	MUNDRA GUJARAT UMPP, INDIA	2007.05 ~ 2010.12	TATA POWER COMPANY LIMITED	800㎿ x 5	BOILER PACKAGE
12	GLOW CFB 3	2007.01 ~ 2010.03	GLOW ENERGY PUBLIC COMPANY LIMITED, THAILAND	115㎿ x 1	EPC
13	NUEVA VENTANAS, CHILE	2006.12 ~ 2009.02	POSCO E&C KOREA	240㎿ x 1	BOILER PACKAGE
14	HSINTA #1,2	2006.09 ~ 2010.10	TPC TAIWAN	500㎿ x 2	BOILER RETROFIT, SCR SUPPLY
15	DOOPEX-1	2005.09 ~ 2007.05	DOOSAN HEAVY INDUSTRIES & CONSTRUCTION	–	TURNKEY
16	HADONG #7,8 POWER PLANT	2005.04 ~ 2009.03	KOREA SOUTHERN POWER CO., LTD	500㎿ x 2	BOILER ISLAND, T/G PACKAGE
17	PORYONG #7,8 POWER PLANT	2004.06 ~ 2008.12	KOREA MIDLAND POWER CO., LTD	500㎿ x 2	BOILER, T/G, SCR, B.O.P PACKAGE
18	NAM-JEJU#3,4 POWER PLANT	2004.05 ~ 2007.03	KOREA SOUTHERN POWER CO., LTD	100㎿ x 2	BOILER, T/G, SCR, B.O.P PACKAGE
19	SIPAT STAGE-1	2004.04 ~ 2009.04	NATIONAL THERMAL POWER CO.NTPC INDIA0	660㎿ x 3	BOILER TURNKEY
20	YONGHUNG #3,4 POWER PLANTS	2004.03 ~ 2009.03	KOREA SOUTH-EAST POWER CO., LTD	870㎿ x 2	BOILER PACKAGE
21	FORMOSA CP1 #7	2004.02 ~ 2005.04	FORMOSA TAIWAN	600㎿ x 1	PRESSURE PART
22	TANGJIN #7,8 POWER PLANTS	2003.10 ~ 2007.12	KOREA EAST-WEST POWER CO., LTD	500㎿ x 2	BOILER, T/G, SCR, B.O.P PACKAGE
23	TAEAN #7,8 POWER PLANTS	2003.10 ~ 2008.03	KOREA WESTERN POWER CO., LTD	550㎿ x 2	BOILER, T/G, SCR, B.O.P PACKAGE
24	SUDOKON THERMAL POWER PLANT	2003.05 ~ 2005.10	ECO ENERGY CO., LTD	50㎿ x 2	BOILER, T/G, DCS, B.O.P PACKAGE
25	TANGJIN #5,6 POWER PLANTS	2002.03 ~ 2005.12	KOREA EAST-WEST POWER CO., LTD	500㎿ x 2	BOILER, T/G, SCR, B.O.P PACKAGE
26	PANWOL AUX. NO.5 BOILER	2000.11 ~ 2002.03	PANWOL Industrial CO	–	TURNKEY CONTRACT
27	UMM AL NAR DESALINATION "B"	2000.03 ~ 2001.09	ABU DHAHI WATER & ELECTRICITY AUTHRITY	105㎿ x 5	BOILER PACKAGE

Turbines

Steam Turbine

no	Project	Commercial Operation	Client	Capacity	Location
1	UAE BNPP #3,4	2022.05.01	KEPCO	1,400㎿	UAE
2	Pocheon LNG Power Plant	2014.11.30	Pocheon Power	270㎿	Korea
3	Yanbu 2	2014.01.23	Hanwha Engineering & Construction	264㎿	Saudi Arabia
4	Yangju CHPP	2013.12.31	Hanjin Heavy Industries	190㎿	Korea
5	PORYONG #3	Retrofit	KOMIPO	500㎿	Korea
6	PORYONG #2	Retrofit	KOMIPO	535㎿	Korea
7	PORYONG #1	Retrofit	KOMIPO	535㎿	Korea
8	ERARING #4	Retrofit	ERARING	750㎿	Australia
9	ERARING #3	Retrofit	ERARING	750㎿	Australia
10	ERARING #2	Retrofit	ERARING	750㎿	Australia
11	ERARING #1	Retrofit	ERARING	750㎿	Australia
12	SHINULCHIN #2	2016.12	KHNP	1,455㎿	Korea
13	SHINULCHIN #1	2015.12	KHNP	1,455㎿	Korea
14	SHINKORI #4	2014.09	KHNP	1,455㎿	Korea
15	SHINKORI #3	2013.09	KHNP	1,455㎿	Korea
16	MARAFIQ #6	2012.07	MARAFIQ	275㎿	Saudi Arabia
17	MARAFIQ #5	2012.05	MARAFIQ	275㎿	Saudi Arabia
18	GHECO-ONE	2011.01	GHECO	700㎿	Thailand
19	CIREBON	2011.05	CEP	698㎿	Indonesia
20	SHINWOLSONG #2	2010.09	KHNP	1,053㎿	Korea
21	SHINWOLSONG #1	2009.09	KHNP	1,053㎿	Korea
22	SHINKORI #2	2009.09	KHNP	1,053㎿	Korea
23	HADONG #8	2009.03	KOSPO	518㎿	Korea
24	PORYONG #8	2008.12	KOMIPO	550㎿	Korea
25	SHINKORI #1	2008.09	KHNP	1,053㎿	Korea
26	PORYONG #7	2008.06	KOMIPO	550㎿	Korea
27	HADONG #7	2008.06	KOSPO	518㎿	Korea
28	TANGJIN #8	2007.08	KEWESPO	518㎿	Korea
29	TANGJIN #7	2007.02	KEWESPO	550㎿	Korea
30	TANGJIN #6	2006.06	KEWESPO	518㎿	Korea
31	TANGJIN #5	2005.12	KEWESPO	518㎿	Korea
32	ULCHIN #6	2004.02	KHNP	1,050㎿	Korea
33	YONGHUNG #2	2003.12	KOSEP	814㎿	Korea
34	YONGHUNG #1	2003.06	KOSEP	814㎿	Korea
35	ULCHIN #5	2003.02	KHNP	1,050㎿	Korea
36	YONGGWANG #6	2002.06	KHNP	1,050㎿	Korea
37	YONGGWANG #5	2001.06	KHNP	1,050㎿	Korea
38	TANGJIN #4	2000.06	KEWESPO	541㎿	Korea
39	HADONG #6	2000.03	KOSPO	541㎿	Korea

Gas Turbine Unit Assembly

no	Project	Commercial Operation	Client	Capacity	Applications
1	Yeong-wol CCPP	2010.12	KOSPO	183㎿ x 3	LNG
2	LaemChabang CCPP	2001.09	Laem Chabang Co	39.6㎿ x 2	LNG & No.2 oil

Gas Turbine Power Plant

no	Project	Commercial Operation	Client	Capacity	Scope
1	Sohar Water and Power IPP Plan	2007.04	SGCC	121.3㎿ x 4	EPC
2	Fujairah Water and Power Plant	2003.06	UOG	121.3㎿ x 4	EPC
3	Fortum	2001.09	Fortum Engineering	116㎿ x 2	EPC
4	Pusan Combined Cycle Power Plant	2001.03	KEPCO (Korea)	2,160㎿	–
5	KPCL Combined Cycle Power Plant	2000.03	Kondapalli Power Co (india)	350㎿	Turnkey

Generators

no	Project	Commercial Operation	Client	Capacity	Location
1	UAE BNPP #3,4	2022.05.01	KEPCO	1,400㎿	UAE
2	Pocheon LNG Power Plant	2014.11.30	Pocheon Power	270㎿	Korea
3	Yanbu 2	2014.01.23	Hanwha Engineering & Construction	264㎿	Saudi Arabia
4	Yangju CHPP	2013.12.31	Hanjin Heavy Industries	190㎿	Korea
5	SHINKORI #4	2014.09	KHNP	1,455㎿	Korea
6	SHINKORI #3	2013.09	KHNP	1,455㎿	Korea
7	SHINWOLSONG #2	2010.09	KHNP	1,053㎿	Korea
8	SHINKORI #2	2009.09	KHNP	1,053㎿	Korea
9	SHINWOLSONG #1	2009.09	KHNP	1,053㎿	Korea
10	HADONG #8	2009.03	Korea	518㎿	Korea
11	PORYONG #8	2008.12	KOMIPO	550㎿	Korea
12	SHINKORI #1	2008.09	KHNP	1,053㎿	Korea
13	HADONG #7	2008.06	KOSPO	518㎿	Korea
14	PORYONG #7	2008.06	KOMIPO	550㎿	Korea
15	TAEAN #8	2007.08	KOWEPO	550㎿	Korea
16	TANGJIN #8	2007.08	KEWESPO	518㎿	Korea
17	TAEAN #7	2007.02	KEWESPO	550㎿	Korea
18	TANGJIN #7	2007.02	KEWESPO	518㎿	Korea
19	TANGJIN #6	2006.06	KEWESPO	518㎿	Korea
20	TANGJIN #5	2005.12	KEWESPO	518㎿	Korea
21	ULCHIN #6	2004.02	KHNP	1,050㎿	Korea
22	YONGHUNG #2	2003.12	KOSEP	814㎿	Korea
23	YONGHUNG #1	2003.06	KOSEP	814㎿	Korea
24	ULCHIN #5	2003.02	KHNP	1,050㎿	Korea
25	YONGGWANG #6	2002.06	KHNP	1,050㎿	Korea
26	YONGGWANG #5	2001.06	KHNP	1,050㎿	Korea
27	TANGJIN #4	2000.06	KEWESPO	541㎿	Korea
28	HADONG #6	2000.03	KOSPO	541㎿	Korea

HRSG (Heat Recovery Steam Generator)

no	Project	Construction	Client	Capacity	Location
1	OML 58 CC Power Plant	2011.04 ~ 2014.04	Daewoo E&C	210㎿ x 2	Nigeria
2	Erzin CC Power Plant	2011.09 ~ 2014.05	General Electric	400㎿ x 2	Iskenderun, Turkey
3	Eurostar CC Power Plant	2011.09 ~ 2014.05	General Electric	400㎿ x 2	Kirklaleli Babaeski, Turkey
4	IEC add on CC Power Plant	2011.03 ~ 2013.12	Israel Electricity Corporation Ltd	400㎿ x 3	Ramat Hovav / Hagit / Eshkol, Israel
5	New Haripur CC Power Plant	2011.03 ~ 2013.08	Hyundai Engineering & Constructions	360㎿	Haripur, Dhaka, Bangladesh
6	Ras Az Zawr CC Power Plant	2010.12 ~ 2014.05	Siemens	241㎿ x 10	Saudi Arabia
7	DGEN CC Power Plant	2010.11 ~ 2013.06	Siemens	400㎿ x 3	India
8	Sohar 2 CC Power Plant	2010.07 ~ 2013.05	Siemens	375㎿ x 2	Oman
9	Barka 3 CC Power Plant	2010.07 ~ 2013.05	Siemens	375㎿ x 2	Oman
10	Toul CC Power Plant	2010.07 ~ 2012.12	Siemens	400㎿ x 1	France
11	UNOSugen CC Power Plant	2010.07 ~ 2013.03	Siemens	385㎿ x 1	India
12	Qurayyah add on CC Power Plant	2009.10 ~ 2013.01	Saudi Electric company	250㎿ x 15	Saudi Arabia
13	Nhon Trach II CC Power Plant	2009.07 ~ 2011.12	Siemens	360㎿ x 2	Viernam
14	Al Shuweihat S2 Power & Water Project	2008.08 ~ 2010.02	Samsung C&T	360㎿ x 4	UAE
15	Duke Integrated Gasification CC Power Plant	2008.06 ~ 2010.05	General Electric	250㎿ x 2	USA
16	OMV Brazi CC Power Plant	2008.04 ~ 2010.03	General Electric	400㎿ x 2	Romania
17	Samsun CC Power Plant	2008.02 ~ 2009.11	General Electric	400㎿ x 2	Turkey
18	Ras Laffan C Power & Water Project	2008.03 ~ 2011.06	Hyundai E&C	395㎿ x 8	Qatar
19	Koudiet CC Power Plant	2008.02 ~ 2009.11	General Electric	400㎿ x 3	Algeria
20	EMAL(Emirates Aluminum) Smelter Cplx.	2007.11 ~ 2010.06	General Electric	1,400㎿ x 4	Taweelah, United Arab Emirates
21	Power Seraya Stage III Rep. CCPP 3+4	2007.09 ~ 2008.12	Siemens Power Generation	756㎿ x 2	Jurong Island, Singapore
22	Qatalum Aluminum Smelter Power Plant	2007.09 ~ 2010.06	Hydro Norsk and Qatar Petrolem	1,400㎿ x 4	Mesaieed, Qatar
23	Montoir CC Power Plant	2007.08 ~ 2008.09	General Electric	400㎿ x 1	Montoir, France
24	Heron CC Power Plant	2007.07 ~ 2008.08	General Electric	400㎿ x 1	Thiva, Viotia, Greece
25	Lares CC Power Plant	2007.05 ~ 2008.07	General Electric	800㎿ x 2	Lares, Portugal

no	Project	Construction	Client	Capacity	Location
26	Jebel Ali Power and Desalination Station M2	2007.03 ~ 2010.03	Dubai Electricity and Water Authority (DEWA)	690㎿ x 2	Jebel Ali, United Arab Emirates
27	Marchwood CC Power Plant	2007.03 ~ 2008.05	Siemens Power Generation	839㎿ x 2	Marchwood, United Kingdom
28	Jebel Ali Power and Desalination Station M1	2007.03 ~ 2010.03	Dubai Electricity and Water Authority (DEWA)	1,380㎿ x 4	Jebel Ali, United Arab Emirates
29	Marafiq IWPP Power Plant (Block 4)	2007.02 ~ 2009.01	General Electric	775㎿ x 3	Jubail, Saudi Arabia
30	Marafiq IWPP Power Plant (Block 1-3)	2007.02 ~ 2009.01	General Electric	2,235㎿ x 9	Jubail, Saudi Arabia
31	Daharki CC Power Plant	2007.02 ~ 2009.04	Foundation Power Company	179㎿ x 1	Daharki, Pakistan
32	Amman East Independent Power Plant	2007.02 ~ 2009.04	National Electric Power Company	480㎿ x 2	Amman, Jordan
33	Barka Ph.II Power and Desalination Plant	2006.12 ~ 2007.10	Suez Energy International	642㎿ x 2	Barka, Oman
34	Star Buck CC Power Plant	2006.12 ~ 2008.02	Taiwan Cogeneration Corp.	550㎿ x 2	Chang Bin Industrial Park, Taiwan
35	Afam VI Power Station	2006.03 ~ 2006.12	Daewoo E&C	670㎿ x 3	Nigeria
36	LG Bugok II CC Power Plant	2006.01 ~ 2006.12	Siemens Power Generation	550㎿ x 2	Korea
37	Al Taweelah New-B Extension CCPP	2005.12 ~ 2006.01	Siemens Power Generation	1,120㎿ x 3	United Arab Emirates
38	Ca Mau CC Power Plant #1,2	2005.12 ~ 2006.01	Siemens Power Generation	1,240㎿ x 4	Ca Mau, Vietnam
39	APPC PDH/PP WHB Project	2005.09 ~ 2006.09	PC PDH/PP WHB Project	180㎿ x 1	Al Jubail, Saudi Arabia
40	Sugen CC Power Plant	2005.09 ~ 2007.06	Siemens Power Generation	1,161㎿ x 3	Sugen, Gujarat, India
41	POSCO Finex #1 CC Power Plant	2005.07 ~ 2006.04	POSCO E&C	146㎿ x 1	Pohang, KyungBuk, Korea
42	Al Ezzel CC Power Plant	2005.01 ~ 2006.01	Siemens Power Generation	1,000㎿ x 4	Manama, Bahrain
43	Benghazi North CC Power Plant	2004.03 ~ 2005.02	Daewoo E&C Co.,Ltd	900㎿ x 4	Benghazi, Libya
44	Shirvan CC Power Plant	2004.03 ~ 2005.02	Iran Power Plant Proj. Manage. Co.(MAPNA)	966㎿ x 4	Khoransan, Iran
45	Sanandaj CC Power Plant	2003.07 ~ 2007.01	Iran Power Plant Proj. Manage. Co.(MAPNA)	966㎿ x 4	Khoransan, Iran
46	Jahrom CC Power Plant	2003.07 ~ 2007.01	Iran Power Plant Proj. Manage. Co.(MAPNA)	1,449㎿ x 6	Jahrom, Iran
47	Damavand CC Power Plant	2003.07 ~ 2007.01	Iran Power Plant Proj. Manage. Co.(MAPNA)	2,898㎿ x 12	Damanvand, Tehran, Iran
48	Kerman CC Power Plant	2003.07 ~ 2007.01	Iran Power Plant Proj. Manage. Co.(MAPNA)	1,288㎿ x 8	Kerman, Iran
49	Kazeroon New CC Power Plant	2003.07 ~ 2007.01	Iran Power Plant Proj. Manage. Co.(MAPNA)	966㎿ x 4	Kazeroun, Fars, Iran
50	Kazeroon Old CC Power Plant	2003.07 ~ 2007.01	Iran Power Plant Proj. Manage. Co.(MAPNA)	421㎿ x 2	Kazeroun, Fars, Iran
51	Yazd CC Power Plant	2003.07 ~ 2007.01	Iran Power Plant Proj. Manage. Co.(MAPNA)	407㎿ x 2	Yazd, Iran
52	Neka CC Power Plant	2003.07 ~ 2007.01	Entergy, Iran Power Plant Proj. Manage. Co.(MAPNA)	437㎿ x 2	Neka, Mazandaran, Iran

Retrofits & Upgrades

no	Project	Construction	Client	Capacity	Location
1	Pocheon CCPP O&M	2011.06 ~ 2019.05	Pocheon Power	780㎿e x 2 Block	Korea
2	Sabarmati #5,6 R&M	2011.05 ~ 2014.01	Torrent Power Limited	121㎿e x 2	India
3	Orot Rabin FGD	2009.12 ~ 2013.04	Kerman, Iran	350㎿e x 4	Israel
4	Ulchin#1,2 Generator Replacement	2009.03 ~ 2012.05	KHNP	950㎿e x 2	Korea
5	HPL Aux. BLR Fuel Conversion (Naphta → CBFS)	2009.07 ~ 2010.04	Haldia Petrochemicals Ltd.	Industrial Plant	India
6	Ulchin Unit 1,2 LP TBN Retrofit	2008.01 ~ 2012.05	KEPCO	950㎿ x 2 NPP	Korea
7	Eraring Unit #2,3 Boiler Upgrade	2008.12 ~ 2010.12	Eraring Energy	660㎿ x 4 TPP	Australia
8	NPP Main Generater Exciter System replacement	2007.12 ~ 2010.12	KEPCO		Korea
9	Eraring Unit #1~4 T/G Upgrade	2007.12 ~ 2012.06	Eraring Energy	660㎿ x 4 TPP	Australia
10	Boryeong Unit 1,2 T/G and Boiler Upgrade	2007.09 ~ 2009.06	KEPCO	500㎿ x 2 TPP	Korea
11	Kori Unit 2,3,4 Generator Replacement	2006.12 ~ 2009.12	KEPCO	650㎿ x 1, 950㎿ x 2 NPP	Korea
12	Youngkwang #1,2 GEN Replacement	2005.12 ~ 2007.12	KEPCO	950㎿ x 2 NPP	Korea
13	Sancheong Hydro Unit 2 refurbishment	2005.06 ~ 2006.06	KEPCO	350㎿ HPP	Korea
14	Ulsan Unit 4,5,6 Generator Replacement	2004.08 ~ 2008.12	KEPCO	400㎿ x 3 TPP	Korea
15	Kori Unit 1 Generator Replacement	2002.02 ~ 2005.06	KEPCO	587㎿ NPP	Korea
16	MD-A #2,3,4 Stator Rewinding	2002.07 ~ 2005.11	IEC	375㎿ x 4 TPP	Israel
17	Ulchin Unit 1, 2 Stator Rewinding	2002.12 ~ 2003.01	KEPCO	950㎿ NPP	Korea
18	Huvis 130T/H BLR Fuel Conversion (Oil → Coal)	2002.09 ~ 2003.06	Huvis Industrial Plant	Industrial Plant	Korea
19	Taichung Unit 10 HP HTR Replacement	2001.04 ~ 2002.05	TPC	550㎿ TPP	Taiwan
20	Ulchin Unit 1,2 MSR Tube Bundle Rehabilitation	2001.03 ~ 2002.08	KEPCO	950㎿ x 2 TPP	Korea
21	Banwol No.5 Aux Boiler add-on	2000.12 ~ 2002.02	KEPCO	62.71㎿ CHP	Korea

Nuclear Power

Overseas Projects

no	Project	Commercial Operation	Client	Capacity	Type
1	UAE Braka #3,4	2019~2020	Emirates Nuclear Energy Corporation (ENEC) / KEPCO	1,400㎿ x 2	Pressurized Water Reactor (APR1400)
1	UAE Braka #1,2	2017~2018	Emirates Nuclear Energy Corporation (ENEC) / KEPCO	1,400㎿ x 2	Pressurized Water Reactor (APR1400)
2	Levy County #1,2	2024~2025	Progress / Westinghouse	1,100㎿ x 2	Pressurized Water Reactor (AP1000)
3	V.C. Summer #2,3	2017~2018	SCANA / Westinghouse	1,100㎿ x 2	Pressurized Water Reactor (AP1000)
4	Vogtle #3,4	2016~2017	Southern Co. / Westinghouse	1,100㎿ x 2	Pressurized Water Reactor (AP1000)
5	Haiyang #1	2014	SNPTC / Westinghouse	1,250㎿ x 1	Pressurized Water Reactor (AP1000)
6	Sanmen #1	2013	SNPTC / Westinghouse	1,250㎿ x 1	Pressurized Water Reactor (AP1000)
7	Qinshan Phase2 #3	2010	NPQJVC	650㎿ x 1	Pressurized Water Reactor (CP-600)
8	Sequoyah #2 RSG		TVA, Westinghouse	1,100㎿ x 1	Pressurized Water Reactor
9	Watts Bar #1 RSG		TVA, Westinghouse	1,100㎿ x 1	Pressurized Water Reactor

Domestic Projects

no	Project	Commercial Operation	Client	Capacity	Type
1	Shin-Ulchin Units #1,2	2017~2018	Korea Hydro & Nuclear Power (KHNP)	1,400㎿ x 2	Pressurized Water Reactor (APR1400)
2	Shin-Kori #3,4	2013~2014	Korea Hydro & Nuclear Power (KHNP)	1,400㎿ x 2	Pressurized Water Reactor (APR1400)
3	Shin-Wolsong Units #1,2	2012~2013	Korea Hydro & Nuclear Power (KHNP)	1,000㎿ x 2	Pressurized Water Reactor (OPR1000)
4	Shin-Kori Units #1,2	2011~2012	Korea Hydro & Nuclear Power (KHNP)	1,000㎿ x 2	Pressurized Water Reactor (OPR1000)

Seawater Desalination Plants

no	Project	Construction	Client	Capacity
1	Yanbu	2011.06~2012.12	SWCC, Saudi Arabia	1 x 15 MIGD
2	Marafiq MED	2011.09~2013.04	Marafiq, Saudi Arabia	2 x 6 MIGD
3	Ras Al Khair	2010.09.27 ~	SWCC, Saudi Arabia	228 MIGD (MSF 160 MIGD + RO 68 MIGD)
4	Jeddah RO	2009.12 ~ 2012.01	SWCC, Saudi Arabia	52.8 MIGD (RO)
5	Shuweihat S2 IWPP	2008.11 ~ 2011.08	Ruwais Suez Tractebel Power Company, United Arab Emirates	100 MIGD (6 Units X 16.7 MIGD)
6	Shuwaikh RO Project	2008.03 ~ 2013.11	Ministry of Energy - E&W State of Kuwait	30 MIGD (RO)
7	Shuaibah Expansion RO Project	2007.07 ~ 2009.09	Shuaibah Expansion Project Company, Saudi Arabia	33 MIGD (RO)
8	Shuaibah IWPP	2006.01 ~ 2009.06	ACWA Power, TNB, Malakoff (Shuaibah Power Company, Saudi Arabia)	194 MIGD (12 Units X 16 MIGD)
9	Sabiya Distillation Plant St. III	2005.05 ~ 2007.12	IP, Ministry of Energy- E&W State of Kuwait	50 MIGD (4 Units X 12.5 MIGD)
10	Zawia MED Plant	2005.02 ~ 2006.10	GECOL Libya	1.1 MIGD (2 Units X 0.55 MIGD)
11	Ras Laffan IWPP	2005.01 ~ 2008.05	IP, Chubu (Q-Power, Qatar)	60 MIGD (4 Unit X 15 MIGD)
12	Shuaiba Pumping Station "C"	2004.12 ~ 2007.12	Public Authority for Industry State of Kuwait	3,600M3/H X 9 Units 18,000M3/H X 9 Units
13	Shuaiba South Rehabilitation	2004.11 ~ 2008.11	Ministry of Energy- E&W State of Kuwait	36 MIGD (6 Units X 6 MIGD)
14	Sohar IWPP	2004.09 ~ 2007.04	Suez Tractebel Belgium (SGCCC, Oman)	33 MIGD & 585 MW (4 Units X 8.3 MIGD)
15	Benghazi North Power MED Plant	2004.06 ~ 2006.10	GECOL Libya	1.1 MIGD (2 Unit X 0.55 MIGD)
16	Sabiya Distillation Plant with Recarbonation System St. I & II	2004.05 ~ 2007.01	Ministry of Energy- E&W State of Kuwait	50 MIGD (4 Units X 12.5MIGD)
17	Fujairah Power & Water Plant with Seawater Intake Facility	2001.06 ~ 2003.12	U.W.E.C., United Arab Emirates	100 MIGD & 660 MW (5 Units X 12.5 MIGD & 37.5 MIGD RO)
18	Umm Al Nar Desalination Station 'B' with Seawater Intake Facility	2000.07 ~ 2002.01	ADWEA, United Arab Emirates	62.5 MIGD (5 Unit X 12.5 MIGD)

Construction

Plant

no	Project	Period	Client
1	Gangnam Branch District Heat Supply Facility Enhancement Work	2009. 06 ~ 2010. 10	Korea District Heating Corp., Gangnam Branch
2	Goyang Samsong Integrated Energy Plant	2008. 09 ~ 2011. 11	Korea District Heating Corp.
3	Pyeongtaek Production Base Plant 2, Phase 3, Step 1 (Tanks #18 & 19) Construction	2007. 06 ~ 2011. 05	KOGAS
4	Pangyo Boosting Station Construction and Bogjeong Boosting Station Enhancement	2007. 04 ~ 2009. 11	Incheon Total Energy Company
5	Sin Gori Nuclear Powr Plant Units 3,4 Main Equipment Construction	2007. 04 ~ 2014. 09	KHNP
6	345㎸ New Suwon-New Yongin T/L Construction (1st)	2006. 11 ~ 2008. 01	
7	Power Generation Testing Facility Construction (DOOPEX-I PJT)	2006. 02 ~ 2007. 05	In-house project
8	Hadong Thermal Power Plant Units 7&8 Turbine EPC Project	2005. 05 ~ 2009. 06	Korea South Power
9	345㎸ New Gangjin-Gwangyang T/L Construction (Section 3)	2005. 01 ~ 2007. 07	KEPCO
10	765㎸ Uljin-New Taebaek T/L Construction (Section 3)	2005. 01 ~ 2007. 07	KEPCO
11	Taean Thermal Power Plant Units 7,8 Construction	2003. 11 ~ 2007. 08	Korea West Power
12	345㎸ Yangyang-Donghae T/L Construction (Section 3)	2003. 08 ~ 2005. 07	KEPCO
13	Cheongsong Pumped-storage Hydro Power Plant Units 1,2 E&M Work	2003. 05 ~ 2006. 12	Korea West Power
14	Youngheung Thermal Power Plant Units 1,2 Desulfurizer Installation	2002. 10 ~ 2004. 12	Korea South-East Power
15	Youngheung Thermal Power Plant Units 1,2 Switchyard Construction	2002. 05 ~ 2004. 04	KEPCO
16	Dangjin Thermal Power Plant Units 5, 6, 7, 8 Construction	2002. 05 ~ 2007. 12	Korea East-West Power
17	Wolseong Nuclear Power Plant Canister Installation	2002. 01 ~ 2002. 11	KHNP
18	Youngheung Thermal Power Plant Units 1,2 E&M Work	2000. 10 ~ 2004. 12	Korea South-East Power

Civil Engineering

no	Project	Period	Client
1	Eoseongjeon-Yangyang Flood Recovery Construction Section 2	2002. 12 ~ 2004. 09	Weonju District Office of Ministry of Land, Transport and Marine Affairs
2	Okcheon-Jeungyag Highway Construction	2001. 12 ~ 2005. 12	Korea Highway Corp.
3	Seocho Power District Construction	2001. 03 ~ 2003. 09	KEPCO
4	Daegu-Busan Highway Section 10 Construction	2001. 02~ 2005. 12	Daegu-Busan Highway
5	Taiwan High Speed Rail Project	2000. 03 ~ 2004. 05	THSRC

Architecture

no	Project	Period	Client
1	Suncheon Doosan We've	2008. 03 ~ 2010. 12	Hankuk Feel D & C
2	Hopyeong Doosan We've	2008. 02 ~ 2009. 10	Clean General Development
3	Sangdo-dong Doosan We've 1st	2007. 11 ~ 2010. 03	I & D
4	Paju Unjeong Doosan We've	2007. 11 ~ 2010. 03	Inchang Construction
5	Asan Baebang Pentaport	2007. 11 ~ 2012. 04	Pentaport
6	Hanam Doosan We've Park	2007. 11 ~ 2010. 07	Daol Real Estate Trust
7	South Weongju Doosan We've	2006. 11 ~ 2009. 04	AK Housing
8	Gwangjin Doosan We've Park	2006. 02 ~ 2008. 08	Hwayang Market
9	North Gajwa-dong Doosan We've	2004. 10 ~ 2007. 01	Jeongweon District Housing Cooperative
10	Jung-dong New Town We've The State	2004. 07 ~ 2007. 09	KB Real Estate Trust
11	Changwon Bansong Complex 2 Aparment	2004. 03 ~ 2006. 09	Korea Housing Corp.
12	Mokdong Doosan We've	2004. 07 ~ 2005. 10	Guna C & D
13	Tongyeong Jooklim Apartment	2003. 07 ~ 2005. 05	Korea Housing Corp.
14	Busan Beomcheon-dong We've Centium	2002. 09 ~ 2005. 04	Daehan Real Eastate Trust
15	Busan Hwamyeong Apartment	2001. 12 ~ 2004. 06	Korea Housing Corp.

MHS ; Material Handling System

Container Handling Ship to Shore Granty Cranes

no	Client	Location	Lifting Capa	Outreach	Units	Delivery
1	US Navy Crane Center	MOTSU, USA	60 MT	53.0 M	2 Units	2012.05
2	KGLPI	KPA, Kuwait	65 MT	47.5 M	6 Units	2011.11
3	JNPT	Jawaharlal Nehru Port India	50 MT	51.0 M	3 Units	2011.03
4	Samarinda Port	Samarinda Port, Indonesia	40 MT	32.0 M	2 Units	2011.02
5	JNPT	Jawaharlal Nehru Port India	50 MT	51.0 M	1 Units	2010.11
6	New Orleans Port	New Orleans Port, U.S.A	65 LT	50.9 M	2 Units	2010.07
7	KBCTIK.E. Busan Container Terminal	Korea	65 MT	63.0 M	1 Units	2010.06
8	Port of Singapore Authority (PSA)	Singapore	65 MT	68.0 M	9 Units	2010.03
9	PPC	Panama	65 MT	62.0 M	4 Units	2010.03
10	SP-PSA	Thi Vai Int'lPort, Vietnam	60 MT	52.0 M	4 Units	2009.03
11	Damietta International Port	Damietta Port	65 MT	62.0 M	14 Units	2009.02
12	JICT	Jakarta Int'l Container Terminal	61 MT	53.5 M	2 Units	2009.02
13	CITPL	Chennai, India	50 MT	52.0 M	3 Units	2009.02
14	E1	Incheon, Korea	50 MT	39.0 M	2 Units	2008.11
15	Kandla Port	Kandla Port	50 MT	46.0 M	2 Units	2007.04
16	Sun Kwang Co., Ltd.	Incheon, Korea	40.6 MT	39.0 M	1 Units	2007.03
17	Jurong Port Pte. Ltd.	Jurong Port, Singapore	65 MT	62.0 M	5 Units	2006.12
18	Jurong Port Pte. Ltd.	Jurong Port, Singapore	65 MT	35.0 M	5 Units	2006.12
19	Han Jin Transportation Co., Ltd.	Pusan, Korea	40.6 MT	35.0 M	1 Units	2006.01
20	Sun Kwang Co., Ltd.	Incheon, Korea	40.6 MT	39.0 M	1 Units	2005.12
21	Sun Kwang Co., Ltd.	Incheon, Korea	40.6 MT	39.0 M	1 Units	2005.08
22	Fraser Surrey Docks	Fraser Port, Canada	65 LT	36.6 M	2 Units	2005.06
23	Korea Container Terminal Authority	Incheon, Korea	40.6 MT	39.0 M	1 Units	2005.04
24	Pusan East Container Terminal	Pusan(PECT), Korea	50 MT	56.0 M	5 Units	2004.05~08
25	Sun Kwang Co., Ltd.	Incheon, Korea	40.6 MT	39.0 M	2 Units	2004.01
26	Korea Container Terminal Authority	Pusan(PECT), Korea	50 MT	56.0 M	1 Units	2003.12
27	HPH / Jakarta International Container Terminal	JICT Indonesia	41 MT	45.0 M	1 Units	2003.05

no	Client	Location	Lifting Capa	Outreach	Units	Delivery
28	HPH / Jakarta International Container Terminal	JICT Indonesia	51 MT	52.1 M	2 Units	2003.03
29	Korea Express Co., Ltd.	Kwangyang, Korea	50 MT	61.0 M	1 Units	2003.02
30	HPH / PT Ocean Terminal Petikemas	KOJA, Indonesia	51 MT	52.1 M	1 Units	2003.01
31	Korea Express Co., Ltd.	Pusan, Korea	50 MT	61.0 M	1 Units	2002.12
32	Jawaharlal Nehru Port Trust	JNPT, India	50 MT	50.0 M	2 Units	2001.05

Container Handling Yard Grantry Crane - RMGC

no	Client	Location	Lifting Capa	Span	Units	Delivery
1	JNPT	JNPT, India	65.0 MT	34.0 M	1 Units	2011.02
2	PNC	Pusan,Korea	65.0 MT	28.4 M	49 Units	2006.11

Electrical Overhead & Gantry Cranes

no	Client	Location	Description	Q'ty	Supply
1	Korea Hydro & Nuclear Power Co., Ltd	Nuclear Power Plant Shin-Ulchin 1 & 2, Korea	(475+475)/90 U.S Ton x 43.59 M Polar Crane	1	2012.08 2013.08
2	Doosan Heavy Casting & Forging BG	Doosan Factory, Korea	350/30 T x 27 M 1	1	2011.08
3	Doosan Heavy Casting & Forging BG	Doosan Factory, Korea	400/100 T x 27 M 1	1	2011.06
4	Korea Hydro & Nuclear Power Co., Ltd.	Nuclear Power Plant Shin-Kori 3 & 4, Korea	(475+475)/90 U.S Ton x 43.5864M Polar Crane	2	2010.04
5	Pohang Iron & Steel Co., Ltd	Kwangyang, Korea	Hot Metal Charging Crane 430/80Ton ×21M 1unit Teeming Ladle Crane (400/80Ton ×19M 1unit 400/80Ton ×21M 1unit)	3	2009.07
6	Pohang Iron & Steel Co., Ltd	Pohang, Korea	350/80 T Hot Metal Charging Crane	2	2007.02
7	Korea Electric Power Corporation	Nuclear Power Plant KEDO 1 & 2, Korea	(350+350)/60 U.S Tonx 42.0624 M Polar Crane	2	2004.03
8	Pohang Iron & Steel Co., Ltd	Kwangyang, Korea	400/80 T Teeming ladle Crane	2	2002.06

Container Handling Yard Grantry Crane - RTGC

no	Client	Location	Lifting Capa	Outreach	Units	Delivery
1	KGLPI	KPA, Kuwait	40 MT	23.47 M	6 Units	2011.11
2	Saigon New Port Company	Vietnam	40 MT	23.5 M	2 Units	2010.07
3	Samarinda Port	Indonesia	40 MT	23.47 M	5 Units	2010.02
4	Port of Singapore Authority (PSA)	Singapore	40 MT	23.7 M	36 Units	2009.12
5	Korea Express Co.,Ltd	Kwangyang, Korea	40.6 MT	23.5 M	1 Units	2009.08
6	SP-PSA	Thi Vai Int'l. Port, Vietnam	40 MT	23.7 M	12 Units	2009.07
7	Port of Singapore Authority (PSA)	Singapore	40 MT	23.7 M	43 Units	2009.06
8	Kandla Port	Kandla Port, India	40 MT	23.47 M	2 Units	2008.12
9	Korea Express Co.,Ltd	Kwangyang, Korea	40.6 MT	23.5 M	4 Units	2008.12
10	E1	Incheon, Korea	40 MT	27.0 M	6 Units	2008.11
11	Korea Express Co., Ltd.	Kwangyang, Korea	40.6 T	23.5 M	5 Units	2007.05
12	Kandla Port	Kandla Port, India	40 MT	23.47 M	2 Units	2007.04
13	Port of Singapore Authority (PSA)	Singapore	40 T	23.7 M	40 Units	2006.11
14	Port of Singapore Authority (PSA)	Singapore	40 T	23.7 M	40 Units	2006.05
15	Port of Singapore Authority (PSA)	Singapore	40 T	23.7 M	42 Units	2005.09
16	Korea Express Co., Ltd.	Inchon, Korea	40.6 T	23.5 M	3 Units	2005.05
17	Global Enterprises Ltd.	Pusan, Kwangyang, Korea	40.6 T	23.5 M	2 Units	2005.01
18	ABG Heavy Industries Ltd.	Jawaharlal Nehru Port, India	40 MT	23.47 M	12 Units	2004.12
19	Korea Express Co., Ltd.	Pusan Port, Korea	40.6 T	23.5 M	2 Units	2004.08
20	Global Enterprises Ltd.	Pusan, Korea	40.6 T	23.5 M	1 Units	2003.12
21	South Gateway Terminals (Pvt.) Ltd.	Colombo, Sri Lanka	40 T	22.7 M	28 Units	2003.05
22	Korea Express Co., Ltd.	Pusan, Kwangyang, Korea	40.6 T	23.5 M	3 Units	2003.02
23	Korea Express Co.,Ltd.	Incheon, Kwangyang, Korea	40.6 T	23.5 M	3 Units	2001.08
24	Pelabuhan Tanjung Pelepas (PTP)	Johor, Malaysia	40 T	26.5 M	12 Units	2001.06
25	Pelabuhan Tanjung Pelepas (PTP)	Johor, Malaysia	40 T	26.5 M	24 Units	2000.04

Coal Handling Equipment

no	Client	Location	Description	Delivery
1	Mong Duong 2	Mongdoung, Vietnam	Reclaimer 1200 TPH x 2 Units Conveyor 3.4 Km (12 Lines)	2013.12
2	Kumho Terminal	여수 낙포항	2400 T/H Continuous Ship Unloader x 2 units	2012.08
3	Pohang Iron & Steel Co., Ltd	Pohang,Korea	3,000 T/H Continuous Ship Unloader X2units	2012.06
4	GHECO-One	Rayon, Thailand	Conveyor 1.9 Km (10 Lines)	2011.07
5	KEPHILCO	CEBU	Ship Unloader 700 TPHx1 Unit Conveyor 1.1 Km (9 Lines)	2010.12
6	Pohang Iron & Steel Co., Ltd	Kwangyang, Korea	3,000 T/H Continuous Ship Unloader X 4 units	2010.09
7	CIREBON	Cirebon	Ship Unloader 650 TPHx2 Units Stacker/Reclaimer 1,300/1,300 TPH Conveyor 3.6 Km (14 Lines)	2010.07
8	Pohang Iron & Steel Co., Ltd	Kwangyang, Korea	3,000 T/H Continuous Ship Unloader X 4 units	2009.10
9	CHECO	Rayon, Thailand	Conveyor 0.2 Km (2 Lines)	2009.10
10	Pohang Iron & Steel Co., Ltd	Kwangyang, Korea	1,500 T/H Continuous Ship Unloader X 1 unit	2009.05
11	Korea Southern Power Co., Ltd.	Hadong #7,8	Stacker/Reclaimer x 2unit, 3000/2600 T/H	2008.05
12	Korea Midland Power Corp.	Boryung #7,8 Korea	1,600 T/H Continuous Ship Unloader x 2 units	2006.12
13	Pohang Iron & Steel Co., Ltd	Pohang, Korea	3,000 T/H Continuous Ship Unloader X 1 unit	2006.09
14	Pohang Iron & Steel Co., Ltd	Pohang, Korea	3,000/1,500 T/H Continuous Ship Unloader x 1 unit	2006.09
15	PT. PLN (PERSESO)	Lampung, Indonesia	Conveyor System	2006.06
16	Korea South-East Power Corp.	Samcheonpo #1~4 Korea	1500 T/H Continuous Ship Unloader x 2 unit	2006.05
17	Korea East-West Power Corp.	Dangjin #5,6 Korea	1500 T/H Continuous Ship Unloader x 2 units, 3000/2600 T/H Stacker/Reclaimer x 2units, Conveyor System.	2005.11
18	Pohang Iron & Steel Co., Ltd	Pohang, Korea	3000/1500 T/H Continuous Ship Unloader x 1 unit	2004.05
19	Jacksonville Electricity Authority	Jacksonville, U.S.A	1500 T/H Continuous Ship Unloader x 1 unit	2001.06
20	Flour Global Service	Jacksonville, U.S.A	Conveyor System	2001.02

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