

Appropriate Methods for Korea-Thailand Cooperation in New & Renewable Energy Sector

January, 2015

Changhoon Lee

Contents

**I . Policies and Trends of Korea's New &
Renewable Energy Market**

**II. Expansion of Korean Energy Companies into the
Global Market**

III. Methods of Cooperation

The background features a stylized, semi-transparent globe on the left side, composed of various geometric shapes and lines. Several curved arrows originate from the globe and sweep across the page towards the right, creating a sense of motion and flow. The overall aesthetic is clean and modern, with a light gray and white color palette.

I . Policies and Trends of Korea's New & Renewable Energy Market

1. Market Policies

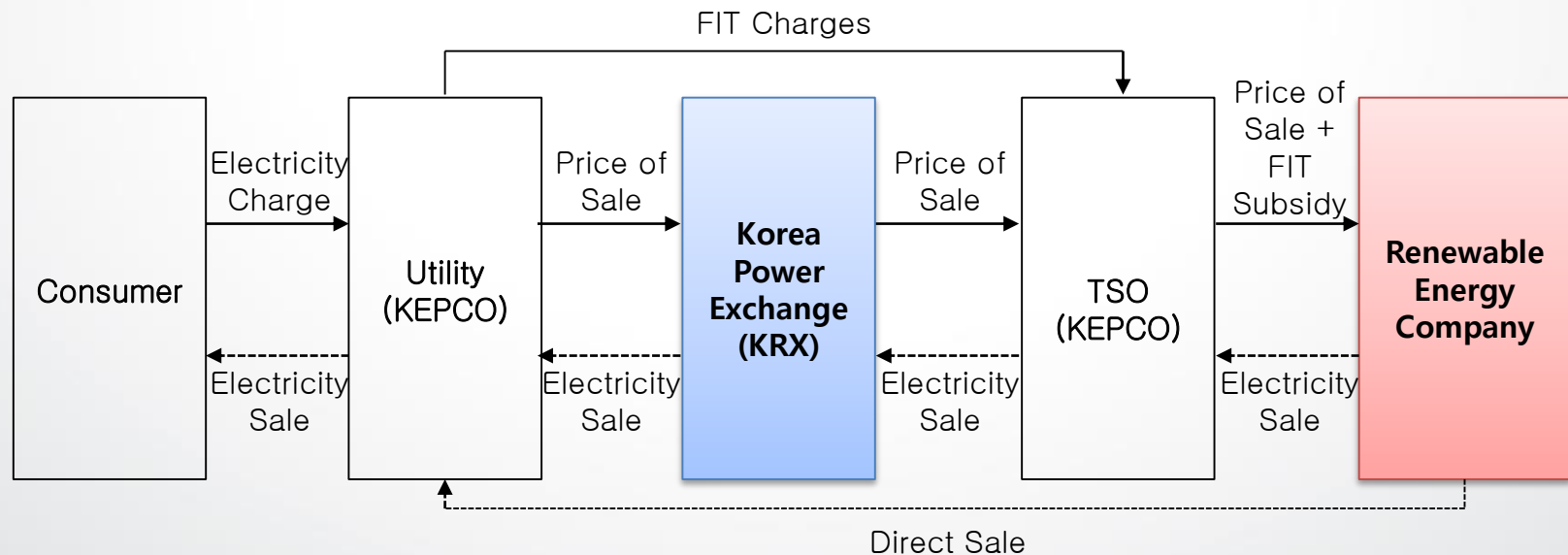
Feed-in Tariff Program(FIT) (2001~2011)



Renewable Portfolio Standard(RPS) (2012~)

- Compensating for cost differences incurred when the sale price of electricity supplied by new & renewable energy generation is lower than the standard price (production unit price : new & renewable energy > previous energy)
- Minimizing investment risks by assuring profit, and vitalizing small-and-medium-sized businesses
- Supporting performance(Year/Million KRW)

2006/9,962 → 2007/26,612 → 2008/119,465 → 2009/262,652 → 2010/331,800



1. Market Policies

Feed-in Tariff Program(FIT)
(2001~2011)



Renewable Portfolio Standard(RPS)
(2012~)

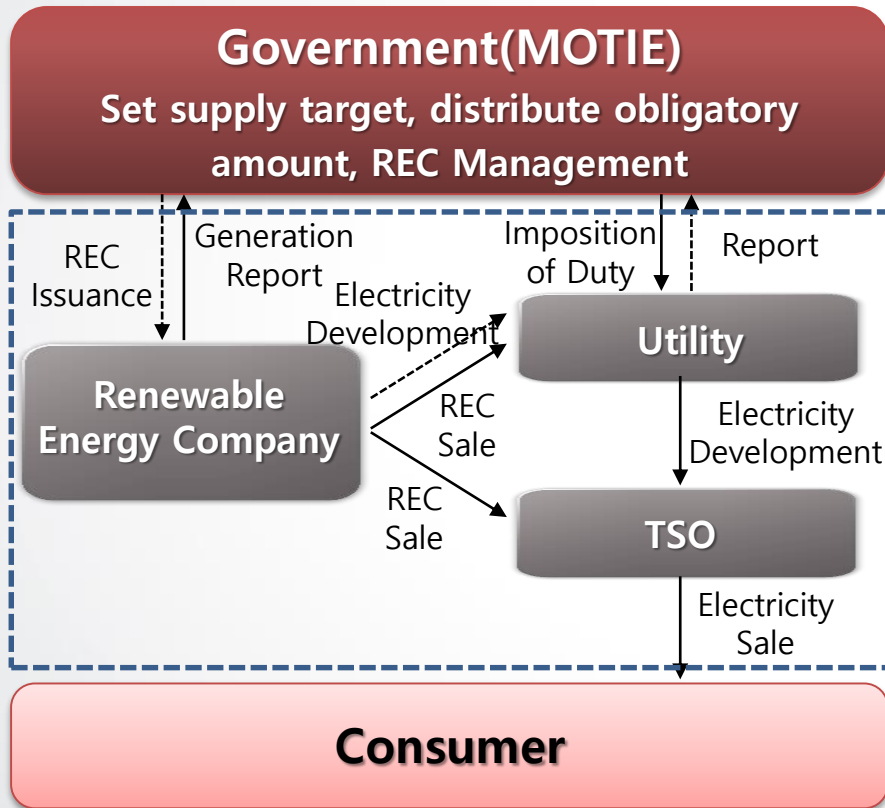


Figure 1. RPS system in Korea

■ Obligatory supply amount: 14 companies*

*KHNP, KOSEP, KOMIPO, KDHC, KWATER
SK E&S, GS EPS, POSCO Energy, etc.

Table 1. Obligatory supply amount

	2012	2013	2014	2015	2016
Total (%)	2.0	2.5	3.0	3.5	4.0
Solar (Gwh)	276	723	1,353	1,971	

2. Market Trends & Prospects

1) Dissemination

- Increasing supply of new & renewable energy up to 11% of total primary energy by 2035
- Diversifying the distribution channels of natural energy, including solar energy, wind power, and geothermal energy, which have been limited by waste materials
- Encouraging participation of the private sector such as solar energy rental businesses and furthering away from the government and public institution-centered distribution method for new & renewable energy

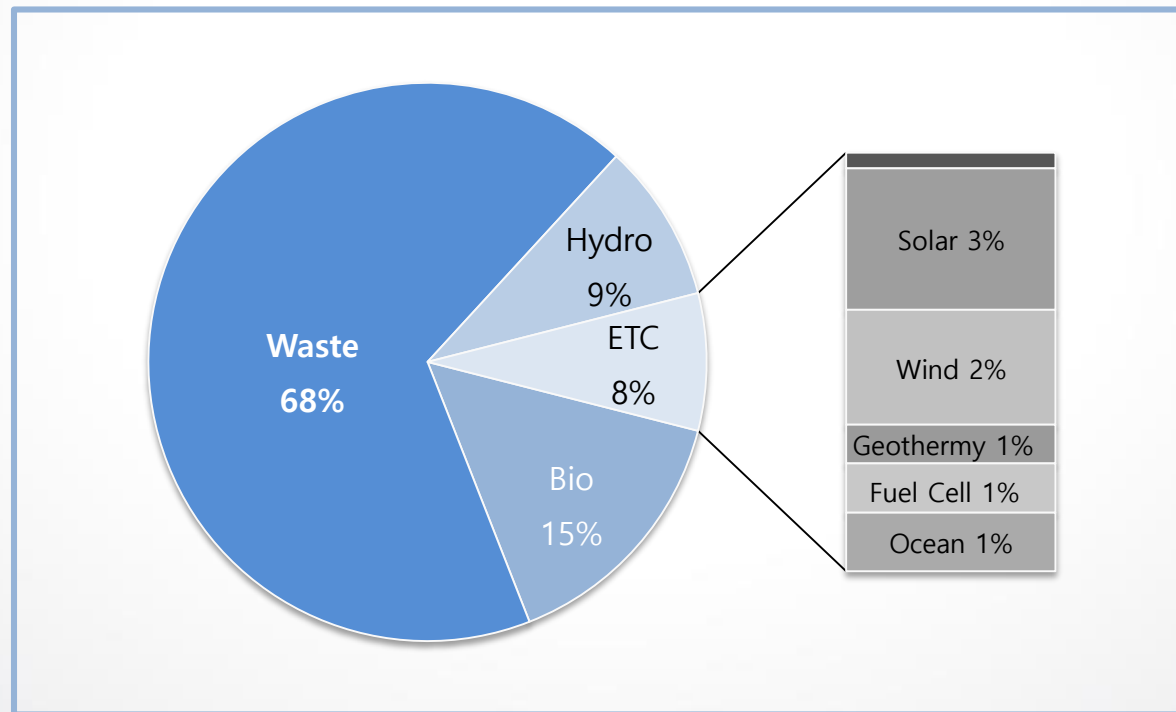


Figure 2. Supply ratio for each new & renewable energy source

2. Market Trends & Prospects

2) Companies

- During the period of 2007-2012, the number of businesses doubled, employment increased by 3.35 times and sales increased by 5.24 times.
- Although the market was depressed in 2012, some businesses have become profitable since the second half of 2013.
- With the increased demand for solar power in the U.S. and Japan, the export of domestic solar power has increased.



Figure 3. New & renewable energy company status

2. Market Trends & Prospects

3) Investment

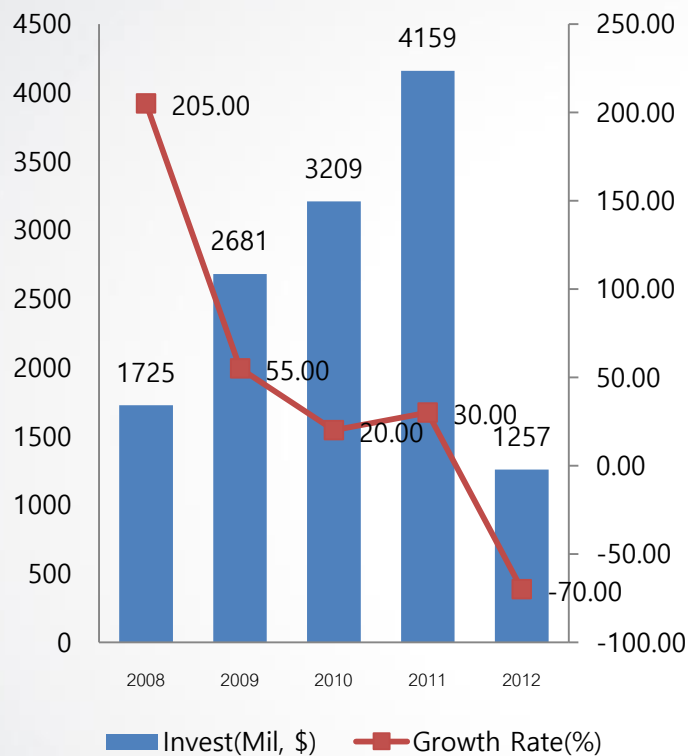


Figure 4. New & renewable energy investment market

- Investment ratio per energy source (As of 2012)
 - 78% solar power, 13% wind power, 7% fuel cell
- Majority of investors in supply obligators (14 companies) according to RPS
 - 5 development public companies planning to invest 6 trillion KRW in 2015
 - Prospect of decreasing investment in biomass and focused investment in wind power and fuel cells
- Effect on investment in low oil price
 - Short-term → Negative
 - Mid- to long-term → Expected to continuously expand
- Overseas investment
 - Expecting to shift away from investment on securing biofuel to advancing into overseas market

2. Market Trends & Prospects

4) Export

- The amount of export is increasing at an annual average rate of 27.8%, of which solar power and wind power are major exporting commodities.
- Recently, due to economic recession, European subsidies have decreased, and Chinese businesses with price competitiveness are slowing down the Korean exports.
- Governmental support for overseas advancement of small-and-medium-sized new & renewable energy companies has a tendency of expanding.
- Despite the decrease in international oil price, the overseas exports are prospectively expanding with reduction of greenhouse gases caused by the climate change.

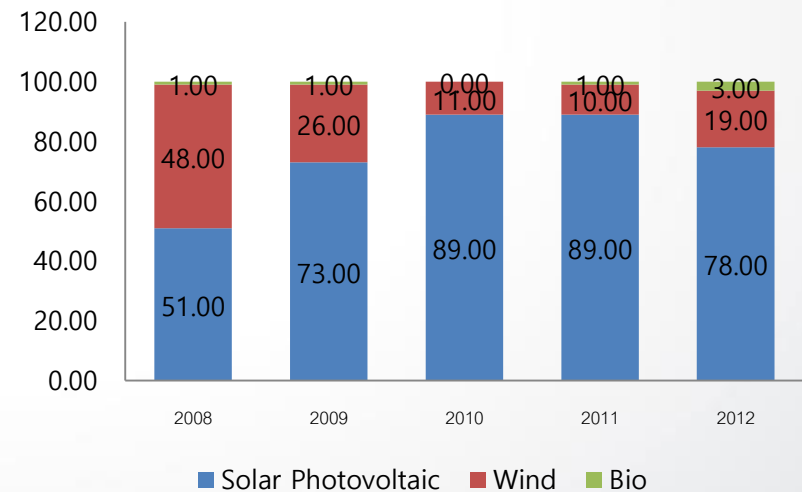
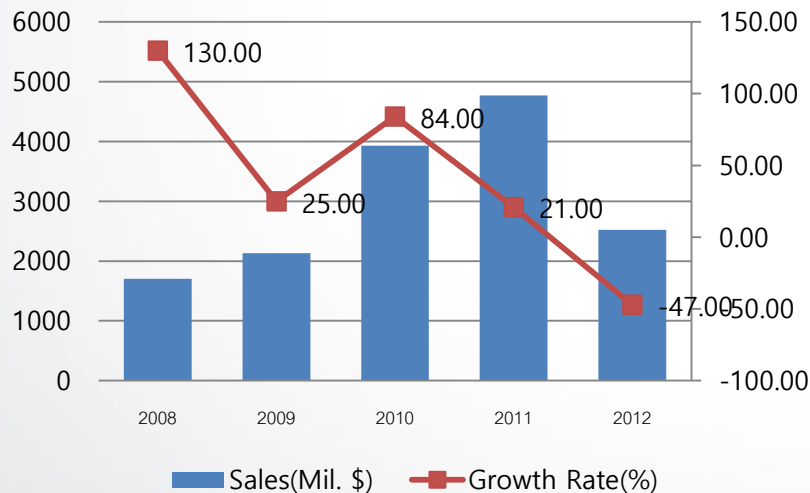


Figure 5. New & renewable energy export scale

The background features a stylized, semi-transparent globe on the left side, composed of various geometric shapes and lines. Several curved arrows originate from the globe and sweep across the page towards the right, creating a sense of motion and expansion. The overall color palette is light and airy, with shades of white and light blue.

II. Expansion of Korean Energy Companies into the Global Market

1. Solar Photovoltaic Energy

■ OCI (www.oci.co.kr)

- Started producing polysilicon since 2008. Has 2nd largest production capacity of 26,000 tons per year in 2013.
- In 2011, it acquired the Cornerstone Power Development, a solar power development company in the U.S., and pursued a profit maximizing strategy through the solar power development project.

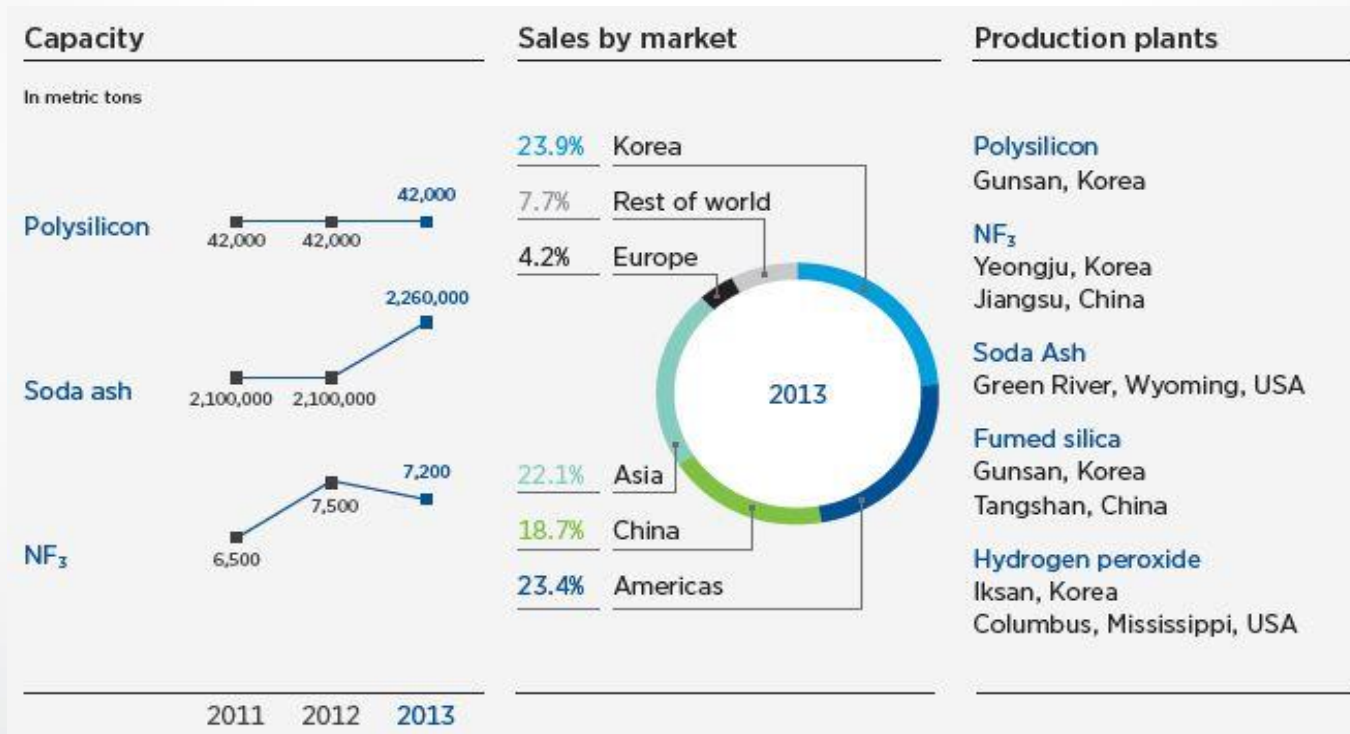


Figure 6. Capacity and sales by market of OCI

1. Solar Photovoltaic Energy

■ Hanwha Chemical (hcc.hanwha.co.kr)

- In 2010, acquired Solarfun Power, a solar power company in China, to advance into the solar power market
- Later on, acquired Q-Cell in Germany to leap to global top 3 standard based on cell production capacity (CHN 1.3GW, MYS 0.8GW, DEU 0.2GW)
- Through all value chains of solar power, achieved vertical integration to secure competitiveness in solar power business (As of 2013, achieved sales of 1,736 billion KRW)

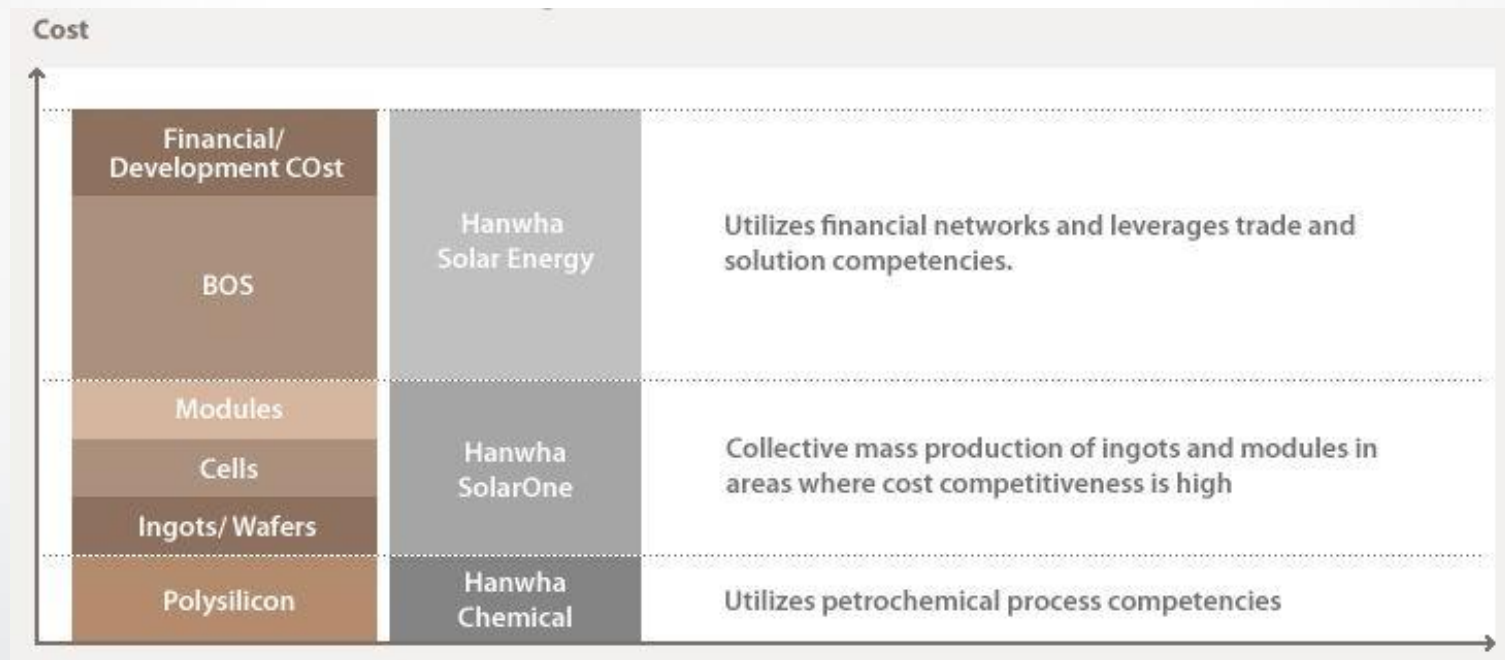


Figure 7. Hanwha Solar business vertical integration

1. Solar Photovoltaic Energy

■ Hyundai Heavy Industries (english.hhi.co.kr)

- Currently, despite operation of the solar cell plants with the capacity of 600MW, the operation rate has been decreased due to market depression
- By investing total 22.6 billion KRW, solar power R&D center is established to promote technology development
- However, due to recent deterioration in business performance, the possibility of restructuring for new & renewable energy business that has been implemented for diversification of business portfolio is under suggestion

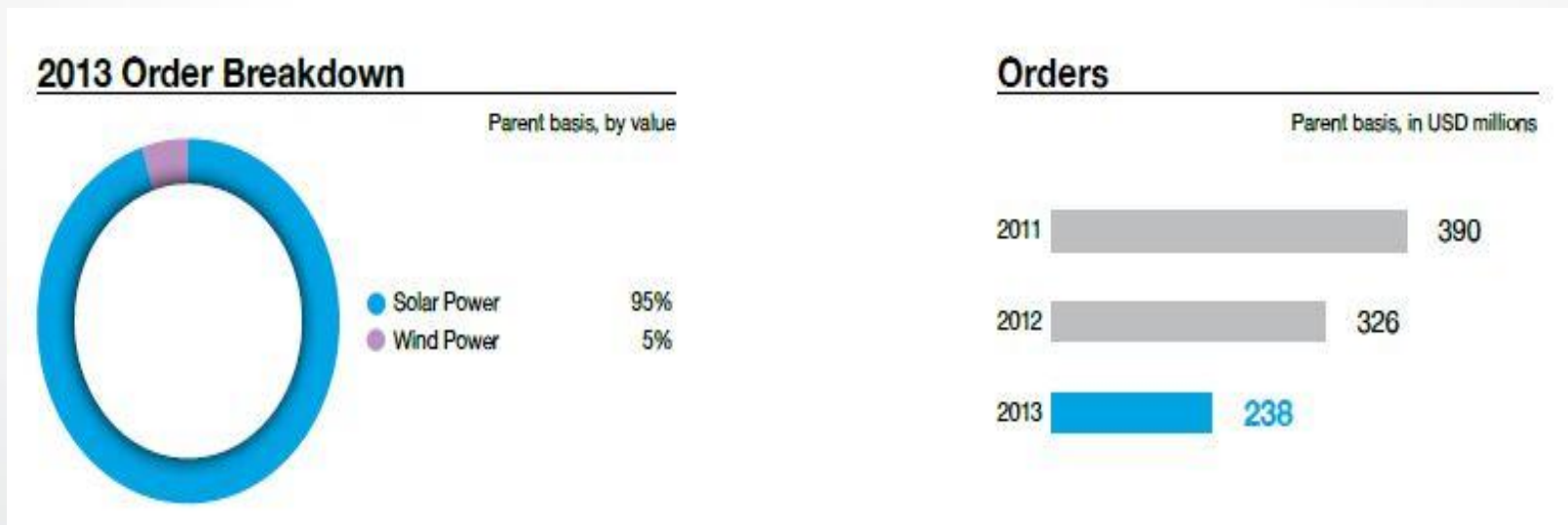


Figure 8. Order Breakdown and orders (in 2013)

1. Solar Photovoltaic Energy

■ Shinsung SOLAR ENERGY (www.shinsung.co.kr)

- Obtains crystalline structure solar cell with the highest efficiency in the world at 20.3%
- Business structure : Cell-Shinsung Holdings, Module-Shinsung CS, Device-Shinsung FA, System-Shinsung ENG
- In April 2014, concluded the agreement on solar power module export with Taiyou (approx. 4.4 billion KRW) and Asahi Alex (9.1 billion KRW) in Japan
- In December, 2014, concluded MOU with Posco Energy for mutual development of convergence project for solar power and fuel cells

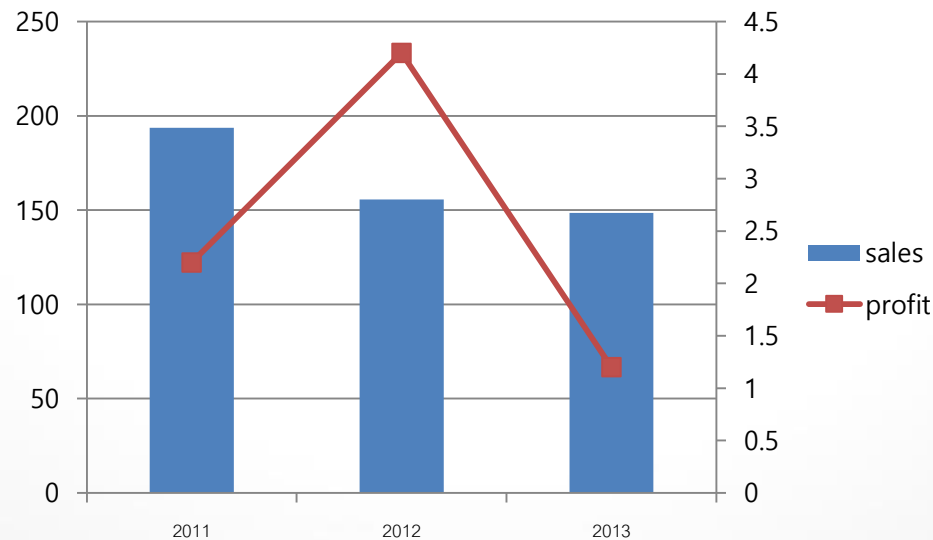


Figure 9. Performance in recent 3 years (billion KRW)

2. Wind Energy

■ Large domestic shipbuilder (Unison, Hyosung, Doosan)

- Searching for ways to expand wind power business through designing and producing capacity of ships and plants, and capital strength
- Since 2002, began to produce wind power generators by independently developing and implementing the governmental task
- Since 2008, entered the wind-power generator market by adopting technology and acquisitions as part of business diversification

■ Hyundai Heavy Industries

- In Gunsan plant, 1.65MW wind power generators are being manufactured, and planning to diversify product lines, including 2-5MW level wind power generators, in the future
- Mutual development of 5MW level wind power generators by entering strategic alliance with AMSC in the U.S., a global wind power generator design company
- Planning to build wind power generation plants in Weihai city in Shantung, China by writing letter of intent with 'Datang Shantung Development Incorporated' in China

2. Wind Energy

■ DSME (www.dsme.co.kr)

- In 2009, acquired DeWind, a wind power company in the U.S., and established a joint company with the state government of Nova Scotia in Canada to promote production of maximum 500 blades and 250 towers annually
- For the offshore wind turbine business, developed 7MW large wind power generators and is planning to advance into the offshore turbine market

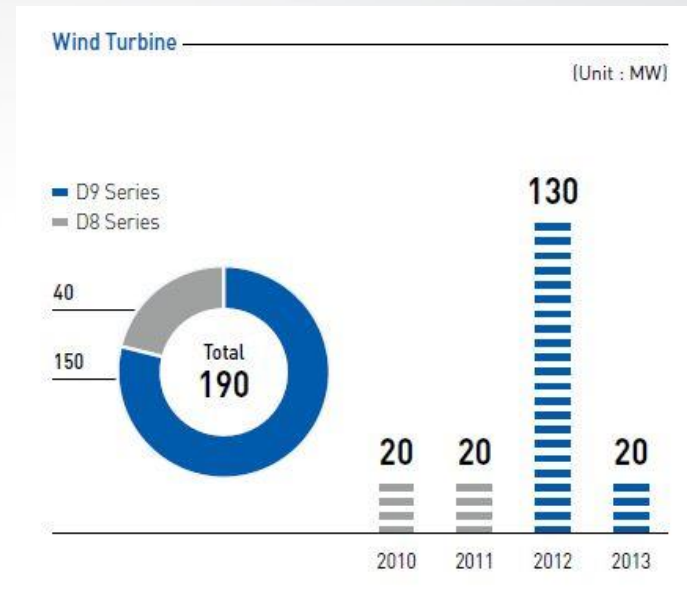


Figure 10. Wind turbine sales

■ Samsung Heavy Industries (www.shi.samsung.co.kr)

- Pursue total offshore wind turbine service company
- Obtains 7MW offshore wind turbine generator, the largest capacity in the world
- In January 2012, concluded agreement with the Fife council in Scotland to build the local grid system and install 7MW offshore wind turbine generators

3. Waste Energy

■ GAIA Energy (www.gaiaenergy.kr)

- Performs energization business of waste resources such as waste plastic, waste tire solid fuel production device and combustion apparatus
- Exporting countries : France, Japan, Switzerland, UK, Canada, U.S., Brazil, Saudi Arabia
- Export amount : 2.6 billion KRW



Figure 11. Business scope in waste energy value chain

3. Waste Energy

■ **Shinsung Engineering** (www.ishinsung.com)

- Provides total solution for new & renewable energy from design to construction
- Leads domestic market in new & renewable energy geothermal cooling and heating system (GSHP) sector
- Exporting countries : Vietnam, China
- Export amount : 1 Billion KRW

■ **IDEAL SYSTEM** (www.idealsys.co.kr)

- By alliance with popular companies overseas, develop organic waste recycling business related plant technology development and perform construction
- Exporting countries: China, India, Southeast Asia, South America
- Export amount: 2.8 Billion KRW

■ **FORCEBEL** (www.forcebel.co.kr)

- Develop organic waste recycling installing business related plant technology and perform construction
- Exporting country: Japan
- Export amount: 2.5 Billion KRW



III. Methods of Cooperation

1. Policy cooperation

■ Diversification of cooperation model

- Cooperation between governments → expand mutual cooperation between local governments and private institutions
- Development of the new & renewable energy industry → enact technological standard, energy security, resource development, etc.
- Improvement of rationality and sustainability of cooperation by structuring consultative groups for each energy source

■ Convergence of strategic issues

- Market expansion of the new & renewable energy and linkage between environment protection and land planning
- Understanding of both nationwide and local energy policy
- Setting up of coordinates for policy cooperation regarding new & renewable energy within the broader range of cooperation such as FTA

■ Strengthening of cooperation network

- Establishment of research institutions and local offices in universities of each country
- Implementation of jointly constructed research programs for mid to long term.
- Sharing of information related to new & renewable energy sector – market trends, companies, universities, research institutions, professionals and technical manpower

Value-Chain Linkage

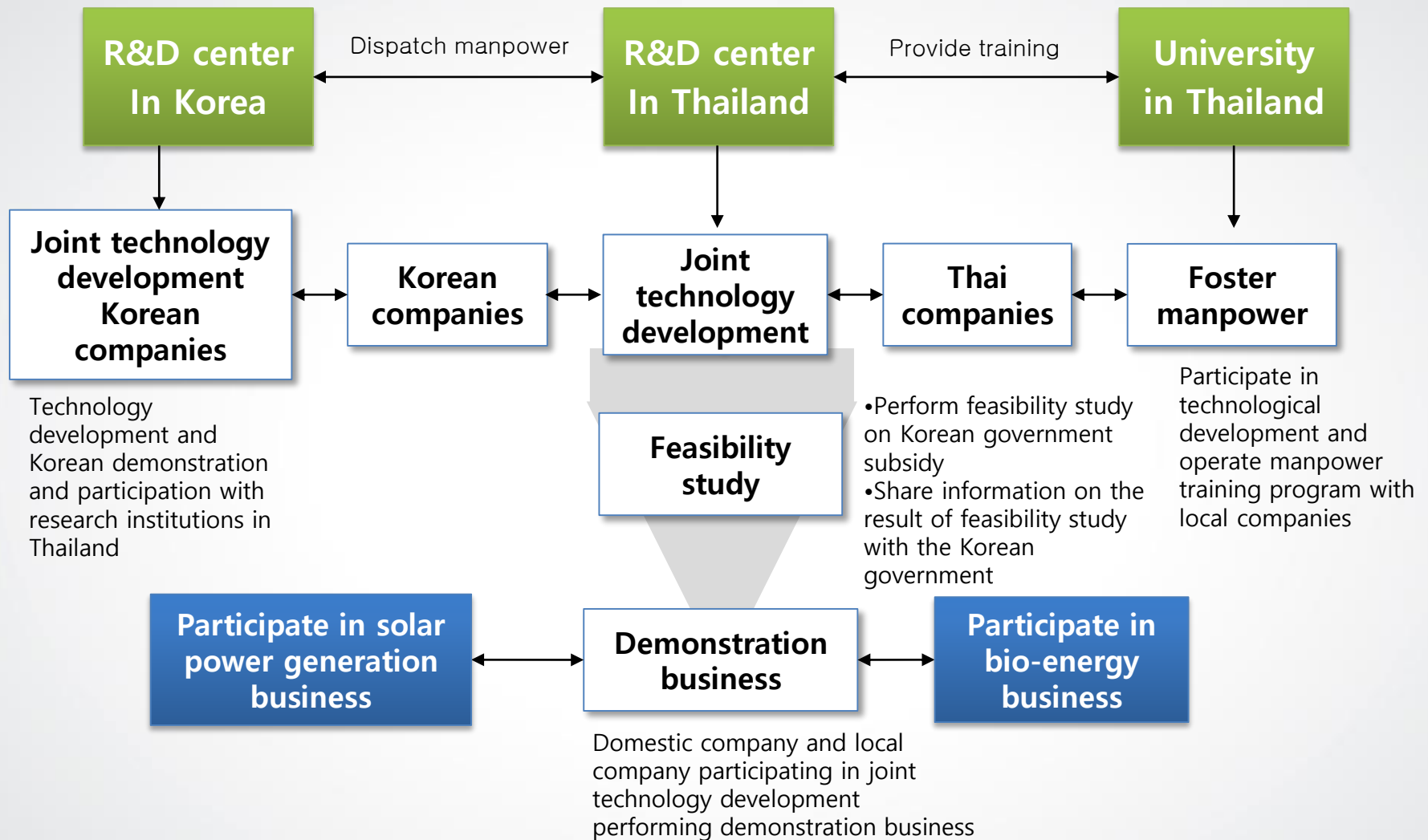
■ Capacity building of Thailand's manufacturing sector (Hardware)

- Develop the manufacturing sector of Thailand through technology transfer from Korea
- Improve electricity infrastructure with high loss factor of power transmission and distribution
- Vitalize corporate cooperation between Korea and Thailand by promoting joint projects and joint venture
- Technology cooperation: Power grid technology, IGCC technology, biodiesel refinement technology, hydroelectric power building technology, etc.

■ Adopting business development model in Korea (Software)

- Develop a large-scale new & renewable energy project by applying a business model in Korea with the highest electricity quality
- Promote project to reduce loss factor of power transmission and distribution
- In connection with the Thai government, provide incubating services to support the development of local new & renewable energy companies
- Major business areas: solar power, waste material, biomass

3. Technology and manpower cooperation



4. Future Project A: "Smart Green City"

■ Moving from 'Green City' to 'Smart Green City'

- Apply eco-friendly new & renewable technology for efficient usage of energy side by side (e.g. Smart Grid)
- In other words, need to promote a policy that directly adopts the modern technology instead of gradual technological development

■ Joint execution of feasibility study business

- Technological, social, cultural and economical feasibility study for candidate location
- Review sustainability by researching investment opportunity, enterprise installation, vitalization of local economy and influx of population
- Budget will be supplied from the EDCF (Economic Development Cooperation Fund) and the ADB (Asian Development Bank Fund) in Korea
- Deduce empowering methods for master plan, action plan and city management

■ Differentiation strategy

- Need to promote project differentiated from city by considering joint advancement to overseas markets through commercialization of project
- Need to establish urban development plan considering local characteristics and city demand
- Resolve urban and energy issues by effectively utilizing limited resources in Thailand

5. Future Project B: Joint advancement into overseas market

■ Vitalization of partnership in the area of strength

- Analyze areas of strength of new & renewable energy sectors in Korea and Thailand
- Obtain reference through export environmental support by each government
- Mitigate regulation and provide administrative support for vitalizing consortium between companies in two countries

■ Demonstration and exchange business opportunity

- Participate in joint business and exchange technology
- Implement fund cooperation side by side
- Create short, mid to long term business opportunity by considering the technological difference in two countries

■ Cooperation business area for joint advancement

- Smart Grid business
- CDM (Clean Development Mechanism) cooperation business
- Convergence business of new & renewable energy and ESS (Energy Storage System)



Thank You