



TASK XVII: QUESTIONNAIRE.

Background:

This questionnaire is based on the marketplace overview and questionnaire of IEA DSM Task XIII (Demand Response Resources) so that the sections I-III are almost the same in both. The country experts of those countries who participated in Task XIII have to check the answers of Task XIII and update them if needed. The country overview of Task XIII was carried out in 2004.

The sections IV - V are new.

Marketplace Overview Form Objective:

The enclosed questionnaire will provide the Operating Agent with a brief overview of each participating country's marketplace structure as well as status of DSM, DG and energy storages. This will help the Operating Agent better understand the similarities and differences amongst the countries participating in Task XVII. This request is not intended to be an in depth research project. It is simply intended to be a brief overview to provide basic facts and understanding that can orient the project team and help share basic information across participants.

Marketplace Overview Form Organization:

The following Marketplace Overview Form is organized utilizing a question and answer format.

There are five categories of questions:

1. **Electric Industry:** Basic overview of market structure and market actors.
2. **Demand Response:** Basic overview of demand response efforts.
3. **Market Transactions:** Basic overview of electricity market transactions.
4. **DG and Renewables:** Basic overview of DG and renewables
5. **Energy storages:** Basic overview of energy storages



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Section I: Electric Industry

1. Does your country operate as one national electricity marketplace or do you have multiple regional electricity marketplaces?

Korea has operated single national electricity market. Following the government-driven restructuring plan and under the electricity business act of Korea, as of April 2, 2001, the KPX(Korea Power Exchange) has been established to operate the single electricity marketplace in Korea.

The pool type of Korean electricity market is the cost-based generation pool (CBP) and the hourly market price is determined based on the system marginal price at each trading hour. Under the CBP, generators are obliged to submit their bids based on the details of their production costs, which are checked and approved by an independent commission. This information is then used to make the least-cost generation schedule to meet the forecasted demand. From these generation schedule results, dispatch information for the individual generators and market prices are determined.

2. If you have multiple regional marketplaces, how many exist in your country? Please explain.

We have only one national electricity marketplace.

3. What market actors perform the following functions in your marketplace: (Please list and briefly describe)

- a. Generation: Six big generation companies and several Independent Power Producers(IPPs). Six big generation companies are subsidiaries of the government-owned single transmission/distribution/retail company, KEPCO,



while the IPPs are existing privatized companies. Generation companies with their generation capacities as of June 30, 2007 are listed below:

1) South East Power(7,195MW), 2) Midland Power(8,500MW), 3) Western Power(7,880MW), 4) Southern Power(7,651MW), 5) East West Power(8,501MW), 6) Hydro & Nuclear Power(18,250MW), 7) IPPs(6,374MW)

- b. Transmission: KEPCO, government-owned single transmission, distribution, wholesale purchase, and retail business company
 - c. Distribution: KEPCO
 - d. Retail customer services: KEPCO
 - e. Reliability management: The KPX operates the electricity market and power system in accordance with the Electricity Market Rule and System Operation Procedures approved by KOREC(Korea Electricity Commission) in MOKE(Ministry of Knowledge and Economy), which are the national electricity industry regulatory bodies.
 - f. Other (please describe):
4. What market actors' work directly with the retail consumers (e.g. distribution company, competitive suppliers, energy service companies, etc)? Please provide brief description of their roles.

In Korea, the KEPCO is the monopolistic retail business company. KEPCO is government-owned and plays the roles of transmission, distribution, wholesale purchase, and retail supply. The original electricity industry restructuring plan, which aimed at the introduction of the retail competition in 2004, has been temporarily ceased for the political reason.

5. Please list key regulatory players and their roles.
- 1) MOKE(Ministry of Knowledge and Economy): Supervision of the national electricity resource planning and short/long-term electricity resource stabilization planning, planning and management of DSM, management of optimal fuel mix and reasonable prices by the sectoral use
 - 2) KOREC(Korea Electricity Commission) in MOKE: Setup/review the electricity market rules, dispute resolution, electricity market monitoring, investigate the unfair trading, proceed the electricity industry restructuring
6. Please list key industry stakeholder groups (e.g. large customer associations, reliability organizations, trade associations, etc.)



Large customers: In Korea, industrial and commercial customers are stakeholder in terms of large customers. Among the industrial customers, heavy and machinery industry companies, iron and steel companies, and chemical industry company are large customers. Among the commercial customers, large building customers such as hotels and offices are large customers and leisure industry are also large customers.

Small customers: Residential customers who are staying in the apartment can be considered as stakeholder groups in small customers. NGO which support customer's right is also a stakeholder in electricity industry.

Energy Companies: In electric industry sector, KEPCO and generation companies exist. Other players such as, KNOC(Korea National Oil Corporation), KOGAS(KOrea GAS corporation), KDHC(Korea District Heating Corporation), etc. can be stakeholders.

Environmental interests: Environmental NGOs which support No-nuclear and sustainable procurement of energy are stakeholders in terms of environmental interests

7. How many commercial, industrial and residential customers exist in your marketplace (add additional customer classes, e.g. agricultural, as needed)?

End-use sectors can be clustered 6 types of customers due to the electricity tariffs structure.

- 1) Residential: 13,112,311 Households
- 2) Industrial: 315,743 Customers
- 3) Commercial: 2,366,333 Customers
- 4) Educational: 30,745 Customers
- 5) Agricultural: 1,087,426 Customers
- 6) Street lighting: 712,278 Customers

8. How many distribution companies operate in your marketplace? Please list the top five largest distribution companies.

We have only one distribution company(KEPCO) in Korea.

9. What is the level of competition in your country. Any changes seen in the future?

- a. In generation: Generation companies are competing each other in the offering their generation availability to the KPX. That is, the generation companies in Korea just submit generation quantities available at each trading hour. Due to the absence of price bidding to the pool, the level of competition in the generation market is quite a bit low.
- b. In wholesale market: Since there is a single wholesale market buyer(KEPCO) in Korea, there is no wholesale competition in Korea.



c. In retail market: Since retail competition is not introduced in Korean electricity market yet, there is no competition in retail market in Korea

10. If you have retail competition, how many competitive suppliers exist in your marketplace?

No retail competition and single retail supplier(KEPCO) in Korea.

11. If you have retail competition, what percentage of the summer and winter peak demands do competitive suppliers supply?

No retail competition.

12. What is the forecasted peak demand growth rate in your marketplace?

Base on the 3rd national basic plan for electric power supply & demand, the average forecasted peak demand growth is 1.8% annually to the year of 2020. In 2006, peak demand was 5,899MW and forecasted peak demand in 2020 is 7,181MW.

13. What is the projected supply (capacity) growth rate in your marketplace?

The average projected supply capacity growth rate is annually 2.2%. In 2006, supply capacity was 6,459MW and projected supply capacity in 2020 is 8,815MW.

Section II: Demand Response at large and small customers

14. Has demand response been attempted in your market? If so, please provide brief description of relevant successes and challenges.

An incentive-based demand response program designed for power system emergency, Direct load control(DLC) program for the industrial customers, has been introduced in July 1, 2002. However this program has never been executed in practice, due to the sound condition of Korean power system reliability.

Therefore, many people blamed the program for the constant payment to the enrolled customers with DLC without actual use of it in the real world.

Regulators, therefore, are now seriously considering the expansion of this system. That is, the economic use of DLC when the power system is the normal state is now under review.

15. Which market actors might be most supportive of demand response in your marketplace? Please explain why.

KPX(Korea Power Exchange), who is the market and system operator in Korea electricity market are most supportive of demand response. Because the KPX is responsible for the reliable power system operation and the stable market operation, the demand response is the one of very attractive options to accomplish it.

Next, KEPCO is also interested in the demand response. Since KEPCO highlights the sound economy and risk management of the retail company in the future markets, the demand response is a portfolio of option for retail companies like KEPCO to reduce the pool purchase cost and manage the viability of market prices which may be realized in the future.

16. Which market actors would be the most likely to offer demand response services to the consumer? Please explain why.

Currently, there is no active demand response program in Korea that we cannot answer this question. However, based on the experience of DLC in Korea, we can guess that some low value-added industrial customers such as, the paper and textile industry have more attention to the demand response. Also, some industrial customers who have responsive loads and re-schedulable production process can participate the demand response well.

17. Can demand response resources participate in electric market transactions today? If so, how?

No

18. What are the most important objectives for demand response? Please explain.

Electricity tariff for the industrial customer in Korea is with the loss on the average production cost. This tariff structure has been designed to primarily promote the competitiveness of domestic industry sectors, while the commercial and residential customers are subsidizing the industrial customers.

Therefore, due to the low electricity price level in industry, most of the industrial customers feel no need to change their electricity consumption pattern even when there is an incentive for that. Therefore, the demand response cannot give a signal to the customers.

So, currently the most important objectives for demand response are to sustain power system reliability and then to stabilize the market prices.

19. Do energy consumers see different electricity prices at different times of the day? (Please explain in terms of how many and by class or size)

We do have some TOU rates for the industrial and commercial customers. Currently, there are 6 types of TOU for the industrial customers and they see different electricity prices at three different time intervals. In a single time interval, the electricity prices are the same throughout the time interval. There are 6 types of TOU for the commercial customers and, as the industrial customers, the commercial customers see different electricity prices at three different time intervals.

20. Have any energy efficiency and/or a demand response market potential studies been completed in your marketplace in the last ten years? YES / NO. Results/references?

No study on the demand response market potential has been made in Korea yet. However, energy efficiency market potential has been investigated several times. Domestic market potential of energy efficiency has been studied by KEMCO through the energy audit programs of industry and the ESCO programs. But specific energy efficiency potentials by energy sources such as, electricity, natural gas, petroleum, etc. are not comprehensively assessed until now. In electric power, energy efficiency goals are described by the national basic plan for electricity supply and demand which is the 3rd plan and set up by 2 year periods. But until now DSM goals are only to reduce peak demands, therefore the specific goals for energy efficiency are not properly incorporated to it. The DSM goals of electricity, together with load management and energy efficiency, are reduce about 14% of peak demand on the basis of BAU scenario in 2020.

21. Do you have energy efficiency target (e.g. 2020) in your country per customer sector?

In electric power sector, target of energy efficiency is included into the national basic plan for power supply and demand by the peak demand saving perspectives which is about 4% reduction of forecasted demands in 2020. Despite the energy efficiency goals of national concerns are set up, the targets of efficiency by individual energy resources are not specifically linked to the national levels.

Section III: Market Transactions

22. What type of electricity products traded in your marketplace (e.g. 5-minute spinning reserve, 30-minute non-spin, day ahead, capacity, hourly energy/spot, etc.)?

We only have the spot(day-ahead) energy market in Korea. No ancillary service such as spinning and non-spinning, no capacity is traded in our marketplace.

23. Do you have a central trading exchange in your marketplace?

Yes. We have the KPX(Korea Power Exchange) as a single central electricity trading exchange in our marketplace.

24. How are reserve margin targets established in your marketplace? Please explain.

KPX establishes the long-term and short-term reserve margin targets in accordance with the Electricity Market Rule and System Operation Procedures approved by KOREC(Korea Electricity Commission) and MOKE(Ministry of Knowledge and Economy)

25. What is the current reserve margin target in your marketplace?

We have 10% reserve margin target in the long-term planning viewpoints. In the short-term power system operation standpoints, 4,000MW is the reserve margin target for the normal operation, which is about 6% reserve margin considering peak demand in Korea. However, since the peak demand has been increased annually and current size of Korean power system is also increasing, there are various opinions that the reserve margin target of 10% is still appropriate for our country.

26. Does your market currently exceed or fall short of the current reserve margin target? Please explain.

Currently, our market exceeds the current reserve margin target. We have 10.1% reserve margin in 2007. Moreover, according the projected supply capacity and peak demand forecast, 16% to 25% reserve margin is expected for the upcoming decade.

Section IV: DG and Renewables

27. What kind of support schemes/guaranteed prices you have for DG/Renewables? Any changes under discussion?

Korea has operated the mandatory market pools for electricity transactions, therefore generating facilities more than 200kW which want to sell the electricity produced should register to the national power market operator, KPX(Korea Power Exchange). Renewable generators of market participation can be compensated by the feed-in tariffs of electricity prices. The government compensates eligible renewable generators for any shortfall between the pool price and feed-in tariffs. The rate of feed-in tariffs in 2007 is shown below.

Resources	Eligibility	Standard prices (KRW/kWh)
PV	above 3kW	677.38~711.25
Wind	above 10kW	107.29
Small Hydro	below 5MW	66.18~94.64
Bio(LFG, Biomass)	below 50MW	68.07~85.71
Ocean	above 50MW	62.81~90.50
Fuel Cell	above 200kW	234.53~282.54

To promote the installation of DG/Renewables, the wide range of government subsidies or low interest loans can be provided to the users according to the installation purposes.

28. How are the markets for DG/renewables arranged? Who buys the electricity produced?

KPX has operated the Capacity Based Pool of electric power since 2002. It's kind of wholesale competition in the markets. Currently only KEPCO purchases all the electricity from the pool according to the market prices which is arranged by the KPX. DG/renewables is treated as the one of market participation entities.

29. What are the targets for DG/Renewables in the future (e.g. 2020)

The long-term targets of Renewables is set up to 5.6% of total primary energy supply in 2012 by the 2nd national renewable energy development and deployment plan and to 9.0% of TPES in 2030 by the national energy fundamental plan. In the national levels, diffusion targets of CHP or dispersed generation excluding renewables are not specifically set up.

30. What is the present aggregated capacity of DG (max 20 MW units)

- Wind: 177.7MW (in 2006)
- Solar: 35.9MW (PV in 2006)



- c. chp excluding micro chp (natural gas, biogas, other biofuels, other fuels): 3,455MW(District heating 1,310MW, Industry complex 2,145MW in 2006)
- d. microchp (at residential customers): 148MW (Small scale cogeneration in 2006)
- e. small hydro: 60.0MW
- f. others

NRE generation capacity in 2006(unit: MW)

	PV	Bio	Wind	Hydro*	Fuel Cell	Sum
Total	35.9	80.3	177.7	60.0	1.0	354.9
Market Registration	10.4	30.3	156.4	55.6	0.3	253.0

* Large Hydro(above 5MW) is excluded.

NRE generation produced in 2006(unit: GWh)

	PV	Bio	Wind	Hydro*	Fuel Cell	Sum
Total	31.2	154.5	238.9	169.7	6.7	601.0
Market Transaction	5.5	119.2	207.7	157.3	0.2	489.9

Registered Generation Capacity in Korean Electricity Markets (unit: GW, as of 2008)

	Hydro**	Coal	Oil	LNG	Nuclear	CHP	Renewables	Sum
Capacity	5.5	20.5	5.4	17.9	17.7	0.9	0.4	68.3
Share(%)	8.0	30.0	7.9	26.3	25.9	1.3	0.5	100

** Hydro(5,492MW): Large(1,528MW), Small(64.0MW), Pumped Storage(3,900MW)

31. What is the present aggregated capacity of larger variable output generation (over 20 MW) not connected to transmission grid

There is no large scale DG resource which is not connected to the transmission grid because of the mandatory electricity market pool in Korea.

- a. wind farms
- b. chp
- c. run-of-river hydro

32. What is the present aggregated capacity of the windfarms connected to transmission grid

- a. Onshore: 156.4MW (327GWh was generated in 2006)
- b. Offshore: limited

33. Are there any potential estimations for the DG/Renewables? Results?

There has been some researches on the potential estimations of CHP, but until now there was no publicly informed or agreed opinions on the DG resources.



In 2007, NRE Center affiliated in KEMCO estimated the economic potentials for adopting renewables as from 3.09% to 4.94% of TPES in 2012. But, the governmental target was set to 5.6% in 2012 by the 2nd national basic plan for renewable development and dissemination. To achieve that goal, heavy investment should be followed.

Section V: Energy storages

34. What kind of energy storages you have in commercial use as to your systems? Estimate for storing capacity (MW/MWh). The purpose of the storages (energy management, power quality, system security, others)?

- a. large scale in the connection of larger generation (hydro/pumped hydro, CAES, heat storages (in connection of chp), others)

Commercial energy storage facilities can be the pumped storage for hydro power generation and thermal accumulators operated with heat supplying facilities. The capacity of pumped storage was 3,900MW in 2006. In the case of KDHC(Korea District Heating Corporation) which is the largest district heating company of Korea, the capacity of thermal accumulators took up 699 Gcal/h that is about 14% of total heat production facilities in 2006.

- b. medium size in the connection of DG or distribution networks (batteries, heat storages, others)

Other energy storage facilities such as, Battery, CAES, Flywheel, etc. had researched and developed for the demonstration purpose, but until now it has not fully developed and commercialized to be interconnected into the grids.

- c. at customer level (heat storages, others):

In Korea, ice storage systems for cooling have been diffused since 1991, helping to cut the peak demand in summer. This system operates chillers and stores the ice to the tanks in the midnight when electricity prices are cheap, and then the stored ice is used in the daytime. Total amount of installed capacity was 649MW in 2006, and KEPCO reported that 398MW of peak shaving was achieved from the deployment of ice storage system.