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# The Unlevel Playing Field:

## How the Power Market Structure Discriminates Against Demand Response to Favor Gas Power Generation

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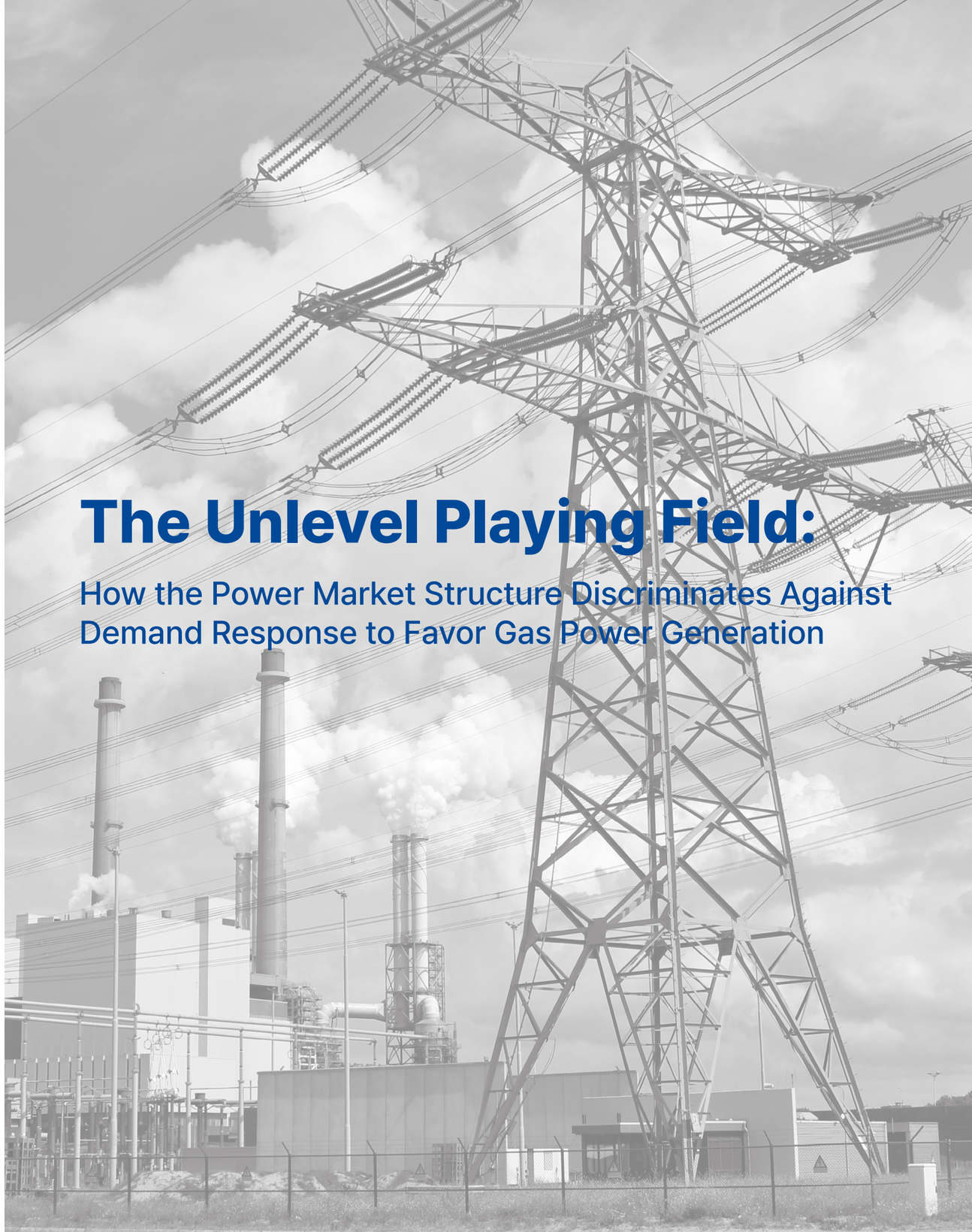

# The Unlevel Playing Field:

## How the Power Market Structure Discriminates Against Demand Response to Favor Gas Power Generation


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# 01. Summary

**Flexible resources that can quickly respond to output variation are necessary under the power system with high renewable energy penetration. Demand Response (DR) can not only reduce the overall operating cost in the power system but also replace expensive new gas-fired power plants. This report aims to point out the challenges to expanding Demand Response with many advantages, due to the current power system which prioritizes gas power generation. Furthermore, this report suggests a policy direction to ensure fair competition between the two resources and to expand the use of Demand Response.**

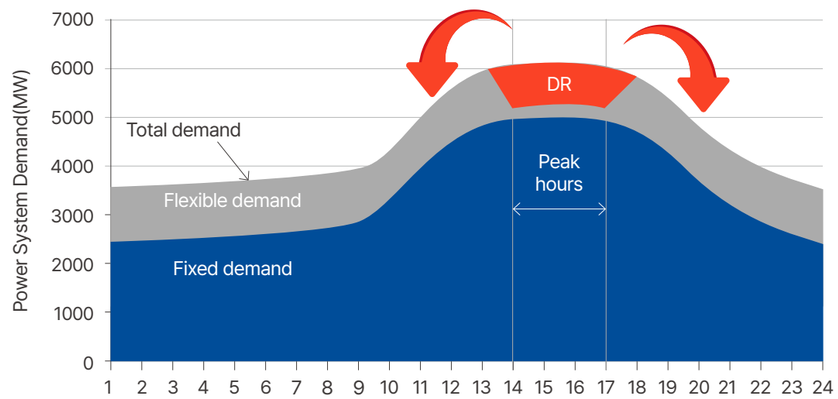
As the decarbonization of the power sector is accelerating globally due to greenhouse gas regulations, the expansion of renewable energy and flexible resources that can facilitate renewable energy is becoming more important. This is because flexible resources can ensure grid stability by quickly balancing electricity supply and demand during the peak hours.

Demand Response replaces the operation of some generators by adjusting electricity demand following the order of Korea Power Exchange (KPX). It can be treated the same as gas power generation since it is a flexible resource that enables smooth output control and reduces peak load. South Korean government has been increasing the reliability of Demand Response that has reached above 100%, by continuously strengthening the registration and response standards so that it can be controlled like a power generator. For example, when the frequency dropped due to the breakdown of a generator in March 2021, Demand Response reduced electricity demand in 4 seconds and returned the frequency in 1 minute. [1]

[1] Electric times (2021.04.15), Fast DR, Stabilize frequency drop in 1 minute'.



Figure 1 – Concept of Demand Response (DR)



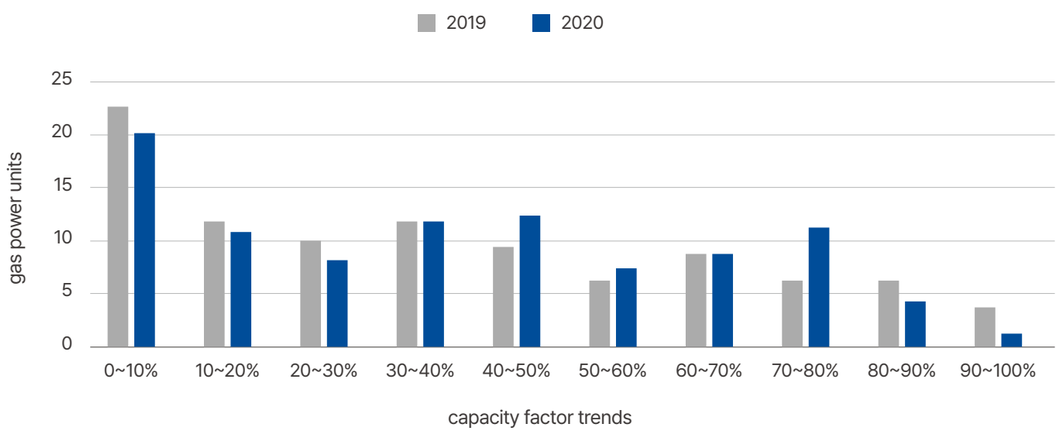

Demand Response which adjusts the electricity demand is reliable enough to replace generation units, but in the current power market, the expansion of gas power generation is prioritized over the use of Demand Response. Instead of using energy efficiently by reducing or shifting the electricity usage, increasing the amount of electricity supply through constructing new gas power plants is mainly being considered. In addition, due to the excessive compensation to gas power generation, construction of new gas power plants with a capacity of five times more than the current Demand Response (4.6GW) is being promoted by 2036 without thorough consideration of long-term economic financial risk. There are mainly three issues when it comes to the Demand Response not being utilized properly: ① power market favorable to gas power generation, ② unfair capacity payment, ③ strict operating standards on Demand Response.

Table 1 – Gas power generation and Demand Response

| Category | | Gas power generation | Demand Response | Details |
|---|---|---|---|---|
| Capacity (GW) | operating | 41.2 | 4.6 | 26 units (13.7GW) planned to be converted from coal to gas by 2036 |
| | planning | 22.3 (2036) | 1.1 (2030) | |
| Cost-plus mark-up policy | | Δ | X | KEPCO's generation companies which owns about 50% of total gas power units, guarantees profitability through cost-plus mark-up policy |
| Capacity payment (KRW/kW) (2021) | | 74,800 | 27,800 ~46,600 | Gas power generation is receiving 1.6 ~2.7 times more capacity payment than Demand Response |
| Ancillary services payment (KRW one million) (2021) | | 53,285 | X | Gas power generation received 53.3 billion KRW for ancillary services in 2021, whereas Demand Response did not get paid for the same services |

**First, the current power market structure disproportionally benefits gas power plants, leading to construction of new gas plants and delaying the phase out of gas plants that contribute little to the grid.** Since KEPCO's generation subsidiaries are guaranteed a fixed level of profit through the cost-plus mark-up policy, they have been promoting the conversion of coal power plants which are supposed to be phased-out to gas power plants regardless of the economic feasibility. In other words, cost-plus mark-up policy guarantees the profitability of new gas power plants, creating an unfair market structure for expanding Demand Response. Furthermore, even though gas power plants with low-capacity factors lack economic feasibility, current market system guarantees profitability of uneconomic gas power plants. This prevents inefficient gas plants from being phased-out in the power market.

Table 2 Capacity factor trends of gas power units [2]




**Second, due to the unfair market structure, gas power generation are overcompensated compared to Demand Response.** Gas power generation received capacity payment that is up to 2.7 times more per year than the reliability-based DR, which is a type of Demand Response. Gas power generators are paid for 24 hours of capacity payment and the payment gets settled regardless of their contribution to the power grid. On the other hand, reliability-based DR is only paid for peak hours of capacity payment, and settlement is made based on its actual contribution to the power system. Furthermore, ancillary services payment, which compensates for frequency adjustment and backup reserve, is only paid to gas power generation.

[2] This source is based on the data provided from National Assembly offices.



**Lastly, it is difficult to expand the demand resource due to the strict operation standards.** Standard of issuing reliability-based DR, which is below 6,500MW of reserve, is very strict so that there was no issuance except for the 4 registration tests. When it comes to economic DR, the standard for the minimum bid price called NBTP (Net Benefit Test Price) is set high. Therefore, the amount of successful bids is relatively small compared to the amount of bids.

The issue of unfair competition between Demand Response and other generation including gas generation was raised in other countries as well. As a result, structural and legal reforms were enacted to enable fair competition between the two resources.

**[UK]**
In the UK a lawsuit was filed under the claim that the government's plan to support the Capacity Market was devised in a way that was unfair for Demand Response compared to other power generators. As a result of the lawsuit, the UK. changed its support plan to enable fair competition for Demand Response in the market by allowing long-term contracts and reducing the minimum capacity for bidding.

**[U.S.]**
In the U.S., the Energy Power Supply Association (EPSA) filed a lawsuit against the Federal Energy Regulatory Commission (FERC), which has the jurisdiction on the bidding process and regulation of Demand Response, under the claim that compensating Demand Response and other generation sources in the same manner was excessive. However, the Supreme Court ruled that the regulatory jurisdiction of the FERC is appropriate, and Demand Response is being compensated at the same level as other generation sources in the U.S.

As such, in order to enable fair competition of Demand Response and gas generation in the Korean market as well, ① the government should re-consider the plan to covert 26 plants (13.7GW) from coal to gas, according to the Basic Plan for Long-term Electricity Supply and Demand. ② A settlement system should be adjusted to a fair level by providing proper compensation to Demand Response that can improve grid stability such as Fast DR and Plus DR. Furthermore, ③ the government should ease the operating standards of reliability-based DR and auction standards for the economic DR to expand Demand Response.

# 02. Background

**Globally, the use of renewable energy is being expanded to mitigate climate change impacts, and the need to secure stable electricity supply to meet growing demand and ensure energy security is increasing. Flexible resources are becoming more important as they help manage electricity supply and demand, secure appropriate reserve power capacity by quickly balancing electricity supply and usage, which helps renewable energy expansion.**

## 1) Global energy policy outlook

While the global use of renewable energy is being expanded to respond to climate change, fossil fuel generators are gradually being phased out in the power market. Furthermore, tightening global environmental restrictions, including the Carbon Border Adjustment Mechanism and RE100, indicate the Korean industries and economy are facing growing international pressure to use more renewable energy.

The global share of renewable energy generation exceeded 10% for the first time in 2021[3] , but South Korea still lags behind at 4.7%. Despite the previous government's plan to increase this renewable energy share to 30% by 2030[4] , the incumbent Yoon administration intends to downgrade the target to 21.5%, per the 10th Basic Plan of Long-Term Electricity Supply and Demand announced late August this year.

## 2) Need for flexible resources

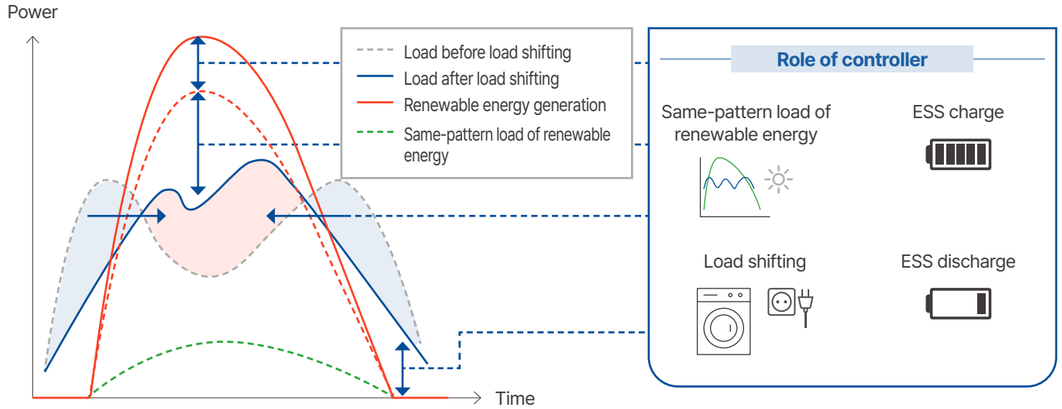
To expand the share of renewable energy generation, which by nature entails intermittent output, the power system should be capable of providing flexibility. Therefore, rather than traditional generators with limited output control, the role of flexible resources becomes more important. Flexible resources not only readily provide easy output control but also offers useful reserve power during winter and summer demand peak seasons.

[3] Ember (2022.03.30), 'Global Electricity Review 2022.'
[4] Carbon Neutrality & Green Growth Commission (2021.10.18), '2050 Carbon Neutrality Scenario'



**[Flexible resources]**
Flexible resources are the resources that improve the reliability, security, and stability of the power system by swiftly balancing the electricity supply and demand. Examples of flexible resources include Demand Response (DR), Energy Storage System (ESS)[5] , Electric Vehicles (EV), hydroelectric power generation, and combined-cycle gas turbine power plants.

Figure 2 – The role of flexible resources [6]




However, the Basic Plans for Long-Term Electricity Supply and Demand announced in Korea thus far have focused more on securing gas power plants than flexible resources. Trends over the past ten years indicate that electricity generation capacity increased by a greater margin than electricity demand.[7] It is important to note that excessive generation capacity rigors the power system, hindering future renewable energy expansion by potentially curtailing its output control.

Table 3 – Average annual growth rate of electricity demand and electricity generation capacity

| Average annual growth rate | 2010~2014 | 2015~2019 |
|---|---|---|
| Maximum electricity demand (%) | 3.7 | 2.4 |
| Electricity generation capacity (%) | 5.2 | 6.4 |

[5] ESS adjusts frequency to consistently maintain power system's load, and it can flexibly adjust power supply by saving or supplying energy through instant charging and discharging.
[6] Monthly Electrical Journal (2020.09), 'Issues in the power system due to expansion of volatile renewable energy sources and responses'
[7] The Ministry of Trade, Industry and Energy (2020.12.28), 'The 9th Basic Plan for Long Term on Electricity Supply and Demand'.

# 03. Demand Response

**There is currently 4.6GW of registered Demand Response in Korea. As a flexible resource, it replaces the construction of new gas power plants and prevents the use of high-cost generators by controlling electricity demand. Just like traditional power generators, Demand Response's reliability has increased with time so that it can provide services in accordance with KPX's dispatch instructions. However, its value is underestimated compared to gas power generation, despite playing the same role in the power market.**

## 1) Current Status

Demand Response (DR) refers to the system that changes electricity consumption pattern by incentivizing the end-use consumers to trade their energy reduction in the wholesale market. That is, unlike power generators, DR stabilizes the balance of supply and demand by shifting or shedding electricity demand rather than supplying electricity. Large-scale industrial customers account for 83% of total DR customers[8], and they participate in its programs by adjusting operations scheduling or by reducing electricity load through saving power for cooling and heating and using backup generators.[9]

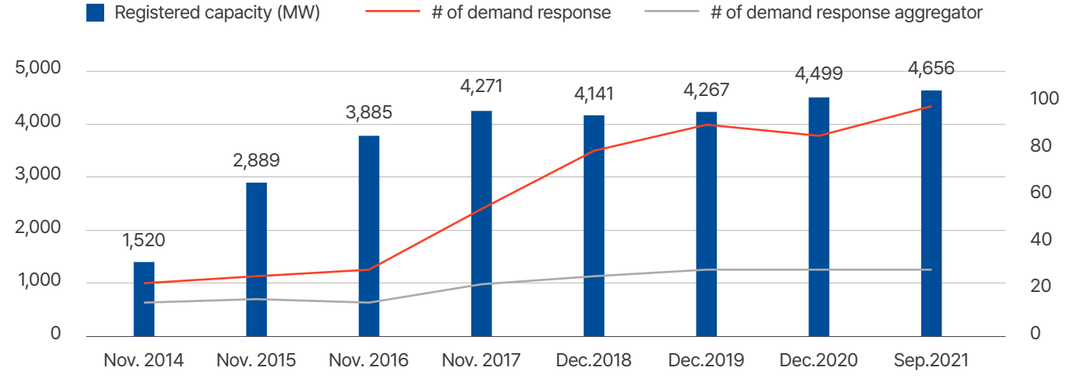
**Figure 3 – Overview of Demand Response[10]**


[8] IEA (2021.12), 'Reforming Korea's Electricity Market for Net Zero'
[9] Korea Power Exchange (2015.05), 'Calculating Appropriate Capacity of Demand Response for Efficient Operation of the Power Market and Research on Ways to Improve the System'.
[10] Power Piggy Bank at Our Home, 'Citizen DR Explained Easy'



The capacity of the domestic DR market increased from 861MW in November 2014 when it was first registered to 4.6GW in 2022[11], equivalent to the aggregate generation capacity of four to five nuclear power plants.

**Table 4 –Demand Response market trends by year[12]**

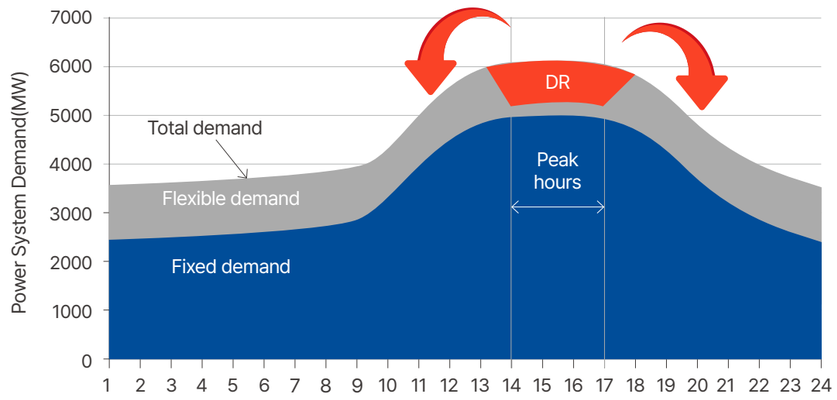



## 2) Role

By responding effectively to peak loads and controlling the power demand during peak hours, DR can bring down the overall electricity prices, as it negates the use of high-cost generators and shifts the maximum demand. Since DR responds to peak load demands and enhances the energy efficiency, it is fully capable of replacing the roles of new generators including gas power plants.

[11] Korea Power Exchange (2022.06.), 'March 2022 Status and Operation Information of Demand Response Market'.
[12] The source is same as above.

Figure 4 – Role of Demand Response[13]




## 3) Institutional Framework

**To align with the heightened importance of Demand Response, the government has diversified its DR programs to meet various purposes and enhanced DR reliability to ensure supply in accordance with the KPX instructions, as are the case for conventional power generators.**

### (1) Diversification of Demand Response programs

Various DR programs are currently offered in South Korea, depending on its DR capacity and the operational purpose. During the infancy of DR programs, the only available options were Reliability-based DR (mandatory reduction) and Economic DR (electricity demand management depending on wholesale market conditions), but the institutional framework was revised to expand the voluntary participation of electricity consumers.

Afterwards, since 2019, voluntary DR programs were extended to include Peak Demand DR and Particular Matter DR. In addition, Residential DR ('Energy Pause Program') designed to encourage the participation of small-scale electricity consumers, Fast DR aimed at preventing the frequency drop in the power system, and Plus DR to minimize the curtailment of renewable energy have been launched.

[13] The Ministry of Trade, Industry and Energy, Growth Technology Office, Future Strategy Team (2011.08.10), 'Concept and Status of Demand Response System'



Table 5 – Overview of Demand Response programs [14]

| Category | | Usage purpose | Operation hours | Compensation |
|---|---|---|---|---|
| Reliability-based DR (Mandatory DR) | | To secure reserve capacity by reducing electricity demand in accordance with KPX instructions, used when the reserve capacity is below 6.5GW. | Weekdays from 09:00 ~ 20:00 (Excluding 12:00~ 13:00) | Default settlement, performance-based settlement |
| Voluntary DR | EconomicDR | To reduce electricity demand by receiving a certain amount of capacity through a successful bid, used when it is more economical than power generators after the bidding process at the day-ahead market. | Weekdays for 24 hours | |
| | Peak Demand DR | To make a bid at the day-ahead market when it is predicted that the demand will exceed the standard projected demand during the Supply and Demand Adjustment Measure Period. | Supply and Demand Adjustment Measure Period *Summer 13:00 ~20:00 *Winter 09:00 ~20:00 (Excluding 12:00~ 13:00) | |
| | Particulate Matter DR | To make a bid at the day-ahead market when Emergency Reduction Measure is issued due to a high concentration level of particulate matter. | weekdays from 06:00 ~21:00 (Excluding 12:00~ 13:00) | Performance-based settlement |
| Residential DR ("Energy Pause Program") | | For small-scale electricity users to reduce electricity demand upon the order of KPX. | weekdays 06:00 ~21:00 | |
| Fast DR (Fast DR, Frequency DR) | | To maintain the reliability standard by automatically reducing demand when the frequency of the electricity grid drops to 59.8Hz or below. | 365 days 09:00 ~18:00 | |
| Plus DR | | To increase the renewable energy capacity through increasing demand when curtailment incurs for renewable power generators in Jeju Island. | weekdays from 09:00 ~18:00 | |

[14] Korea Power Exchange (2022.05.31), 'Full text of the Electricity Market Operation Rules (220531, Official Notice)'

## ● Expansion of Plus DR

Going forward, the role of Plus DR, which manages the supply and demand by increasing electricity demand during the hours with excess electricity supply, will become more important. When flexible resources are not expanded along with the expansion of renewable energy, the power system becomes unstable due to the frequent output fluctuation of renewable energy, which can lead the supply becoming greater than the electricity demand. In this case, renewable energy generation is forcefully halted to reduce power supply, balancing the supply and demand. Therefore, the demand should grow in conjunction with the power supply to prevent the curtailment of renewable energy.

Currently, Plus DR only applies to Jeju Island, where the share of renewable power generation is significant. But Plus DR will be operated on a national level in the future as renewable energy use expands accordingly.

**[Curtailment of renewable energy in Jeju Island]** [15]

With the rapid increase of renewable energy in Jeju Island, the number of curtailment cases per year is also on the rise. Jeju island's share of renewable energy in 2021 was 18%[16], which is significantly higher than the national average of 3.9%.[17, 18] Since the region comprises of many smaller islands, Jeju Island operates on an independent power system separately from the mainland. In addition, since there is no power transmission system that sends the Jeju-produced electricity to the mainland, the supply and demand for power must be balanced independently within the area. Therefore, renewable energy generators are ordered to curtail their output under potential concerns of system overloads and blackouts. The number of yearly curtailment cases of wind power generation in Jeju Island rapidly increased from 6 in 2016 to 77 in 2020.

As a response, the government introduced Plus DR in December 2020 to improve the grid flexibility in which sufficient demand can cover for the fluctuations in the electricity supply. Currently, the Plus DR system provides settlement money to the electric vehicles that charge during the excess electricity supply hours, thereby increasing the power demand.

[15] Jeju News (2021,04.18), 'First Reverse Transmission of New Renewable Energy Power to a Different Region'
[16] Electric Times (2022.02.17), 'Young-Hwan Kim mentioned that "Participant-friendly system should be prepared for Energy Transition"
[17] KOSIS (2022.04.18), 'New Renewable Energy Generation Capacity (Excluding All Non-renewable Waste)'
[18] The share of renewables only covers solar and wind.



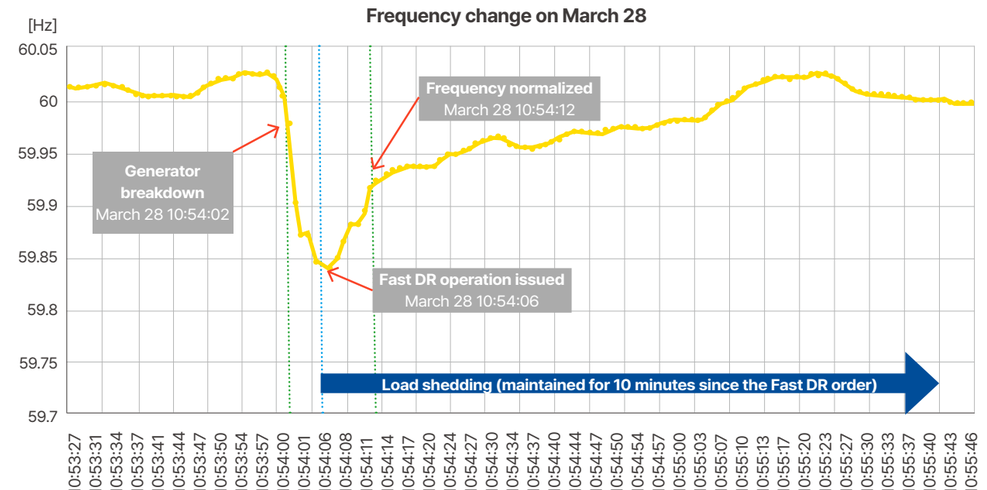
## ● Expansion of Fast DR

Fast DR is a crucial resource that stabilizes the power system by quickly responding[19] in case of power system issues caused by unstable demand and supply. Normally, the frequency of the power system is maintained at 60Hz. However, in case the frequency drops to 59.85Hz or below due to a sudden circumstantial change, Fast DR is issued to immediately reduce the electricity demand for 10 minutes to recover the frequency. Since a blackout can occur when the frequency drops to 59.0Hz or below, Fast DR is an efficient resource that can prevent blackouts by reducing demand without having to build more gas power plants. The role of Fast DR will become more important in the future, as renewable energy use expands, and energy efficiency maximization is prioritized over construction of more gas power plants.

**[Instances of Fast DR Operation]** [20]

On March 28, 2021, the frequency of a 918MW Shin-Seocheon coal-fired Power Generation Site rapidly dropped from 60Hz ~ 60.05 Hz to 59.85Hz as it broke down during commercial operation. In just four seconds afterward, Fast DR was issued and reduced the demand by 620MW in one minute. The frequency was restored to 59.9Hz and the power system was normalized. An additional 210MW was reduced over the next six minutes, completely bringing the frequency back to normalcy.

**Figure 5 - Fast DR, adjusting frequency**




[19] Fast responding resources refers to generation capacity that can maintain more than 4 hours of output through central feed generator's response within 20 minutes that is separate from operating reserve capacity. It can perform the role of quickly responding to excessive volatility in the power system. Source: Korea Power Exchange (2020.03), 'Detailed Operation Regulations on Technology Assessment'.
[20] Electric times (2021.04.15), 'Fast DR, Stabilize frequency drop in 1 minute'.

### (2) Strengthened reliability of Demand Response

The reliability of the Demand Response system has continued to improve as it has been required to meet strengthened response and reduction requirements. This means that Demand Response systems are required to respond immediately to KPX's orders just like power generators. In May 2018, the Electricity Market Rule Revision Committee introduced a rule revision that strengthened the reliability of the Demand Response market.[21]

**Table 6 – Proposal for rule revision in the DR market [22, 23]**

| Category | Before revision | After revision |
|---|---|---|
| Requirement to issue the request to reduce demand | When the demand exceeds target demand | When the demand exceeds target demand, taking into consideration the reserve power capacity |
| Registration test reduction duration | 1 hour | 3~4 hours |
| Termination of participating customer status | - | May be terminated before the trading market opens |

Demand Response, which is controllable, can manage electricity supply and demand by playing the identical role as power generators. After the rule revision, the reliability of Demand Response reached above 100%, and it can respond according to the order of KPX just like other power generators. 100%+ reliability means that there was a greater reduction performed compared to the ordered reduction amount. In 2021, Reliability-based DR reduced 1,285MWh of demand and Economic DR 509,426MWh. The reduction implementation rate compared to the ordered reduction amount was 111% and 157%, respectively.

**Table 7 – Demand reduction status of Reliability-based DR and Economic DR in 2021 [24]**

| Category | Reliability-based DR | Economic DR |
|---|---|---|
| Reduction amount (MWh) | 11,285 | 509,425 |
| Reduction implementation rate (%) | 111 | 157 |

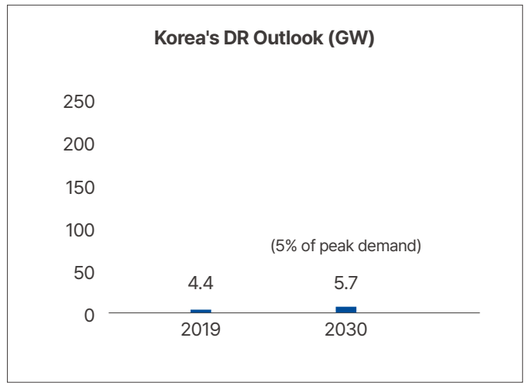
[21] Korea Power Exchange (2018.05), 'Rule Revision to Improve Reliability of Demand Response Market'
[22] The source is same as above.
[23] The Demand Response market design has continually revised afterwards. Recent revision in 2022 covers that test reduction duration was changed to 1 hour for Small and Medium-scale DR and Plus DR. Furthermore, regarding termination of participating consumer status, Demand Response consumers can cancel the registration within the next 2 days after the finalization of mandatory reduction capacity.
[24] Korea Power Exchange (2021), 'Status and Operation Information of Demand Response Market'

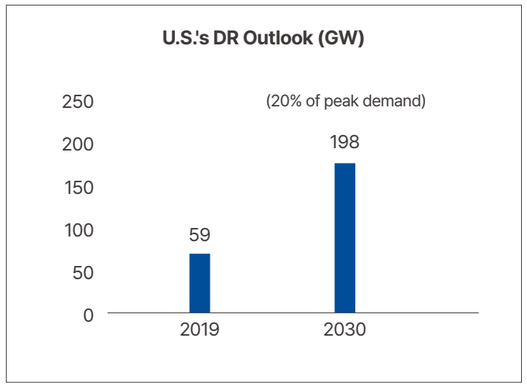


## 4) Future plans

As the proportion of renewable energy generation increases, the role of Demand Response will also expand. Korea witnesses a bigger need for DR in summertime when air conditioning requires a greater electricity demand. Until now, the system operated with the focus on Reliability-based DR and economic DR, which existed since the early days of the Demand Response market. But going forward, the role of new programs like Plus DR and Fast DR will get increasingly hold a greater significance in the power system. The issue is that Korea's current plan to expand Demand Response is rather conservative. According to the 8th Basic Plan on Electricity Demand and Supply, Demand Response will increase to reach 5.7GW by 2030, which merely covers 5% of the total peak demand.[25] Meanwhile, the U.S. assesses that Demand Response can help reduce 198GW by 2030, 20% of the peak demand, which implies that the Korean power market is underestimating the potential of Demand Response. [26]

**Table 8 – Comparison of the outlook of Demand Response in Korea and the U.S.**



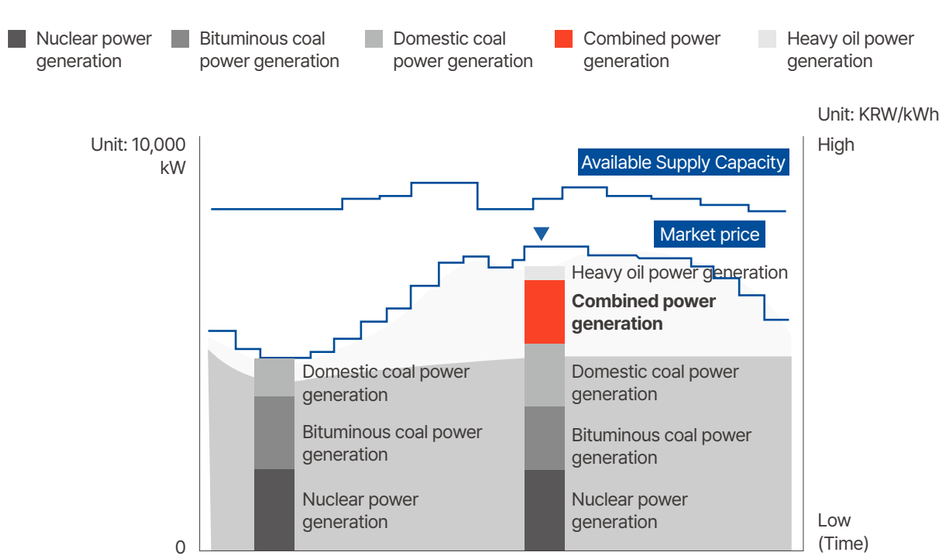

[25] The Ministry of Trade, Industry and Energy (2017.12.29), 'The 8th Basic Plan on Electricity Demand and Supply'
[26] Brattle (2019.07), 'The National Potential for Load Flexibility – Value and market potential through 2030'

# 04. The Unlevel Playing Field: unfairness in the power market

**Gas power generation and Demand Response play the same role of reducing the peak load. However, the current power market is intrinsically designed to favor gas power generation and thus, Demand Response does not have a fair chance of competition with other resources. Below is an analysis and comparison between the two resources' operation and compensation, as well as the factors that are detrimental to a fair market environment.**

Gas power generation and Demand Response play the same role in that they can both balance electricity supply and demand during peak hours and increase the reserve power capacity. Gas power generation is usually reserved for peak hours with peak electricity demand – despite its high fuel cost, gas power's output control is relatively easier compared to coal-fired or nuclear power generation.[27]

**Figure 6 – Roles of gas power generation [28]**




[27] Electric Times (2017.02.06), 'Paradigm shift between base load and peak load'.
[28] This figure simplifies the electricity trading volume in terms of energy source.



However, in Korea, gas power generators are much more frequently operated, even outside of peak hours. Gas power capacity is 9 times bigger than Demand Response capacity; its trade volume is even 314 times bigger.

**Table 9 – Comparison of the status of gas power generation and Demand Response in 2021**

| 2021 | Gas power generation | Demand Response | Details |
|---|---|---|---|
| Capacity (GW) | 41.2 | 4.6 | Gas power generation capacity: X9 of Demand Response |
| Electricity reduction amount or trading volume (GWh) | 163,401 | 521 | Gas power trading volume: X314 of Demand Response |

In addition, though it is possible to partially replace gas generation with Demand Response, the current policy plans to disproportionately expand gas generation even further. According to the 10th Basic Plan on Electricity Demand and Supply announced by the government, 26 coal-fired plants waiting to be shut down will be converted to gas power plants by 2036, on top of additional gas plants being constructed in Tongyeong, Ulsan, and Yeosu. The capacity of gas power plants will increase from 41.2GW to up to 63GW in 2036. [29]

On the other hand, the operation hours and performances of Demand Response of each system indicate that DR is extremely underutilized, considering its high reliability. In most cases, they were not even operated for a week per year, and even the annual reduction amount of Economic DR, which was operated relatively more often, merely recorded 492GWh. The bidding went through for a mere 297GWh, less than half of the originally bid amount of 736GWh. Considering that the actual compensation cannot exceed the 'bidding amount X 1.2' (356GWh) regardless of the reduced volume, both the successful bidding amount and the compensation level are below satisfactory.[30]

[29] There may be changes to the number of power plants to be constructed in the future as the new Basic Plan on Electricity Demand and Supply will be announced at the end of this year, but it seems that the construction of power plants in which construction plans are already announced will proceed as planned.
[30] Korea Power Exchange (2021), 'Status and Operation Information of Demand Resource Trading Market'

Table10 – Operation hours and performance of Demand Response in 2021 [31]

| Category | | Operation hours | Reduced or increased demand amount |
|---|---|---|---|
| Reliability-based DR(Mandatory DR) | | 4 occasions | 10.9GWh reduced |
| Voluntary DR | Economic DR | 248 days | 492GWh reduced |
| | Peak Demand DR | 6 days (20 hours) | 970MW reduced |
| | Particulate Matter DR | 1 day | 1,982MWh reduced |
| Residential DR("Energy Pause") | | 54 occasions | 1,354KWh reduced |
| Fast DR(Fast DR, Frequency DR) | | 4 occasions | 3,422MW-10min reduced |
| Plus DR | | 10 days (29 hours) | 19,478MWh increased |

As such, this Chapter will analyze the barriers to expanding Demand Response.

## 1) Excessive 'reward system' that prioritizes gas power generation

**The current power market's cost-plus mark-up policy disproportionally induces the expansion of new gas-fired power plants and hinders the phase-out of gas power plants that contribute little to the grid.**

The 10th Basic Plan on Electricity Demand and Supply says that as much as 13.7GW of electricity will be converted from coal-fired to gas power generation. Cost-plus mark-up policy is the reason why the construction of large-scale gas power generators, 3 times the currently registered capacity of Demand Response (4.6GW), is made possible.

**[Cost-plus mark-up policy]** [32]

The cost-plus mark-up policy was devised by the government to recover the excess profit of KEPCO's subsidiaries in charge of power generation and guarantee a substantial profit level for 30 years. Among the private power producers, only the ones that own coal power plants are eligible for compensation per the cost-plus mark-up policy.

**[Settlement adjustment coefficient]** [33]

[34]The settlement adjustment coefficient is applied to control the electricity transaction settlement between the 1) central dispatch coal-fired generators and 2) generators of businesses whose share of 50% or higher is owned by an electricity sales business under the government's price regulation (KEPCO.) When KEPCO purchases electricity from power generators, the settlement adjustment coefficient between 0 to 1 is applied to the SMP (System Marginal Price) to adjust its profit.

[31] The source is same as above.
[32] Korea Power Exchange (2021.12.29), 'Full Text of Detailed Operation Regulations on Cost Assessment (211229)'
[33] The source is same as above.



Because the current power market guarantees an unconditional profit for KEPCO's subsidiaries which have their own gas power generators[35], these operators are often recklessly pursuing the construction of new gas-fired power plants. If the cash flow of the generation companies with gas power units fall short of the unit cost combined with profit, their settlement adjustment coefficient may be tweaked under the current cost-plus mark-up policy, guaranteeing the generation companies' net income.[36] Building new gas plants carry the risk of becoming stranded assets while pursuing for the reduction of greenhouse gas emissions and carbon neutrality; even so, the power generation subsidiaries do not have an economic incentive to stop, as gas generation is always the profitable option for them.

Table 11 – Projected cost-plus amount and settlement amount of coal power plants in 2017 (Unit: KRW 100 MM) [37]

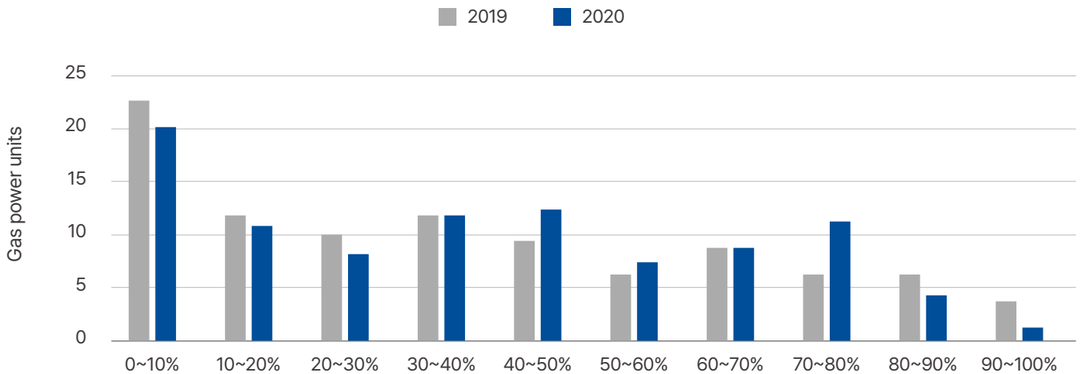
| Cost-plus amount | | Expected total payment per year | | Difference in amount |
|---|---|---|---|---|
| Fixed cost | 1,850 | Energy settlement amount | 2,878 | |
| Depreciation | 738 | RSEP | 2,666 | |
| Operation and maintenance cost | 402 | RGSCON | 1 | |
| Appropriate investment amount | 636 | RSCON | 3 | |
| Appropriate corporate tax | 203 | RCOFF | 205 | |
| △Deduction (exceeded days of suspension) | △129 | Others | 3 | |
| Fuel cost | 1,675 | Capacity settlement amount | 373 | |
| Total | 3,525 | Total | 3,251 | 274* |

→ The cost-plus amount **is calculated based on the tentative investment submitted by the business.** After the final investment amount is confirmed, the cost-plus amount will be recalculated to settle the difference in the amount.

[34] Korea Power Exchange (2022.01.24), 'Full text of the Electricity Market Operation Rules (211228 Official Notice)'
[35] KEPCO' generation companies own about 50% of total gas power units.
[36] Korea Power Exchange (2021.12.29), 'Full Text of Detailed Operation Regulations on Cost Assessment (211229)'
[37] Debate Forum Presentation Material (2020.05.18), 'New Coal-fired Power Plants and Cost-plus Mark-up Policy, are They Fine as They Are'

While many gas plants do fail to contribute to the power system, with more than half of the plants being operated for shorter than 30% of the year, they are still in operation rather than phased out because the current compensation scheme guarantees a certain level of profit for power generation operators.

Table 12 – Capacity factor trends of gas power plants [38]




[38] Utilized the material submitted by the Korea Power Exchange and the Ministry of Environment to the National Assembly.



## 2) Settlement scheme which is unfavorable to Demand Response

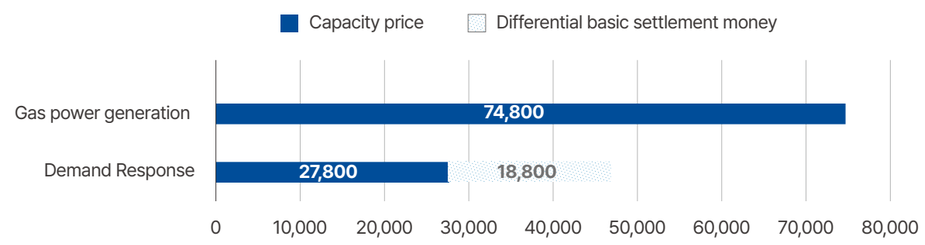
**While gas power generation is guaranteed the fuel cost, capital investment cost, and eligible investment payment through the cost-plus mark-up policy, Demand Response does not receive appropriate payment compared to gas power generation. Demand Response is only eligible for a significantly lower capacity payment compared to gas power generation. What is worse, DR is not eligible for the ancillary services payment (compensates for frequency adjustment and reserve power capacity) at all.**

### (1) Capacity payment

Gas power generation takes up a significant portion of total capacity payment provided to all power generation sources per year. In 2021, the capacity payment received by gas power generation amounted to KRW 3.1 trillion, approximately half of the total capacity payment given to all generators (KRW 6.5 trillion). For reference, the capacity payment[39] received by Demand Response in 2021 was KRW 254.1 billion.[40]

When it comes to the current calculation method of capacity payment, it is of particular concern that gas power generation and Demand Response, which are used for peak demand, are not treated fairly. As of 2021, the capacity price (KRW 74,800/kW) for gas power generation was 1.6 to 2.7 times higher than the capacity price for Reliability-based DR (27,800 ~ 46,600/kW).[41]

Table 13 – Capacity payment unit price in 2021 (KRW/kW)




[39] Although the payment given as a compensation for fixed cost of Demand Response resource is called basic payment, we used the consistent term of "capacity price" to help readers' understanding.
[40] Korea Power Exchange (2022.05), '2021 Electricity Market Statistics'
[41] Capacity Price is rounded to the nearest tens for readability.

**[Capacity payment]** [42]
As a settlement money paid in return for responding to KPX's power generation order, capacity payment is provided at the bidding price of the suppliable capacity, regardless of whether the gas power plants have actually been operated.

**[Differential basic settlement money]**
This settlement money is provided differentially in proportion to the participation level in the power market. No participation means no settlement money; KRW 18,800 was paid for the participation of the yearly maximum cap of 60 hours in 2021.

**① Difference in the eligible timeslots for capacity payment**

Although the payment method[43] of the two resources is the same, the difference in capacity payment occurs because the eligible timeslots for payment are different. While gas power generation receives the entire payment for 24 hours, Reliability-based DR receives payment for only the peak hours (weekdays from 09:00 ~ 20:00, excluding 12:00~13:00). While both are mainly used within high electricity demand hours, only the gas power receives capacity payment even for non-peak hours, indicating a skewed and excessive compensation.

**② Differential capacity payment according to the level of contribution to the power system**

In addition, unlike Reliability-based DR that receives differential payment according to its contribution to the power system, gas power generation receives the same payment regardless of the degree of participation. The capacity payment for Reliability-based DR is categorized into fixed basic settlement and differential basic settlement, and the differential basic settlement changes depending on the degree of participation of Economic DR. In 2021, a business that only participated in Economic DR and not Reliability-based DR received KRW 27,800; if it took part in Economic DR for 60 hours (maximum eligible hours), it would receive KRW 46,600/KW, the total amount of the eligible differential basic settlement money. However, gas power plants are eligible for a static price (KRW 74,800/KW) regardless of the actual generation amount. This is another factor that incentivizes the gas plants to stay in the market rather than being phased out, despite contributing very little to the power system

## (2) Ancillary services payment

Although Demand Response adjusts frequency and performs ancillary services, it does not receive any ancillary services payment. On the other hand, gas power generation is eligible for a significant amount of ancillary services payment.

[42] In the formula for calculating capacity price, basic capacity price, capacity price coefficient, capacity price coefficient for each hour are considered for both Demand Response and gas power generation.
[43] Korea Power Exchange (2019.02), '2019 Payment Rules Explanation for Power Market Managers'



**[Ancillary services payment]** [44]
It is a payment provided for adjusting frequency, securing appropriate reserve power capacity, supplying reactive power, operating self-starting generator, etc. to maintain the safety and reliability of the power system.
Its categorization is as follows: frequency control reserve power capacity payment, 1st reserve power capacity payment, 3rd reserve power capacity payment, fast-responding resource payment, self-starting generation payment, and ancillary service payment.

Table 14 – Status of ancillary services payment in 2021 [45]

| 2021 | Gas power generation | Demand Response |
|---|---|---|
| Ancillary services payment (KRW one million) | 53,285 | - |

Fast DR is difficult to attract users because the settlement money is the same, though the management cost is higher than regular DR. Unlike other Demand Response, additional installment of electric meter, modem, etc. is needed through an electricity capacity information provider as Fast DR reduces demand in a few seconds by responding to the order of KPX. Therefore, a sizable initial investment is required for Fast DR; but currently, it only receives the adjusted settlement money proportionate to the performance in demand reduction.[46]

However, the ancillary service settlement payment, a subcategory of ancillary services payment, to be received by gas power generation will increase starting from the 2nd half of this year. This is because the KPX announced that it will increase the ancillary service settlement payment by up to 10 times through adjusting the subcategory items in the electricity price from this September. As Demand Response is not subject to this change, this is an unfair policy for Demand Response, which is fully capable of providing the reserve power capacity just as gas power does.

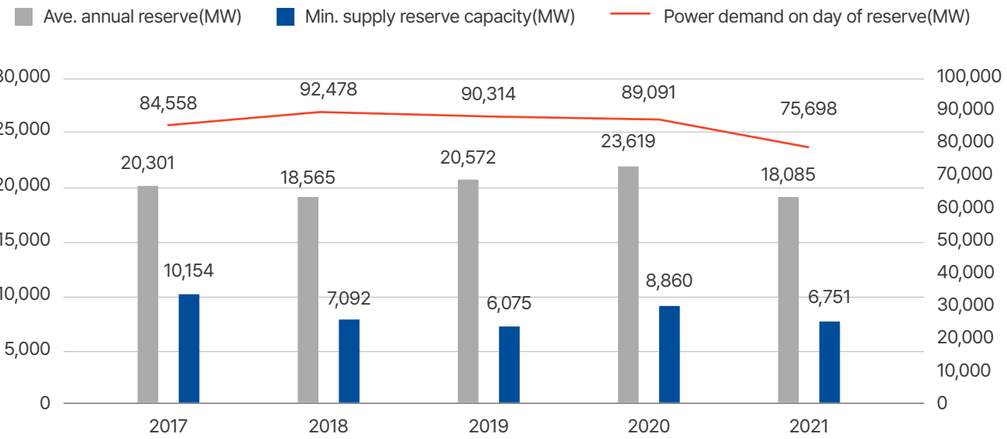
[44] Korea Power Exchange (2022.01.24),'Full text of the Electricity Market Operation Rules(211228 Official Notice)'
[45] Korea Power Exchange (2022.05), '2021 Electricity Market Statistics'
[46] The adjusted payment for Fast DR is given differentially according to the number of operations. When operated once, it is KRW 2600/kW-10min. When operated twice, it is KRW 1,560/KW-10min. When operated 3 times or more, it is KRW 1,040/kW-10min.

## 3) Strict operating standards on Demand Response

### (1) Strict standards on operation order of reliability-based DR

The operating standards on Reliability-based DR have gradually become stricter since the launch of the Demand Response trading market, making the Reliability-based DR being practically unused. Though the standards have been slightly eased afterwards, they are still strict compared to the minimum and average reserve power capacities. In June 2022, the operating standards were eased from 'below the reserve capacity of 5,500MW' to 'below 6,500MW,' in line with the Emergency Electricity Supply and Demand Measure. However, the minimum supply of reserve capacity from 2017 to 2021 was 6,075MW (August 13, 2019). This means that even if the current operating standards are applied, Reliability-based DR cannot be issued, with the exception of the case in 2019. [47]

Table 15 – Minimum reserve power capacity performance for the last 5 years [48]




[47] Korea Power Exchange (2022.05), '2021 Operation Performance of the Power System'
[48] Same as above.



The operation criteria for the Reliability-based DR are quite strict; the only occasions of the operation order after June 2020 were for a reduction test and a re-reduction test. In 2021, the Reliability-based DR was also ordered twice for reduction test purposes (in June and December), reducing a total of 11,285MWh in demand.

Table 16 – Issuance of Reliability-based DR in 2021 [49]

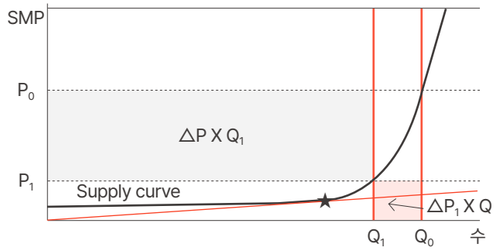
| Month | Hours(h) | Requested amount of reduction (MWh) | Reduction amount (MWh) | Reduction performed (%) |
|---|---|---|---|---|
| June | 16 | 763 | 772 | 101 |
| | 17 | 1259 | 1463 | 116 |
| | 18 | 1303 | 1600 | 123 |
| | 19 | 1371 | 1496 | 109 |
| | 16 | 451 | 418 | 93 |
| | Total | 5147 | 5749 | 112 |
| December | 15 | 731 | 826 | 113 |
| | 16 | 1272 | 1330 | 105 |
| | 17 | 1270 | 1498 | 118 |
| | 18 | 1281 | 1395 | 109 |
| | 16 | 34 | 31 | 91 |
| | 17 | 422 | 456 | 108 |
| | Total | 5010 | 5536 | 110 |
| Total | | 10,157 | 11,285 | 111 |

[49] Korea Power Exchange (2021), 'Status and Operation Information of Demand Resource Market'

### (2) Distorted bidding price of Economic DR

Since the current net benefit test price is often set higher than the power system price (System Marginal Price; SMP), there are not many instances in which Demand Response wins the bidding. When bidding for Demand Response in the day-ahead market, the reduction price should be higher than the price level at which social net benefits start to occur. The price floor (lowest price) at which the net benefits start to accrue is referred to as the net benefit test price, or NBTP. NBTP refers to the minimum wholesale market price in which the saved amount of electricity purchase cost due to Demand Response is greater than the settlement payment. In other words, NBTP is a price set to prevent the losses of power system operators in case low-price and large-scale DR wins the bidding. KPX announces the NBTP every month based on the supply curve of power generators. However, since the Korean power market only reflects the variable costs and excludes fixed costs in the supply curve, NBTP is formed within a relatively higher price range.

Table 17 – Calculation method of the Net Benefit Test Price

| Concept | Calculation formula |
|---|---|
|  | $\triangle P \times Q1$<br>(**Cost of electricity purchase saved** due to Demand Response)<br>><br>$P1 \times \triangle Q$<br>**(Demand Response settlement)** |



# 05. Overseas cases

Globally, Demand Response is considered to be highly important as it brings clear benefits, such as reducing economic cost on power purchase and supply. As such, countries have adopted system with legal regulations in place to enable fair competition between Demand Response and other generation resources.

The case of the UK revising its plan to support its Capacity Market and the case of the U.S. in which FERC Order 745 was issued show that appropriate intervention of the government in implementing relevant policies are necessary for fair competition between Demand Response and other generation sources.

## 1) UK: Revising the plan to support the capacity market

Tempus Energy, a Demand Response supplier in the UK claimed that the plan to support the Capacity Market discriminates against demand resource technology and filed a lawsuit requesting the European Commission to revoke its approval regarding the support plan. The original court sided with Tempus Energy. As a result, the UK. government partially revised its Capacity Market scheme that was unfairly designed in order to enable fair competition between Demand Response and fossil fuel power generation sources.

### (1) Background

The Capacity Market scheme was founded in the UK in 2014 to prepare against blackouts during the peak hours and the sudden increase in electricity prices. Under this system, the reserve power capacity is purchased 4 years ahead of the power supply delivery date of the capacity providers through the T-4 auction. Afterward, the T-1 auction is held 1 year ahead of the power supply delivery date to appropriate additionally needed reserve power capacity.

The UK notified the European Commission of this plan to support the Capacity Market in June 2014, and the European Commission in July of the same year approved the plan as it does not violate the state aid regulation of the European Union [50].

[50] According to the state aid regulation of the European Union, an aid provided through national resource of a member state must be compatible with the internal market within the European Union.

### (2) Main points

Tempus Energy[51], a Demand Response supplier, claimed that the government's plan to support the Capacity Market discriminates against demand resource technology by granting preference to fossil-fuel capacity providers. It further claimed that the government's plan violates the state aid regulation of the European Union, as such discrimination represents incompatibility with the internal market[52] , and filed a lawsuit requesting the European Commission to revoke its approval regarding the support plan.

The original court acknowledged the claims made by Tempus Energy and ruled the revocation of the European Commission's approval regarding the support plan for the Capacity Market. As a result, the European Commission ordered the UK government to revise its plan to support the Capacity Market to enable fair competition of Demand Response and other generation sources.

Following the order from the European Commission, the UK revised the contract term length and minimum capacity threshold for the Demand Response contract in its plan to support the Capacity Market. Before the revision, 15-year long-term capacity contracts could be signed for generation sources, but only 1-year short-term contracts could be signed for Demand Response. In addition, the minimum capacity threshold for participation in the Capacity Market was 2MW, so it restricted the participation of relatively smaller Demand Response capacity providers from participating in the market. The revised plan to support the Capacity Market allows 3 or 15-year long-term contracts to be signed for Demand Response that meet certain criteria, and the minimum capacity threshold to participate in the Capacity Market is reduced to 1MW, which lowers the barrier for Demand Response capacity providers to participate in the Capacity Market.

**Table 18 – Comparison of the bidding conditions for Demand Response**

| | Before the revision | After the revision |
|---|---|---|
| Contract term | Only short-term contract of 1 year could be signed. | 1-year, 3-year, 15-year contracts can be signed. |
| Minimum capacity threshold (MW) | 2 | 1 |

[51] Tempus Energy is a demand resource supplier that reduces electricity demand during the electricity peak hours by developing Demand Response resource technology and software that interacts with smart home appliances.

[52] Article 107 of the Treaty on the Functioning of the European Union (TFEU) states, "Save as otherwise provided in the Treaties, any aid granted by a Member State or through State resources in any form whatsoever which distorts or threatens to distort competition by favouring certain undertakings or the production of certain goods shall, in so far as it affects trade between Member States, be incompatible with the internal market."



Due to the business characteristics of Demand Response, the possibility of bidding at the T-1 auction is higher than at the T-4 capacity auction. When comparing the secured capacity from the T-1 auction before and after the revision of the plan to support the Capacity Market, it can be found that the secured capacity of Demand Response has increased since the revision. Demand Response comprised 5% with 195MW of the entire secured capacity in the T-1 auction in 2018, but it comprised 11% with 239MW secured through contracts out of the entire secured capacity in 2020.

Comparison of the secured capacity from the T-1 auction before and after the revision of the plan to support the Capacity Market[53]

**Table 19 – Comparison of T-1 auction bids before and after revision of the capacity market plan**

| Year | Demand Response (MW) | Gas generation (MW) | Total (MW) |
|---|---|---|---|
| 2018 | 195 (5%) | 2,030 (56%) | 3,626 |
| 2020 | 239 (11%) | 986 (44%) | 2,252 |

### 2) U.S.: Upholding the Federal Energy Regulatory Commission(FERC)'s regulatory jurisdiction of Demand Response

**The FERC[54] in the U.S. announced the FERC Order 745, which states that "when a Demand Response resource meets the net benefits cost criteria, it must be compensated at the market price for energy (LMP) in the same manner as other generation sources." The ESPA claimed that FERC's Order 745 was unconstitutional because FERC is overstepping its regulatory jurisdiction, but the Supreme Court determined that Order 745 did not overstep the regulatory jurisdiction of FERC and made the ruling to uphold Order 745. As such, the transmission system operators in the U.S. wholesale market equally compensates Demand Response resources that meet certain criteria as other generation sources.**

[53] Nationalgrid ESO (2019.06.24) 'Final Auction Report – 2018 year ahead Capacity Auction(T-1)',
Nationalgrid ESO (2021.03.12) 'Final Auction Report – 2020 one year ahead Capacity Auction(T-1)'

[54] Federal Energy Regulatory Commission (FERC) is an independent government agency that regulates transportation of crude oil and gas through pipeline in the interstate commerce, transmission and distribution of electricity, etc.

## (1) Background

The Energy Policy Act and the U.S Department of Energy highlighted the importance and the necessity of implementing Demand Response for price stabilization in the wholesale market through a report. Against this backdrop, the FERC issued Order 745 in 2011 regarding Demand Response. The main points of Order 745 were that Demand Response could substitute generation sources and contribute to supply stabilization of the electricity market, and that if it could be determined through net benefits price test that it was also effective from the cost standpoint, such Demand Response resource should be compensated at the market price for energy (Locational Marginal Price, LMP[55])[56]. Furthermore, FERC emphasized that calculating the compensation at the market price for energy for Demand Response was absolutely necessary for receiving "fair and reasonable" amount in the wholesale market. Through Order 745, FERC expected that the trading market for Demand Response would be vitalized, and stable reserve would be secured and the use of fossil fuels would be greatly reduced through reducing demand when there's peak load.[57]

Through FERC's Order 745, the Demand Response market was vitalized and this enabled electricity demand to be met by utilizing Demand Response instead of operating high-cost generators during electricity peak hours. Under this situation, the capacity providers criticized that their profits have declined as they can't operate high-cost generators during the hours when electricity demand is high and that compensating Demand Response equally as other generation sources that require constructing power plants through incurring large-scale capital cost is providing excessive compensation for demand resources.

## (2) Main points

In 2012, the EPSA claimed that FERC's Order 745 goes beyond the regulatory scope of the FERC according to the Federal Power Act (FPA)[58] since Demand Response is traded in the retail market instead of wholesale market, and that the regulatory jurisdiction regarding Demand Response should be given to the state government. Under such claims, the EPSA filed a lawsuit with the D.C. Court of Appeals to determine the illegality of Order 745.

[55] LMP is a regional marginal price which consists of a system marginal price (SMP), transmission congestion cost and transmission loss cost.
[56] FERC (2011. 03), 'Order No. 745: Demand Response Compensation in Organized Wholesale Energy Markets'
[57] Korea Energy Economics Institute (Dec. 2015) Basic Research Report – "Analysis of the Effect of Demand Resource's Participation in the Electricity Market"
[58] FPA's Section 201, 205, 206 grants FERC all authority and jurisdictions to set and regulate electricity price in the wholesale market and other relevant conditions, but Section 201(b) states that FERC has no jurisdiction over "any other sale" or regulatory power over "any other sale."

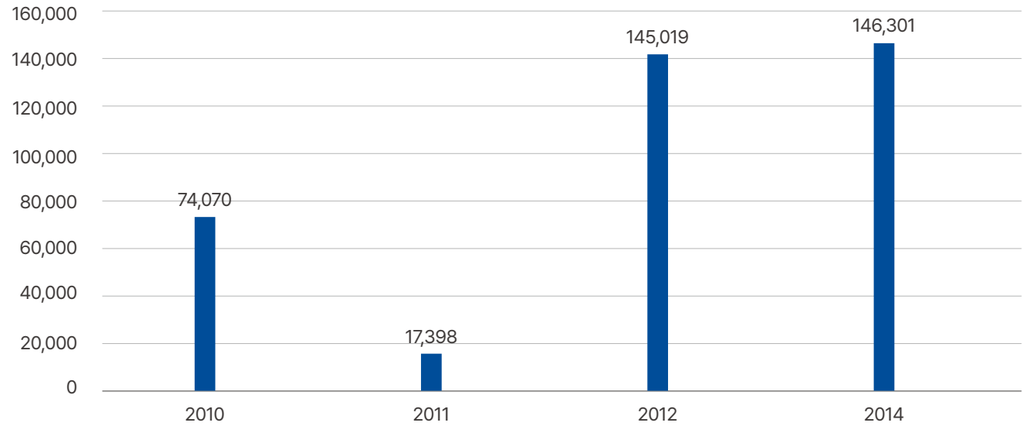


In 2014, the D.C. Court of Appeals, the original court, vacated the FERC's Order 745 after determining that FERC is attracting retail customers to the wholesale market, which will reduce retail electricity consumption, thereby violating the restriction of jurisdiction under the FPA.

However, after an appeal, the Supreme Court determined that since the bidding of Demand Response in the systemized wholesale market affects electricity price from interstate electricity trading[59], the FERC is acting within the scope of the regulatory jurisdiction according to the FPA. In addition, the Supreme Court emphasized that all aspects of regulating Demand Response occurs only in the wholesale market regardless of what impact the regulation of Demand Response has on the retail market, and revealed that the only rationale behind FERC's regulation of Demand Response is improving the wholesale market. As such, the Supreme Court determined that FERC's Order 745 does not go beyond the scope of its regulatory jurisdiction according to the FPA although it may affect the retail market, and ruled that Order 745 is valid.

When comparing the amount of electricity reduction through economic Demand Response resource within the PJM before and after the announcement of FERC's Order 745 in 2011, it can be found that the amount of electricity reduced through economic Demand Response has approximately doubled since the announcement of Order 745.

Table 20 – Economic DR Yearly MWh Reductions [60, 61]




[59] PJM stated that they were able to save $650 million worth of cost per week through Demand Response resource in 2013.
[60] PJM, Demand Response – Monthly activity reports (2010, 2011, 2012, 2014)
[61] Data for 2013 were not included in the graph due to inaccessibility.

# 06. Conclusion

In order for Demand Response to prevent the construction of 26 new gas-fired power plants to be converted from coal-fired power plants in Korea, we need to create a just and fair environment for DR and gas power generation to compete openly in the market. Also, the implementation of the following three conditions is necessary to expand the capacity of DR and further enhance its utility: 1) revisiting the idea of gas power generation conversion, 2) establishing a fair settlement payment scheme, and 3) preparing ways to utilize DR.

## 1) Reducing dependency on unnecessary gas power generation

The plan to convert 26 coal-fired plants (13.7GW) to gas power plants, specified in the working plan for the 10th Basic Plan on Electricity Demand and Supply and which is triple the capacity of the current DR registration volume, must be withdrawn. The current administration will prepare the 10th Basic Plan on Electricity Demand and Supply, reflecting the 2030 NDC and the 2050 carbon neutrality scenario announced last year. Allowing the reckless conversion of coal-to-gas should not be included in the Plan if the government intends to consider the long-term outlook of gas power generation and its subsequent economic feasibility. If the new gas power plants amounting to 13.7GW in total capacity are all constructed, they are likely to be phased out in a decade or two, whilst pursuing for the carbon neutrality goals. They could end up being stranded assets, eventually incurring a sizable social and economic loss[62].

Furthermore, the cost-plus mark-up policy should be reformed. It creates an unfair condition for the expansion of DR by unnecessarily attracting excessive investment in gas power generation. Gas power plants with low economic feasibility that contribute little to the power system are either maintained or expanded, while Demand Response that can replace new gas power plants are not – this is fundamentally because the power market is not running on market principles. As such, there should be reviews to overhaul the current power market compensation scheme which currently allows the reckless conversion of coal-fired plants into gas power generation and does not phase out gas power plants that contribute little to the system. This will prevent the construction of unnecessary new gas generation facilities and help liquidate outdated gas power plants with no economic feasibility.

[62] According to 'Whack-a-Mole' report by Solutions for Our Climate, when 13.7GW of coal power capacity is converted to gas power in align with below 2°C scenario, stranded asset risk could amount to $60 billion by 2060.



## 2) Establishing a fair settlement payment scheme

There should be a fair settlement scheme that balances gas power generation and DR, as DR can prevent the new construction of gas power generators and replace the existing ones. KPX should fairly consider the eligible timeslots for DR and gas power generation and reform the capacity payment system. That is, since gas power generation and DR both operate exclusively in certain times of the day, capacity payment should be limited accordingly, and the total settlement amount should be made smaller. If the renewable energy supply expands in the future, the demand for DR during daytime or weekends with the highest utility for photovoltaic power generation will increase; the mandatory reduction hours for DR should be determined in a reasonable manner, as well.

In addition, DR should be eligible for receiving the same ancillary services as gas power generation, as it is a fast-responding resource which provides reserve capacity. This will incentivize the customers to take part in various DR programs. Though Fast DR and Plus DR are ever-more needed in a power system in which the renewable energy share is significant, they are yet unable to contribute effectively to the system. Therefore, there should be an appropriate compensation scheme for the reserve power and ancillary services provided by DR.

## 3) Establishing ways to utilize Demand Response

It is necessary to review the appropriate standards for each program to expand Demand Response. Easing the strict issuance standards of reliability-based DR will make its use much more versatile. The current operation standards for Reliability-based DR, revised this June, allow for operation only when the reserve power capacity is below 6,500MW. Despite the revision, there was no instance of the reserve power capacity dropping below 6,500MW with the exception of the time when it dropped to 6,075MW in 2019. This means that Reliability-based DR, despite recording a sizable reduction performance, is not being utilized properly. Therefore, appropriate operation standards should be reviewed, and the standards should be eased accordingly.

Also, NBTP (standard bidding price for Economic DR) should be adjusted in a way to draw more bids[63]. To this end, the total variable costs including the environmental costs should be reflected in the NBTP calculation to eventually ease the standards. Economic DR currently provides an average of 0.9GW and maximum of 2.7GW in electricity during the Supply and Demand Adjustment Measure Period in summer[64], but these figures lag far behind the registered capacity of 4.6GW. If the total variable costs are accounted for in NBTP, the power generator supply curve will go up and NBTP will be established at a lower price. This will lead to a better and accurate valuation of DR and help send more appropriate price signals to the market.

[63] The current NBTP is calculated after the demand curve of generators is produced by Korea Power Exchange. It is generated at the point when the profit of power system operators and the cost paid for Demand Response become the same. However, in the case of Korea, the proportion of existing power generation with affordable variable cost is high, and the difference in unit price of generation for each generator is very significant. Therefore, the supply curve is in the shape of a staircase, so distorted NBTP is generated.

[64] The Ministry of Trade, Industry and Energy (2021.07.13), [Press Release] 'Smart Power Demand Management with Demand Response (DR)'

# Appendix

## 1. The case of UK revising its plan to support the Capacity Market

### 1) Lawsuit filed by Tempus Energy

Tempus Energy is a demand resource supplier that reduces electricity demand during the electricity peak hours by developing Demand Response resource technology and software that interacts with smart home appliances. Tempus Energy claimed that the government's plan to support the Capacity Market discriminates against demand resource technology by granting preference to fossil-fuel capacity providers. It filed a lawsuit against the European Commission to revoke its approval for the government's support plan, claiming that such discrimination entails incompatibility within the EU regional market and therefore is in violation of the EU State Aid Regulations.

### 2) Judgment of the Court

#### Original court's ruling

The EU General Court acknowledged that the European Commission violated its investigative duty by failing to conduct an official investigation under reasonable suspicion that government's plan to support the Capacity Market may be incompatible with the regional EU market, and ruled that the EU Commission's approval on the support plan for the Capacity Market be revoked.

Although the EU General Court's grounds for ruling in favor of Tempus Energy's claims mainly rest on the procedural legal violations, the court also acknowledged discrimination against Demand Response in the plan to support the Capacity Market. The court saw that Demand Response was under discrimination in the following three areas.



First, the plan is unfair because the contractual terms for Demand Response businesses and power generation businesses were differently applied. The plan to support the Capacity Market states that power generation businesses that satisfy certain conditions can sign long-term contracts of three years and 15 years. However, only power generation businesses were subject to sign long-term capacity contracts, and not DR businesses. Since DR operators were only eligible to sign one-year short-term contracts, the court ruled the practice unfavorable and discriminatory.

Second, the Court saw that the cost recovery scheme was unfairly applied to DR businesses. According to the plan to support the Capacity Market, costs are recoverable for electricity consumed from 16:00 to 19:00 on weekdays during wintertime. But the support plan also requires household consumers to use up the reserve power, making it virtually impossible for electricity reduction to happen during this time. In turn, DR operators face difficulty in recovering the costs – therefore, the Court found that the criteria for cost recovery was innately established in an unfavorable way towards DR businesses.

Third, the Court found that the bid bond requirements to participate in the Capacity Market bidding and the dynamics between the T-4 T-1 biddings also discriminate against Demand Response businesses. According to the plan to support the Capacity Market, bidders must pay the bid bond up front. The minimum bidding threshold for the Capacity Market is set at 2MW according to the plan. DR operators may consolidate electricity generated from various sites to meet this threshold, but they should pay the bid bond for the entire 2MW whatsoever. There are more hurdles for DR operators to pay the same amount of bid bond as other businesses since the industry is at its infancy. Therefore, the EU General Court saw that the bid bond requirements restricted Demand Response businesses' entry into the Capacity Market.

In the UK T-4 biddings are held four years prior to the power supply and T-1 biddings are held one year prior to purchase additionally needed power capacity. But such a scheme is unfair to DR businesses. DR businesses are more likely to take part in T-1 biddings, but their eligible purchase capacity is dependent upon the pre-determined capacity at T-4 biddings, which they would have not participated in. Therefore, the EU General Court ruled that the current plan discriminates against DR operators, as it neither ① guarantees the bidding threshold of 50% at the T-1 biddings, nor ② guarantees the mandatory execution of T-1 biddings.

### Appellate court's ruling

Eventually, the ruling was overturned by the Appellate Court. But it is necessary to note that the reversal was not due to the Court finding grounds for a fair competition between DR and original power sources according to the support plan. Rather, the Appellate Court saw that the EU Commission violating legal procedures was a stretched interpretation of the Commission's investigative duties.

## 2. U.S. Federal Energy Regulatory Commission (FERC)'s Order 745

### 1) EPSA's recommendation

In 2012, the Electric Power Supply Association (EPSA) and the California Independent System Operator (CAISO) claimed that FERC's Order 745 goes beyond the regulatory scope of the FERC according to the Federal Power Act (FPA) since Demand Response is traded in the retail market instead of wholesale market, and that the regulatory jurisdiction on Demand Response should be granted to the state government. Under such claims, the EPSA filed a lawsuit with the D.C. Court of Appeals to determine the illegality of Order 745.

Sections 201, 205, 206 of the Federal Power Act (FPA) grant the FERC total authority and jurisdictions to set and regulate electricity price in the wholesale market, as well as other relevant conditions. However, Section 201(b) states that FERC has no regulatory power over "any other sales."

### 2) Judgment of the Court

#### The D.C. Court of Appeals' ruling

In May 2014, the D.C. Court of Appeals, the original court, annulled FERC's Order 745 upon determining that FERC is attracting retail customers to the wholesale market, which will reduce retail electricity consumption, thereby violating the restriction of jurisdiction under the FPA and being involved with the direct regulation of the retail market.

#### The Supreme Court's ruling

During an appeal, the Supreme Court found that since the bidding of Demand Response in the organized wholesale market affects the electricity prices from inter-state power trading, the FERC is acting within the scope of the regulatory jurisdiction pertinent to the "matters that affect the sales of the wholesale market" as stated in Sections 205 and 206 of the FPA. In addition, the Supreme Court emphasized that all aspects of regulating Demand Response occur only in the wholesale market regardless of what impact the regulation of Demand Response has on the retail market, and stated that the only cause for the FERC to regulate DR is solely to improve the wholesale market environment.  As such, the Supreme Court ruled the Order 745 valid - although the Order may have effects on the retail market, it still does not surpass the scope of the FERC's regulatory jurisdictions according to the FPA.

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Solutions for Our Climate (SFOC) is a non-profit corporation based in Korea established in 2016 in order to advocate for stronger climate and air policies.
SFOC is led by legal, economic, financial, and environmental experts with experience in energy and climate policy and works closely with domestic and overseas nonprofit organizations.

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# The Unlevel Playing Field:

## How the Power Market Structure Discriminates Against Demand Response to Favor Gas Power Generation