

# EU Policy Background and Realities for “Coal Phase-out”<sup>1</sup>

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## Introduction

This paper first reviews coal power generation trends in the European Union, then summarizes coal phase-out policies in the EU and its major member states, and finally analyzes implications of the coal phase-out considering the differences in the status of coal power generation and energy conditions in these countries. It mainly focuses on the United Kingdom, France, the Netherlands and Germany that have either announced or indicated the phasing out of coal power generation, while paying attention to similar trends in Spain, Italy and Poland where relevant.

## 1. EC coal power generation in recent years

The EU’s power generation in 2015 totaled 3,234 TWh of which coal power generation was 775.0 TWh or 24.0% of the total<sup>2</sup>. The EU consumes more lignite than other regions in the world<sup>3</sup>, with lignite power generation accounting for 40.5% of EU’s coal power production in 2015 (Figure 1). Lignite, characterized with lower calorific value thus higher CO<sub>2</sub> emissions intensity per power generation, is used mainly in Germany and Poland that are major lignite producers. Japan’s coal power generation in 2015 totaled 342.7 TWh, fueled solely by steam coal<sup>4</sup>.

The EU has been implementing energy and environment policies that give priority to decarbonization. In 2008, it started the EU emissions trading system (EU-ETS). However, from 2010 to 2012 coal power generation in the EU increased and gave a rise to “Coal Renaissance,”<sup>5</sup> with a temporal dropping due to economic downturn and a power demand decrease between 2008 and 2010.

Factors behind the rise in coal power generation are complex. Regarding coal power generation capacity, new plants totaling 14.6 GW went on stream in Germany, Italy and the Netherlands in the period<sup>6</sup> (see 4.)

On operational aspects, coal power generation maintained its competitive advantage in fuel, carbon and electricity markets, as explained below:

In the fuel market, coal prices declined on a global recession and an oversupply, while natural gas prices increased<sup>7</sup>.

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<sup>1</sup> This paper is an updated version of “Research on Influences of European Coal Supply and Demand on Global Coal Market” (a FY2016 survey on advanced overseas coal development for an overseas coal development support project), a report made in March 2017 under a contract with the Japan Oil, Gas and Metals National Corporation (JOGMEC).

<sup>2</sup> Eurostat Including CHP (combined heat and power)

<sup>3</sup> According to IEA statistics, lignite amounts to 806.8 Mt or 10.5% of global coal consumption at 7,706.0 Mt in 2015 and for 403.0 Mt or 58.3% of EU coal consumption at 690.8 Mt. EU lignite consumption commanded 50.0% of global lignite consumption.

<sup>4</sup> IEA 2016

<sup>5</sup> EurActiv (December 16, 2014), Coal Medium-Term Market Report 2014, IEA, etc.

<sup>6</sup> Including capacity of plants that started operation in Central and Eastern Europe, the total capacity of coal power plants that went on stream in the EU in or after 2010 comes to 17.2 GW, according to Platts WEPP (March 2017).

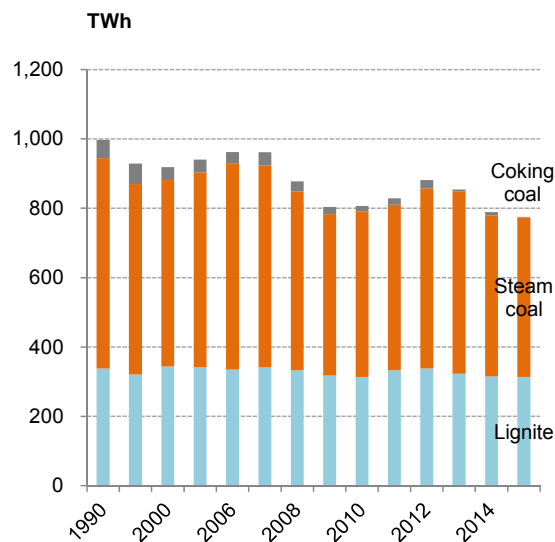
<sup>7</sup> Spot prices of steam coal in Europe rose sharply in 2008, plunged in 2009 and rose until 2011 without recovering their levels before the Lehman Shock and continued falling until 2016. Meanwhile, wholesale prices of natural gas rose back after a plunge in 2009. In 2012 and 2014, the price level recovered to the level that was before the Lehman Shock in some countries, and no substantial fall was

In the electricity market, natural gas power generation with a high fuel cost decreased remarkably as many countries introduced the feed-in tariff (FIT) system to politically expand renewable energy power generation.

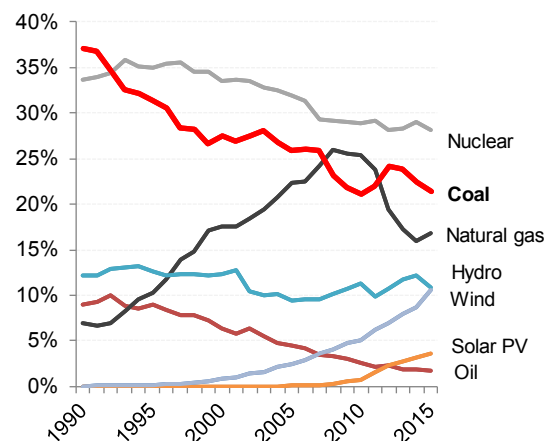
In the carbon market where EU emission allowances (EUAs) are traded under the EU-ETS, the EUA price rose close to €30/tCO<sub>2</sub> in 2008 but plunged later on the recession, EUA oversupply and FIT power growth. The price fell to €7.5/tCO<sub>2</sub> in 2012 and has remained slack.

Under the EU-ETS, gas’s share in the generation mix sharply declined, with coal’s share expanding (Figure 2), running counter to decarbonization policy. This situation prompted the EU and its members to rapidly toughen regulations on coal power generation (see 2 and 3). These policy signals together with closing down of aged coal power generation capacity (Table 1) led EU coal power generation to turn downward in 2013 and fell to the lowest level since 1990 in 2015

According to a long-term energy outlook released by the European Commission in July 2016, coal’s share in the generation mix in the EU will decline to 15% in 2030 and to 5% in 2050<sup>8</sup>.



Source) IEEJ based on Eurostat  
Figure 1 Coal power generation by coal type in 28 EU countries



Note) 15 West European countries excluding Central and East European countries

Source) IEEJ based on IEA World Energy Statistics 2016  
Figure 2 Power generation share in 15 EU countries

Table 1 Factors behind recent coal power generation decline in major EU countries

UK	<ul style="list-style-type: none"> <li>Coal power generation capacity totaling 5 GW was closed under environmental regulations (Large Combustion Plants (LCP) Directive) in the second half of 2012<sup>9</sup>.</li> <li>Low-carbon policy enhancement (including the introduction of the Carbon Price Floor (CPF) system in April 2013) was announced in 2011 (see Chapter 2).</li> </ul>
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seen in 2012 and 2013.

<sup>8</sup> EU Reference Scenario 2016: Energy, Transport and GHG Emissions Trends to 2050, European Commission. Coal power generation fuels are classified as solids, including all types of coal, coke, BKB (brown coal briquettes), peat, oil shale and oil sand (Eurostat).

<sup>9</sup> Coal Medium-Term Market Report 2014, IEA

Germany	<ul style="list-style-type: none"> <li>While the Grafenrheinfeld nuclear power station (1,345 MW) was closed in June 2015, rapid growth in renewable energy power generation limited coal power generation growth<sup>10</sup>.</li> </ul>
France	<ul style="list-style-type: none"> <li>Seven coal power plants were closed in 2013 and three more in 2014<sup>11</sup>.</li> </ul>
The Netherlands	<ul style="list-style-type: none"> <li>Five coal power plants that started operation in the 1990s were closed in 2015.</li> </ul>
Belgium	<ul style="list-style-type: none"> <li>The Langerlo plant (556 MW), the last domestic coal power plant, was closed in March 2016<sup>12</sup>.</li> </ul>

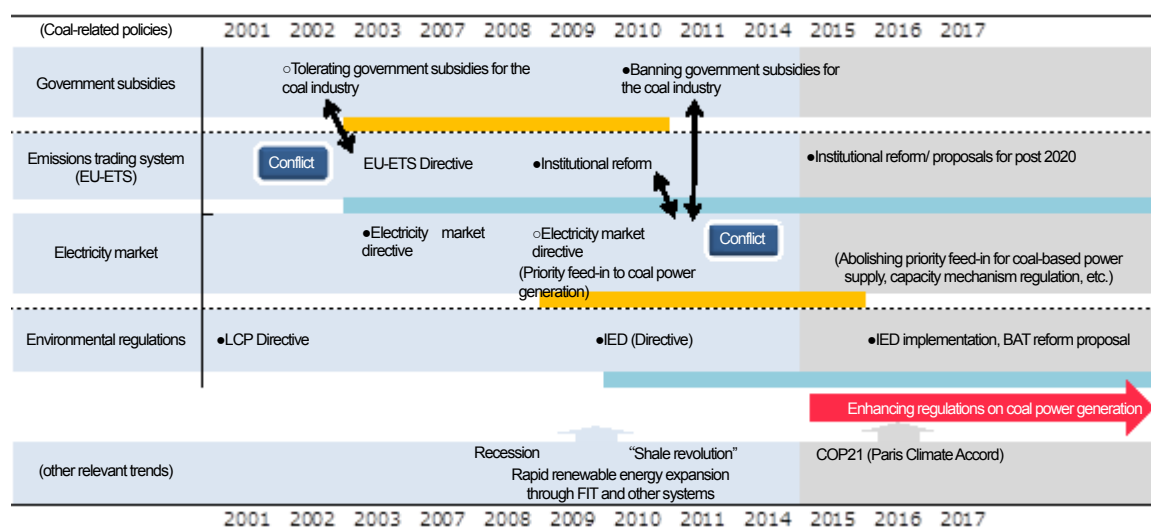
Source) IEEJ based on relevant documents

## 2. Failure and reconsideration in EU's coal related policies

The following reviews EU's coal related energy and environment policies so far and outlines future policy orientation:

### 2.1 Contradictions in low-carbon policy

Energy and environment policies of the EU have two main goals – the promotion of climate change policies and the realization of an integrated (single) energy market for stable energy supply and greater economic efficiency. Both put emphasis on market principles. The single energy market policy calls for deregulation including the unbundling of power transmission and generation, and in the pursuit of climate change policies, emissions trading system (EU-ETS) was introduced as a cost-effective GHG emission reduction measure in 2008, spearheading global efforts in using the market mechanism in environmental field.



Notes: LCP: Large Combustion Plant, IED: Industrial Emission Directive, BAT: Best Available Technology, ETS: Emissions Trading Scheme, FIT: Feed-in Tariff

Source) IEEJ based on European Commission documents

Figure 3 Chronology of EU coal-related measures

Soon, however, the EU-ETS plunged into dysfunction branded as a “lost decade”<sup>13</sup>, indicating the difficulty in allocating emission allowances appropriately in ever changing socio-economical situations surrounding the scheme.

<sup>10</sup> Coal Medium-Term Market Report 2016, IEA

<sup>11</sup> G7 Coal Phase Out: France, A Review for Oxfam International, September 2015, Julian Schwartzkopff & Chris Littlecott

<sup>12</sup> Coal Medium-Term Market Report 2016, IEA

<sup>13</sup> EurActiv (February 24, 2017), etc.

Apart from the problems in the design of the EU-ETS, EU energy and environment policies were then plagued with contradictory measures in coal protection and restriction. As a protection measure, the EU introduced a regulation on state aid to uncompetitive coal mines<sup>14</sup> in 2002 just before the EU-ETS directive was issued. Until the regulation was abolished in 2010, EU countries provided subsidies to coal production to cover a deficit (production costs' excess over sales prices).

In Electricity Market directive, the EU introduced a measure that would allow feed-in priority for coal power generation<sup>15</sup> in 2009, a year after the EU-ETS was fully launched in 2008. The directive states, "A Member State may, for reasons of security of supply, direct that priority be given to the dispatch of generating installations using indigenous primary energy fuel sources, to an extent not exceeding, in any calendar year, 15% of the overall primary energy necessary to produce the electricity consumed in the Member State concerned." Accordingly, Spanish government took a measure to give feed-in priority for power generation that is based on domestic coal, for the reason that electricity sources would be required to back up growing renewable energy power generation to stabilize power supply (see 3.). The Spanish measure was approved by the European Commission in September 2010 for implementation<sup>16</sup>.

## 2.2 Energy and environment policy reconstruction and coal<sup>17</sup>

In recent years, the EU faced various challenges and concerns in the energy field, including power grid destabilization and cost hikes through rapid growth in renewable energy power generation, as well as a conflict with Russia over natural gas supply and expanding energy cost gaps with the United States.

While stable supply and cost containment of energy grew important, the Energy Union was agreed on in February 2015 as the framework of the future EU energy strategy. It cited various initiatives including the expansion of natural gas (LNG) utilization, the diversification of nuclear fuel supply sources, the enhancement of power system and market interconnection between member states and power storage. However, it made no mention of coal power generation.

As energy mix is subject to each EU member country's sovereignty, the EU is not assumed to seek the abolishment of any specific power source. However, measures have been taken to effectively achieve a substantial cut in coal power generation and promote climate change policies (Table 2).

**Table 2 Major EU measures to toughen regulations on coal power generation**

Regulation targets/measures	Outline
State aid	<p><u>Banning state aid to the coal industry</u><sup>18</sup></p> <ul style="list-style-type: none"> <li>• Banning state aid to the coal industry</li> <li>• Existing aid must be reduced rapidly, may continue based on plans to close uncompetitive coal mines by the end of 2018. Mine operators who fail to close their mines by the deadline will have to pay back the aid received.</li> </ul>

<sup>14</sup> Regulation on state aid to the coal industry(1407/2002/EC)

<sup>15</sup> Article 15 (4), Internal Electricity Market Directive (2009/72/EC)

<sup>16</sup> State aid rules in the coal sector and linked energy sector under the Energy Community Treaty and European Law, Peter Staviczky and Phendon Nicolaidis, June 2015

<sup>17</sup> Yoko Ito, "EU Coal Power Generation Policy Reconstruction," *Energy Economics*, Vol.43, No.1, pp.31-52

<sup>18</sup> 2010/787/EU

EU-ETS	<p><u>Tightening emission prices</u></p> <ul style="list-style-type: none"> <li>• Introduction of an annual emission allowance reduction rate: 1.74%<sup>19</sup> annually between 2013 and 2020 and by 2.2%<sup>20</sup> (proposed rate) from 2021</li> <li>• Control over emission allowance flow to the market: Emission allowance supply will be reduced between 2014 and 2016<sup>21</sup> and a Market Stabilization Reserve will be created in 2018 to automatically adjust emission allowances outstanding in the market<sup>22</sup>.</li> </ul> <p><u>Mandatory auction of emission allowances for power generation sector (from 2013)</u></p> <ul style="list-style-type: none"> <li>• In place of grandfathering, power generators are required to purchase emission allowances in auctions.</li> <li>• Central and East European countries will be allowed to grant power generators emission allowances until 2019 while being required to modernize power generation infrastructure and diversify their energy mixes<sup>23</sup>.</li> </ul>
Industrial Emission Directive (IED)	<p><u>Emission standards for air pollutants (SO<sub>2</sub>, NO<sub>x</sub>, PM)</u></p> <ul style="list-style-type: none"> <li>• The standards began to apply in 2016. Facilities failing to meet the standards will be required to be closed by the end of 2023. At the same time, the BAT (Best Available Technology) standards will be tightened.</li> </ul> <p><u>CCS (Carbon Capture and Storage) ready requirement (CCS ready)</u></p> <ul style="list-style-type: none"> <li>• Power generators have been requested to assess CCS feasibility and take measures to add CCS facilities<sup>24</sup>.</li> </ul>
Electricity market directive/regulation revision (proposal)	<p><u>Requirement in Capacity Mechanism<sup>25</sup></u></p> <ul style="list-style-type: none"> <li>• Generation capacity emitting 550 gCO<sub>2</sub>/kWh or more shall not be committed in capacity mechanisms 5 years after the entry into force of the Regulation.</li> </ul> <p><u>Abolishment of feed-in priority for coal power generation<sup>26</sup></u></p> <ul style="list-style-type: none"> <li>• Priority feed-in may be applicable to renewable energy and/or combined heat and power only</li> </ul>

Sources) IEEJ based on European Commission documents and other sources

With regards to coal production, EU member states are required to rapidly reduce state aid<sup>27</sup> and submit plans for closing uncompetitive coal mines by the final deadline at the end of 2018 and to collect all state aid from coal mines failing to be closed by the deadline.

As for the EU-ETS, the EU plans to expand policy intervention to tighten the carbon market and raise the cost of coal power generation. At the same time, distortions in electricity market as well as carbon

<sup>19</sup> Article 9, 2009/29/EC

<sup>20</sup> COM (2015) 337

<sup>21</sup> Of emission allowances planned to be allocated through auctions in 2014-2016, 900 million t was deducted.

<sup>22</sup> The reserve is designed to absorb any excess of emission allowances outstanding in the market over a predetermined standard and release allowances to cover any shortfall below the standard.

<sup>23</sup> These countries' per capita GDP in 2006 is required to be 50% or less of the EU average (Article 10 (a), 2009 directive). The provision applies to eight countries (Bulgaria, Cyprus, Czech Republic, Estonia, Hungary, Lithuania, Poland and Romania). Subject to the provision are power generating facilities that started operation in or before 2009.

<sup>24</sup> The IED is ambiguous for the case if power generators conclude CCS as infeasible. It is left for regulatory authorities in member states to decide whether power generators meet approval requirements in consideration of CCS-ready requirements (Article 36-2, IED)

<sup>25</sup> Electricity market directive revision proposal (November 2016) COM(2016) 861 final

<sup>26</sup> Electricity market directive revision proposal (November 2016) COM(2016) 864final

<sup>27</sup> State aid was to be reduced by 25% or more from the 2011 levels by the end of 2013, 40% by the end of 2015, 60% by the end of 2016 and 75% by the end of 2017 (Article 3 (f), 2010/787/EU).

market caused by policy support for renewable energy power generation will be corrected by giving wider role for competition principles. Regarding coal power generation, however, the EU has turned to more direct measures that would deter investment, namely through command-and-control environmental regulations (Industrial Emission Directive or IED) instead of leaving it to market-based guidance. IED standards are much looser compared with state-of-art facilities in Japan<sup>28</sup>.

For the capacity mechanism to secure power supply capacity, the European Commission announced a draft rule in November 2016 to set a CO<sub>2</sub> emission standard (550g/kWh) that coal power plants could not meet without CCS, implying that coal power generation should be excluded from the capacity mechanism. According to the above-mentioned long-term energy outlook by the European Commission, CCS-ready fossil power plants will be 833 MW in 2020 and 1,083 MW in 2030, indicating that CCS-ready coal power generation is unlikely to expand. For the purpose of securing supply capacity, the United Kingdom and Germany have decided to provide subsidies to some coal power plants. However, these subsidies represent a tentative relief on the premise that they will be closed down in near future.

### 3. Coal phase-out policies in major EU countries

The following discusses the current status of major EU countries' coal phase-out policies:

#### 3.1 UK

In the Climate Change Act 2008, the UK government set a target of cutting GHG emissions by 80% from 1990 by 2050, developing legislative infrastructure to tackle with climate change on a permanent basis<sup>29</sup>. In addition, the Energy Act 2013<sup>30</sup> introduced the carbon price floor (CPF) and the emission performance standard (EPS) for fossil power plants.

The CPF, a carbon tax to support ET-ETS carbon prices, was raised from the initial level of £4.94/tCO<sub>2</sub> to £9.55/tCO<sub>2</sub> in April 2014 and to £18.08/tCO<sub>2</sub> in April 2015, pushing up coal power generation cost<sup>31</sup>.

The EPS sets the maximum power plant CO<sub>2</sub> emissions at 450gCO<sub>2</sub>/kWh, effectively banning new coal power plants without CCS<sup>32</sup>.

In November 2015, the UK government announced a plan to abolish all domestic coal power plants by 2025<sup>33</sup> and launched consultations on the matter in November 2016. By this, specific measures and procedures to complete the coal phase-out by 2025 without jeopardizing energy security<sup>34</sup>.

<sup>28</sup> The EU regulatory standards (under the IED) for SO<sub>x</sub> and NO<sub>x</sub> are 150 mg/NM<sup>3</sup> for the strictest case (new facilities with output at 300 MW or more, approved in and after 2013), compared with 28.6 mg/NM<sup>3</sup> for SO<sub>x</sub> and 20.5 mg/NM<sup>3</sup> for NO<sub>x</sub> in one of the state-of-art facilities in Japan (converted from ppm standards).

<sup>29</sup> Documents and speech by Sir David King, Foreign Secretary's Special Representative for Climate Change, Foreign & Commonwealth, on October 2016

<sup>30</sup> The act provides for introducing a series of regulations to implement the electricity market reform (EMR).

<sup>31</sup> The decline in natural gas prices have also raised the economic efficiency of gas power generation, according to the Coal Medium-Term Market Report 2015, IEA.

<sup>32</sup> The EPS applies to new fossil power plants that are 50 MW or larger and to large-scale renovation or extended operation of existing large fossil power plants, while no retroactive application to existing plants. (UK government website)

<sup>33</sup> Press release, the Department of Energy & Climate Change (November 18, 2015)

<sup>34</sup> COAL GENERATION IN GREAT BRITAIN The pathway to a low-carbon future: consultation document, Dept. for Business, Energy and Industrial Strategy, November 2016

### 3.2 France

While in France the dominant power source has been nuclear, then French President Francois Hollande vowed to reduce nuclear energy's share in the generation mix and restrict fossil fuels' share at the same time by expanding renewable energy. For this purpose, the French government introduced a carbon tax in 2014 on household gas, oil (heating) and coal consumption. However, power generation and industrial sectors subject to the EU-ETS have been exempted from the carbon tax<sup>35</sup>.

In the face of slack EUA prices, the government indicated a policy to impose a floor price on CO<sub>2</sub> emissions in the power generation sector. Specifically, it presented a proposal to revise the above-mentioned exemption and impose €20/t on CO<sub>2</sub> emissions from coal power generation in 2020 and €50/t in 2030<sup>36</sup>. However, strong opposition from mining and energy industry trade unions led the government to give up on the proposal<sup>37</sup> even after coordinating with major energy companies.

While the tax proposal was expected to enhance gas power generation's advantage over coal power generation, it was pointed out that competition from coal power generation in neighboring Germany and Spain would work to the disadvantage of French gas power generation<sup>38</sup>. Therefore, the French Environment Ministry commented that carbon tax should be implemented at the EU level<sup>39</sup>.

In November 2016, then French President Hollande announced again a plan to abolish coal power generation by 2023<sup>40</sup>. However, the presidential election brought about a change of government in June 2017. Energy policy under New President Emmanuel Macron calls for closing 17 nuclear reactors and eliminating coal power generation within five years<sup>41</sup>.

### 3.3 The Netherlands

While the effectiveness of the EU-ETS was losing confidence, the District Court of The Hague in June 2015 ruled that the Dutch government was required to enhance climate change policies to reduce CO<sub>2</sub> emissions by 25% from 1990 by 2020<sup>42</sup>. Based on the ruling, the Dutch government announced in April 2016 a series of measures including the closure of coal power plants built in the 1990s.

As the government measures were viewed as insufficient by some stakeholders<sup>43</sup>, however, in September 2016, the Dutch Parliament passed a target of cutting CO<sub>2</sub> emissions by 25% by 2020 and by 55% by 2030<sup>44</sup>. To attain the target, which is one of the most ambitious in Europe, closing of all the 10 domestic coal power plants is viewed necessary.

Although five of them were closed in 2015, there has been a debated whether three ultra-supercritical coal power plants (owned by E.On, RWE and Engie) that went on stream in 2015 should

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<sup>35</sup> Platts (December 19, 2013)

<sup>36</sup> EurActiv (July 12, 2016)

<sup>37</sup> EurActiv (October 24, 2016)

<sup>38</sup> EurActiv (July 12, 2016)

<sup>39</sup> EurActiv (October 24, 2016)

<sup>40</sup> Independent (November 18, 2016)

<sup>41</sup> EurActiv (July 12, 2017)

<sup>42</sup> The Guardian (June 24, 2015)

<sup>43</sup> Doing Justice to Climate Change, CE Delft, June 2016

<sup>44</sup> The Guardian (September 16, 2016)

be closed as well (see 4.3).

### 3.4 Germany

The German cabinet in June 2011 decided on the Energiewende energy transition policy to phase out nuclear power plants by 2022 and substantially expand renewable energy. The government has set a target of cutting GHG emissions from 1990 level by 55% by 2030, 70% by 2040 and 80-95% by 2050.

The rapid increase in renewable energy that received government support ( FIT) lowered the electricity market price and market exit of gas power generation became remarkable, while coal power generation increased, running counter to the GHG emission reduction policy. In response, Strommarkt 2.0 electricity market reform proposal gained cabinet approval in October 2015, which included plans for "strategic reserves". By this, the government ordered suspension of power supply from eight lignite power plants (with total capacity of 2.7 GW, owned by Vattenfall, RWE and Mibrag) to the wholesale electricity market, instead, decided to provide capacity payment, totaling €1.6 billion on condition that these plants be closed by 2019<sup>45</sup>.

In November 2016, Chancellor Angela Merkel announced the Climate Protection Plan 2050 to attain the target of GHG emission cuts by 2050, including a measure to phase-out coal power generation<sup>46</sup>. As noted above (see 4), however, the government has had difficulties in forming national consensus on specific deadlines for the coal phase-out.

### 3.5 Poland

Poland is the largest steam coal producer in the EU, and coal's share in the generation mix is as high as more than 80%. Power demand is expected to grow as its GDP has doubled since accession to the EU in 2004. Given unstable gas supply from Russia, energy security is positioned as a top priority for the Polish economy<sup>47</sup>. In August 2015, the government unveiled a draft of the Energy Policy 2050 framework<sup>48</sup>, indicating that Poland would maintain coal as a dominant power source though its relative share in generation mix would be reduced. It would also consider switching to highly efficient coal power plants and using integrated gasification combined cycle (IGCC) plants.

Poland has opposed the EU's ambitious climate change target with the concern that investment could flow out to emerging economies in Asia<sup>49</sup>. The current administration<sup>50</sup> has indicated its will to enhancing domestic coal protection by investing 2 to 2.5 billion zlotys (about 52.8-66 billion yen)<sup>51</sup> in new coal mine development while closing inefficient mines<sup>52</sup>. Given domestic coal price remain low and Russian coal being

<sup>45</sup> A press release by the European Commission (May 27, 2016)

<sup>46</sup> EurActiv (September 28, 2016)

<sup>47</sup> A press release by the Ministry of Energy (November 16, 2016)

<sup>48</sup> The draft was subjected to consultations until September 18, 2015. Due to a government change, however, its finalization has been postponed and is expected to come in the second half of 2017, the Polish Ministry of Energy in an interview (January 19, 2017).

<sup>49</sup> Kaigai Denryoku (Overseas Electricity), May 2016, Japan Electric Power Information Center, Inc.

<sup>50</sup> Through a presidential election in May 2015, Andrzej Duda won the presidency, leading the single-party administration of the center-right Law and Justice party (PiS).

<sup>51</sup> Converted at the exchange rate of 26.4 yen to the PLN (zloty)

<sup>52</sup> Kaigai Denryoku (Overseas Electricity), May 2016, Japan Electric Power Information Center, Inc.



highly competitive, however, the coal industry's financial conditions are seen as unlikely to improve<sup>53</sup>.

### 3.6 Spain

The Spanish government had subsidized the domestic coal industry to support its competitiveness against imported coal to secure stable power supply and address the employment problem. In 2012, however, it announced a substantial cut in coal industry subsidies as part of budget consolidation efforts. In 2013, the government compiled the Coal Industry Framework 2013-2018, including the gradual closure of uncompetitive coal mines within five years and a 15% cut in coal industry employment<sup>54</sup>.

Under the EU regulation on state aid to the coal industry (see 2)<sup>55</sup>, a plan to provide €21 billion (about 2.52 trillion yen<sup>56</sup>) in subsidies for 26 coal mines was approved by the European Commission (May 2016) on the premise of their closure by 2019. Subsidies will thus be abolished in 2018<sup>57</sup>.

In addition to the subsidies for coal mines, Spanish government had provided an incentive for coal power generation between 2010 and 2014<sup>58</sup> (see 2). Environment protection groups strongly opposed the incentive, filing lawsuits in 2010 and 2014<sup>59</sup>. The EU General Court ruled that the incentive did not conflict with the regulation on state aid to the coal industry<sup>60</sup>. However, the European Parliament in its written questions to the European Commission doubted the advisability of the incentive from the viewpoints of state aid and CO<sub>2</sub> emission reduction policies<sup>61</sup>. Such incentive is expected to be abolished by the EU rule<sup>62</sup> (see 2).

### 3.7 Italy

In a national referendum in June 2011, 94% of voters opposed the restart of nuclear reactors<sup>63</sup> in Italy. Oil power generation had been switched to gas and coal power generation since the 2000s, bringing gas and coal power generation dominant in its generation mix in recent years.

The government has so far made no commitment to the abolishment of coal power generation and approved new coal power plant construction in recent years (see 1). In his speech in June 2015, however, then Prime Minister Matteo Renzi commented that "such past choices led to the expanded utilization of coal, the present enemy", indicating that a policy shift would be required<sup>64</sup>.

Against this backdrop, in October 2015, Enel, an Italian utility 25% of its share owned by the government, announced a plan to build no new coal power plants and to focus on the cost reduction of

<sup>53</sup> An interview with the Institute of Power Engineering (Poland) (January 20, 2017)

<sup>54</sup> Eurofound (official EU website)

<sup>55</sup> EurActiv (June 1, 2016)

<sup>56</sup> Converted at the exchange rate of 120 yen to the euro

<sup>57</sup> 2010/787/EU

<sup>58</sup> EurActiv (September 30, 2010)

<sup>59</sup> The plaintiffs were a gas company (Castelnou Energía) and an environmental NGO (Greenpeace).

<sup>60</sup> State aid rules in the coal sector and linked energy sector under the Energy Community Treaty and European Law, Péter Staviczky and Phendon Nicolaidis, June 2015

<sup>61</sup> European Parliament, Parliamentary questions, 21 April 2015

<sup>62</sup> COM (2016) 864 final

<sup>63</sup> BBC News (June 14, 2011)

<sup>64</sup> G7 COAL PHASE OUT: ITALY A REVIEW FOR OXFAM CHRIS LITTLECOTT & JULIAN SCHWARTZKOPFF, September 2015

renewable energy power generation and the development of smart technologies aiming at carbon neutral by 2050<sup>65</sup>.

#### 4. Realities and implications of coal phase-out in EU

The following analyzes implications of the coal phase-out in major EU countries, based on the coal related situations in the EU, major EU countries and Japan (Tables 4 to 6).

Table 4 Coal Supply and Demand

	Year	EU	U.K.	France	Spain	Italy	Netherlands	Germany	Poland	Japan
<b>Coal supply/demand, etc.</b>										
Coal production (Mt)	1990	1,044.8	91.0	12.8	35.5	1.0	0.0	434.0	215.1	8.0
	2015	500.0	8.5	0.0	3.1	0.1	0.0	184.7	135.2	0.0
	2030	101.6	1.7	0.0	0.5	0.0	0.0	28.7	39.4	0.0
Coal consumption (Mt)	1990	1,188.8	106.7	30.9	46.8	22.4	14.1	451.0	187.6	115.7
	2015	690.8	38.0	12.4	23.8	19.6	18.1	239.2	134.7	191.5
	2030	185.5	4.2	5.0	5.3	11.3	6.3	65.6	43.3	187.8
Lignite/coal consumption (%)	1990	57.5	0.0	6.8	35.4	4.9	0.5	80.7	35.9	0.0
	2015	58.3	0.0	1.4	0.0	0.0	0.2	74.0	47.4	0.0
Dependence on coal imports (%)	2015	52.3	79.6	98.0	85.4	99.6	100.0	45.7	10.6	100.0

Sources) IEA for 1990 and 2015; European Commission for EU in 2030; estimates made for Japan by the Institute of Energy Economics, Japan, based on the Basic Energy Plan

Table 5 Generation Mix

	Year	EU	U.K.	France	Spain	Italy	Netherlands	Germany	Poland	Japan
<b>Power mix, etc.</b>										
1990	Coal	40.2	65.0	8.5	40.1	16.8	38.3	58.7	97.5	13.5
	Gas	7.5	1.6	0.7	1.0	18.6	50.9	7.4	0.1	19.6
	Nuclear	30.8	20.7	75.3	35.9	0.0	4.9	27.8	0.0	23.2
	Renewables	0.7	0.2	0.5	0.4	1.5	1.0	0.3	0.0	1.3
2015	Coal	26.0	27.0	1.5	20.9	20.4	27.4	42.3	84.8	34.0
	Gas	17.4	32.9	4.4	19.3	38.2	52.7	14.4	5.5	39.2
	Nuclear	26.7	18.1	76.1	21.1	0.0	3.6	15.0	0.0	0.9
	Renewables	17.7	19.2	7.0	24.8	21.8	15.6	24.7	11.9	7.9
2030	Coal	16.0	0.9	0.0	5.3	13.8	15.2	38.0	65.0	26.0
	Gas	18.6	27.2	2.0	17.4	37.9	45.0	17.8	14.9	27.0
	Nuclear	22.0	26.9	63.3	20.0	0.0	3.0	0.0	0.0	21.0
	Renewables	32.1	42.9	24.1	45.1	30.5	36.8	39.8	18.5	23.0
Net power exports (TWh)	2015	14.3	-20.9	64.1	0.1	-46.4	-8.8	48.3	0.3	0.0

Note) Positive numbers in net power export columns represent net exports.

Sources) IEA for coal and renewables in 1990; European Commission documents for EU in 2015 and 2030; IEA for Japan in 2015, the Basic Energy Plan for Japan in 2030; Eurostat for net power exports

<sup>65</sup> Enel, 23 October 2015

Table 6 Coal Power Generation Capacity

	Year	EU	U.K.	France	Spain	Italy	Netherlands	Germany	Poland	Japan
<b>Coal power generation capacity</b>										
Installed capacity (GW)	2015	176.6	18.7	5.4	10.4	9.5	7.1	50.8	28.5	45.7
Installed capacity (GW)*	2017	168.2	15.3	3.3	10.2	10.7	5.9	51.4	32.1	43.6
Lignite (%)	2017	31.4	0.0	0.0	0.0	0.0	0.0	41.8	29.0	0.0
Less than 500,000 kW (%)	2017	60.4	20.8	8.5	72.2	51.1	0.0	35.3	93.8	25.9
Outdated (%)**	2017	44.8	83.0	3.0	34.3	43.9	18.6	30.9	57.9	10.2
Subcritical (%)	2017	79.2	100.0	100.0	100.0	51.1	18.4	61.4	94.4	25.3
Supercritical (%)	2017	10.0	0.0	0.0	0.0	30.3	21.8	16.1	5.6	38.1
Ultra-supercritical (%)	2017	10.8	0.0	0.0	0.0	18.5	59.8	22.6	0.0	36.7
Generation efficiency (%)	2014	38.3	39.5	39.6	37.8	38.6	41.8	38.4	35.3	43.3
Failing to meet environmental standards (%)***	2012	39.0	53.0	67.0	25.0	16.0	4.0	21.0	100.0	
Planned new capacity (GW)		14.8	0.0	0.0	0.0	0.0	0.0	2.2	8.3	19.5
Lignite (%)	2017	31.4	0.0	0.0	0.0	0.0	0.0	50.0	16.3	0.0
Subcritical (%)	2017	16.4	0.0	0.0	0.0	0.0	0.0	0.0	5.9	4.0
Supercritical (%)	2017	21.7	0.0	0.0	0.0	0.0	0.0	0.0	30.7	2.8
Ultra-supercritical (%)	2017	48.3	0.0	0.0	0.0	0.0	0.0	100.0	51.4	89.0
Projected installed capacity (GW)	2030	100.9	0.5	3.8	4.0	5.1	4.4	36.8	20.7	47.0

Notes) \*Percentages are based on capacity. Lignite shares represents lignite excluding unclassified coal.

\*\*Operation started before 1980.

\*\*\*Percentage shares of total capacity for 504 power plants (including coal and other power plants). For Japan, 2030 represents the fiscal year.

Sources) Platts WEPP (March 2017) for installed capacity; Platts WEPP (March 2017) for EU's planned new capacity; Environment Ministry documents for Japan's planned new capacity; Platts for Japan's planned new capacity breakdown (parameter at 14.3 GW); power generation efficiency estimated from IEA; European Environment Agency for percentage shares of plants failing to meet environmental standards; European Commission for EU's projected installed capacity, Basic Energy Plan for Japan's projected capacity

#### 4.1 Strategic opportunities for climate policy appeal (UK, France)

All the coal power plants operating in UK are subcritical. They started operation in the 1960s or 1970s and are outdated. Many of them fail to meet EU air pollutant standards set in the Industrial Emissions Directive (IED).

Many of the nuclear power plants started operation in the 1970s or 1980s and gas power plants based on gas supplies from North Sea oilfields increased rapidly along with the privatization of the power sector in the 1990s. On the other hand, little additional investment has been made in coal power plants since their building mainly in the 1960s<sup>66</sup>.

In 2011, the British government announced that coal and nuclear power plants with total capacity of about 20GW (accounting for one quarter of existing power generation capacity) would be retired in coming ten years<sup>67</sup>. In 2014, it introduced support measures for nuclear and renewable energy power generation<sup>68</sup>. As for nuclear power generation, the Hinkley Point C power station is now under construction for operation starting in the mid-2020s. The government is viewing additional plans to build new nuclear power plants<sup>69</sup>.

<sup>66</sup> An interview with BEIS (January 26, 2017)

<sup>67</sup> Energy White Paper (2011)

<sup>68</sup> Under electricity market reform based on the Energy Act 2013, the United Kingdom introduced the Feed-in Tariff with Contracts for Difference (FIT CfD) system in 2014.

<sup>69</sup> An interview with BEIS (January 26, 2017)

The UK has been engaged in climate change policies, setting a target of GHG emission reduction for 2050 as early as in 2008 (see 3). Promoting domestic consensus as well as enhancing its leadership in climate change policies and international negotiations are of great interests to the UK.

In this light, the aged coal power plants that need to be shut down were turned into a strategic opportunity for the UK government to announce a coal phase-out quicker than any other countries and emphasize its low carbon initiatives globally. France's stance is seemingly similar to that of the UK. Coal's share in the French generation mix has been as minor as several percent over more than 20 years<sup>70</sup>. The vast majority of coal power plants are of small size, with only four facilities totaling about 3 GW -- Le Havre (EDF), Cordemais (EDF), Gardanne (Uniper) and Saint-Avold (Uniper)<sup>71</sup>. Most of them, including the large four, commenced operation in the 1980s. As is the case with the UK, all the facilities are subcritical and non-compliance to environmental regulation is high.

The UK and France have inefficient coal power plants that need to be closed anyway. The fact that in both countries public acceptance for nuclear power generation is high apparently makes it easy for them to adopt coal phase-out policy.

#### **4.2 Difficulties in coal producing countries (Germany, Poland)**

In contrast to the UK and France, for Germany and Poland, as coal producing countries, the importance of coal in both production and consumption is higher than other EU countries, thus plagued with energy security concerns.

As for Germany, it must secure power sources to cover the planned nuclear phase-out (see 3). In aspiring further expansion of renewable energy, it's been facing growing costs and power transmission infrastructure problems. Investment in gas power generation has been deferred due to slack electricity market prices.

Coal power plants in Germany totals to 9.8 GW and comprising a key power source with more than 40% share in its generation mix. The facilities are mostly ultra-supercritical, with commercial operation date in or after 2010. The Federal Ministry of the Environment has indicated a view that as the energy sector is required to cut CO<sub>2</sub> emissions by at least 61% from 1990 by 2030<sup>72</sup>, coal power generation will have to be abolished<sup>73</sup>. However, the Federal Ministry of Economic Affairs and Energy, the industry sector and some officials in the government and ruling party<sup>74</sup> have been strongly opposing early closure of the plants. While the above-mentioned Climate Protection 2050 plan touches on the phase-out of coal power generation, no national consensus has been formed on a specific target year.

Poland has been maintaining its view on the importance of coal<sup>75</sup>. In its Energy Policy 2050, now

<sup>70</sup> According to IEA statistics, coal's share of the French generation mix since 1990 peaked at 9.6% in 1991 and ranged from 4% to 6% from 1993 before standing at 2.2% (1.5% in Eurostat) in 2015.

<sup>71</sup> The remaining facilities are small plants whose capacity is below 112,500 kW, the minimum standard level at which environmental assessment is required in Japan.

<sup>72</sup> EurActiv (September 28, 2016)

<sup>73</sup> Clean Energy Wire (December 16, 2016)

<sup>74</sup> Denki Shimbun (December 7, 2016) • EurActiv (September 28, 2016)

<sup>75</sup> Some people view Poland as attempting to use its continued utilization of domestic coal as a bargaining chip to win advantages in EU-wide climate change policies. Kaigai Denryoku (Overseas Electricity), May 2016, Japan Electric Power Information Center, Inc.

under consultation, it positions coal power generation as a major power source as ever. Although in 2009 Poland announced its intention to introduce nuclear power generation, the plan has been delayed and no nuclear power plant is expected to start operation by 2030 if any<sup>76</sup>. As Poland is eager to lessen its dependence on Russia, natural gas cannot be a realistic option, considering also economic efficiency and industry protection of coal<sup>77</sup>.

The Polish government has been alert to the EU's enhancement of climate change policies and opposed the CO<sub>2</sub> emission standard in the Capacity Mechanism (see 2). However, the EU's public lenders, such as the European Investment Bank (EIB) and the European Bank for Reconstruction and Development (EBRD), have adopted lending policy that would substantially restrict finance to coal power generation. In this circumstance, Poland may face financial limitations as well as the EU climate change policy constraints.

For Germany and Poland, coal phase-out is a difficult theme closely linked to energy security and the economic development in coal producing regions. Their policy orientation may also attract interests in view of EU's efforts in securing common position regarding coal.

### 4.3 A case in stranded assets? (The Netherlands)

In the Netherlands, gas power generation has been the main source of power generation, but coal power generation increased as state-of-art ultra-supercritical coal power plants with total capacity of 3.5 GW went on stream in 2014 and 2015. As stated above (see 3), the Netherlands has set a GHG emission reduction target that makes coal phase-out inevitable. A Dutch environment protection group is in view that the closure of coal power plants including the latest facilities would be the most cost effective. Their claim is based on estimates made by a consulting company (CE Delft) under a contract with green power utility (Eneco). According to the estimates, an option to close one or two latest coal power plants and CCS implemented in industry sector would be the most economic option costing €40 million annually. An option to reduce CO<sub>2</sub> emissions to the same extent through other measures (including the promotion of biomass utilization and measures in livestock farming and transportation sectors) without closing coal power plants would raise annual cost by up to €80 per household<sup>78</sup>.

In its own estimates, the Ministry of Economy states the closure of all coal power plants by 2020 would cost €7 billion and points out that an increase in power imports from neighboring countries to fill the gap would bring down actual CO<sub>2</sub> emission cuts. The minister of economy has commented that the above-mentioned three coal power plants are the cleanest in Europe, opposing to their early retirement<sup>79</sup>. If they be closed without fully recovering investment, it may become the typical case in which coal power plants become stranded assets.

In Italy, like the Netherlands and Germany, ultra-supercritical coal power plants (with total capacity at 1.3 GW) went on stream in or after 2010. However, its government has not indicated any intention for early retirement of them.

<sup>76</sup> An interview with the Polish Energy Ministry (January 19, 2017)

<sup>77</sup> Interviews in Poland (January 19-20, 2017)

<sup>78</sup> Doing Justice to Climate Change, CE Delft, June 2016

<sup>79</sup> The Guardian (September 16, 2016)

#### 4.4 Risks accompanying coal phase-out in EU

Regarding EU countries' coal phase-out as reviewed above, the following risks and challenges may require consideration:

First, power supply capacity must be secured. While the abolishment of coal power generation presumes sharp growth in renewable energy power generation (Table 5), it is uncertain whether renewable energy could expand substantially on a commercial basis without depending on FIT and other support measures.

Second, the EU is endowed with cross-border grid networks which provide not only high flexibility for energy security but also the possibility that if one country abolishes coal power generation, neighboring countries' coal power generation may increase through the cross-border electricity market. The effectiveness of coal phase-out in decarbonization needs to be assessed in this particular context of the EU.

Third, the EU has 12 coal producing countries<sup>80</sup>, unlike Japan that shifted to import of coal in the 1980s. For coal producing countries, employment and local community issues are vital. Coal phase-out without concrete proposals to tackle these issues may induce protectionist backlash.

### 5. Conclusion and implications for Japan

As discussed above, EU countries' coal phase-out commitment might have come as a sudden reaction to past policy conflicts or failures in decarbonization, rather than as a milestone they reached after steady carbon reduction efforts.

The EU on the whole is moving in the direction of abolishing or reducing coal power generation through energy policy reform and low-carbon policy enhancement. However, such policy direction is accompanied by risks and challenges. The implications of coal phase-out for EU member states differ depending on their status in coal power generation and energy situations. The EU has remarkably lagged behind in improving coal power plants efficiency and air pollution reductions compared to Japan. The UK and France in particular have aged coal power plants, thus their coal phase-out are rational and inevitable. Their governments' timely announcement of their coal phase-out poses strategic value. In both countries, public acceptance for nuclear power generation may have facilitated their coal phase-out.

On the other hand, Germany, the Netherlands and Italy are running newly built coal power plants, thus may suffer economic losses on any premature coal phase-out. Germany and the Netherlands have had difficulties in forming consensus on the timing for the abolishment of coal power generation. While the Netherlands and Italy have established natural gas power generation as the main generation source, Germany with higher dependence on coal may face energy security concerns, especially because nuclear phase-out policy has been pursued. Germany also has a domestic coal industry and will have to take socioeconomic measures if to phasing out of coal. Poland has a serious concern in energy security and domestic coal industry protection, thus no plausible path has been seen for reducing coal power generation substantially.

Japan for its part has achieved the world's cleanest coal utilization by continuous efforts in raising

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<sup>80</sup> As of 2015, 12 EU countries were producing coal. The largest producer was Germany with output at 184.7 Mt, followed by Poland with 135.2 Mt and the Czech Republic with 46.4 Mt and Greece with 46.2 Mt. The United Kingdom has closed all underground coal mines by the end of 2015. (Coal Information 2016, IEA)

generation efficiency and environmental measures. On the other hand, Japan has its own issues in energy policy: uncertainties about the restart of nuclear power plants, securing stable and economic supply of natural gas, renewable energy power generation costs and grid stability. In light of the role coal power generation in Japan as well as its unique energy situations, the possible implication of coal phase-out may be very different from those in EU countries.

Given these points, Japan must be cautious in applying coal phase-out policy that is pursued by European countries. Through the review of the Basic Energy Plan and the long-term GHG emission reduction strategy, Japan may rather need to clarify the role of coal power generation in its energy and environment policies. It should also elaborate the role Japan could play in applying highly efficient, low emissions coal power generation technologies in other countries, with a possible contribution to addressing global energy and environment problems. At the same time, further improvement in efficiency and commercialization of low carbon technologies including CCUS (Carbon dioxide Capture, Utilization & Storage) and worldwide deployment of them are required.