Chapter 3

Prospects of US Finance Regulations for Dissemination of Coal-fired Power Plants

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CHAPTER 3

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3.1. Overview

The Barack Obama administration, in intensifying its voice on the global warming issue, has positioned the diffusion of clean energy as one of the main pillars of its energy policy.

In January 2010, the US submitted to the United Nations Framework Convention on Climate Change a national-goal plan to reduce greenhouse gas by 17 percent by 2020, with enactment of a relevant domestic law as a provision.

The Climate Action Plan, announced by President Obama in June 2013, emphasises the promotion of spread of renewable energy technology, but also carries a policy that puts the introduction of advanced CCS technology as a precondition for financial support for overseas coal-fired power generation.

In December 2013, the Export-Import Bank of the United States (US Eximbank) introduced major regulations on financing coal-fired power plants (CPPs) and technology export. With that, and taking stock of future consequences of such financing regulations, it is necessary to study and analyse in a multifaceted and comprehensive way the following: 1) environmental regulations on domestic coal-fired power generation, 2) price competitiveness of coal-fired power generation, 3) global framework for climate-change countermeasures, 4) trends of coal-fired power plants and technology export in other countries, and 5) domestic political dynamics.

3.2. Prospects of Financing Coal Projects

A. Export-Import Bank of the United States Regulations

Immediately after the announcement by the Obama administration of the Climate Action Plan in June 2013, the US Eximbank cancelled financing consideration for the Thai

Binh Two Coal-Fired Power Plant in Viet Nam[5]. In the preceding five years until the announcement, the US Eximbank had been financing CPPs in South Africa with US$805 million for a total of 4,000 MW generated power, and India[6] with US$917 million for a total of 4,800 MW generated power.

In December 2013, the US Eximbank announced the Supplemental Guidelines for High-Carbon Projects regulating export of American coal-related facilities. The guidelines call for non-approval of financing for export of facilities related to CPPs unless the prospective recipients are: 1) highest-efficiency CPPs in the poorest countries that have, from an economic viewpoint, no options other than coal-fired power generation, or 2) equipped with the carbon capture and sequestration (CCS) technology[7].

B. Perspectives on the US Limit on Financing Coal Projects Abroad

Such strict regulations by the US Eximbank are a result of campaigns by advocacy groups, including pro-Democrats and environmental non-government organisations, who emphasise the necessity for the US to internationally take active initiatives centred on the climate change issue. Such initiatives, as called for, should not only enhance environmental regulations on domestic coal-fired power generation but limit as well the expansion of overseas coal-fired power generation.

On the other hand, opposing voices (mainly of Democrats from coal-producing states who do not always support the stringent attitude of the Obama administration towards the coal industry, and the majority of Republicans) call for Congress to relax regulations against the coal industry, and ask for a vote with regard to the financing by the US Eximbank of CPPs and technology export. These critics claim that enhancement of global-warming countermeasures will weaken the global competitiveness of the US industry and lose business opportunities under increasing global demand for coal.

The following may offer points to the trend of financing for future US export of coal-fired power generation technology.

[5] Bloomberg *Businessweek*, 18 July 2013.
[6] *The Washington Post*, 27 June 2013.
[7] http://www.whitehouse.gov/the-press-office/2013/06/25/fact-sheet-president-obama-s-climate-action-plan

a. Environmental Regulations on Domestic Coal-fired Power Generation

Since the formation of the Obama administration in 2009, the Environment Protection Agency (EPA) has been enhancing the environmental regulations on thermal power plants in the US.

In December 2011, EPA announced the Mercury and Air Toxic Standard for Power Plants (enforced in April 2012; compliance period until 2015) regulating newly constructed and existing 25-MW or higher thermal power plants (coal-fired and oil-fired), metals such as nickel and chromium, and acid gases such as sulphur dioxide (SO_2) and mono nitrogen oxides (NO_X). It also requires power plants to introduce proven emission-control technology and desulfurisation equipment. A reduction level similar to power plants which have achieved the maximum reduction rate is required for same-scale power plants. It also obligates power plants to install, by 2015 (although up to a two-year extension is allowed), emission-control equipment for hazardous air pollutants.

The EPA regulations are expected to reduce 90 percent of mercury emissions from CPPs, 88 percent of acid-gas emissions, and 41 percent of SO_2 emissions from thermal power plants.

In June 2014, the Clean Power Plan was announced based on Section 111 (d) of the Clean Air Act and intended to reduce CO_2 emissions from power plants (see next section). But with the resistance from the industrial circle concerned about the high costs of replacing or discarding the facilities of existing power plants, and with the Republican party enjoying a majority in both houses of Congress, how stringent the final regulations of the Clean Power Plan would be remains to be seen.

Enhanced US regulations on domestic CPPs will also enhance US incentives to limit the spread of overseas CPPs.

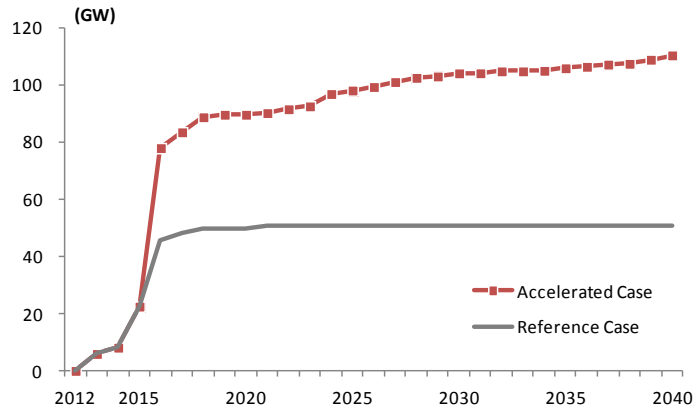
b. Price Competitiveness of Coal-fired Power Generation

One reason more voices are demanding enhanced regulations on CPPs in the US is the lower price of natural gas as a result of the shale gas revolution. With the enhanced price competitiveness of natural-gas-fired with coal-fired power generation and the slowing growth of electric power demand, and enhanced environmental regulations, construction

costs of new CPPs and repair costs of the existing ones are rising[8].

According to the *Annual Energy Outlook 2014* published by the Energy Information Administration (EIA), the installed capacity of coal-fired power generation totalling 310 GW (as of 2012) is expected, by 2020, to be reduced by approximately 50 GW in a reference case, and approximately 90 GW in an accelerated case (Figure 3.1).

Figure 3.1: Cumulative Retirement Capacity of Coal-fired Power Plants



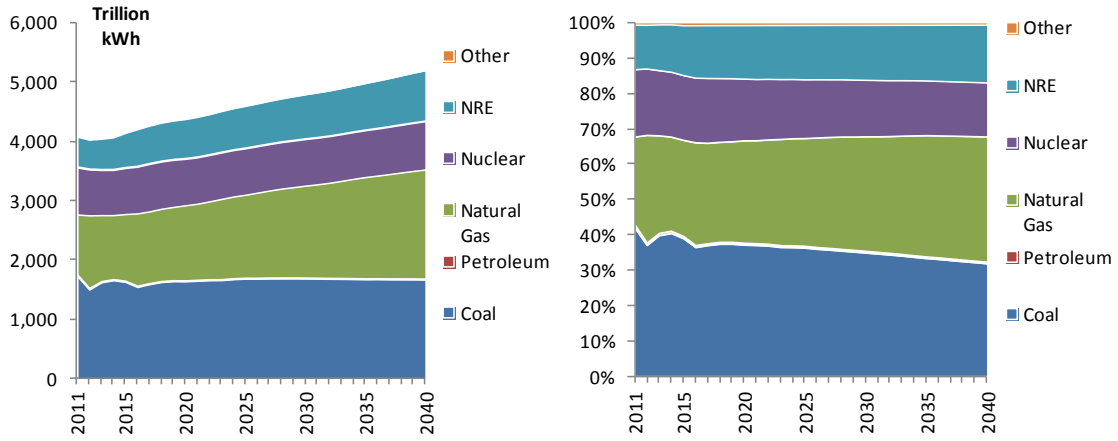
CPP = coal-fired power plant, GW = gigawatt.
Source: Energy Information Administration, *Annual Energy Outlook 2014.*

As of 2013, coal-fired power generation accounted for 40 percent of total power generation in the US.

Coal-fired power generation is estimated to level off at less than 1,700 TWh toward 2040. From 2012 to 2040, gas-fired power generation is expected to increase by 1.5 percent, but coal-fired power generation is expected to increase by only 0.4 percent. On the other hand, even by 2030, the ratio of coal in the power source mix is 35 percent, exceeding natural gas (32 percent). Past the middle of the 2030s, however, the ratios are reversed. By 2040, the ratios of natural gas and coal are expected to be 35 percent and 32 percent, respectively (Figure 3.2).

[8] In March 2014, EIA announced the abolition of a total of 5,360,000 kW-worth of coal-fired power plants after November 2013 as a result of obligation to achieve the MATS standards, slowing electric power demand, and enhanced competitiveness of the natural-gas-fired power plants. It is also expected to abolish additional 60,000,000 kW-worth of coal-fired power plants by 2020. http://www.eia.gov/todayinenergy/detail.cfm?id=15491

Figure 3.2: Electricity Generation, by Fuel (Reference Case)

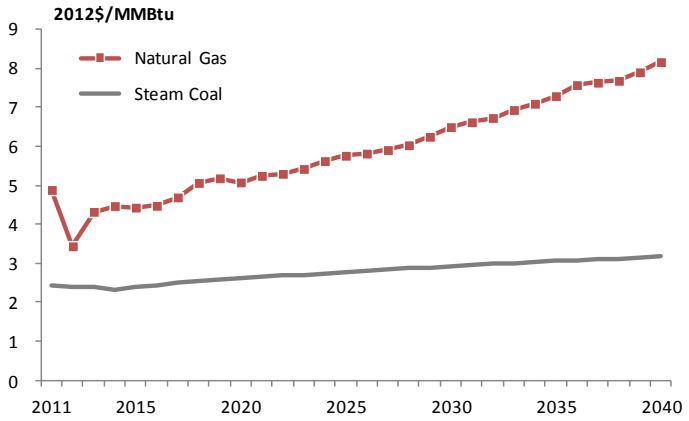


kWh = kilowatt-hour, NRE = new and renewable energy.
Source: Energy Information Administration, *Annual Energy Outlook 2014*.

In the *Annual Energy Outlook 2014* reference case, the price of natural gas for power generation in competition with coal is estimated to rise from US$3.44/MBtu in 2012 to US$5.07/MBtu in 2020, and keeping a higher increase rate thereafter (Figure 3.3).

The reference case assumes that increased production of shale gas is realised as expected (i.e. the ratio of shale gas in US natural-gas production would increase from 40 percent in 2012 to 53 percent in 2040). It also takes into account effects on energy price of starting liquefied natural gas export and so forth.

Figure 3.3: Prices of Coal and Natural Gas to Power Sector (Reference Case)



MMBtu = one million British thermal units.
Source: Energy Information Administration, *Annual Energy Outlook 2014.*

Preconditions for this estimation naturally contain uncertainty. For example, increased shale gas production may not be realised at the currently estimated rate due to reasons such as large-scale environmental issues in the future. Also, the price of domestic natural gas may skyrocket due to other reasons. In such a case, coal-fired power generation may not be smoothly phased out in the US due to its higher cost competitiveness. If utilisation of coal-fired power generation cannot be domestically reduced, it will be difficult for it to be financially discontinued internationally.

The price of natural gas will also be affected by fluctuations of the price of crude oil (Table 3.1). In short, if the price of crude oil will rise over a long period, it will also discourage abolition of coal-fired power generation in the US.

Table 3.1: Projected Prices of Crude Oil and Natural Gas

Prices (2012 US$ per unit)

	2012	2020			2030			2040		
		L	R	H	L	R	H	L	R	H
Crude Oil (WTI, barrel)	94.12	66.90	94.57	148.28	69.90	116.99	171.69	72.90	139.46	202.24
Natural Gas (Henry Hub, MBtu)	2.75	4.35	4.38	4.73	5.75	6.03	6.88	7.43	7.65	8.34

L=Low Oil Price; R=Reference; H=High Oil Price

MBtu = million British thermal unit, WTI = West Texas Intermediate; bench mark crude oil in US.
Source: Energy Information Administration, *Annual Energy Outlook 2014.*

c. Global Framework for Climate-Change Countermeasures

By the end of the 21st Conference of the Parties to the United Nations Framework Convention on Climate Change (COP21) in Paris in December 2015, an agreement should have been reached on a legal framework for 2020 or later, in which all countries will participate. An international vote on the reduction obligation of China—the world's largest source of greenhouse gas emissions—will have a great effect on US coal policy. One main reason the US refused to ratify the Kyoto Protocol was China’s lack of reduction obligation.

Introspecting on the US refusal to ratify the Kyoto Protocol, the Obama administration has announced a policy to enhance global-warming countermeasures internationally and domestically, while looking forward to taking leadership in the international framework after COP21.

At the US–China summit meeting in November 2014 in Beijing, the US announced its goal of reducing CO_2 emissions by 26–28 percent or less by 2025, whereas China came up with a policy to raise the ratio of non-fossil fuels in the energy mix to around 20 percent, as it expects CO_2 emissions to peak by around 2030. In the international framework for 2020 or later, it is still quite uncertain whether China will accept an internationally binding numerical goal of greenhouse gas emissions. If it refused again to bear an international obligation to achieve the goal, the US would assumedly follow suit.

d. Coal-fired Power Plants and Technology Export Trend in Other Countries

Focusing on Asia, including China and India and the developing countries in other regions, it is virtually unavoidable to see an increase in coal consumption in the predictable future. Under such circumstances, should there be an increase in export of clean coal facilities and technologies from countries outside the US, the latter will very likely cancel or relax the voluntary restraints it set up under the pressure from the domestic industry.

China is America's biggest joint-development partner of clean-coal technology. As described in Chapter 1, however, China is becoming active in exporting CPPs. Already, there are worries about the possibility that exports by American corporations may be disadvantaged by the US Eximbank's control over financing.

e. Domestic Political Dynamics

The Obama administration seems bent on leaving a clean energy policy, including climate-change countermeasures, as its legacy.

With the Republican party enjoying a majority in both houses of Congress and winning gubernatorial election in 24 of 36 states—some of which are leading coal-producing states—it will be more difficult for the Obama administration to obtain congressional support in regulating coal-fired power generation. Already, the Republican party has expressed a strong intention to review environmental regulatory bills promoted by EPA, including the Clean Power Act Plan[9].

[9] http://thehill.com/policy/energy-environment/e2-wire/223398-senate-gop-steeling-for-battle-against-the-epa

With two years remaining, the Obama administration is expected to exert efforts to achieve a 'historical result' concerning climate change. Particularly, the US is expected to take the initiative in forming an international framework at COP21. At the same time, a primary election is set to start in January 2016 leading toward the next presidential election in November of the same year. Based on the lessons of the 2014 midterm election and for reasons of sound election strategy, it would not be wise for the Obama administration to excessively stimulate the industrial circle; even the Democrats may not agree should the current administration attempt to enhance the environmental regulations.

3-3. Clean Power Plan

In June 2014, EPA announced the Clean Power Plan to reduce by 30 percent CO_2 emissions from domestic thermal power plants by 2030, with 2005 as reference point.[10]

A. Implementation Plan

The Clean Power Plan provides that EPA shall formulate a CO_2 emission-reduction target value by state and for each state to formulate an implementation plan in response to it and submit it to EPA by June 2016. Should a state require a grace period after submitting the first plan, it has to submit the final version by June 2017 in case of a single-state plan and by June 2018 in case of a multistate plan. After receiving the plan, EPA will announce the result of examination within 12 months.

B. CO_2 Emissions Reduction Goal

The Clean Power Plan targets a 30-percent reduction of CO_2 emissions by 2030 (compared with that of 2005 of 730,000,000 tons).[11] It is the first time for the US to regulate CO_2 emissions from power plants (control of air pollutants such as mercury, SO_2 and NO_x has already been introduced). However, instead of directly controlling emissions of each power plant, CO_2 emissions-reduction target values are set for each state; a two-stage midterm goal (2020–2029) and final goal (2030) are set (Table 3.2).[12]

[10] http://www2.epa.gov/carbon-pollution-standards/clean-power-plan-proposed-rule
[11] As of 2013, CO_2 emissions from American energy sources were 10 percent lower than in 2005. http://www.eia.gov/environment/emissions/carbon/
[12] No target values are set for Vermont and Washington, DC because they have no power plants.

The Clean Power Plan provides up to four building blocks as means to reduce CO_2 emissions; combining those blocks is at the discretion of each state.

Building Block 1: Higher-efficiency coal-fired power generation (six percent higher thermal efficiency)[13]

Building Block 2: Higher operating rate of existing natural gas combined cycle (NGCC) (as of 2012, from 44 percent national-average operating rate to 70 percent state-average operating rate)

Building Block 3: Expanded utilisation of renewable energy and nuclear power (development promotion of renewable energy power sources, operation of existing nuclear power plants, and secure development of nuclear power plants under construction)[14]

Building Block 4: Improved energy efficiency toward a 1.5 percent annual reduction of power consumption

According to an analysis by the National Economic Research Association Economic Consulting on various effects of the Clean Power Plan, the power loss as a result of abolition of coal-fired power generation capacity between 2014 and 2031 is estimated to be 97 GW in case of combining only building blocks 1 and 2, and 220 GW in case of combining 1 to 4, respectively (Table 3.3).

In October 2014, Ed Whitefield of the energy and commerce committee of the House of Representatives and concurrent chairman of the power subcommittee issued a statement criticising EPA's program as unrealistic, and claiming that if the Clean Power Plan is put into practice, more than 45 GW of coal-fired power generation will be lost, costs of at least more than US$366 billion will be incurred over 15 years, and electric power charge would, on the average, increase from 12 percent to 17 percent across the country.[15]

[13] According to EPA's estimation, the cost required to improve thermal efficiency is US$100/kW (2011 price).
[14] Including survival of 5.7 GW of nuclear power plants highly likely to be decommissioned.
[15] http://energycommerce.house.gov/blog/study-epa%E2%80%99s-power-plan-could-total-least-366-billion

Table 3.2: Target Value for Each State (CO_2 Emission Factor, lb/MWh)

	CO_2 Emissions per Unit (as of 2012)	Provisional Target Rate (2020−2029)	Final Target Rate (2030)	Reduction Rate (2012−2030)
Alabama	1,444	1,147	1,059	27%
Alaska	1,351	1,097	1,003	26%
Arizona	1,453	735	702	52%
Arkansas	1,640	968	910	45%
California	698	556	537	23%
Colorado	1,714	1,159	1,108	35%
Connecticut	765	597	540	29%
Delaware	1,234	913	841	32%
Florida	1,200	794	740	38%
Georgia	1,500	891	834	44%
Hawaii	1,540	1,378	1,306	15%
Idaho	339	244	228	33%
Illinois	1,895	1,366	1,271	33%
Indiana	1,923	1,607	1,531	20%
Iowa	1,552	1,341	1,301	16%
Kansas	1,940	1,578	1,499	23%
Kentucky	2,158	1,844	1,763	18%
Louisiana	1,466	948	883	40%
Maine	437	393	378	14%
Maryland	1,870	1,347	1,187	37%
Massachusetts	925	655	576	38%
Michigan	1,696	1,227	1,161	32%
Minnesota	1,470	911	873	41%
Mississippi	1,130	732	692	39%
Missouri	1,963	1,621	1,544	21%
Montana	2,245	1,882	1,771	21%
Nebraska	2,009	1,596	1,479	26%
Nevada	988	697	647	34%
New Hampshire	905	546	486	46%
New Jersey	932	647	531	43%
New Mexico	1,586	1,107	1,048	34%
New York	983	635	549	44%
North Carolina	1,646	1,077	992	40%
North Dakota	1,994	1,817	1,783	11%
Ohio	1,850	1,452	1,338	28%
Oklahoma	1,397	931	895	36%
Oregon	717	407	372	48%
Pennsylvania	1,540	1,179	1,052	32%
Rhode Island	907	822	782	14%
South Carolina	1,597	840	772	52%
South Dakota	1,135	800	741	35%
Tennesse	1,903	1,254	1,163	39%
Texas	1,298	853	791	39%
Utah	1,813	1,378	1,322	27%
Virginia	1,297	884	810	38%
Washington	763	264	215	72%
West Virginia	2,019	1,748	1,620	20%
Wisconsin	1,827	1,281	1,203	34%
Wyoming	2,115	1,808	1,714	19%

CO_2 = carbon dioxide.
Source: Environment Protection Agency website. https://www.federalregister.gov/articles/2014/06/18/2014-13726/carbon-pollution-emission-guidelines-for-existing-stationary-sources-electric-utility-generating

Table 3.3: Overview of Energy System Impacts of State Compliance Scenarios (Annual Average, 2017–2031)

	Total Coal Retirements through 2031	Coal-Fired Generation	Natural Gas-Fired Generation	Henry Hub Natural Gas Price	Delivered Electricity Price	Electricity Sector CO2 Emissions
	GW	TWh	TWh	2013$/million Btu	2013¢/kWh	million metric tons
Baseline	51	1,672	1,212	$5.25	10.8	2,080
State Unconstrained (BB1-4)	97	1,191	1,269	$5.36	12.0	1,624
Change from Baseline	+45	-481	+57	+$0.11	+1.3	-456
% Change from Baseline	+18%	-29%	+5%	+2%	+12%	-22%
State Constrained (BB1-2)	220	492	2,015	$6.78	12.6	1,255
Change from Baseline	+169	-1,180	+802	+$1.53	+1.9	-825
% Change from Baseline	+69%	-71%	+66%	+29%	+17%	-40%

CO_2 = carbon dioxide, BB = building block, Btu = British thermal unit, GW = gigawatt, TWh = terawatt-hour.
Source: National Economic Research Association Economic Consulting, *Potential Energy Impacts of the EPA Proposed Clean Power Plan*.