

# Renewable Energy, Nuclear Power and Climate Change Policy in Japan and France

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There are many ways to reduce carbon emissions in order to mitigate climate change. Switching from coal to natural gas and improving energy efficiency are two examples. But bringing down emissions dramatically over the long term inevitably requires developing renewable energy. Japan was an early leader on renewables, but faltered when it cut subsidies from 2003 to 2009. Germany stands out as a leader, but Denmark, the Netherlands, Spain and Italy have also invested enormous resources in renewables. France has lagged behind, along with the US and Britain, yet in recent years these states too have taken big steps to promote renewables. France and Japan also stand out as the world's second and third most important nuclear energy states. Japan is currently confronting the question of whether nuclear power is viable in the aftermath of the Fukushima disaster. France, though far away, is also moving away from nuclear power.

Japan and France are interesting cases for considering how economic national interest is weighed against environmental values. The two share a relatively interventionist past and an emphasis on industrial policy.<sup>1</sup> Both states have taken early and unusually strong industrial policy approaches to energy security. France emphasized nuclear policy as a way of securing energy independence in response to the oil shocks of 1973-80. Japan stands out for its early adoption of energy efficiency. Since the 1990s, both states have carried out important broad market reforms and shifted away from earlier *dirigisme*.<sup>2</sup> Yet both states continue to follow energy policies that are more cautious and oriented to national energy security than the more

environmentally oriented Germany and the more laissez-faire, militarily oriented and energy rich United States. Energy policy in both Japan and France has evolved in the context both of global concern with climate change and of concerns about nuclear safety, especially since the Fukushima disaster.

Both France and Japan use less energy per person, and per unit of production, than the US. This is a general pattern that characterizes the states of Europe and Asia compared to the rich and less densely population states of North America and Australasia. Moderate energy use, seems to stem from long-standing resource scarcity that have produced policies to protect farmland, restrain urban sprawl, and to implement energy taxes, and subsidies for public transportation. In 2007 Japan produced only 17% of its own energy, and most of that came from nuclear power, which was much reduced in the aftermath of the Fukushima tsunami (see Table 1). France managed to produce more than half of its own energy, but only negligible amounts of this came from domestic fossil fuels; almost all came from France's enormous nuclear power industry. The EU 15 more broadly produce 46 percent of their own energy, much of this coming from North Sea oil and gas. The US produces 71 percent of its own energy, and Canada is a major net energy exporter. Denser population in France and Japan and histories of concern with resource scarcity predispose states to be vigilant about energy security, but they don't determine policy outcomes.<sup>3</sup> Many factors shape energy policy.

Table 1 Percent of total final energy supply from domestic sources								
	Coal and Peat	Crude	Gas	Nuclear	Hydro	Geothermal, Solar, etc.	Combustible Renewables and Waste	Total*
Japan	0.0	0.2	0.7	13.4	1.2	0.7	1.4	17.6
Germany	16.5	1.4	3.9	11.1	0.5	1.3	6.8	41.4
France	0.1	0.4	0.3	43.5	1.9	0.2	5.0	51.4
EU 15	5.6	7.6	10.2	14.8	1.6	1.1	5.5	46.4
US	24.3	13.6	19.0	9.3	0.9	0.6	3.5	71.2
Canada	12.6	59.7	55.9	9.0	11.8	0.1	4.3	153.4

Source: Calculated from International Energy Agency, National Energy Balances, 2007.

<http://www.iea.org/stats/index.asp>

EU 15 are the states of Western Europe plus Finland and Greece, the first fifteen members of the EU before the entry of the mostly former Warsaw Pact states in 2004.

### Japan: Climate Change Policy

Climate change first became an issue of international concern in the late 1970s. The United Nations oversaw the creation of the Intergovernmental Panel on Climate Change (IPCC) in 1988. Soon thereafter European states began adopting policies to reduce emissions, and Japan followed a few years later. In 1995 the first Conference of the Parties (COP) to the Framework Convention on Climate Change (FCCC) was held in Berlin. At the third COP meeting, held in Kyoto in 1997, diplomats agreed to the Kyoto Protocol, under which developed nations would cut emissions from 1990 levels by 5.2 percent by the 2008-2012 period. That same year the US Senate said it would not ratify an agreement that did not include developing countries or that would limit American economic growth. In 2001 President Bush confirmed the Senate decision by refusing to ratify, but the Protocol came into effect anyway in 2005 when Russia ratified.

Japan's first climate change policy was the Action Program to Arrest Global Warming, adopted in October 1990. It sought to stabilize Japan's emissions to 1990 levels by 2000, but led to no concrete policies and ultimately failed to produce results.<sup>4</sup> Measures were passed to promote climate action policy in 1997 and 1998 and Japan ratified the Kyoto Protocol in June 2002.

The process of negotiations over the Kyoto Protocol ended up producing an agreement that was resented in Japan because it seemed to unfairly favor Western Europe. The Protocol set the base year at 1990, a high point for Western European emissions and just before the shuttering of much energy and coal intensive heavy industry in the former East Germany and in Britain. And the Protocol restricted the sorts of loopholes and work-arounds that would help Japan, such as credits for letting forests regrow and absorb carbon.

Despite business complaints about the Kyoto Protocol, Japanese government leaders expressed determination to comply with the Protocol in order not to lose face internationally. The model of emissions reduction that Europe offered was mandatory caps on emissions combined with emissions trading, but Japanese business insisted voluntary cuts would suffice. In 2005 the EU Emissions Trading System (EU ETS) set caps on the 11,000 firms emitting the largest quantities of greenhouse gases in the twenty-five EU member states. The Europeans did not find it easy to decide how to allocate emissions and ended up giving away too many emissions rights..<sup>5</sup> Many observers both in Japan and the United States concluded from the European problems that they were better off avoiding cap and trade.

Japanese climate change policy involved considerable conflict between prime ministers, who want to deliver results in order for Japan to garner international respect, and business, which was opposed to costly policy measures. In July 2008 Prime Minister Fukuda Yasuo announced

that Japan would adopt emissions trading, but business opposition limited the program to voluntary rather than mandatory limits. Prime Minister Aso Tarō announced in June 2009 that Japan would reduce its greenhouse gas emissions by 15 percent from 2005 levels by 2020. The leader of the Democratic Party of Japan (DPJ), Hatoyama Yukio, came to power in 2009 having been sharply critical of the climate change policy of the previous LDP administration.<sup>6</sup> In the 2009 election campaign the DPJ proposed adoption of cap-and-trade, a government program to purchase electricity from renewable sources (feed-in), and a “global warming tax.”<sup>7</sup> 50 percent of voters supported the DPJ target of a 25 percent cut.<sup>8</sup> Business was strongly opposed.

The DPJ government put forward a bill that set forth a goal of cutting emissions 25 percent from 1990 levels by 2020 and by 80 percent by 2050<sup>9</sup>. But Hatoyama was not able to get his policies enacted after winning the election, because he was unpopular, because business was opposed to expensive energy-saving measures and because many in his own party opposed his proposed expansion of nuclear capacity.<sup>10</sup> The public was also opposed new nuclear power plants. A November 2009 poll found that 54 percent were uneasy about nuclear power, while only forty-two percent felt “safe.”<sup>11</sup> In hopes that the December 2009 COP 15 meeting in Copenhagen might lead to a more ambitious international agreement to replace the Kyoto Protocol, Hatoyama proposed expanded aid to developing countries, but the meeting’s results were limited.

As the recession ground on, and as Japanese resentment grew over the lack of participation in the Kyoto Protocol of developing countries and the US, Japanese support for the Kyoto Protocol declined. Toward the end of the COP 16 meeting in Cancun in 2010, Japan announced it would not renew its adherence to the Kyoto Protocol. Observers were startled that Japan would drop out of an international agreement that bore the name of its ancient capital.<sup>12</sup>

Although Japan was not at the forefront of leadership on an international climate change agreement, Japan was an early leader on both energy efficiency and renewables. In 1971 Japan used 8.5 PJ per \$US billion of GDP, less than any other major advanced industrialized economy, and less than the average for what would become the first fifteen EU states (the EU before the entry of ten mostly former Warsaw Pact states in 2004, see Table 2). By 1985, when Japan's economy was on a par with those of France, Germany and the UK, Japan's energy efficiency was much better than these peer European economies. In 1985 Japan's energy used per unit of GDP PPP was just two-thirds that of Germany, and 15 percent lower than that of France. By 2000, to a great degree because of explicit climate change mitigation policy, the EU 15 had caught up with Japan and have since remained roughly on a par with Japan. France made considerable improvement, although not as much as the rest of Western Europe. The US and Canada also improved, although they remain far above Japanese and European levels of energy use.

Table 2: Total Primary Energy Supply (PJ) per \$billion GDP PPP

	1971	1975	1980	1985	1990	1995	2000	2005	2006	2007
Japan	8.5	8.1	7.4	6.7	6.4	6.7	6.7	6.3	6.1	5.9
France	9.1	8.2	8.1	8.0	7.5	7.4	6.9	6.8	6.6	6.4
Germany	12.0	11.3	10.9	10.2	8.5	7.3	6.6	6.5	6.3	6.0
UK	11.4	10.0	9.1	8.3	7.3	7.0	6.1	5.4	5.2	4.8
EU 15	9.5	8.8	8.4	7.9	7.2	6.9	6.3	6.1	5.9	5.7
Canada	17.0	16.8	16.3	14.2	13.3	13.6	12.0	11.5	11.1	10.8
US	17.3	16.2	14.7	12.4	11.4	10.9	9.8	8.9	8.6	8.5

Petajoules per billion US dollars of GDP PPP, in 2000 dollars.

EU 15 is the EU members of Western Europe plus Greece and Finland.

Data source: International Energy Agency. "CO2 Emissions from Fuel Combustion Highlights." Paris, 2009. <http://iea.org>

From 1990 to 2009, EU states made deep emissions cuts, the US increased emissions, and Japan made modest cuts (See Table 3). Again, to a great degree this was because of the

shutdown of steel making, shipbuilding and other heavy industries in Britain and Germany. If we look at reductions in emissions after 1997, at which point the shutdown of coal-intensive industry in Germany and Britain was largely complete, the differences are less stark. Note that these figures are from the UN, and take into account carbon “sinks,” that is absorption of carbon by regrowing forests and changes in agricultural practices. This is the accounting approach that was favored by Japan and the US.

Table 3: Change in Absolute Quantity of Emissions

	1990 to 2009	1997 to 2009
France	-12.9%	-11.9%
UK	-27.7%	-20.3%
Germany	-23.0%	-12.5%
EU 15	-15.0%	-12.0%
Japan	-5.0%	-9.6%
US	5.6%	-7.4%

Data source: International Energy Agency. "CO2 Emissions from Fuel Combustion Highlights." Paris, 2011. <http://iea.org>

Was the pattern of emissions cuts unfair? Davis and Caldeira analyzed the degree to which emissions are outsourced. They were interested in whether Chinese and other developing countries were generating emissions on behalf of rich countries, which buy their industrial goods. Davis and Caldeira did find this to be the case, and they also show that rich countries vary in how much outsourcing they do. By doing this, they produce a good measure of how much different emissions industrialized states are responsible for. By this method, Germany, the UK and Japan have virtually identical levels of emissions per unit of GDP, while France has a lower level, due to its heavy use of nuclear energy. Davis and Caldeira net out the energy and emissions embodied in exports and imports to arrive at figures for emissions *of consumption*. Davis and Caldeira did their analysis using data from just before the ratification of the Kyoto Protocol. To come up with a rough estimate of emissions based on consumption in 2009, I've

adjusted Davis and Caldeira's 2004 figures by the rate of change from the UN figures for 2004-9 (see Table 4). Based on these figures, it doesn't look like Japan was badly done by. In 2009, Japan's emissions of consumption per capita were 3 percent less than Germany's, the highest major emitter in Western Europe, and per unit of GDP were 1 percent higher. Japan's emissions of consumption were 14 and 16 percent higher than the EU 15's overall figures. This would seem to be the best measure of the *fairness* of how things worked out between Western Europe and Japan and by this measure Japan is pretty comparable to its peers in Western Europe.

Table 4: Estimate of Emissions of Consumption, 2004-2009

	Emissions of consumption per capita, 2004	Emissions of consumption, tons per \$1,000 GDP PPP 2004	Change in total emissions per capita, 2004-9	Change in total emissions per unit GDP, 2004-9	Estimated emissions of consumption per capita, 2009	Estimated emissions of consumption, tons per \$1,000 GDP PPP, 2009
France	9.3	0.34	-12.4%	-13.1%	8.2	0.30
UK	13.6	0.48	-16.5%	-15.9%	11.3	0.40
Germany	12.7	0.48	-8.8%	-12.2%	11.6	0.42
EU 15	11.7	0.44	-15.5%	-16.1%	9.9	0.37
Japan	12.5	0.47	-10.0%	-8.9%	11.2	0.43
USA	22.0	0.61	-12.4%	-12.6%	19.3	0.53

Estimate based on Davis and Caldeira's figures for 2004, and the rate of change from 2004-9 based on UN figures including LULUCF. Note that the estimate for 2009 is crude, and assumes no change in economic structure from 2004 to 2009.

Emissions per capita in metric tons. GDP PPP is in 2000 dollars for both 2004 and 2009.

Data from Davis and Caldeira (2010) and International Energy Agency. "CO2 Emissions from Fuel Combustion Highlights." Paris, 2011. <http://iea.org>

Chart 1 shows emissions per capita, and one can see a gradual decrease across the major industrialized states.



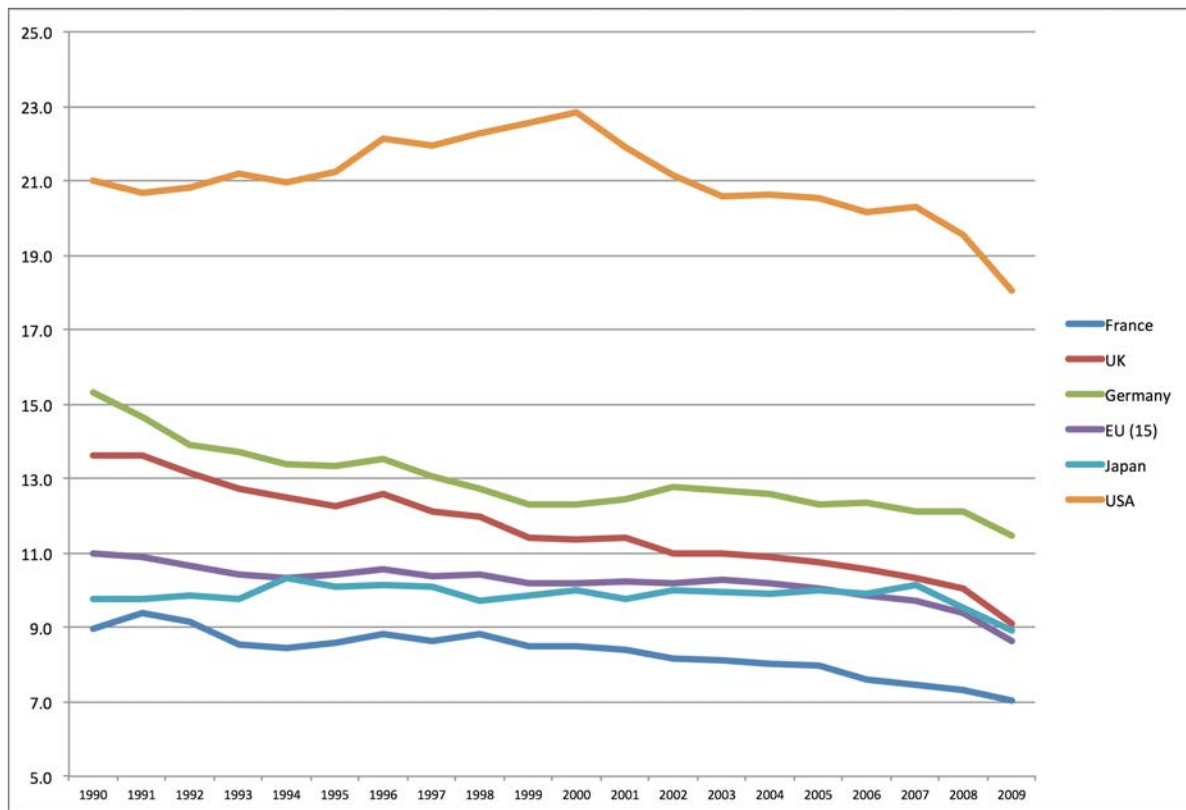


Chart 1. Tons of emissions per capita. Source: IEA data.

The diffusion of knowledge and concern about climate change among the Japanese public underlay Japanese policies on climate change.<sup>13</sup> As seen in Table 5, compared to Western Europeans, the Japanese public was more convinced that climate change is a serious problem caused by human activity and is more willing to make economic sacrifices to mitigate it. The percentage of Japanese seriously concerned about global warming was even higher, 77 percent, in 2007 when the question was first asked, than in 2009 when the public's attention had shifted to the recession and concern had dropped to 65%.<sup>14</sup>

Table 5. Opinion about Climate Change in North America, Europe and Asia			
	Climate change caused by human activity	Global Warming is a Very Serious Problem	Should Pay Higher Prices to Address Climate Change
Japan	91	65	68
China	58	30	88
India	53	67	85
S. Korea	92	68	69
Canada	61	47	54
US	49	44	41
Germany	59	60	54
UK	48	50	53
France	63	68	51
Spain	71	61	49
Russia	52	44	32
First item is from 2007 and 2008 Gallup poll, <a href="http://www.gallup.com/poll/117772/Awareness-Opinions-Global-Warming-Vary-Worldwide.aspx#2">http://www.gallup.com/poll/117772/Awareness-Opinions-Global-Warming-Vary-Worldwide.aspx#2</a>			
First and second items are from Pew poll: <a href="http://pewresearch.org/pubs/1427/global-warming-major-problem-around-world-americans-less-concerned">http://pewresearch.org/pubs/1427/global-warming-major-problem-around-world-americans-less-concerned</a>			

## Renewable Energy Policy in Japan

Japan was an early innovator in renewable energy, especially, solar. In the 1970s, in order to increase energy security, Japan introduced the Sunshine Plan, which promoted photovoltaic (PV) cells. Japanese firms made rapid technological progress in the 1980s, despite the lack of immediate commercial successes. The technology behind solar cells was close to that of the semiconductors for computers, so that Japan's leading semiconductor firms also produce photovoltaic cells. This policy was combined with promotion of energy efficiency and hybrid car technology. Japan produced significant quantities of PV cells by the early 1990s. Dietmember Kōno Tarō pushed for a feed-in tariff (FIT), which would guarantee a stable price

for renewable energy, in 2000 to give further support to solar technology, but was successfully opposed by manufacturers, the utilities and mainstream media.<sup>15</sup>

METI began to reduce subsidies for photovoltaics in 2003 and stopped them in 2005, at a time when Japan produced half of the world's photovoltaic cells. In 2007 Japan was still the world's top producer of photovoltaic cells with a global market share of 25 percent.<sup>16</sup> But the pace of growth fell behind. Japanese business leaders expressed dismay about being left behind by other countries, particularly Germany.<sup>17</sup> Many pointed to Germany's use of feed-in tariffs as the model for promoting solar energy.

The key to boosting Germany's solar capacity was the 1991 introduction of a feed-in tariff in to guarantee a cost-based revenue stream to investors. Feed-in tariffs were first developed in the United States in 1978, but were much more widely used in Germany. A feed-in tariff (FIT) guarantees that producers of renewable energy will a certain profit over a given time period.<sup>18</sup> By 2011 the feed-in tariff had spread to 92 states, provinces, and countries around the world.<sup>19</sup>

By 2008 Japan's global market share had dropped to 20 percent, in third place after China and Germany. By 2009 investment in renewable energy, which had been overwhelmingly concentrated in solar energy, had dwindled markedly. Because of concern about Japan being left behind, in 2009 METI revived a subsidy for home solar equipment which had been canceled in 2005. Critics argued that Japan was not going far enough because it only was setting up a system for purchasing surplus electricity, rather than purchasing it all at the cost of production.<sup>20</sup> The Japanese press noted that Germany had increased its feed-in tariff in 2004 and had increased its sales of solar energy equipment 9 times by 2007.<sup>21</sup> Germany surpassed Japan in 2007 as the top country for installed solar capacity.<sup>22</sup> By 2011 Japan had fallen to third place behind

Germany and Italy, although it was still ahead of Spain and the US.<sup>23</sup> Japan introduced a feed-in tariff in July 2012.

In late 2009 the feed-in tariff for solar energy was reinstated.<sup>24</sup> Japan's industrial policy approach of targeting solar industry rather than offering a broader feed-in tariff that would apply to other forms of renewable energy meant that Japan developed little wind energy, the dominant renewable energy in the rest of the world and that overall Japan has made less progress in developing renewable energy than Western Europe.<sup>25</sup> Coincidentally, a new Feed-In Tariff Law was approved by the Naoto Kan cabinet just hours before the Fukushima earthquake of March 11, 2011. It was passed on August 26, 2011 over the opposition of industry, the utilities, and METI.<sup>26</sup>

Japan's Feed-In Tariff law mandates that utilities sign contracts with producers of five types of renewable energy: wind, geothermal, photovoltaic solar, mini-hydroelectric and various kind of biogas and biomass energy. These providers must all be approved by METI based on financial and technical standards. This tariff system was proposed in April 2012 by the Agency for Natural Resources and Energy, which is under METI. The tariffs are generous by world standards. The large-scale wind and solar tariffs of 23.1 yen and 42 yen/kWh respectively are more than double those of France and Germany. The mega-solar tariff rate is nearly three times that of France and Germany.<sup>27</sup> The resulting jump in solar investment in roughly doubled its capacity.

One criticism of Japan's FIT is that it favors large firms. Another is that, although Germany has six different FITs for different types of solar, Japan has only one, and only two types for wind. And Japan seems to favor the utility companies by not guaranteeing renewable producers access to the grid and making them pay the costs of grid connections. But those who

defend the FIT system argue it was intended to get things up and running quickly and can be adjusted later. The intent is for big profits to attract rapid investment growth.<sup>28</sup> Expectations were that the FIT would cost the average consumer 70 to 100 yen a month. Industrial users may see their costs go up more significantly, which is of course intended to prod them to increase efficiency.<sup>29</sup>

### Renewable Energy Worldwide

Renewable energy accounted for 19% of total final energy worldwide in 2011. Almost half of the world's renewable energy is currently supplied by traditional biomass, such as wood burning. Hydropower is still the next biggest source of power. But these two forms of energy have limited potential for growth, and create environmental problems. In looking for "sustainable" forms of energy that have the potential for longterm growth and viability, emphasis is on other technologies such as solar and wind. In 2012 hydropower grew 3 percent worldwide, while other new technologies grew 21.5 percent. The biggest area of growth in energy generation capacity is in wind energy. In 2012 renewables accounted for over half of all new electric power generation capacity. Global wind capacity increased by 19 percent in 2012. Wind represented 39 percent of all capacity added in Europe in 2009, more capacity than that based on any other technology.<sup>30,231</sup> Worldwide, more money has been put into solar recently than into wind technology. 57 percent of investment in renewables in 2012 went to solar, and 96 percent of that went to photovoltaic technology, rather than concentrating solar technology, for example. Investment in wind was valued at a little over half that in solar.<sup>332</sup> Among major investors in solar PV, Germany, Italy and Spain led the way in terms of per capita installation,

with France behind them and Japan even a bit further behind. Wind is still cheaper than solar PV, at 5-16 US cents per kWh vs 12-38 cents in OECD countries.<sup>433</sup>

The overall picture of clean energy development by country can be seen in the table below. Note here that this table shows energy technologies that are considered sustainable, and does not include large-scale hydroelectric energy both because large dams bring various environmental problems and because the potential for increasing large-scale hydro is limited. Table 6 shows the six biggest advanced industrialized countries by GDP, along with China. As of 2012, most of these economies had roughly similar levels of clean renewable energy development. Although China stands out for the large size of its clean energy sector, this sector is not especially large relative to the amount of energy China uses. The two big advanced economies that stand out for the large size of their renewables sectors are Germany and Italy. The term “clean energy” means that the environmental costs are limited.

Table 6, Clean Renewable Energy Investment by Country

	2012 investment (billions \$US)	Installed Renewable Energy (GW)	Installed renewable capacity per person (kW per person)	Ratio of installed renewable capacity to energy consumption	5 yr growth rate	Wind (GW)	Small Hydro (GW)	Solar (GW)	Biomass (GW)	Total primary energy consumption in Quadrillion BTUs
China	65.1	152.0	0.11	1.29	23%	74.0	65.0	6.5		118.2
France	4.3	13.9	0.21	1.31	22%	7.4		3.6		10.6
Germany	22.8	71.0	0.88	5.39	17%	31.0		32.0	5.8	13.2
Italy	14.7	31.5	0.53	4.42	26%	7.9	4.6	16.0		7.1
Japan	16.3	27.0	0.21	1.34	6%	2.6	13.2	7.4	3.1	20.2
UK	8.3	15.3	0.24	1.81	22%	8.7		2.1	3.9	8.5
US	35.6	133.0	0.42	1.40	11%	59.4	48.7	8.1	13.4	95.1
Source:										
The Pew Charitable Trusts. "Who's Winning the Clean Energy Race? 2012 Edition." In The Clean Energy Economy. Washington, DC, 2013.										

Total primary energy consumption is from US Energy Information Administration website, <a href="http://www.eia.gov/">http://www.eia.gov/</a> , accessed Mar 31, 2014.
Figure for China is estimated based on figure for 2011 increased by the 2012 GDP growth rate of 7.8% provided by the World Bank.
Ratio is between GW of installed renewable capacity and total primary energy consumption in quadrillion BTUs.

One obstacle to greater development of wind power is that Japan has limited land area for renewable energy installations. Two watts of wind-energy can be produced on a square meter of land, vs. twenty watts for solar power. But there is a challenge even siting in solar power. So far, most solar projects have been set up in the more sparsely populated north of the country. SoftBank has announced three solar projects in Hokkaido with a total capacity of 180 MW. But there are problems for Hokkaido in absorbing all the power.<sup>34</sup> One solution that has been sought for wind power is in siting it offshore. Although 60 percent of the world's floating wind turbines are in Europe, 23 percent are now in Japan.<sup>35</sup>

The feed-in tariff has been very successful in Japan. Preliminary data suggest that Japan was the second largest installer of new solar energy in 2013. Japan installed 6.9 GW compared to China's 11.3 GW and the US's 4.8 GW. Germany dropped from 6.7 to 3.3 GW. France dropped to .7 GW from a peak of 1.69 in 2011.<sup>36</sup>

#### Nuclear power after Fukushima

The 2010 Basic Energy Plan set the goal of having nuclear plants supply 50 percent of Japan's electricity by 2030. Japan was to build nine new nuclear facilities by 2020 and another fourteen or more by 2030. Funds for energy R&D were to be channeled heavily toward nuclear power. Export of nuclear technology was a major goal as well.<sup>37</sup> But very quickly after the earthquake and tsunami of March 11, 2011 and the nuclear disaster that followed, Japan shut all of its nuclear reactors and they remain shut. Public opinion in the immediate aftermath of the

Fukushima disaster was strongly in favor of permanently stopping the use of nuclear power. A June 2011 *Asahi Shimbun* poll found that 74 percent favored phasing out nuclear power, while only 14 percent were opposed to doing so.<sup>38</sup>

Germany had decided quite early that it would phase out nuclear power. In 2001 Environment Minister Jürgen Trittin announced that all nuclear plants would be shut down by 2022, but in 2010 Chancellor Angela Merkel gave the nuclear plants an extension until 2036.<sup>39</sup> With the German government moving away from nuclear power, German industry followed. In September 2011 Siemens announced it would no longer build nuclear power plants. Switzerland and Italy had both followed Germany's lead in shifting away from nuclear power, but in the larger international arena there were still plans to build nuclear power plants in India, China and elsewhere. French observers noted that Germany's withdrawal from nuclear engineering created expanded opportunities for French firms.<sup>40</sup>

Japan's peak business association, the Keidanren, has tended to support industries that use a lot of fossil fuels, like steel and cement. The president of the Keidanren typically comes from heavy industry. Thus the big users of fossil fuel based energy tend to share the views of the utility companies and to predispose organized business against alternative energy sources. This is a reason Japan shifted away from supporting renewable industry after 2000.<sup>41</sup>

The Japanese government announced on April 11, 2014, that Japan would restart nuclear power plants when the reactors were judged safe. The plan is now for nuclear power to be reduced to "as low as possible" a level by introducing more renewable energy. Half the Japanese public still opposes restarting the reactors.<sup>42</sup> It remains to be seen whether local authorities will allow nuclear power plants to re-open.



The new FIT stimulated new investment. One of the first projects was Kyoto Solar Park, a solar facility that started operation in July 2012 and was the project of two prominent entrepreneurs, Kazuo Inamori, the founder of Kyocera Corporation, and Masayoshi Son, the founder of SoftBank. Son jumped in quickly after the Fukushima disaster to create new renewable energy projects. As of May 2011 he had plans for ten large-scale solar projects. By summer 2011 three-quarters of Japan's prefectural governors had said they wanted to work with Son. Son created the Japan Renewable Energy Foundation in September 2011. He argued that by 2030 Japan could supply two-thirds of its electricity from renewable sources.<sup>43</sup> But his biggest proposal was to create a "super grid" that would cost two trillion yen (20 billion dollars) to build and 50 billion yen (500 million dollars) a year to maintain. The grid was to run the length of Japan and permit renewable energy to enter a national energy market. In addition he proposed creating an East Asia Super Grid that would connect Japan to South Korea and China.<sup>44</sup> In 2013 Japan passed new legislation to carry out a sweeping reform of the electric power market. A key part of the legislation is the creation of a national power grid company by 2015.<sup>45</sup>

The LPD is becoming polarized over nuclear policy. In March 2013 Abe dismissed the majority of the anti-nuclear members of the government energy policy board.<sup>46</sup> Remarkably, the prime minister who oversaw the enactment of the earlier nuclear centered energy policy, Koizumi Junichirō, now is a fervent opponent of nuclear power. In August 2013 Koizumi invited nuclear power industry representatives to try to convince him that nuclear power was sustainable. He was not convinced and now argues Japan should not use nuclear power. He has created considerable problems for the nuclear power industry. The nuclear industry wants both for existing plants to be restarted and for new plants to be built.<sup>47</sup>

## France, Nuclear Power and Climate Change Policy

Among the rich industrialized countries France has an unusual energy history in its heavy reliance on nuclear power. It sources three-quarters of its electricity from nuclear plants; no other major industrialized country gets more than 19 percent from nuclear power. France developed its nuclear power industry quickly in response to the oil shocks of the 1970s and 1980s. Although in the 1970s France depended on imported oil for almost two-thirds of its total primary energy supply (TPES, that is, all energy including electricity and other sources), it cut the proportion of oil to one-third of TPES largely by shifting to nuclear power. France's nuclear plants were built during a twenty year period from 1977 to 1996.<sup>48</sup> In 2008 nuclear power provided 77 percent of France's electricity and 43% of its total energy.<sup>49</sup>

Why did France place so much emphasis on nuclear power? One big reason is that France lacked the natural sources of fossil fuels that Britain and Germany had. It did not have the coal resources of these two other countries, and also did not have the oil and gas that Britain developed beginning in the 1980s. In the mid-1980s France imported 98 percent of its gas, 99 percent of its oil and 100 percent of its coal.<sup>50</sup> In these ways France looks much like Japan, but France was more reluctant than Japan to trust international sources of supply for its energy. France was able to expand its nuclear power plants quickly in part by keeping costs down. One way was that the national electric utility company, Electricité de France, ordered reactors in bulk for a series of largely identical power plants.<sup>51</sup> France also kept costs down by using somewhat less stringent design standards than other European countries, such as Germany. Germany, required that concrete reactor shells be capable of withstanding a direct crash by fighter aircraft,

and that stringent measures be taken to guard against sabotage. France simply required that plants be safe against impact by a small private plane.<sup>52</sup>

Another reason that France developed such a large nuclear power industry is that it did not pull back in the face of the dangers that were suggested by the Three Mile Island partial meltdown in 1979 or the Chernobyl explosion and fire of 1986. Both left and right parties were united in supporting nuclear power, as a way to assure energy independence. Even after Chernobyl, French socialists reaffirmed their support for nuclear power, in part because of concerns with job loss if the construction of nuclear plants were suddenly halted.<sup>53</sup> This was a rather different situation from that in Germany, where the left was suspicious of nuclear power for taking away coal miners' jobs.<sup>54</sup> France was farther away from Chernobyl, and lacked a significant coal industry.

When climate change became an issue, the position of the French government was largely that it should not be obligated to do much to reduce emissions since its large nuclear sector already kept emissions low. Although the initial purpose of France's campaign to promote nuclear energy was not to minimize carbon emissions, it certainly had that effect. From 1980 to 1993 French emissions from electric power generation dropped 76 percent, and France's overall emissions dropped 25 percent. French energy-intensive industries were especially opposed to spending money to cut emissions. France did not do much to promote innovative renewable energy. It developed large-scale hydro, and wood supplied one-quarter of the energy for home heating in the 1990s. But there was limited scope for increasing large-scale hydro further, and wood was criticized by the International Energy Agency for environmental negative effects. As of the mid-1990s, France had been an early innovator in wave-based electricity

generation, and experimented with solar heating.<sup>55</sup> But overall its investment in innovative renewable energy was modest.

Yet, the EU has required France to also reduce emissions, and France has complied, due also to environmental pressures from within France and concerns that France modernize its economy. While France has not been the environmental leader that Germany has been, it has generally fallen in line with directives from the EU. As Pierre-Nöel Giraud, Ute Collier and Ragnar Löfstedt put it, “France may be considered as the ‘first follower,’ as compared to Germany as the ‘first mover.’”<sup>56</sup>

France ratified the Kyoto Protocol in 2002. But the more important international regulatory context within which French policy has developed is the European Union. EU policy has been very important in shaping and directing French energy and climate policy. France carried out EU directives to liberalize the energy sector in 2004 with a law concerning the electric and gas utilities. In 2004 it began a Climate Plan, which was then updated in later years. In 2005 it enacted a new energy law that included measures for promoting renewable energy. A carbon tax was considered in France but rejected.<sup>57</sup> After a period of delegation of much of the specifics of climate change policy to national governments, core policies were centralized in the form of the Emissions Trading System and EU restrictions on automobile emissions.<sup>58</sup> France was a part of the EU emissions trading scheme. The EU-ETS restricted CO<sub>2</sub> emissions from plants in six industries but allowed trading. The EC Energy-Climate Package required EU members to cut energy consumption by 2020.<sup>59</sup>

## French Renewable Energy Policy

The domestic political process to address climate change took a jump with the an Environmental Round Table (Grenelle de l'environnement) in 2007 in which business, unions, NGOs and government leaders met to discuss the environment. It was called a “Grenelle” after the 1968 meetings between business and labor designed to address high-level issues. In 2007 France also combined a number of governmental agencies into an expanded ministry, which has gone through a couple of name changes but is now called the Ministry of Ecology, Sustainable Development and Energy. In 2009 France passed the Grenelle 1 law, which set a goal of drawing 23 percent of France’s energy from renewables by 2020, established an energy-climate tax and provided for increased funding for R&D for renewable energy.<sup>60</sup>

The 23 percent goal was a bit over what was required by the 2008 EU Energy-Climate Package. France was moving slowly to this goal as of 2007, when renewables made up 12 percent of electricity consumption. Specific plans were to be developed on a regional basis to take advantage of different natural endowments in different regions of France for renewable energy. The key support for renewable energy development was a system of feed-in tariffs.<sup>61</sup>

The tariffs were established in 2000 and were raised in 2006 and 2007. France doubled its feed-in tariff in 2006 and saw a jump in installed solar capacity from 35 to 230 MW by 2009.<sup>62</sup> There are also tax credits to support renewable energy. Electricité de France is required to purchase electricity produced from renewable sources. A particularly high tariff was provided for solar, but the weaker tariff for wind did not stimulate much investment.<sup>63</sup>

But in December 2010 the government halted large solar projects to “avoid a bubble”<sup>64</sup> and to control costs. The utility monopoly was appreciative.<sup>65</sup> Industry sources claimed that PV energy grew slowly because Sarkozy was tied politically to the nuclear power industry. In 2010 the French government put a three month moratorium on new PV licenses. It then put 500 MW annual cap on the sector and limited the ground-mounted sector by changing the feed-in tariff to only apply to projects less than 100 kW. A number of large photovoltaic projects that had been in the planning stages were withdrawn. Solar energy companies naturally protested Sarkozy’s policy.<sup>66</sup> The PV sector watched the 2012 election closely and was anxious for François Hollande to win.<sup>67</sup> French PV firms made the pitch that PV would be good for jobs and for France’s overall economic interest. In the run-up to the 2012 presidential election presented a white paper to the political parties with a plan it claimed would shift the balance of trade by 3.4 billion euros in France’s favor and also produce 125,000 jobs.<sup>68</sup> The political clout of the PV sector may be limited because it is concentrated in three regions, Provence-Alpes-Côtes d’Azur, Languedoc-Roussillon and Pays de la Loire.<sup>69</sup>

The shift to bidding for large plants cut investment in PV power by half in 2012. President François Hollande proposed setting up a European solar company along the lines of Airbus.<sup>70</sup> In 2006 France and Germany had created a French-German Office for Renewable Energy (Office franco-allemand pour les énergies renouvelables, OFAENR). In 2013 France and Germany announced they would join together in a cooperative venture on the model of Airbus to promote the energy transition. France and Germany are looking at possibilities for a joint solar panel factory run by the French National Institute of Solar Energy and Germany’s Fraunhofer Institute.<sup>71</sup>

In 2012 France announced it would receive tenders for five wind farms.<sup>72</sup> Wind power investment had lagged, due to tough permitting procedures.<sup>73</sup> Wind farms were only permitted in “green zones,” and not in taboo “red zones.”<sup>74</sup> German firms complained about being shut out. The German company, Nordex, which makes wind turbines, complained that the French government prefers French manufacturers in its tenders for wind power. The company said that it decided not to participate in the tender, since it saw itself as shut out from fair competition<sup>75</sup>.

#### French Approaches to Nuclear Power since Fukushima

In the aftermath of Fukushima, Sarkozy pledged to spend 1 billion euros to improve nuclear technology. The sum was to include spending both for better safety and for new nuclear power plants. The government announced it would carry out new stress tests and also that it would promote offshore wind.<sup>76</sup> But Sarkozy argued strongly that nuclear power should be continued and that he would not pay excessive attention to safety. Although the Nuclear Safety Authority said that the Fessenheim reactors in Alsace were safe to operate for a forty year period ending in 2017, provided certain improvements were made, Sarkozy said in February 2012 that his government had requested that EDF attempt to keep the plants running for an additional twenty years.<sup>77</sup> French leaders are quite aware that nuclear power gives them a price advantage on energy over other European countries. In 2012 French electricity was the second cheapest in the EU, at 10 cents (Euro) per kWh vs 14 cents in Italy, Germany or the UK. But it was expected that electricity costs would go up as France attempted to make nuclear power safer in the wake of Fukushima.<sup>78</sup> In 2009 Japan had somewhat high electricity prices for industry compared to general OECD, and higher for households. France had median prices for industry and rather low prices for households.<sup>79</sup> French socialists quickly followed the decisions in

Germany and Switzerland to gradually abandon nuclear power. Laurence Rossignol, the Socialist environment secretary said that the party's new position was, "Because Fukushima ended the myth that nuclear energy can be safely controlled."<sup>80</sup>

The Hollande government is currently facing the question of whether the reactors' lives should be extended. Hollande stated during his campaign that he intended to cut its share of nuclear power to 50 percent by 2025.<sup>81</sup> Before his election, Hollande promised to use some of the money that EDF would have invested in retrofitting Fessenheim to fund renewables projects.<sup>82</sup> The French Socialist Party said in February 2012 that it would fund renewables with profits from nuclear power. It proposed that Hollande would raise the dividend paid by EDF to the state.<sup>83</sup>

There was strong German criticism early on about France's safety rules for nuclear plants. In 1986, German environmentalists protested the safety regulations used by the French government in the building of a new nuclear power facility built at Cattenom, on the France-Luxembourg border and very close to Germany.<sup>84</sup>

Soon after the Fukushima disaster, the German government announced it would immediately close its seven oldest plants and suspend the restart of an eighth plant. It also announced it would speed up the closing of all of its reactors to 2022, although the target date was later postponed to 2036.<sup>85</sup> This position was strongly supported by the German public. In 2013 over 80 percent of Germans supported closing the country's nuclear power plants. German nuclear energy dropped from 23 percent of German electricity in 2010 to 16 percent in 2012. Renewables grew in the same period from 12 to 18%.<sup>86</sup>

The International Energy Agency report concluded that the emphasis on solar was was "intertwined with its industrial policy." PV was support with money for R&D, by the National



Solar Energy Institute and by the requirement that each region of France build a solar energy installation of some 50 MW.<sup>87</sup>

Overall, the EU is making good progress toward the goal of sourcing 20 percent of its energy from renewables by 2020. Two-thirds of new capacity comes from renewables.<sup>88</sup> But a problem is the lack of development of the grid so that all the new renewable energy can be used. Another problem is that differences among forms of support in different EU member states make it harder to share an electric grid. European states are reluctant to subsidize another state's green energy.<sup>89</sup> The European Commission has criticized France and the Czech Republic for not following rules about access for renewable power to national electric grids. Another problem is that the recession has cut into funding for renewables. Some of the boldest leaders in renewables, Spain, Denmark and Italy, have all cut funding. The ETS has not had great impact on emissions. It is undermined by carbon offsets. European states pay to pollute elsewhere.<sup>90</sup> Policy-makers are shifting in looking to natural gas as a quick fix for energy security and shifting away from renewables. France has decided not to exploit shale gas domestically, but Algeria claims to have more shale gas than natural gas.<sup>91</sup>

## Conclusion

France and Japan historically have scarce fossil fuels of their own and share long-standing concern about security of energy supply. The oil shocks prodded both states to engage in far-ranging policies to deal with energy. In France's case, the policy was to emphasize nuclear power. Japan put special emphasis on energy efficiency and renewables, although it also developed a large nuclear industry.

Both states were outsiders in a sense to the process of the development of the Kyoto Protocol. The insiders, as it were, were Germany and some of the smaller northern European countries that pushed hard to deal with climate change and early developed renewables. Both Japanese and French leaders considered that they had done a lot already to rein in emissions.

The global recession placed a heavy burden on the global climate change agreement. In both Japan and France, efforts to reduce emissions faltered. But the Fukushima disaster of 2011 created a new shock, in some ways akin to that of the oil shocks of 1973-1980. Japan jumped quickly to restart its long-standing renewables industry with a generous FIT. Remarkably, France has also introduced an FIT and the government has opened up the possibility of moving away from nuclear power.

In both states, left and right matter. But left and right leaders are constrained by an evolving consensus on energy. In both states vested interests tied to the nuclear power industry and cheap energy have enormous power. But as renewables get established, they begin to have some of their own power. Interestingly, renewables seem to begin to develop a power base in rural areas—the power base of conservative parties. This is true in Japan, France and Germany— and in Texas.

A pattern in the European continental countries and in Japan is a different balance between solar and wind than in the Anglo-Saxon countries. France, Germany and Japan have all invested much more heavily in solar relative to wind than is the case in the US or Britain. To some degree this may reflect natural endowments. Wind takes up more space than solar and is more practical in less densely populated areas. Solar also doesn't have the negative visual, aesthetic impact of wind turbines and perhaps will tend to be preferred in the same societies that successfully keep down the number of billboards on rural highways. But the relative emphasis

on solar power seems also to reflect the long-standing, industrial policy orientation of these different states.

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