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Germany's Energiewende Enjoys Broad Support, But Policy and Technical Challenges Must be Solved

Q&A with Jürgen Weiss, The Brattle Group

Jürgen Weiss is an energy economist and Principal of **The Brattle Group**, an international economic expert services firm of 250 professionals. Weiss leads the firm's climate change practice out of its Cambridge, Massachusetts and Rome offices.

Weiss has over 20 years consulting experience in the energy/environment interface area. At Brattle, he works with utilities, regulators and NGOs in the United States, Europe and the Middle East on issues related to renewable energy, energy efficiency, storage, market design for low carbon resources and the impact of rapid defossilization on existing assets and market structures.

Weiss has served as an economic expert in regulatory proceedings for renewable energy procurement for the Massachusetts Attorney General, Cape Wind. In 2014, he was part of the team that developed a regional compliance mechanism for Section 111(d) of the Clean Air Act on behalf of and collaborating with Great River Energy. Also in 2014, Weiss prepared a report for the Solar Energy Industry Associations on potential lessons to be learned from Germany's system of renewable energy support.

Previously, Weiss ran the global consulting business for Point Carbon. In that role he oversaw consulting work related to developing long-term CO2 price forecasts for various utility and public sector clients.

CCBJ: Germany is arguably the nation with the most aggressive commitment to decarbonize electricity supply. At the same time, it has pledged to phase out nuclear power by 2022. Can you describe Germany's challenges in reaching its goals for GHG mitigation?

Weiss: Germany has made steady progress towards the renewable energy goals enshrined in its own as well as European legislation. With approximately 30% renewable energy share in 2014, the country is on track to meet its longer-term goals of 40-45% renewables by 2020, 50-60% by 2030 and at least 80% by 2050.

This has not translated into equivalent decreases of GHG emissions due to the loss of nuclear generation after Fukushima and a substitution away from gas and towards coal over the last few years. Obviously, all else equal, the closing of nuclear power plants likely does have the effect of increasing GHG emissions—since not all of this capacity can immediately be replaced by renewables. Nonetheless, the phase out of nuclear power in Germany should likely be taken as a given since this policy has very broad support among the German population.

For that reason, the switch from gas to coal is likely the most significant near-term challenge related to meeting GHG goals rather than just renewable energy goals. In the medium term, it will also be important to create complementary infrastructure and achieve further cost-declines on the renewable front so that renewable energy can continue its path of replacing fossil fuel (and nuclear energy) going forward, as their share significantly exceeds that of other large economies.

CCBJ: In an ideal scenario, high European carbon prices would favor efficient gas power plants and disadvantage coal power plants. But with carbon prices very low, the opposite result is occuring. Grid operators are dispatching more low-cost, high-carbon coal power plants and fewer high-cost, low-carbon combined cycle gas turbine (CCGT) power plants. How do you foresee this situation turning around?

Weiss: There is broad agreement that the European Union Emissions Trading Scheme (EU ETS) needs reform. Many efforts are underway to address the shortcomings. Recent agreements on a 2030 goal (40% GHG reductions relative to 1990 emissions) will help, but there are still fears that the EU ETS is oversupplied with allowances (some banked, some related to free allowances given to Russia

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as an enticement to sign the Kyoto protocol) and that measures to "manage" the EU ETS price are needed going forward.

However, it is also worth noting that the case for switching from coal to gas is not nearly as clear cut in Germany as it is in the United States. That is because the price difference between coal and gas is much higher in Germany—gas prices are closer to $10/MMBtu, so two to three times more expensive than in the United States.

The carbon price needed to achieve significant fuel switching is therefore quite a bit higher than the carbon price that would be needed to achieve fuel switching in most of the United States. As a matter of fact, it is at least possible that, should gas prices stay at current levels or increase and renewables continue their path of declining costs, coal to renewables switching would be economical at lower carbon prices than coal to gas switching. If this turns out to be true, the efforts to move to more gas-fired power generation may, ex post, be considered misguided.

Finally, it is worth mentioning that the current set of new coal-fired power generation is likely the last generation of such plants to be built. They tend to be the result of the prospect of free allowances for new efficient generation around 2008, but no one today is seriously considering planning for new coal-fired generation.

CCBJ: RWE, EON and other incumbent utilities say their CCGT plants are losing vital peak-hour revenues because solar, with no marginal cost, gets automatically dispatched first at those times. RWE has mothballed almost 4GW of CCGT capacity. It would seem that the grid will need this CCGT capacity going forward. What's your perpsective?

Weiss: It is absolutely true that CCGTs are hit harder by the decline in wholesale prices than coal generation, even though they tend to be more flexible and hence better suited to help integrate increasing amounts of renewables with the existing system. I am not sure whether the utilities built these CCGTs reasonably expecting higher CO2 prices.

It is clear that going forward more flexibility will be needed as more intermittent renewable generation is being added to the system. It is less clear whether existing (or new) CCGTs powered with relatively expensive natural gas will be the least cost option to provide the necessary flexibility.

For this reason, there is a strong economic argument to bring storage options to market in Germany. In fact, storage makes more economic sense in the near term there than in the United States. Also, everybody in Germany talks about the importance of increasing the participation in demand side in markets, even though relatively little progress has been made on that front.

It is likely that a short term solution will be to create incentives for CCGTs not to retire when they would based on the current economics—through a higher carbon price as a result of higher CO2 prices or other measures, such as some form of capacity-related compensation, either a formal capacity market, a strategic reserve or some similar mechanism. All of these are currently being discussed in Germany.

CCBJ: As you say, Germany would benefit from more electricity storage capacity. Yet the delta between peak and base prices is far too low to justify investment in large-scale electricity storage projects such as pumped hydro. Are European policymakers addressing this?

Weiss: As I just mentioned, given the high gas prices, storage may have a better chance in Europe than in the United States, especially since Europe's GHG reduction goals are more ambitious than those in the United States and hence storage has the additional advantage of not requiring additional emissions the way gas-fired generation does.

One surprising effect of more renewables in Germany has indeed been the relative collapse of peak-off-peak price differentials. All else being equal, this would seem to worsen the economic prospects for storage. However, the standard view of peak versus off-peak prices being the primary drivers of storage economics may be somewhat simplistic. Storage benefits from fluctuations in prices over various time scales. In some sense, properly designed ancillary services markets should value the ability to smooth short-term fluctuations in prices, which are proxies for supply-demand mismatches.

Therefore, one obvious approach would be to improve ancillary (and energy) markets. It may also be that providing incentives to provide capacity directly—through some form of capacity market or related incentives—would be a means of increasing the economic attractiveness of storage.

Finally, but really as a last resort, storage can be encouraged through direct support to compensate for the absence of other market-based incentives. Germany is currently providing such support.

CCBJ: How about demand response market mechanisms that incentivize load shifting to times of strong renewable generation or that utilize networked loads (such as water treatment pumps) to provide GHG-free voltage regulation? To what extent do you think these solutions will figure in the future German/European electricity system?

Weiss: There is a lot of discussion in Germany about ways to use the demand side as a means of matching demand and the supply of renewable energy. Creating more price-responsive demand is a big part of that discussion and the current question is related to how to make that happen. There is also discussion of creating demand when there is excess generation from renewable energy.

In particular, Germany is experimenting with new and controllable loads, perhaps most notably (and most surprisingly to US audiences) with using electrolysis to make hydrogen when power is very cheap, or negatively priced. There are several pilot projects currently in operation. Electrolizers use power to split water into oxygen and hydrogen. The hydrogen can be injected into the gas network (hydrogen content of up to 10 percent in natural gas networks causes no harm harm) or it can be stored onsite and then used as fuel for fuel cells to produce electricity when needed. Recent advances in fuel cells are beginning to make this a viable option.

CCBJ: What roles are you and your colleagues at Brattle playing in advising German power market participants?

Weiss: Currently, the debate about capacity mechanisms and potential uses of demand-side resources is intense, but largely theoretical. We can provide useful practical experience—Brattle has been very involved both in the design and improvement of capacity markets and in understanding the kinds of mechanisms that make demand response possible—from the US that can help inject realism and practical experience into the current debate in Germany.

CCBJ: To achieve 40% GHG reductions by 2030, as Europe committed to do recently, and 80% reductions by 2050, which scientists say is needed, new technologies will be required. What do you think is needed to develop next-generation power technologies that can achieve massive GHG reductions?

Weiss: It is well understood that carbon prices are likely a necessary but not sufficient condition for solving the problem. Carbon prices, by themselves, will induce mature low-carbon technologies to be deployed. However, since non-carbon technologies are at various stages of development, and some have not been invented yet, various approaches are needed to foster innovation and initial deployment of less mature, or yet-to-be-invented, technologies.

Over the past decades, the amount of funds spent on basic energy research has declined both in absolute and in relative terms. Given the magnitude of the potential climate change related risk, it would seem that in addition to supporting less mature technologies, more effort on basic research would be a no-brainer.

Finally, a stable and final commitment to removing fossil fuels from our energy systems, as Germany has made, would greatly improve the eco-system for changing our energy supply away from fossil fuels quickly.

All serious projections of the costs of removing carbon from our energy system suggests that the costs of doing so would be modest, especially relative to the insurance value this would provide against the risks of climate change. ☼

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