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How Opposite Energy Policies Turned The Fukushima Disaster Into A Loss For Japan And A Win For Germany

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Japan thinks of itself as famously poor in energy, but this national identity rests on a semantic confusion. Japan is indeed poor in fossil *fuels*—but among all major industrial countries, it's the richest in renewable *energy* like sun, wind, and geothermal. For example, Japan has nine times Germany's renewable energy resources. Yet Japan makes about nine times less of its electricity from renewables (excluding hydropower) than Germany does.

That's not because Japan has inferior engineers or weaker industries, but only because Japan's government allows its powerful allies—regional utility monopolies—to protect their profits by blocking competitors. Since there's no mandatory wholesale power market, only about 1% of power is traded, and utilities own almost all the wires and power plants and hence can decide whom they will allow to compete against their own assets, the vibrant independent power sector has only a 2.3% market share; under real competition it would take most of the rest. These conditions have caused an extraordinary divergence between Japan's and Germany's electricity outcomes.

Before the March 2011 Fukushima disaster, both Germany and Japan were nearly 30% nuclear-powered. In the next four months, Germany restored, and sped up by a year, the nuclear phaseout schedule originally agreed with industry in 2001–02. With the concurrence of all political parties, 41% of Germany's nuclear power capacity—eight units of 17, including five similar to those at Fukushima and seven from the 1970s—got promptly shut down, with the rest to follow during 2015–22.

In 2010, those eight units produced 22.8% of Germany's electricity. Yet a comprehensive package of seven other laws passed at the same time coordinated efficiency, renewable, and other initiatives to ensure reliable and low-carbon energy supplies throughout and long after the phaseout. The German nuclear shutdown, though executed decisively, built on a longstanding deliberative policy evolution consistent with the nuclear construction halts or operating phaseouts adopted in seven other nearby countries both before and after Fukushima.

Moreover, the *Energiewende* term and concept began before 1980, and Germany's formal shift to renewables—now well over 70 billion watts installed—began in 1991, 20 years before Fukushima, then was reinforced in 2000 by feed-in tariffs. Those aren't a subsidy but a way for customers to buy, and hence developers to finance and build, the renewables society chose, with a reasonable chance for sellers to earn a fair return on their investments. FITs' values have plummeted in step with renewable costs, so developers now commonly opt to earn higher market prices instead.

This integrated policy framework and the solid analysis behind it meant that the output lost when those eight reactors closed in 2011 was entirely replaced *in the same year*—59% by the 2011 growth of renewables, 6% by more-efficient use, and 36% by temporarily reduced electricity exports. Through 2012, Germany's loss of 2010 nuclear output was 94% offset by renewable growth; through 2013, 108%. At this rate, renewable growth would replace Germany's entire pre-Fukushima nuclear output by 2016.

Contrary to widespread misreportage, closing those eight reactors did not cause more fossil fuel to be burned. Whenever renewable sources run in Germany, both law and economics require them to displace costlier sources, so renewables always make fossil-fueled plants run less, though often in more complex patterns. The data confirm this: from 2010 through 2013, German nuclear output fell by 43.3 TWh, renewable output rose by 46.9 TWh, and the power sector burned almost exactly as much more coal and lignite as it burned less of the costlier gas and oil. German utilities bet against the energy transition and lost. Now they gripe that the renewables in which most of them long underinvested have made their thermal plants too costly to run.

Despite those big utilities' self-inflicted woes, Germany adopted a coherent and effective strategy of boosting efficiency and renewables and ensuring their full and fair competition. In contrast, Japan replaced its own, larger lost nuclear generation almost entirely by increasing its imports of costly fossil fuels. These opposite policies produced opposite results.

Japanese people sweltered through the summer of 2011 with impressive cohesion but inadequate electricity and much personal sacrifice. Spurred by Metropolitan Government policies, Tōkyō peak demand fell by 10.7 billion watts or 18% (for big businesses, a remarkable 30%), roughly displacing TEPCO's lost peak nuclear output. Across the metro area, TEPCO's electricity sales fell 11%. But that was not true for Japan as a whole, so power plants' fuel use soared. In contrast, Germany's electricity supply remained so ample that it continued to export more electricity than it imported, even to nuclear-powered France. Germany's net power exports have set new records in each of the past two years.

Japan's economy wilted while Germany's thrived, adding several hundred thousand clean-energy jobs—part of the energy transition's net macroeconomic benefit. Japan's electricity prices soared while Germany's wholesale electricity prices fell more than 60%—including 13% in 2013 alone, when year-ahead prices hit eight-year lows. That's why French energy-intensive industries complain that they can't beat their German competitors' one-fourth-lower power prices. The latest manufactured myth of German “deindustrialization” is ironic because big German industries pay approximately those low and falling wholesale prices and are exempted from paying for the renewables that cause them, as well as from grid charges. Those burdens were instead heaped on households (whose bills are half taxes), though household tariffs have now stabilized as providers' old contracts roll over.

Japan's carbon emissions soared while Germany's power plants and industries emitted no more carbon. (German power-sector emissions fell slightly in 2013: more solid fuel was burned but more efficiently, saving slightly more than electricity output rose.) To be sure, *total* German carbon emissions rose slightly in 2012 due to a cold winter, and in 2013 due to the record power exports that were coal-fueled because of a trifecta of spiking gas prices, cheap coal diverted from shrinking U.S. markets, and an overallocated European carbon-emissions market. But in the first quarter of 2014, German coal-burning and carbon emissions shrank again, as is expected to continue. Germany remains far ahead of meeting its Kyōto climate obligations—by far the most stringent in Europe.

In short, German policy gave renewables fair access to the grid, promoted competition, weakened monopolies, and helped citizens and communities own half of renewable capacity. In 2013, Germany's nuclear generation reached a 30-year low while renewable generation, 56% greater, set a new record, reaching an average of 27% of domestic use in the first quarter of 2014 and a brief peak of 74% on 11 May.

Japan has 5% more land, 68% more people, 74% more GDP, and far more sun and wind than Germany, but through February 2014 had added only about one-fifth as much solar power as Germany, and almost no windpower. These produced just 0.97% of Japan's 2012 electricity—one-third India's share, or #29 worldwide—and 1.5% in 2013. Of the roughly 41 billion watts (95% solar) in Japan's order pipeline, much remains lawfully stalled by utility red tape and intransigence.

More than the sacred sun on Japan's flag, its leaders appear to worship old policies that retard wide use of the energy sources now taking over the global market. Since 2008, half the world's added electric generating capacity has been renewable. Non-hydroelectric renewables, chiefly wind and solar, got a quarter-trillion dollars of private investment and added over 80 billion watts in each of the past three years. Three of the world's top four economies—China, Japan, and Germany, as well as India—now produce more electricity from non-hydro renewables than from nuclear power. Japan is on that list only because its nuclear production is roughly zero; it remains the rich nations' renewable laggard. Perhaps the unexpected May 2014 court decision that prohibited restart of the Oi reactors as unsafe, and for the first time prioritized public safety over utility profits, may signal an emergent change beyond the cosmetic reforms offered by the executive and legislative branches—2016 “deregulation” in name only.

In 2012 and 2013, China made more electricity from wind than from the world's most aggressive nuclear power program. In 2013, China added more solar power than its first developer, the United States, has installed in its whole history. But Japan is heading in the opposite direction: of the 8 GW of renewables brought into operation in the first 20 months after it introduced renewable FITs in July 2012, 97.5% was solar and only 1% windpower. Windpower (especially onshore where it's cheapest) is stymied, first by uniquely slow and onerous approval processes and then by outright rejection by utility monopsonists who get to bar competitors from their regional grids. Japan's windpower association projects the same market share in 2050 that Spain achieved three years ago.

It's not hard to figure out why. Solar power displaces daytime peak that's costly to generate, but the way the solar feed-in tariff works, it's profitable for utilities. In contrast, they lose money on cheap windpower that also runs at night, displacing coal and nuclear. Japan's latest rules reiterate utilities' right to refuse renewable power that would displace such legacy “baseload” plants. Japanese business leaders may be upset to learn that their electricity, among the world's costliest, is even costlier because their utilities run their own costlier thermal plants while rejecting windpower with nearly zero operating cost.

The electricity reforms passed in late 2013 by the lower house of the Diet (23 years after Germany's reforms began) still let Japan's utilities reject cheaper renewable power for any reason or no reason. Many claim renewables could harm grid stability. So why do Germany, with 25% renewable electricity in 2013, and Denmark, with at least 47%, have Europe's most reliable electricity, about ten times more reliable than America's? These countries, like three others in Europe (none very rich in hydropower) that used roughly half-renewable electricity in 2013—Spain 45%, Scotland 46%, Portugal 58%—simply require fair grid access and competition. Of all major industrial nations, only Japan doesn't.

Germany also uses energy more efficiently. In each of the past three years, German electricity consumption fell while GDP grew. During 1991–2013, *i.e.* since reunification, German real GDP grew 33% using 4% less primary energy and 2% less electricity, and emitting 21% less carbon. Even more ambitious savings are available and planned.

In contrast, Japan's world-leading energy efficiency gains in the 1970s later stagnated. Japanese industry has continued to improve, and remains among the most efficient of 11 major industrial nations, but Japan ranks tenth in industrial cogeneration and commercial building efficiency, eighth in truck efficiency, and next-to-last (tied with the U.S.) in car efficiency. Yet Japan's sky-high energy prices make energy efficiency very profitable, most of all in buildings. Semiconductor company Rohm's office opposite Kyōto Station, for example, cut its energy use 46% and repaid its cost in two years. With a few exceptions, like the Tōkyō Metropolitan Government's efficiency efforts, few Japanese buildings have received the kind of *kaizen* (continuous improvement) that has long distinguished Japanese industry.

To revitalize its economy and politics, Japan needs an efficiency-and-renewables leapfrog that enables the new energy economy, not protects the old one. Japanese frogs jump too, says Bashō's famous haiku "The old pond / frog jumps in / plop." But we're still waiting for the plop.

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