

## Plan B: Japan Rethinks Its Nuclear Future

*The beginning of the end, or the end of the beginning, or mere readjustment?*

By Perry Sioshansi\*

Before the Fukushima Nuclear Plant went out of control following the magnitude 9 earthquake and the ensuing tsunami on 11 March 2011, Japan was on record to increase its dependence on atom for electricity generation from the current 30% to roughly 42% by 2020 and 49% by 2030. That would have required the building of at least 14 new reactors. That was the government's Plan A, strongly endorsed by the 10 private electric utilities, Tokyo Electric Power Company (TEPCO) being the largest by a big margin.

In mid May 2011, however, Prime Minister Naoto Kan announced that time had arrived for Plan B – a future less heavily reliant on nuclear power. At an official briefing, a sober looking Mr. Kan in un-characteristically undiplomatic language said, “The existing energy policy outline needs to be scrapped, and discussions should be started from scratch.”

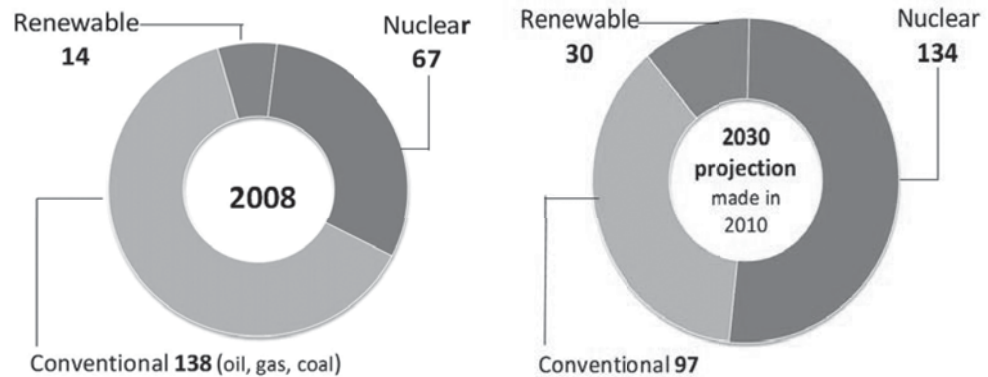
He added that the country's overwhelming historical dependence on imported oil and nuclear power must be augmented by increased reliance on domestic renewable energy resources and on energy conservation. Japan, like South Korea, has virtually no indigenous energy resources other than hydro – which have already been largely tapped.

The envisioned about face, assuming that the Minister's views prevail and are pursued, will mark the beginning of the end for Japan's important nuclear industry. Before the Fukushima accident, the country's 55 operating reactors had a rated capacity of 47 GW – only France and U.S. have more installed nuclear capacity.

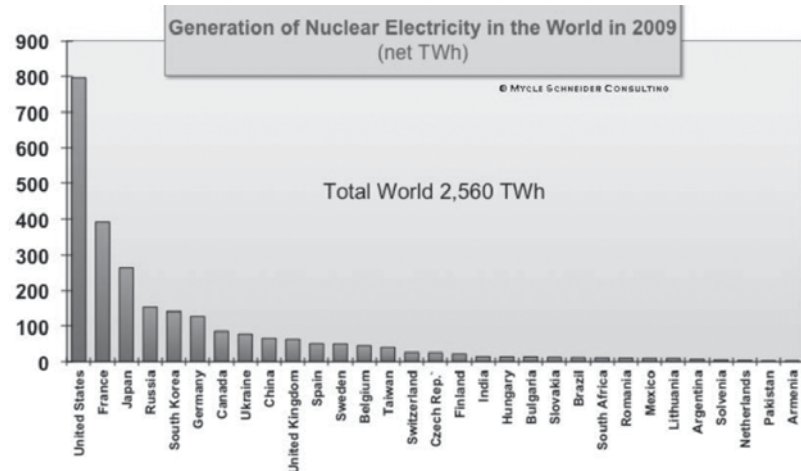
But the writing is already on the wall. Fukushima's 6 reactors are unlikely to ever see the light of day, while several other TEPCO nuclear facilities may also come under pressure to shut down, some permanently. The government has already ordered Chubu Electric Power Co to shut down the Hamaoka nuclear plant due to safety concerns.

The nuclear's crisis of confidence in Japan is being felt in countries close and far. South Korea, the other regional nuclear powerhouse with 21 operating reactors and nearly 19 GW of installed capacity, is also re-examining its nuclear future in face of safety concerns. Korea, which currently depends on nuclear generation for 31% of its electricity needs, was planning to increase this share to 48% by 2022 and 59% by 2030. These ambitious plans are now under review.

In Germany, the decision to shut down 7 existing reactors has resulted in increased greenhouse gas emissions due to more heavy reliance on coal-fired plants – not a desirable outcome (see next page). Ironically, some of the gap created by the absence of the 7 nuclear plants has been filled by nuclear imports from France and the Czech Republic.



*Now to Plan B*  
*Japan's power generation mix, 2008 and as previously planned for 2030, in million metric tons of oil equivalent*  
 Source: The Wall Street Journal (11 May 2011) based on IEA data



*Nuclear power*  
*Nuclear generation by country, 2009 data in TWh*  
 Source: Nuclear power in a post-Fukushima world, WWI, 2011

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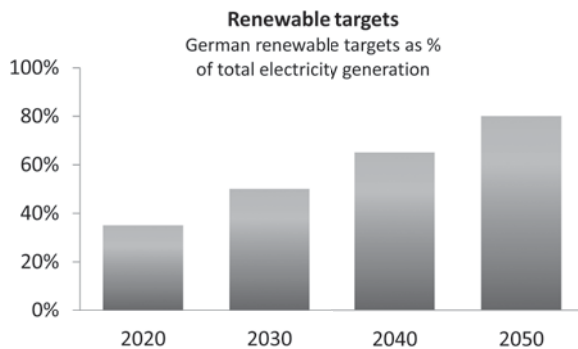
### Germany's Knee Jerk Reaction to Fukushima

German Chancellor Angela Merkel, like all politicians, has a habit of changing her mind on the country's energy direction based on what is politically expedient. A few months ago, after much debate, she granted the German nuclear operators a breather. The decision was to allow the life of the 17 existing reactors to be extended by an average of 12 years in return for extracting roughly \$43 billion from the country's 4 nuclear operators, Eon, RWE, EnBW and Vattenfall.

Following the Fukushima accident, Ms. Merkel has made an abrupt about face. First, she ordered 7 of the oldest units to be shut down for a 3-month evaluation period – many observers assume that these, plus 1 unit already out of service for repairs, would never come on line again.

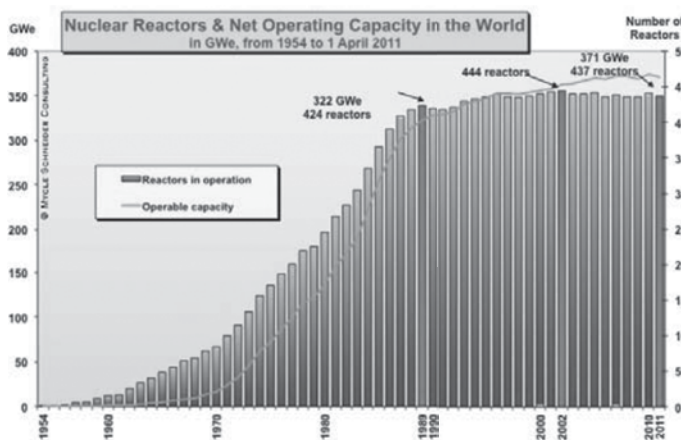
Now, an appointed commission looking into the country's future energy options is expected to propose that all 17 reactors be phased out within a decade, replaced with wind, natural gas-fired generation and coal. If approved, it would require the share of renewable energy to increase to 35% 2020, 50% by 2030, 65% by 2040, eventually approaching 80% by 2050, an astonishing target for Europe's industrial powerhouse.

There are a number of guesstimates on how much this would cost – predictions are that average retail electricity rates may have to rise by 25-30%, saddling consumers with an additional \$47 billion, disproportionately affecting businesses. One estimate puts the cost of additional investments required to fill the nuclear gap at €20 billion per year for a decade. One can only surmise that the big 4 German generators are not particularly happy about the recent turn of events.



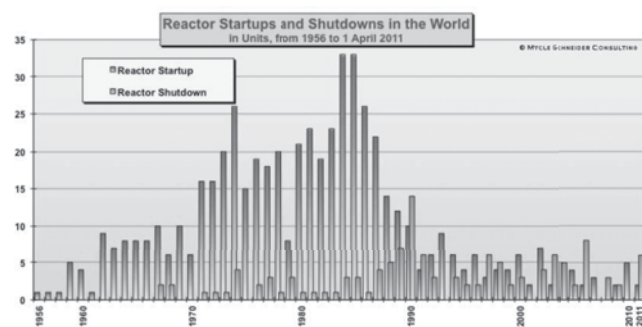
Source: German Govt. proposals

## Nuclear's Best Years Are Behind Us



Peak nuclear?  
World nuclear fleet, 1954-2011, installed capacity in GW

Source: Nuclear power in a post-Fukushima world, WWI, 2011



Not so rosy  
Nuclear reactor connections and shutdowns, 1956-2011

Source: Nuclear power in a post-Fukushima world, WWI, 2011

### And that was before Fukushima

When it rains, it pours. The nuclear power sector, never universally loved, appears to be getting more than its share of bad news these days. To top it off, a report prepared for the Worldwatch Institute (WWI) on the occasion of the 25th anniversary of the Chernobyl accident – the worst civilian nuclear accident ever experienced to date – concludes that nuclear energy's best years are already behind us.

“The (nuclear) industry was arguably on life support before Fukushima. When the history of the nuclear industry is written, Fukushima is likely to begin its final chapter,” according to Mycle Schneider, lead author of *The World Nuclear Industry Status Report 2010-2011: Nuclear Power in a Post-Fukushima World*. Perhaps slightly overstated, but only time will tell.

The global nuclear generation peak has already occurred, most likely in 2005-6. In 2009, nuclear power plants generated 2,558 TWhs of electricity, about 2% less than 2008. This, according to the Nuclear Energy Institute, industry's lobby organization, was the fourth year in a row of declining generation.

As of 2011, before the Japanese disaster struck, there were 437 nuclear reactors operating in the world, seven fewer than in 2002. At least 14 reactors have been shut down since the accident occurred in Japan and Germany alone – most are not likely to resume operations. More may follow in other countries as further stress testing is carried out.

Moreover, the WWI reports that in 2008, for the first time since the beginning of the nuclear age, no new unit was started up. In 2009-10, 7 new reactors were added while 11 were shut down.

The proponents of the industry often dreamed of a nuclear renaissance – but even the die-hard supporters are now faced with a re-assessment given the negative public perception generated by the recent Japanese accident.

The figure on right shows a slight pickup in new construction of new reactors in the past few years, mostly attributed to a massive planned build in China and India. But even in these countries, the wisdom of the planned rapid nuclear expansion may come into question. China is apparently reviewing its earlier plans, India may follow.

The overwhelming problem facing the industry, however, is the rapid aging of the existing fleet. Even assuming successful re-licensing, life-extension, and uprating – technical alterations at existing plants to increase their output – the existing fleet will eventually have to be phased out of service, sooner or later. Without a massive investment into new reactors, there is no future for nukes.

In the mean time, other developments are eclipsing the nuclear’s role as an important component of electricity generation. According to WWI, in 2010, worldwide cumulative installed capacity from wind turbines, biomass, waste-to-energy, and solar power surpassed installed nuclear capacity. Far more money is pouring into renewable energy than nuclear power – total investment in renewable energy technologies was estimated at \$243 billion in 2010. Very little money is currently flowing to new nuclear projects in Europe or America. Such trends are becoming hard to ignore.

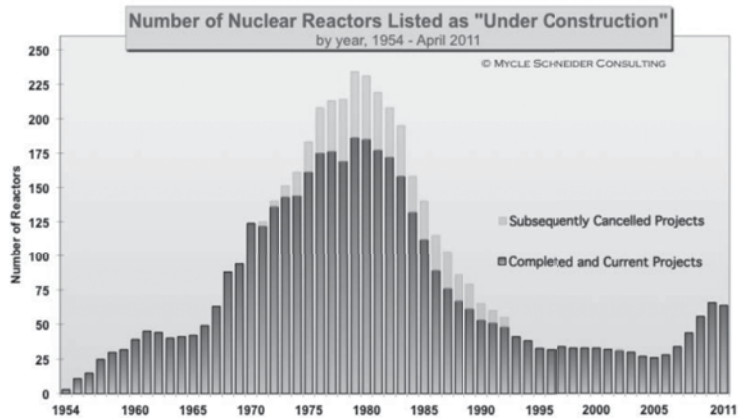
WWI points out that annual renewable capacity additions have been outpacing nuclear start-ups for 15 years. In the U.S., for example, the share of renewables in new capacity additions has increased from 2% in 2004 to 55% in 2009 and growing, with no new nuclear capacity added.

The story is pretty much the same in Europe, where natural gas and renewables will continue to dwarf nuclear’s contribution in the electricity generation sector going forward as they have during the past decade. All the talk about the nuclear renaissance – well – appears to be mostly talk.

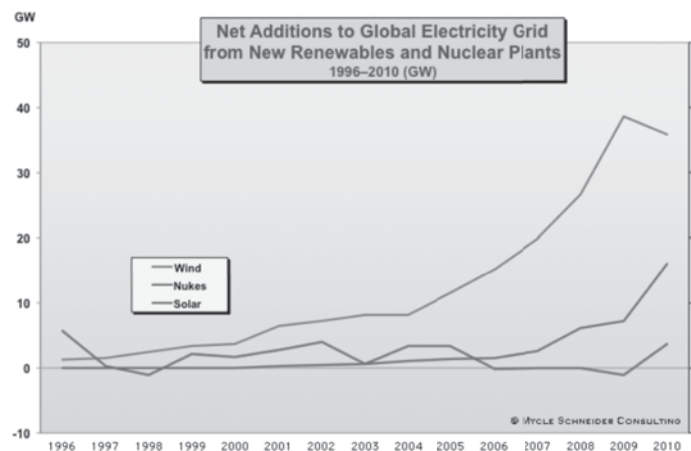
“U.S. news headlines often suggest that a nuclear renaissance is under way,” said WWI President Christopher Flavin. “This was a big overstatement even before March 11, and the disaster in Japan will inevitably cause governments and companies that were considering new nuclear units to reassess their plans.”

Mr. Flavin adds, “The Three Mile Island accident caused a wholesale reassessment of nuclear safety regulations, massively increased the cost of nuclear power, and put an end to nuclear construction in the United States. For the global nuclear industry, the Fukushima disaster is an historic—if not fatal—setback.”

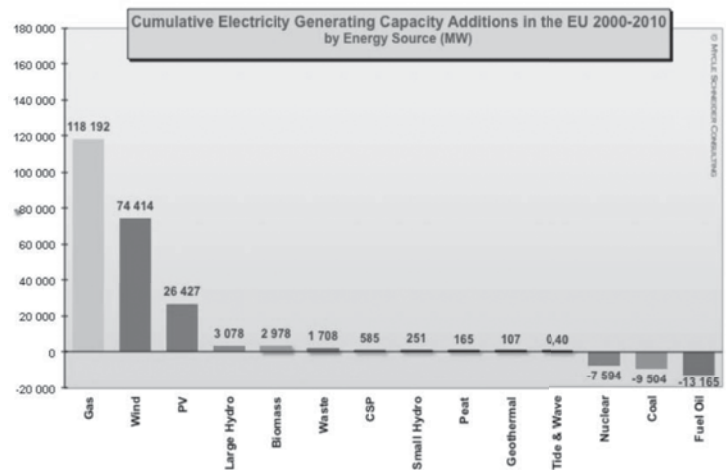
WWI may be over exaggerating slightly, but the overwhelming evidence is not pleasant news for the nuclear industry.



*Time for reassessment*  
 Number of nuclear reactors under construction  
 Source: Nuclear power in a post-Fukushima world, WWI, 2011



*Follow the money*  
 Net additions to global electricity grid from new nuclear and renewables, 1990-2010, in GW



*Do you see a nuclear renaissance here?*  
 Cumulative electricity additions in EU, by energy source, 2000-10, in MW  
 Source: Nuclear power in a post-Fukushima world, WWI, 2011