

Nuclear's Exit

By Gunter Pauli

This article introduces a creative approach to the exit of nuclear power as one of the 100 innovations that shape "The Blue Economy". This article is part of a broad effort to stimulate entrepreneurship, competitiveness and employment.

The Market

There are 442 nuclear power stations operational in 30 countries generating 375GW of energy. There are 16 nations constructing 65 nuclear plants for an additional 63GW. China is building 27 new plants, Russia 11. The United States operates with 104 the largest number of nuclear energy generators, well ahead of France (58) and Japan (48 taking the defunct plants in Fukushima into account). Some 212 plants are older than 30 years and while there is no absolute science on how long these nuclear centers are safe to operate, the German Chancellor Angela Merkel set the stage by ordering all plants older than 30 years closed indefinitely. The European Union operated in 2010 143 plants down from its peak of 177 in 1989.

The relative decline of nuclear had been cast in stone well before the Fukushima disaster. Lithuania and Italy decided to exit nuclear altogether, while Finland laments that the 1.6GW facility being built by French (AREVA) and German (Siemens) industries is now 5 years behind schedule and has a +70% cost overrun. Solely the delays impose an extra annual bill of €1.3 billion on the consumers, without providing for the increased capital costs. The latest plant ordered by Georgia Power in 2010 is budgeted at \$17 billion. The investment cost per kilo Watt hour (kWh) before March 11, 2011 was estimated at \$7,000. However the additional safety measures that will be imposed are likely to increase the cost to \$10,000 per kWh. It is said that new nuclear plants will be capable of providing base load energy at 5.9 cents per kWh. The real cost – stripping nuclear of all its subsidies, depreciation advantages, insurance protection, financing support and waste disposal arrangements is closer to 25 or even 30 cents kWh. Nuclear energy not only enjoys limited liability covered by society, nuclear on top of this is not competitive.

Therefore it is no surprise that in spite of the massive subsidies and legal protection, in 2010, installed capacity for renewables, solely covering wind (193 GW), waste to energy (65 GW), hydropower (80GW) and solar (43 GW) globally surpassed nuclear (375 GW), well before the trilogy of disasters demonstrated that the impossible does happen. Now that the Pacific and Indian Ocean rims are off-limits for any new nuclear power project, the question is how will the world go forward in its quest to generate renewable and affordable energy?

The Innovation

The Blue Economy proposes that we use what we have and that we study the competitiveness of each innovation without expecting subsidies. If in the end the subsidies are offered does not matter, the key is to succeed in the acid test: are there renewable energy solutions that are truly affordable. Over the past months I presented a portfolio of technologies through the Blue Economy Innovations program. These breakthroughs have not received much attention probably because these require a complex know-how. However if deployed as a cluster, this handful of sources of heat and electricity will redraw and strengthen the present landscape of renewable energies. The three innovations are: a) vertical wind turbines placed inside existing high voltage transmissions masts (Case 11), b) redesigning existing municipal waste water treatment (MWWT) plants to combine water treatment with organic municipal solid waste to produce biogas (Case 51), and c) the combined heat and power generation with double-sided PV wafers placed inside a recycled container equipped with tracking optics eliminating all moving parts (Case 53).

If we are serious about embarking on a renewable energy strategy without the caveat of incalculable risks related to nuclear, then we have to go beyond the present mix of solar, wind, hydro and waste to energy. Whereas these four energies spearheaded the renewables over the past three decades, we need to embrace additional opportunities that are immediate and cheaper. It is here that a creative approach to the use of existing facilities like MWWT, and pylons come into play.

Let us jointly run the numbers. If Germany were to complement 500 of its 9,600 MWWT with highly efficient biogas generators based on the Scandinavian Biogas know-how benchmarked in Ulsan, Korea, then the potential baseload supply could reach as much as 5GW at an estimated total investment cost of €10 billion. This capital expenditure is roughly 5 times lower than nuclear and the time between decision and on-stream electricity is limited to two years compared to a decade, also five times better, thus offering a much better cash flow. Biogas has a secure and predictable generation - no one doubts that organic waste and waste water will be in permanent supply - and therefore provides stability to the grid.

If in addition, Germany could install inside one third of its 150,000 high transmission masts vertical turbines designed by Wind-it (France), then it could generate another 5GW, at approximately one tenth of the cost of nuclear or €5 billion in total.

There are 1,900 landfills in Germany. If only 20 hectares at 200 of these defunct portions of the landfills were covered with the combined heat and power generators from Solarus AB (Sweden) that generate per hectare equipped with 2,000 units (100 rows of 20) 1,830 kWt and 1,360kWe, then the potential energy supply increases with another 5.44 GWe and 7.32 GWt. The heat can be used to reduce the largest consumer of electricity in households: warming up water. If the life of these panels were more than 20 years, then the cost per kWh is under one Eurocent!

The First Cash Flow

The daily demand for electricity in Germany is approximately 70 GWh with peaks of 80 GWh. Nuclear energy represents +20 percent, or about 15 GWh. The calculations above indicate that even with only a fraction of productive use of the existing infrastructure it is possible to replace all nuclear (5+5+5.4 GW). However, benchmarked analyses indicate that the cost of production for these three energy sources is at or below 2 cents per kWh. The present transfer cost in Germany for nuclear to the grid is 5.6 cents per kWh. At such low cost, financing represents no problem and considering the speed with which these systems can be installed, one can even plan the phasing out nuclear within the next 3 to 5 years, provided one involves the local decision makers in charge of operating landfills and MWWT. The unions are all in favor.

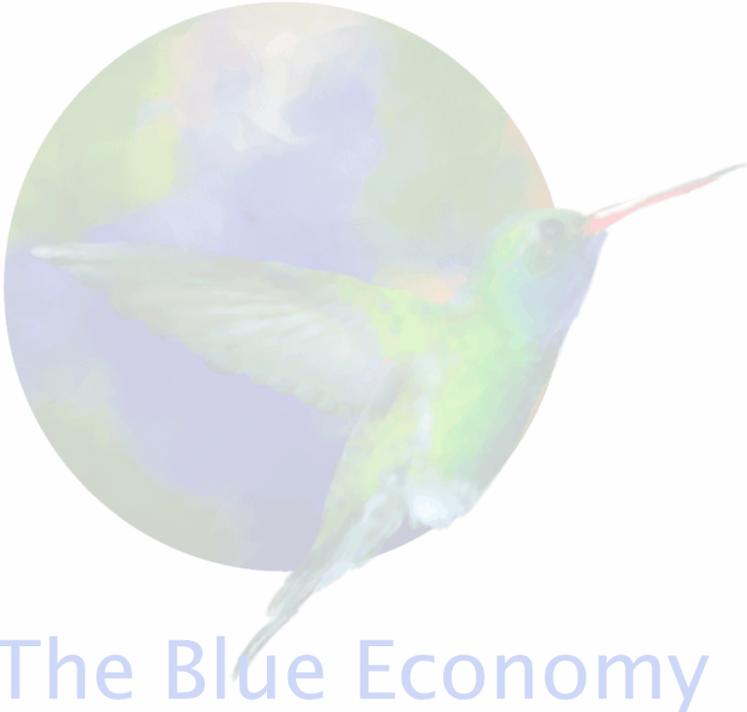
The Opportunity

The obvious additional benefit is the generation of jobs. And the three technologies retained are only a few of the broad portfolio of potential breakthroughs. Imagine that all railways and freeways were equipped with the Wind-it technology? Imagine that all major waste water plants of industrial food processing companies adopted a biogas strategy? Imagine that half of German households were to substitute electric water heating with luminescent thermosyphons, reducing household consumption with 15 percent? Germany which is already a world leader in the export of green technologies, could now even position itself as the world's largest exporter of green energy, strengthening its metal, machinery and renewable energy sector which relies on a strong tissue of middle sized companies. However, the most powerful shift in the design of an exit strategy for nuclear is that the price difference between 2 and 5.6 cents (3.6 cents per kWh) for the 15 GW of nuclear to be replaced, accumulates each year into approximately €4.7 billion. This cash flow, generated by the system thanks to the efficiencies possible by smartly exploiting an available infrastructure with simple technologies could be sufficient to finance the exit of nuclear and the financing of the additional capital requirements over a 10 year period.

Now that it seems that the cash is available, a consensus could emerge whereby energy companies and the communities with a large exposure to investments in nuclear power could be provided an exit based on the net present value of their assets - and actually get a pre-agreed payment for discontinuing nuclear energy. And while the forced closure of the oldest plants already knocked 20-25 percent of their value and the present uncertainty is likely to cause a further downward pressure on their shares (TEPCO – the owner of the Fukushima nuclear power stations already lost 75 percent of its market capitalization), it would not be difficult for financial engineers to come up with a package solution that permits the exit from nuclear through a win-win strategy, simple broadening the benefits for all, reducing risk and embracing innovations that are mature for implementation.

Subsequently, Germany could even become the world's financial hub, financing the exit of nuclear based on consensus and cash flow. This is the ultimate objective of the Blue Economy: respond to the basic needs of all with what we have, offer the necessary products and services that are good for your health and the environment at a lower cost, while building up social capital. It seems like we see how this can be achieved – quicker than we ever thought.

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The Blue Economy

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... Further information on the 100 innovations at www.theblueeconomy.org

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