Fire Ice

After Fukushima, Japan has a promising – and dangerous – new source of energy

by Ascanio Vitale

Throughout history, Japan has proven its ability to quickly get back on its feet after natural catastrophes or the devastation of war. With the Fukushima wound still festering, the government has had to tackle the difficult task of radically changing the country's energy profile.

Pushed by public opinion – 75% of the population supports permanently closing Japan's 54 nuclear power plants – the government has launched a very broad plan to diversify the country's main energy sources. The key obstacle is how to juggle the growing cost of fossil fuels, on which the country is almost totally reliant, with the need to cover an additional 23% of national electricity consumption that had been produced by nuclear power until the Fukushima meltdown in 2011.

Japan is the world's biggest gas importer. The collapse of the yen on international markets and the close links between gas and oil price fluctuations have had a serious impact on the national budget, which as a consequence is on the rise. Abruptly taking almost all the country's nuclear power plants offline for inspections has meant that the current percentage of the country's supplies dependent on oil, coal and gas has risen to 90.6%.

Japan is faced with a tough challenge: it must restructure its entire power generation system in just a few years, while containing costs in an unfavourable economic climate and guaranteeing low utility prices and safe supply lines – all essential conditions for the country's future economic development.

One area in which the government has invested heavily is methane hydrates, namely gas reserves trapped in water-ice systems. These frozen gas formations are often located just below the seabed near continental fault lines.

As far back as the 1990s, research on methane hydrates had already proven its enor-

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↑ Staff of the Tokyo Electric Power Co. After the Fukushima nuclear disaster, the Japanese government has had to drastically review the country's energy profile.

mous potential, since the quantity of carbon contained in these compounds is estimated to provide more energy than the planet's oil, gas and other hydrocarbon reserves combined.

Like many extraction technologies, the first step is to localise and assess potential reserves, before testing to come up with an operating procedure and design the necessary infrastructure. This is a very long-term project, in which Japan alone will invest $700 million in research.

Even Russia has invested in this area, particularly over the last decade, in light of the imminent decline of its oil production, which the International Energy Agency (IEA) predicts may begin in 2015. In contrast, Canada and the US have recently stopped investing in methane hydrate to concentrate on new techniques for extracting shale gas, which is seen as more promising and competitive.

In actual fact, during the last 20 years of research on hydrates, little more than four million cubic metres of gas have been produced at a cost 3,000 times the market value, without any guarantee of the energy source's actual economic competitiveness in the medium term. This is because the great potential for extraction has been accompanied by technical problems that have even been flagged by the US Defence Department and many other international research organisations.

The most worrying issue is the instability of methane hydrate deposits, whose dynamics are still unknown. The most hair-raising scenario is the possibility of unwittingly causing the uncontrolled release of high pressure gas.

Last August, the discovery of an enormous methane release from the seabed off the coast of Spitsbergen, in Norway, has shown these deposits are sensitive to minor changes in temperature (presumably because the frozen gas starts to melt). A mere 1°C increase in the temperature of the Arctic Sea over the last 30 years is apparently triggering events that could drastically accelerate climate change. Research by Cambridge University and the Erasmus University in Holland, recently published in *Nature* magazine, assessed that the economic damage of a potential – albeit hypothetical – release of 50 billion tons of methane from the Eastern Siberian Sea would be an estimated $60,000 billion (€44,260 bln).

Concerns about extraction activities are further compounded by underwater landslides that might ensue, plus damage due to earthquakes, which are particularly frequent in Japanese waters. These doubts have also been raised by the state Japan Oil, Gas and Metals National Corporation (JOGMEC).

Unfortunately, Japan's energy policy contains little provision for renewables and fails to exploit potential energy savings covering over 25% of national requirements.

Studies published in the last two years show that offshore generation alone – from wind, wave and tidal power – could help Japan cover 30% of its energy requirements in just 10 years, for half the investment and with stable energy costs.

Apart from a few virtuous examples of renewable installations built in record time, such as the wind farm off the coast of Fukushima province, the Japanese government has so far neglected its committments, focusing instead on stabilising the cost of imported energy supplies.

On the increasingly treacherous path of international climate change negotiations, the future energy supply scenario still has many unknowns. This is particularly true for potentially unstable methane deposits, since this is a 'greenhouse gas' with a global warming potential 21 times that of carbon dioxide (CO2) over the next hundred years, according to a UN climate change working group.

Ascanio Vitale *is an aerospace and electronic engineer. A campaigner for Greenpeace and the WWF, he is the Director of Stop* CO_2 *in London.*