

NEWS IN FOCUS

GENETICS Halfway mark for 1,001 *Arabidopsis* genome project **p.14**



PHYSICS Rare-isotope facility gets a boost from hard times **p.15**

SPACE SCIENCE Duo of probes set to dance through lunar gravity **p.16**

NEUROSCIENCE Brain scans challenge the concept of free will **p.23**

H. YAMAGUCHI/CORBIS



Yoshihiko Noda is Japan's sixth prime minister in five years, replacing Naoto Kan after his resignation.

ENERGY

Japan's new leader faces energy gap

Power policy remains in flux.

BY DAVID CYRANOSKI IN TOKYO

Yoshihiko Noda, Japan's new prime minister, has a daunting in-tray to deal with: a faltering economy, a huge reconstruction effort following the devastating earthquake and tsunami in March, and an ongoing nuclear emergency at the Fukushima Daiichi power plant. Elected on 29 August after Naoto Kan's resignation last week as leader of the ruling Democratic Party of Japan,

Noda must also contend with the threat of a complete vacuum where the country's energy policy should be.

After the Fukushima disaster, Kan vowed to "leave nuclear energy behind", but made no clear plans to fill the energy gap. And neither Noda nor the other leadership contenders articulated a clear position on energy during the brief election campaign. When pressed on the issue, they steered clear of strong statements about the future of nuclear power or how they would

keep the lights on in its absence. "We have no energy policy," says Tatsuo Oyama, who studies investment in power utilities at the National Graduate Institute for Policy Studies in Tokyo. "It's a serious issue that Noda has to deal with."



WWW.NATURE.COM/JAPANQUAKE

Last year, Japan committed to constructing 14 new reactors so that nuclear power would provide half of the country's electricity by 2030. But after the accident at Fukushima, public mistrust of the technology prompted Kan to ditch the plan. He also ordered existing reactors to be taken offline for a series of stress tests, in addition to normal inspections. All but one of the country's 54 existing reactors are set to be shut down by May 2012, removing a quarter of Japan's power capacity. Restarting them would require approval from local governments, which they may be reluctant to grant.

Kan had promised that renewables and efficiency measures would make up the shortfall, but did not explicitly say how. "He made a change but he did it without debate and without a road map," says Tsutomu Toichi, an energy specialist at the Japanese Institute of Energy Economics in Tokyo. "It was very abrupt."

The short-term consequence has been a jump in the use of fossil fuels, including an estimated 20% increase in imports of expensive liquefied natural gas. Toichi says that there could be a 20% increase in the cost of producing electricity in 2012 if nuclear reactors are shut down as expected, probably leading to higher rates for consumers. This week, the Tokyo Electric Power Company announced that it is considering a 10% hike in next year's electricity rate. Citizens' willingness to economize has trimmed power demand in Japan, but Oyama believes that the sagging economy has also reduced electricity consumption. Hiromasa Yonekura — chairman of Sumitomo Chemical, headquartered in Tokyo and Osaka, and head of the powerful Japan Business Federation (Keidanren) — has repeatedly warned that high prices could force companies to move operations overseas.

To prevent this, Toichi says that the new government must get the nuclear plants back online as soon as possible. Despite public opposition, Noda has hinted that nuclear will continue to make up part of Japan's energy ▶

► mix, and industry minister Banri Kaieda announced for the first time this week that he expects some reactors to restart this year.

That would be a step in the wrong direction, says Tetsunari Iida, director of the Tokyo-based Institute for Sustainable Energy Policies, who wants the country to seize the opportunity to invest in renewable energy.

On 12 September, Iida will launch the Japan Renewable Energy Foundation, which is backed by ¥1 billion (US\$13 million) from Japan's richest man, telecoms mogul Masayoshi Son. The foundation will bring together some 100 experts from around the world to analyse obstacles to implementing renewable energy, and offer policy recommendations to the new government.

The foundation's cause did get a boost from Kan, who had agreed to step down only if Japan's parliament passed a bill to support clean energy. The bill, which passed on 26 August, will next year guarantee a minimum price for wind, solar and other renewable energies that will make them more attractive for suppliers to invest in.

Iida is confident that this will help to sustain the shift away from conventional power sources. He notes that, from 2008 to 2010, Japan's annual increase in solar-power capacity jumped from 230 megawatts to almost 1 gigawatt, giving the country a total capacity of 3.6 gigawatts. He believes that the renewables bill will make huge solar farms economically attractive for the first time. "I think next year we'll see a tenfold jump in solar and fivefold in wind," he predicts. Many say that this is unrealistic. "It's impossible within two years, and too ambitious within ten," says Toichi.

A bill on global warming could also boost renewables by preventing Japan from filling its energy gap with fossil fuels. But the bill's prospects are dim, even though its aim — a legally binding target to reduce greenhouse-gas emissions to 25% below 1990 levels — was once a cornerstone of the Democratic Party's manifesto. "Because of the reduction in our reliance on nuclear power, it will be very difficult" to hit that target, says Toichi.

Japan's parliament has so far declined to consider the bill, and political support for it is waning rapidly. "The new majority position [within the Democratic Party] is to get rid of the 25% target," says Iida.

Yet despite the uncertainties that now cloud Japan's future, Kan's administration did at least deliver one clear achievement on energy policy, says Iida. "There is now a broad consensus that we need to reduce our reliance on nuclear power. That is the atmosphere now." ■



D. WEIGEL

Variation among *Arabidopsis* strains can reflect genetic adaptation to their local habitat.

GENOMICS

Halfway point for 1,001 genomes quest

Plant researchers map diversity of Arabidopsis thaliana.

BY HEIDI LEDFORD

Joseph Ecker's teenage son listened intently as his father told him about the 1000 Genomes Project, which aims to sequence and compare the genomes of 1,000 people. Ecker, a molecular geneticist, explained that he and his colleagues were launching a similar project for the plant *Arabidopsis thaliana*. "My son said, 'Well then you should sequence 1,001,'" Ecker recalls. "He's a very competitive kid."

And so the *Arabidopsis* '1001 Genome Project' was born. More than four years later, a loose confederation of laboratories is on the verge of making that challenge a reality. Papers published online in *Nature*¹ and *Nature Genetics*² this week report the sequencing of nearly 100 *A. thaliana* genomes, the first swathe released by the project; around 400 more have been sequenced, but are not yet ready for publication. Last week, Ecker's group at the Salk Institute in La Jolla, California, won a US\$2-million grant from the National Science Foundation (NSF) to polish off another 500 strains, and to catalogue expressed RNAs and map DNA methylation, a chemical modification that affects gene expression.

Arabidopsis thaliana, or thale cress, is a small weed with a simple genome that stands in as a genetic reference for plants with more complex genomes. The genome project aims to uncover genetic changes that enable plants to adapt to their local environments. There are thousands of strains of *A. thaliana* in stocks worldwide, each of which might carry unique traits that helped it to thrive in its natural environment — tolerance for drought, perhaps, or defences against viral pathogens. "If you learn which genes are important for these traits, you could

breed them into crops — to allow them to move into a new environment or continue to succeed where they face climate change," Ecker says.

The mining of natural variation for genetic information has gained momentum as faster DNA sequencing has delivered multiple genomes from wild populations. Similar projects are under way in mice, fruitflies, rice and, of course, humans. "If you go into nature, you find all these fascinating mutations that have survived the sieve of natural selection," says geneticist Trudy Mackay of North Carolina State University in Raleigh, who leads the work in fruitflies. "But in the past we've been hampered in our ability to tease them apart."

The 1001 Genome Project has had some problems, however. Unable to get funding for a single project, participating labs went their own ways, getting grants from a variety of sources, says Detlef Weigel, a plant biologist at the Max Planck Institute for Developmental Biology in Tübingen, Germany, who has spearheaded the project. The result was a fragmented effort, with each group sequencing strains and using techniques that best fitted its own research.

And Ecker frets that this ad hoc coalition won't even have a central place to deposit and organize its data. *Arabidopsis* researchers have relied on The Arabidopsis Information Resource (TAIR), but NSF funding for that project is being phased out and its fate is unclear. "We don't want to have these data scattered all over the place," says Ecker, "but there may be nowhere to put them." ■

1. Gan, X. *et al.* *Nature* <http://dx.doi.org/10.1038/nature10414> (2011).
2. Cao, J. *et al.* *Nature Genet.* <http://dx.doi.org/10.1038/ng.911> (2011).