

DEVASTATION IN JAPAN

Nuclear Power's Global Fallout

The crisis at the Fukushima Daiichi nuclear power plant, like the accidents at Three Mile Island and Chernobyl, is prompting countries around the world to reassess the safety of their plants and their nuclear aspirations. The map on this page provides a snapshot of the number of nuclear reactors in operation (dark blue) and under construction (green), locations of power plants in relation to seismic hazard zones, and reactions to events in Japan in some countries. The following pages examine what we have learned about radiation risks from previous exposures (p. 1504), improvements in safety since the boiling water designs at Fukushima (p. 1506), what to do with the wrecked reactors (p. 1507), and damage to research facilities from the earthquake (p. 1509).

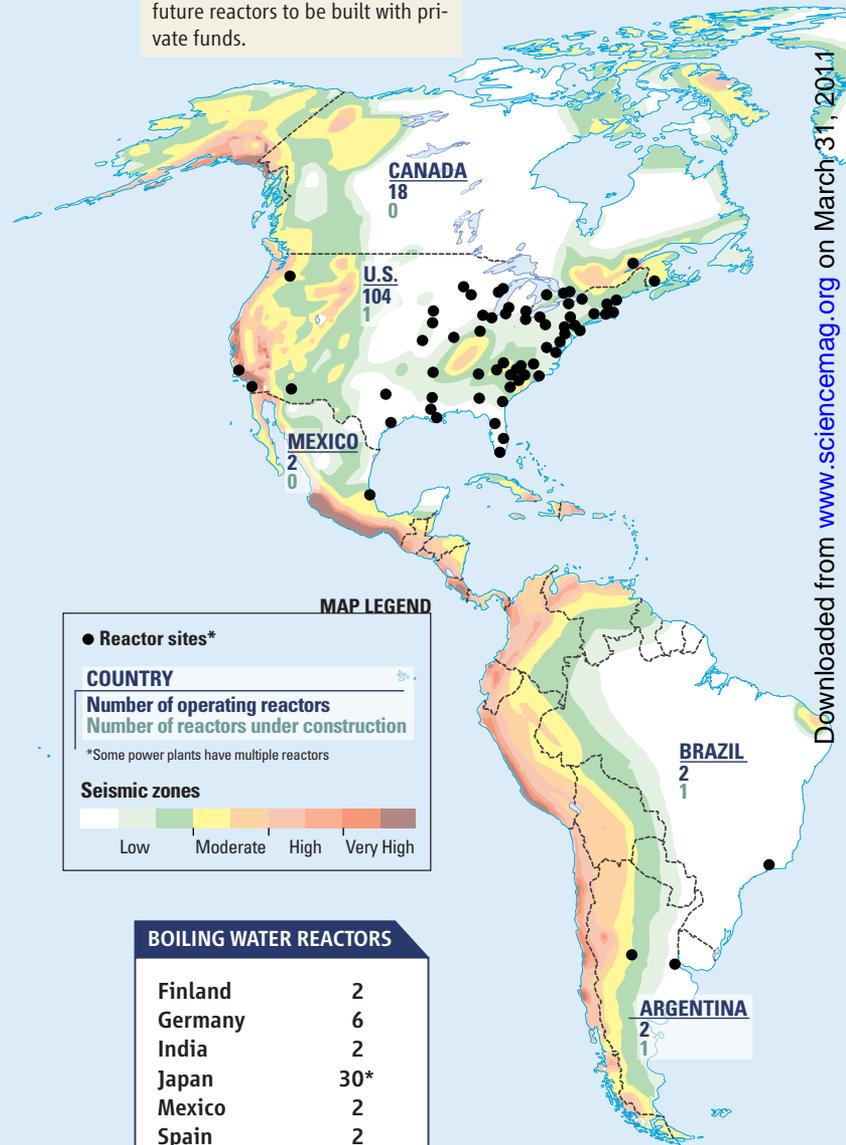
—NEWS STAFF

FRANCE

The French government has promised a safety audit of the country's 58 nuclear reactors. But the government has made clear that nuclear energy will remain the cornerstone of France's 40-year-old policy of energy independence and has rejected calls for a referendum on atomic energy. France generates over 75% of its electricity with nuclear power, more than any other country in the world.

UNITED KINGDOM

The government has asked its chief nuclear inspector to compile a report on the implications of the Fukushima accident for Britain's current and future nuclear plants. Energy and climate change secretary Chris Huhne said: "We should not rush to judgment. It is important that we have the full facts at our disposal." Current policy is for future reactors to be built with private funds.



UNITED STATES

The United States is the world's largest producer of nuclear power, but no new reactor has been built there for 3 decades. The Nuclear Regulatory Commission has ordered a safety review of the 104 existing U.S. plants, some of which are in seismically active areas. The Obama Administration has proposed expanding nuclear capacity largely by stimulating new construction with loan guarantees; opposition to that plan is likely to strengthen.

BRAZIL

Mines and Energy Minister Edison Lobão said Brazil's federal government will review security at the country's twin nuclear reactors at Angra and halt construction of a third, due to go on line in 2015, until the review is completed. The Fukushima crisis has renewed calls to create an independent regulatory agency for nuclear power in Brazil.

ARGENTINA

Events in Japan have reopened debate over Argentina's aging reactors. Its oldest plant dates to 1974, and another has been under construction since 1981 but is not yet complete. Critics call it a "Model T."

MAP LEGEND

- Reactor sites*

COUNTRY

- Number of operating reactors
- Number of reactors under construction

*Some power plants have multiple reactors

Seismic zones

Low Moderate High Very High

BOILING WATER REACTORS

Finland	2
Germany	6
India	2
Japan	30*
Mexico	2
Spain	2
Sweden	7
Switzerland	2
Taiwan	4
United States	35

*4 are advanced boiling water reactors

MAP SOURCE: GLOBAL SEISMIC HAZARD ASSESSMENT PROGRAM; REACTOR TOTALS: EUROPEAN NUCLEAR SOCIETY; BOILING WATER REACTOR TABLE: IAEA

Downloaded from www.sciencemag.org on March 31, 2011

GERMANY

Chancellor Angela Merkel suspended for 3 months a newly enacted law that postponed Germany's planned phase out of nuclear power. Several older reactors, which got a reprieve under the law, are now being shut down, and some are unlikely to come back on line. During the 3-month moratorium, the government will reassess the safety of all 17 reactors and is expected to propose amendments to the new law in accordance with the findings.

BELGIUM

The Belgian government decided in 2003 to phase out the country's seven nuclear reactors, which produce half of Belgium's electricity. But the first phase, shutting the three oldest reactors by 2015, was recently pushed back 10 years. Environmental groups hope the Fukushima disaster will swing the pendulum back in their direction.

SWITZERLAND

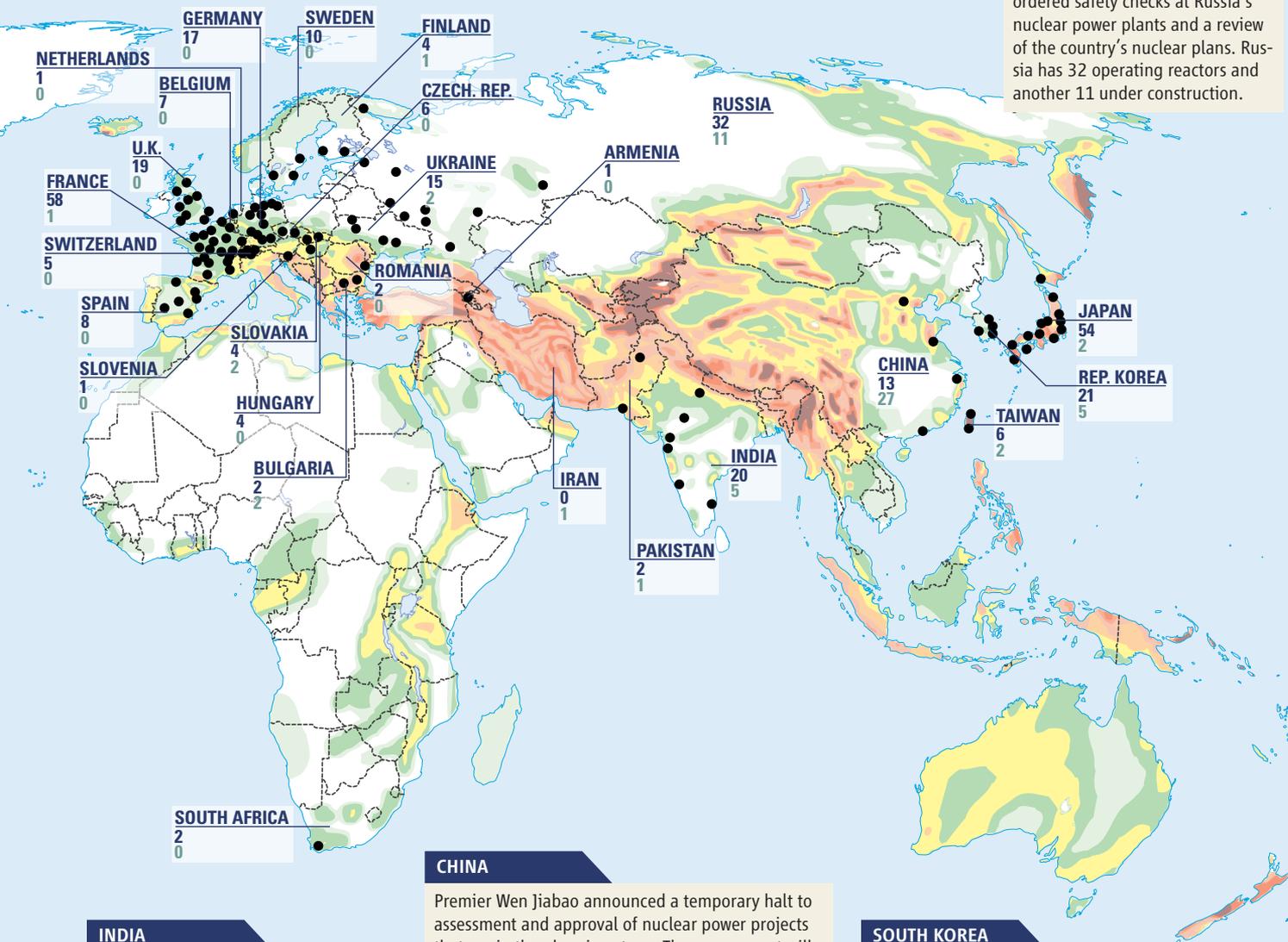
Switzerland generates 40% of its electricity with its five nuclear reactors. Last week, the government suspended feasibility studies for three potential reactors, and politicians across the political spectrum have spoken in favor of a nuclear power phaseout, though most have been vague about a timeline.

ITALY

A 1987 referendum, influenced by the Chernobyl disaster, led to Italy shutting down its four nuclear power plants between 1987 and 1990. Silvio Berlusconi's government has supported plans to build at least four new reactors, starting in 2013. A referendum this spring could block those plans.

RUSSIA

Prime Minister Vladimir Putin ordered safety checks at Russia's nuclear power plants and a review of the country's nuclear plans. Russia has 32 operating reactors and another 11 under construction.



INDIA

Prime Minister Manmohan Singh ordered a safety review of India's 20 operating nuclear reactors. In an interview with *Science*, Srikumar Banerjee, chair of India's Atomic Energy Commission, said no shutdowns are planned. India has five plants under construction and aims to produce 25% of its electricity from nuclear power by 2050.

CHINA

Premier Wen Jiabao announced a temporary halt to assessment and approval of nuclear power projects that are in the planning stage. The government will conduct a comprehensive review of all nuclear facilities, draw up nuclear safety regulations, and adjust its 15-year nuclear power-development plan. China has the world's most ambitious nuclear power program, with 13 reactors in commercial operation, 27 under construction, and as many as 50 more in the pipeline. The temporary halt applies only to projects yet to be approved; China's growing reliance on nuclear power is expected to continue.

SOUTH KOREA

South Korean President Lee Myung-bak ordered safety reviews of the country's nuclear reactors as well as procedures for handling emergencies. The country's 21st nuclear reactor started commercial power production at the end of February, another five reactors are under construction, and further expansion is planned. Knowledge Economy Minister Choi Joong-kyung said now is not the time to review the country's nuclear power policy.