Would the world be better off without nuclear power?

A debate on www.economist.com by Amory Lovins

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For four decades we have known modern energy systems could threaten civilisation in two ways—climate change and nuclear proliferation—so we must reject both fates, not trade one for the other.

New nuclear build worsens both problems. It provides do-it-yourself bomb kits in civilian disguise. It reduces and retards climate protection by saving 2-10 times less carbon per dollar—and 20-40 times slower—than superior low- and no-carbon competitors. But taking economics seriously and buying those cheaper options instead can protect climate, peace and profits.

Nuclear enthusiasm pervades powerful bureaucracies from Beijing to London and Tokyo to Washington, so 65 nuclear plants were under construction worldwide at the end of 2010. Twelve had been so listed for over 20 years, 45 had no official start-up date, most were late, 50 were in four untransparent power systems (25 in China, 25 in India, Russia and South Korea), all 65 were bought by central planners, and not one was a free-market purchase fairly competed against or compared with alternatives.

In contrast, renewables rule the marketplace, providing half the world's new generating capacity in 2008-09 and 55% in America in 2009 (compared with 2% in 2004). But while wind and solar boom, nuclear and coal orders wither. Their cost and risk dissuade investors.

New American nuclear plants are 100% or more subsidised, but cannot raise private capital because they have no business case—just four daunting risks.

First, the Fukushima accident just vaporised the balance sheet of the world's fourth-largest power company. A 2007 earthquake had cost TEPCO perhaps $20 billion; this one could cost it over $100 billion. And with such an unforgiving technology, accidents anywhere are accidents everywhere.

Next, ways to save electricity are getting better and cheaper, flattening OECD and slackening global demand growth: integrative design even offers expanding not diminishing returns. “Negawatts” are China's top development priority.

Third, atrophied skills, overstretched supply chains and sheer complexity keep nuclear capital expenditure soaring. The last American nuclear binge's threefold cost overruns devastated utilities' balance sheets: only 41% of ordered plants were built and survive. In the past five years, estimated capital expenditure for new build rose three-eightfold. No country has demonstrated a nuclear learning curve. Even France's last plant was 3.5 times more costly and nearly twice as slow as its first. France's new Finnish plant is nearing twice its planned cost and duration; its French sister station also disappoints.

Finally, innovation and mass production, not giant units, make nuclear power's renewable competitors inexorably cheaper: wind turbines by one-fifth since 2007 (and now beat new nuclear costs two-threefold), and solar by half with another 10-25% drop expected this year. No wonder “micropower”—CHP (combined heat and power) plus renewables minus big hydro—made 91% of the world's new electricity in 2008.

In 2010 all renewables excluding big hydro got $151 billion of global private investment (nuclear got none) and surpassed nuclear power's total global installed capacity. By 2014 they will exceed its output. Just one new solar power plant, buildable sooner than one new reactor, would outproduce and outcompete all 65 under-construction reactors.

But doesn't the variability of wind and solar disqualify them as unreliable? Quite the contrary.

All power plants fail. When nuclear or coal plants fail—6-7% of the time without warning and another 4-7% predictably—1 billion watts vanish in milliseconds, often for weeks or months. Physics makes suddenly stopped nuclear plants hard to restart: when nine plunged from 100% to 0% output in the 2003 north-east America blackout, they were idled for days and took a fortnight to restore fully.

Fortunately, utility engineers have cleverly designed the grid so all these intermittent (unpredictably failing) power stations back each other up. Variable renewables can do the same but fail more gracefully. Achieving equal or better reliability even with 80-90% variable renewables takes four steps: diversify wind and solar by

location (seeing different weather) and by type (responding differently); forecast them; add renewables dispatchable at need (small hydro, geothermal, biomass/waste, solar-thermal-electric, etc); and integrate them with flexible demand and supply. Four German states' 2010 electricity was thus 43-52% wind-powered. Denmark is one-fifth wind-powered and has Europe's most reliable electricity at its lowest pre-tax prices.

Computing no longer needs mainframes; electricity no longer needs giant plants. A diverse portfolio of mass-produced generators networked in microgrids can be as resilient as the internet, so the Pentagon prefers them. Onsite and local generation even bypass the 98-99% of power failures that originate in the grid.

China is now number one in five renewable technologies and aims to be so in all. Thanks to private enterprise, China passed its 2020 wind-power target in 2010 and India has more wind power than nuclear power. China's 2006 renewables (excepting big hydro) had seven times nuclear's capacity and were growing seven times faster; by 2010 that gap had widened despite the world's most ambitious nuclear programme.

New nuclear build is uneconomic and unnecessary, so we need not debate whether it is also proliferative and dangerous. In a world of fallible and malicious people, it is actually both, but even after 60 years' immense subsidies and devoted effort, nuclear power still cannot clear the first two hurdles—competitiveness and need. End of story.