The murky costs of nuclear power

BY DANIEL SARAGA

It's cheap, say proponents, but is that really so? In the U.S., banks are keeping their distance because the financial risks are too high.

What is the real cost of nuclear power? Even Christoph Frei, Secretary General of the World Energy Council, conceded during an interview with Reflex in May 2011 that he couldn't provide a simple answer.

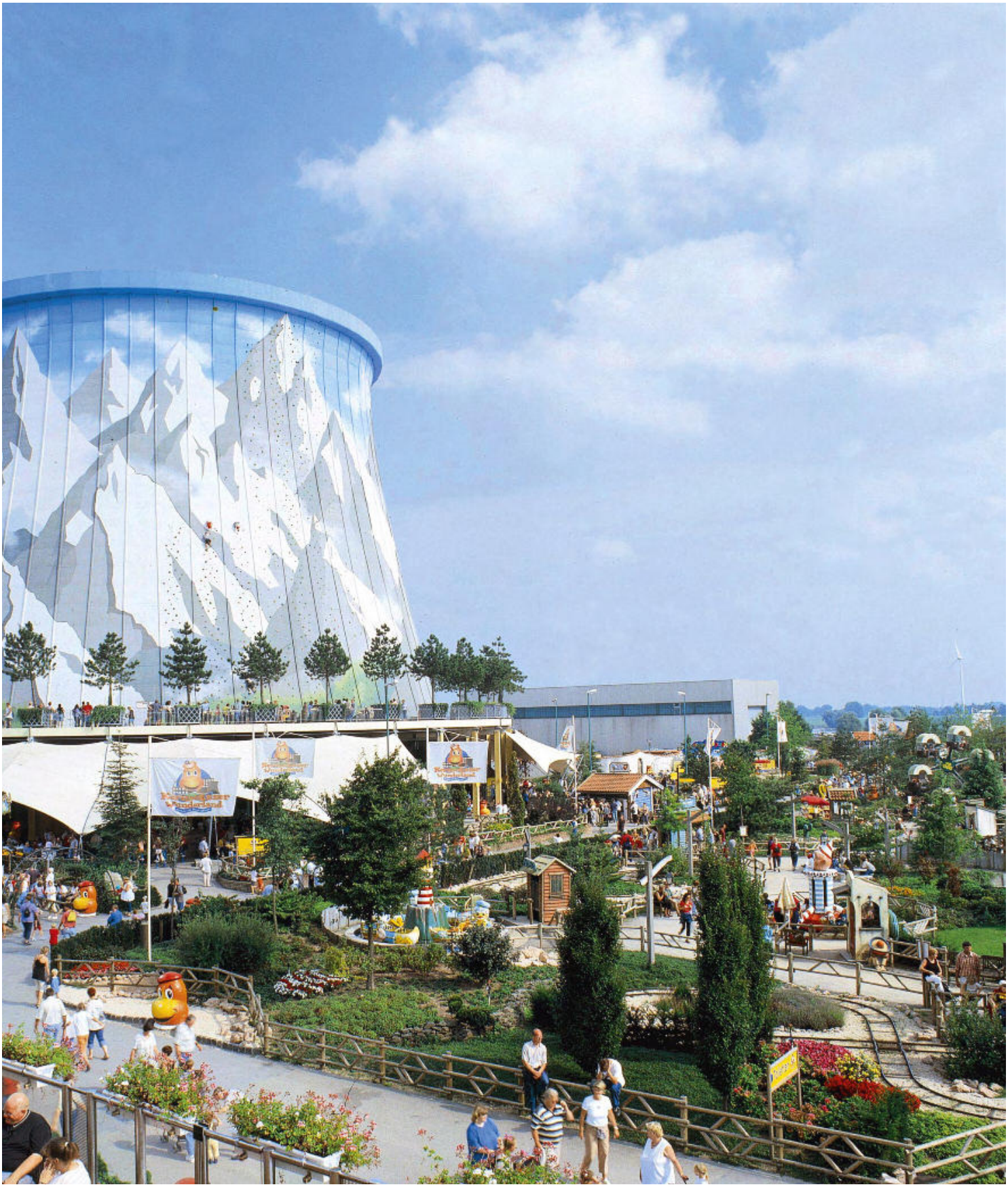
The first problem is that estimates vary as widely as opinions on nuclear power, and judging the neutrality of the analyses is hardly an easy task. One of the most detailed studies is by Geoffrey Rothwell, a senior lecturer in public policy at Stanford University, who puts the cost at 6.4 to 9.6 cents per kilowatt-hour. He doesn't hide the fact that he "grew up nuclear" – his father worked in the nuclear power industry and the mascot of his high school, in the city that produced the plutonium used in the bomb dropped on Nagasaki, was an atomic bomb. Another detailed study, by Craig Severance, an accountant specializing in energy, comes up with a price of 25-30 ¢/kWh. Judging from his emphasis on the drawbacks of nuclear power, one can only assume that he is an ideological opponent.

In the meantime, prices are rising. The bulletin of the International Atomic Energy Agency cited 0.9 ¢/kWh in 1985, 1.9 ¢/kWh in 2000 and 2.7-11.2 ¢/kWh in 2007.

The various analyses agree on at least one thing: two factors radically influence the price of nuclear power: construction costs and financial costs. Together, these account for nearly three-quarters of the final price. One might think the price was influenced by the cost of decommissioning plants or insuring against potential accidents, but the former is negligible and the latter neglected (see box).

CONSTRUCTION GETS BOGGED DOWN

Even construction costs are hotly debated, with estimates ranging



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Built between 1972 and 1985 for 7 billion deutschemarks, the Kalkar nuclear power plant never went into production because of antinuclear protests. In 1995, this 4th generation power plant was transformed into the "Wunderland Kalkar" theme park.

INA FASSBENDER / REUTERS

An amusement park ride was installed inside the cooling tower of the Kalkar nuclear station, which never went into use.

The insignificant cost of decommissioning

"We don't have any idea what the true price of decommissioning a nuclear power plant is," warns University of Greenwich professor Stephen Thomas. "The number of installations that have been completely dismantled can be counted on one hand." The numbers from these rare examples are staggering: $635 million for the Yankee reactor in Maine, built in 1972 for $180 million ($810 million in 2004 dollars), $820 million for the Yankee in Connecticut. Decommissioning a reactor can cost nearly as much as building it in the first place.

Other cases involve research reactors that are 10 times less powerful than commercial installations, such as the Siloé reactor in Grenoble (estimated at $240 million, see Reflex, May 2011). These costs could come down with experience, particularly since the more recent reactors are designed with future decommissioning in mind. But it will still be expensive: the British Nuclear Decommissioning Authority estimates that cleaning up the country's 19 reactor sites will cost at least £70 billion. According to Stanford expert Geoffrey Rothwell, an amount equivalent to one-third of construction costs should be set aside for decommissioning.

Paradoxically, these exorbitant amounts affect the price per kWh only marginally because they involve work that will be done in the distant future. The sums set aside for decommissioning are small when they're put into a current budget because of the phenomenon of "actualization" familiar to financiers. Explains Thomas: "At a theoretical annual interest rate of 3%, $50 million invested today will be enough to generate the $1 billion that will be required to decommission a reactor in 100 years." Nuclear-waste storage follows the same logic, also becoming a negligible factor on a purely financial basis.

"It may be good news from a financing point of view, but it's less rosy for the society that will have to do the work and pay the bill if the money hasn't been set aside," adds Thomas, since reality doesn't always mesh with theory. "Funding for these future costs was a total failure in England. The money put aside was not isolated during the first decades and was badly invested by the electricity suppliers. There's almost nothing left today. Asking a company to set money aside for a whole century is clearly a huge gamble."

from $2,000 to $7,000 per kW of installed power. In Europe, the new EPR reactors (see box) are not encouraging: the one currently being built in Flamanville, France, will cost at least €6 billion, as opposed to the €3.3 billion originally estimated. It will not go online in 2012 as forecast, but in 2016. Its brother in Olikiluto, Finland, may start up in 2013, four years behind schedule and €2.6 billion over budget. "These plants are too big, they're real monstrosities," sighs Rothwell. "In Finland, the construction has even gotten bogged down in the permafrost that's melting because of global warming."

Overruns end up being borne by the public

For Stephen Thomas, an expert in the economics of nuclear power at the University of Greenwich (UK), any estimate of a new project under $6,000 dollars per kW is suspect. "We've never built a generation III+ reactor and we don't yet know how much they cost." Budget overruns are common in the nuclear industry: the 75 plants built in the U.S. during the 1960s and 1970s overran their budgets by factors of three to five, according to the U.S. Energy Information Administration. No wonder nearly 100 reactor projects have been canceled in the U.S.

Construction delays don't only dramatically increase basic costs, but they also affect the cost of financing. This is because the huge sums that must be borrowed are tied up for years before revenues can produce any returns. At annual lending rates of 5% to 15%, financing adds another 13% to 40% to the building cost (see infographic).

UNINTERESTED BANKS

The economic viability of a new nuclear plant strongly depends on interest rates, which are in turn influenced by how financial markets judge a project's uncertainties. Currently the atmosphere is pessimistic. In 2009 the rating agency Moody's considered taking an "even more negative" view of an investment in a new nuclear power plant in the U.S. Despite the prevalent view a decade ago that nuclear energy would make a comeback, only two US projects now have any chance of completion.

Surprisingly, banks are not all that worried about political uncertainties, such as anti-nuclear protests and increases in accident insurance, or in such technological issues as the cost of decommissioning. Nuclear power's enemy number one is natural gas, according to Rothwell: "The market price of electricity is determined by that of gas, which is so volatile that it's impossible to know how much a kWh will cost in a given year. It's too much of a risk for the banks." Thomas concurs: In a free market, financial institutions are not interested in investing in this kind of energy. In fact, nuclear is viable only where markets are regulated or prices are guaranteed by the state. In both cases, overruns end up being borne by the public. A technological marvel for some, a total mistake for others, nuclear power is above all a political paradox: it has been supported for decades by free-marketers, but it is viable only with state regulation. ■

Financing: theoretical optimism

In Switzerland electricity from a new nuclear power station will cost 6-7 centimes per kWh, according to the Paul Scherrer Institute, and 6-9 centimes according to BKW, a major electricity producer. These numbers are similar to those estimated for the U.S. by Stanford energy policy expert Geoffrey Rothwell.

Regulated for consumers, the Swiss electricity market is free at the wholesale level – a situation that most economists consider unfavorable for financing nuclear power. Even so, until the Japanese accident BKW was optimistic about its chances of finding co-financing for a new plant, says spokesperson Antonio Sommavilla. He specifies that "concrete agreements hadn't yet been reached because the first steps were mainly been to prepare permit requests." Now that the country has decided to opt out of nuclear power, it's a purely theoretical issue.

FUKUSHIMA: A PROVISIONAL ASSESSMENT

Of the 200,000 people evacuated in the first days after the catastrophe, only half have been able to return to their homes. Traces of radioactivity were measured in Yokohama, several hundred kilometers to the south.

Officially, six employees of the Tokyo Power Company received radiation doses of 250 mSv (2.5 times the smallest dose clearly associated with an increased cancer risk), according to the Japanese government's report to the IAEA in September 2011. Three employees have died (leukemia, heart attack and "complications" of an undisclosed illness). The total amount of radioactivity released is estimated at 4 to 6 times 1017 Bq, or about 10 times less than following the Chernobyl accident – but estimates for the two catastrophes vary significantly.