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Latin America's Nuclear Future

Jorge Zanelli Iglesias

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Energy Challenges in the Americas

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Cover Image:

Ribeirao das Lajes dike with its forest bordering the reservoir, an example of Light S.A.'s reforestation program. Light, a subsidiary in Brazil of the French company EDF (Électricité de France), distributes electricity to 80% of the State of Rio de Janeiro and implements environmental protection programs. ANTONIO SCORZA/AFP/Getty Images.

Latin America's Nuclear Future

By Jorge Zanelli Iglesias

What are the challenges and opportunities for nuclear power in Latin America? Will nuclear energy continue to be a marginal player in electric generation in the region (2% vs. 15% worldwide)? Are the drivers to revive the nuclear industry elsewhere in the world going to be observed here as well?

Nuclear Power: World Outlook

As of 2010, 436 nuclear reactors generated about 15% of the world's electricity. Hydraulic power, the other major low-emissions energy source, provided nearly 20%. But while hydraulic power is constrained by the availability of large rivers and depends on climate, nuclear power still has considerable room for growth. After a modest start in the 1950s and exponential growth in the 60s, the nuclear industry stagnated for 30 years in the western world, primarily as a result of the increase in interest rates caused by the 1973 oil crisis.

During the stagnation period, the nuclear industry developed progressively simpler, safer and more robust reactors. Streamlined procedures improved performance, helped boost load factors from 60% to 90%, and extended service life by about 30%. Since the first reactor that produced enough power for four light bulbs in 1951, the technology has come a long way. Nowadays, the nuclear industry is probably the safest (fewer accidents per MW generated); most reliable (load factors above 90%); economically attractive, even



including decommissioning and waste management (comparable with coal-burning); and environmentally friendly (tiny CO₂ footprint) energy source.

The last decade has witnessed a revival of the nuclear industry driven by increasing demand for energy. In a context of uncertainty in oil prices and supplies, especially in the emerging economies, and

concerns over greenhouse gas emissions, the supply security of nuclear power has made it more attractive. This has led to a rebound in construction, especially in East Asia, and prompted several European governments to revise their nuclear policies. China and India plan to increase their nuclear capacity by some 100,000 megawatts by 2020, and the US

Nuclear Regulatory Commission has received applications for 30 new nuclear reactors to go online in the next decade.

A new concern is global warming, presumably an effect of burning fossil fuels, which in a few decades returns to the atmosphere the CO₂ that was captured by plants over several hundred million years. Even some environmentalists formerly opposed to nuclear power advocate the use of nuclear technology to eliminate fossil fuels from electric generation worldwide. If the growing trend is maintained, nuclear power could be generating more than 20% of the world's electricity in 20 years.

Latin America's Nuclear Countries

Argentina and Brazil, like other world powers after World War II, developed nuclear energy as an outgrowth of military programs in the 1950s. Nuclear programs in these South American countries were sparked by the hegemonic ambitions of the authoritarian, nationalistic governments headed by strongmen Juan Domingo Perón and Getúlio Vargas, respectively. In the 1970s, military regimes in both countries covertly attempted to develop missiles and to master the complete nuclear fuel cycle. Although their civilian nuclear industries did not require it, both succeeded in controlling the heavy water enrichment and production cycle. Nuclear electricity was essentially a cover for military programs rather than a true attempt to secure the energy supply. With the return to democracy, both Argentina and Brazil abandoned their military goals, developing civilian nuclear power programs that have safely and reliably delivered 935MWe and 1,900MWe to their respective grids.

Mexico, in contrast, never started a military nuclear effort. In the early

1960s the government concluded that, at prevailing uranium prices, it made sense to sell oil abroad and import nuclear fuel rather than burn oil to produce electricity. This led to the construction of the Laguna Verde Plant in 1988, which has successfully provided some 1,330MWe to the Mexican economy.

The 5,300 MW of nuclear generation in these three countries covers about 5% of their internal demand and accounts for 2% of Latin American electricity generation. Argentina and Brazil are completing construction of third reactors (Atucha II and Angra III, respectively). Mexico is expanding the capacity of its Laguna Verde facility by 20% and is considering construction of eight new reactors as part of plans to reduce its carbon footprint. This vigorous growth, which could triple output by 2025, has wide political support, a big change from the opposition the original plant encountered in the 1980s.

New Concerns, New Players

In recent years, several Latin American governments have expressed interest in starting new nuclear programs. Apart from Cuba, however, where efforts in this direction were started and then aborted, no new programs have been launched since the 1980s. After so many unfulfilled announcements, and the abundance of hydraulic and fossil fuel resources in the region, those claims can reasonably be dismissed as sheer advertising for image-building, without a serious commitment.

Brazil, Venezuela, Mexico, Colombia, Peru, Ecuador and Bolivia are rich in fossil fuels; Brazil has vast untapped hydroelectric potential; Paraguay exports five times the electricity it consumes;

and, until recently, Argentina had a natural gas surplus. Such abundance makes nuclear energy unattractive as a short- or medium-term option. However, as economic growth forces up demand and fuel prices, as CO₂ emissions become increasingly objectionable and eventually taxed, and fewer rivers remain untapped, burning fossil fuels for electric generation will become uneconomical, unpopular and unethical. Sooner or later, Latin American economies will have to look for alternatives that can provide base-load electricity safely, reliably, affordably and sustainably to replace today's primary sources: hydropower, coal and gas. Renewables – wind, solar and geothermal – are intermittent, considerably more expensive and less reliable than the standard primary sources and, contrary to standard opinion, not as environmentally friendly with current technology. Scale is also an issue: It takes around 20,000 acres of wind turbines to match the output of a standard coal-burning plant. As energy-storing technology evolves, some nonconventional alternatives should play an important role in the future matrix, but which ones and when remain open questions. Since the only certain fact about the future is the growing need for energy, countries with limited energy resources that could jeopardize their economic future would be wise to invest in a proven technology such as nuclear, which could deliver energy to the required scale at a reasonable cost and in reasonable time.

Chile and Uruguay are seriously considering nuclear power as an alternative. These two countries are net energy importers, with limited fossil fuel deposits and little room for growth in hydropower. They seem the most likely candidates to join the regional nuclear club.

Reaching this goal, however, is a complex affair for any nation, hinging on unpredictable factors and internal and external political barriers that must be overcome.

Challenges and Opportunities

Countries that intend to start civilian nuclear power programs must not only have the financial resources to invest in the technology, but must also be technologically sophisticated and institutionally mature, with the necessary legal and regulatory government agencies. These nations should also have a safety culture that goes beyond having enough manpower to operate nuclear reactors, a regulatory body and a minimal technological network to support the nuclear industry. They must have the human resources trained for high standards of safety and rigor.

Civilian nuclear power programs require broad social consensus. Both imaginary fears and legitimate concerns about nuclear energy must be addressed, and the long-term commitments cannot be overlooked. The first power that nuclear reactors generate brings with it irradiated fuel containing high-activity, long half-life radionuclides that must be kept in isolation for several centuries. Although this is not technologically difficult to do, it underscores the fact that starting a nuclear power program requires having answers to questions that might arise a hundred years down the road. In participatory democracies, this requires a high level of public consensus and governments that guarantee transparency, thoroughness and best practices through competent, rigorous, independent and fully empowered regulatory agencies.

Nuclear countries must also satisfy the international community with a clear commitment to

peace. All Latin American and Caribbean countries have ratified the Tlatelolco and Nuclear Non-Proliferation treaties, but recent ambiguous statements by Brazilian authorities with regard to the legitimacy of the military use of nuclear energy have cast a shadow over the civilian nature of that country's program. Venezuela's plans to join Iran's nuclear efforts have also raised concerns in the international community. Although there are no signs that Venezuela has the technological knowhow or the intention to become a rogue state like North Korea, it is still a matter of concern that Venezuela, Brazil and Argentina have yet to endorse the Additional Safeguards Protocol to allow unimpeded nuclear inspections.

Recurring international concerns about terrorist groups getting hold of fissile material to make weapons, or spent fuel and other radioactive material to produce "dirty bombs," are exaggerated given the enormous technological difficulties involved in building a working nuclear bomb and the inefficiency of a dirty bomb as terrorist propaganda.

Regional integration is probably the key to ensuring viable, robust and transparent nuclear programs. International cooperation could help newcomers establish their regulatory infrastructures. The industry could benefit from an extensive network of advanced technology providers, with training and certification of operators and inspectors carried out at regional centers. Integration could also provide assurances to all stakeholders of compliance with non-proliferation agreements and avoidance of the military use of nuclear power, similar to the ABAAC agreement between Argentina and Brazil for the enrichment of uranium. Electrical integration of the region, like the

SIEPAC project in Central America or similar efforts in the Southern Cone, would make the grids more stable, economically efficient and robust under local or seasonal climate fluctuations. Finally, an integrated Latin American nuclear energy effort could play a role similar to that of EURATOM, which started the European economic integration that gave rise to the EEC 40 years later.

The recent earthquake and tsunami that struck Japan have raised legitimate concerns about the safety of the nuclear industry. The accident at the Fukushima power plant prompted antinuclear voices demanding the suspension of new reactor construction and possibly reducing existing nuclear generation. Although it is too soon to tell whether human responsibilities contributed to the magnitude of the accident, the lessons learned from this experience will be incorporated into the next generation of nuclear reactors, significantly improving the safety and reliability of the nuclear industry, in an evolution similar to that of the aviation industry. The nuclear industry will certainly suffer in the short term as governments and investors revise their plans and the technology absorbs the lessons learned. As the dust settles in a scenario of increasing energy demands, however, renewed growth can be expected. The image of nuclear energy will suffer in the eyes of the public, but its safety record will not change much from its historical level, keeping it one of the safest and most environmentally friendly forms of electric generation. ■

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