Four years after the meltdown at Japan's Fukushima nuclear power station paralyzed the sector, nuclear energy is again gearing up globally for what appears to be a long-awaited renaissance.

But while nuclear power's rebirth from China to Argentina is driven by the imperative of finding clean and reliable power, it must still overcome a host of obstacles, including lingering concerns over safety, lousy economics, and growing worries about the risks of nuclear proliferation. And all of that could strangle the latest nuclear rebound before it really gets started.

"Right now, the nuclear renaissance is happening, and it's happening in East Asia," said Geoffrey Rothwell, principal economist at the OECD Nuclear Energy Agency in Paris. Asia alone could invest as much as three-quarters of a trillion dollars in new nuclear reactors in the next 15 years as the region seeks to meet growing energy demand while grappling with rising concerns about pollution.

Nuclear power's development hit the pause button everywhere after the March 2011 accident at Fukushima, which led to the evacuation of hundreds of thousands of Japanese and the idling of Japan's entire nuclear fleet. Indeed, some countries, such as Germany, swore off nuclear power altogether after the accident. Others, such as Belgium, Sweden, and Switzerland, plan to phase out nuclear energy when their current reactor fleets retire.

But Japan is moving closer to restarting its first reactor since the accident, with plans to fire up the Sendai plant in the country's southwest this summer; another 15 reactors await approval to restart.

Chinese regulators just approved China's first new reactors since the Fukushima disaster. Chinese nuclear power is going gangbusters, with some two dozen plants under construction and another two dozen in the pipeline. Beijing hopes to have 58 gigawatts of nuclear power — more than half the nuclear capacity of the United States — operational by the end of the decade. And to meet its ambitious climate and energy goals, China may need to nearly triple that already huge nuclear build by 2030.

Other countries around the world, from Saudi Arabia to South Africa to the United Kingdom, are also giving nuclear power a fresh look, impelled by both the desire to generate electricity with no greenhouse gas emissions and the need to bolster energy security by reducing reliance on imported fuels such as oil, coal, and natural gas.

The United Kingdom, for instance, figures it needs nuclear power to meet its goals for cutting carbon emissions in the years to come. The Saudis need to find ways to generate rising amounts of electricity without burning valuable crude oil. Turkey hopes that nuclear energy will insulate it from excessive reliance on imported fuel.

In all, according to the International Energy Agency, there are almost 400 gigawatts of nuclear generation operating around the world, with another 72 gigawatts under construction. But despite all the technological advances that the nuclear industry has

made, especially the development of a new generation of power plants, many problems that have dogged nukes for decades loom as large as ever.

Safety concerns that flared after the accidents at Three Mile Island in the late 1970s and Chernobyl in the mid-1980s have, in many countries, only increased since Fukushima. The fact that the bulk of nuclear energy's future lies in China, a country with a checkered record on industrial safety, has made more than a few nervous.

The economics of generating electricity with hulking nuclear reactors are as challenging as ever, especially in a world awash with cheap natural gas and increasingly competitive renewable energies like wind and solar power. And in a world rattled by the specter of nuclear confrontation, the spread of civilian nuclear power programs to a gaggle of new countries sparks fresh fear about the risks of proliferation.

Public concern over the safety of nuclear plants is still a huge issue in earthquake-prone Japan. Thousands demonstrated in Tokyo this month on the fourth anniversary of Fukushima. Many local politicians have tried to ride anti-nuclear sentiments into office, and high-profile public figures like Nobel Prize-winning writer Kenzaburo Oe have urged the country to follow Germany's example and swear off nukes. Despite the recent green light for some reactors, many experts believe the majority of the country's mothballed nuclear reactors will be retired without ever restarting.

In China, the breakneck pace of nuclear development has some experts worried that safety and regulation will take a back seat to growth. Last summer, French nuclear regulators said that Chinese officials were understaffed and unprepared for the size of their nuclear program; one told the French Parliament that Chinese regulators are "overwhelmed." While China took advantage of the post-Fukushima pause to review both its reactor designs and its approach to nuclear regulation, the country doesn't yet appear as transparent or safety-focused as, say, the nuclear industry in the United States.

"When you look at the situation with respect to safety in a lot of other industries, it starts to make you nervous," said Matthew Bunn, a nuclear expert at Harvard University's Kennedy School of Government. "But when you talk to people who have worked with the Chinese nuclear industry, they say they understand this completely and understand they have to be different from other industries," he said.

Ideally, if China had more regulators and a more open system, with nongovernmental organizations staffed with nuclear experts airing these issues in public, it would bolster confidence in China's ability to handle the pace of its nuclear expansion, Bunn said.

Public concerns about the safety of nuclear power would probably be easier to address if the economics in most places weren't so lousy.

The reactors under construction in the United States are over budget and behind schedule. The proposed nuclear plants in the U.K. require subsidies from the government to compete with other sources of electricity, a legal move that has sparked a fight between

London and other European countries. Countries like Hungary and Turkey are counting on Russian financial assistance and Russian firms to build their nuclear power plants. Western firms operating in the open market simply can't compete with Russian firms backed by Russian government money, especially when power prices are low.

The reason that nuclear plants have been so expensive in the past is largely because they are so complex and time-consuming to build. Coupled with ever-increasing safety requirements that have only increased in the wake of Fukushima, the cost of capital needed to build reactors is much higher than that for other energy projects. Even once they're built, nuclear plants often struggle to compete against cheap alternatives, such as natural gas.

At the same time, many power markets fail to reward nuclear energy for the two big contributions it does make: a steady source of baseload generation and a lack of carbon emissions. That's why nuclear proponents itch for a price tag on carbon emissions, so that nuclear-generated electricity will be better able to compete with dirtier sources of power, such as coal and gas.

China may be able to show one way out of that dilemma. Many power plants built in the past, such as those in the United States, were essentially one-of-a-kind designs. But China is building scores of identical power plants, meaning it could finally capture the kind of cost efficiencies that come with mass production.

"If you have some kind of unified command and control of the nuclear sector, you can make one type of power plant over and over again and get these economies of scale," Rothwell said.

What's more worrisome than dicey economics is that the quest for energy security is driving many countries to insist on the right to enrich their own uranium for use in power plants, rather than just buying reactor fuel on the global market. Uranium that is enriched a little bit is good for power plants. Uranium that is highly enriched is good for bombs. That's at the heart of the international showdown over Iran's nuclear program.

But even among America's allies, the question of enrichment and the risks it poses for proliferation are a constant concern. South Korea's insistence on being able to enrich its own uranium has delayed the renewal of a nuclear-cooperation pact with the United States, for example. And while the United States convinced the United Arab Emirates to forswear enrichment in its nuclear program, other Arab countries insist on having the right to enrich, especially as Iran appears poised to win acceptance of its own enrichment capability. Saudi Arabia, for example, wants nuclear power and domestic enrichment — largely with an eye toward a future nuclear threat from Iran.

"The countries that insist on retaining that option of enriching their own uranium, those are the countries we would be most concerned about from a proliferation standpoint," said Paul Bernstein of the National Defense University's Center for the Study of Weapons of Mass Destruction.