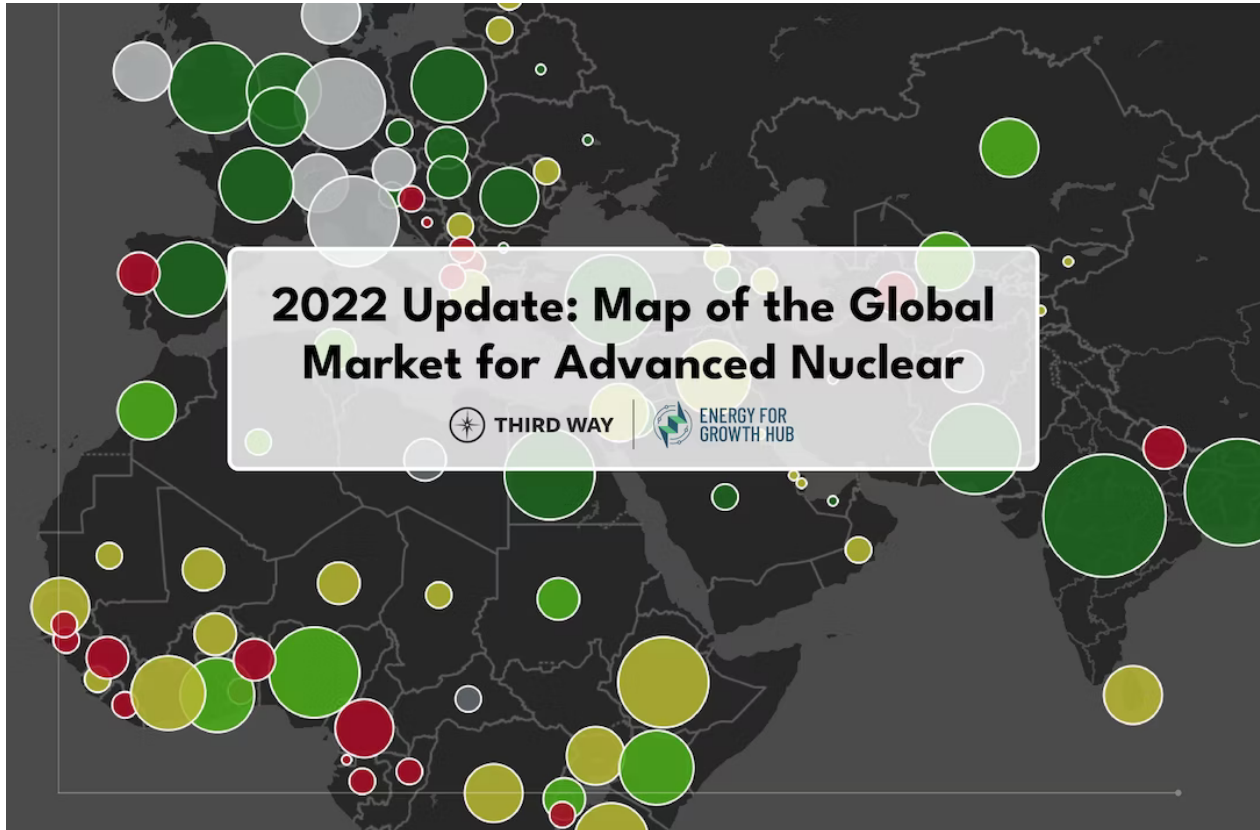


# 2022 Map of the Global Market for Advanced Nuclear: Emerging International Demand



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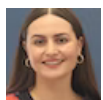
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## Takeaways

Third Way and Energy for Growth Hub have been mapping the global market for advanced nuclear over the last few years, tracking both projected energy demand growth to midcentury and various metrics on civil nuclear “readiness” for countries around the world. The big difference in 2022? *The once-potential market for advanced nuclear is now becoming real*—facing both energy security crises and decarbonization challenges, countries are now increasingly outspoken about their interest in advanced nuclear. The US is poised to meet this demand, but it must take proactive steps to seize the first opportunities in this burgeoning market.

In 2020, Third Way, in partnership with the [Energy for Growth Hub](#), began mapping the global market for advanced nuclear energy. [The first map](#) was a groundbreaking study estimating the potential global market for advanced nuclear over the next few decades, examining both countries’ readiness to deploy advanced nuclear technologies and projected electricity demand growth by 2050. The findings of this analysis were clear: there were strong indications of robust international demand for advanced nuclear in the upcoming decades, supporting continuation of our efforts to invest in and pursue nuclear energy innovation and advanced reactors.

This first-of-a-kind map was followed by an [update in 2021](#), which incorporated the latest data and projections and also conducted a deeper dive into select country markets—looking not only at projected demand for power, but also desalination, industrial heat, electric vehicles, and coal replacement for these specific countries.

Third Way and Energy for Growth Hub now unveil the 2022 update of the global markets map, which includes expanded energy demand growth projections (industrial heat, desalination, EVs, etc.) for all countries in the study. While this year’s iteration integrates the most up-to-date information and data on readiness metrics and demand projections, *perhaps the most significant update since 2021 has been the emergence of actual demand for advanced nuclear technologies*, meaning that this exercise is no longer just theoretical. Following the Russian invasion of Ukraine, [countries are now more urgently seeking secure, reliable energy supplies to reduce their dependence on authoritarian petrostates](#), which in turn, has led to real expressions of interest in and demand for advanced nuclear.

Such developments should not only fundamentally alter how we use and view this map, but should drive urgency and immediate change in our policies on the development, deployment, and export of advanced nuclear technologies.

## **Topline Takeaways and 2022 Updates**

The major update with the 2022 map is, as previously mentioned, the inclusion of additional energy demand growth projections beyond electricity for all countries: desalination, coal replacement,

electric vehicles, and industrial heat.

The topline takeaways have remained relatively consistent going back to previous versions of the map, although specific figures have varied slightly:

## **Topline Takeaways**

### **1. Electricity demand is growing rapidly and will continue through the foreseeable future**

- Total electricity consumption is projected to approximately double to over 47,000 TWh annually. This is like adding six United States' worth of power consumption over the next 30 years.
- Around 75% of new demand will come outside of High Income countries, down 12% from the previous year's figure.

### **2. Advanced nuclear is well positioned to meet this new demand**

- 87% of all new electricity demand will occur in countries we rate as ready by 2030 ("Green") or potentially ready by 2030 ("Light Green").
- A total of 52 countries are projected to be markets for advanced nuclear power before 2050, this is up 3 countries from the previous year.
- 9 countries that don't currently have operating commercial nuclear plants are nonetheless considered viable markets today. An additional 10 countries could be markets for advanced nuclear by 2030, and likely will be by 2050.

### **3. The global market for nuclear power could potentially triple by 2050**

- Under our baseline assumptions of up to 20% of new demand supplied by nuclear in Green countries, 10% in Light Green, and 5% in Yellow, we estimate that around 17% of all new electricity demand could be served by nuclear power by 2050.
- This 17% figure implies new nuclear generation of about 4,200 TWh annually, roughly correlating to a potential market size of ~\$380 billion per year based on a tariff of \$90/MWh.
- Additional demand drivers (desalination, industrial heat, electric vehicles, coal replacement) could increase projected new nuclear generation and market size even further: if just 10% of coal generation in Green, Light Green, and Yellow countries (all countries that could be a market for advanced nuclear by 2050) were replaced with nuclear, this would add another 1,000 TWh, or roughly \$90 billion annually.

- If we assume 10% of new demand from coal replacement, industrial heat, electric vehicles, and desalination needs will be served by nuclear, then this total rises to 2,700 TWh, or \$250 billion annually.

Some notable new findings and specific updates/changes since the 2021 map are listed below:

- Uzbekistan and Kazakhstan were both upgraded from “potentially ready by 2030” (Light Green) to “ready by 2030” (Green).
- Uganda entered into the “potentially ready by 2030” (Light Green) category for the first time in the history of this map.
- Electricity demand in East Asia and the Pacific will more than double by 2050, accounting for 52% of the total global increase, an even more significant portion than projected last year.
- Poland has extremely significant coal-replacement needs. At almost 150 TWh this is fully over one-half of the projected demand growth in the country.

## Real Demand, Real Policy Solutions

Unlike prior years, we are no longer just talking about the global market in the abstract—we now have concrete examples of real demand for these technologies. At COP26 last year, [NuScale Power and Nuclearelectrica publicly announced a teaming agreement](#) to jointly work towards the deployment of a NuScale small modular reactor (SMR) plant in Romania (a country we rate as Green, with significant new demand and coal replacement needs). This announcement was followed up by a US commitment at the G7 Leaders’ Summit in June 2022 to contribute [\\$14 million for a Front-End Engineering and Design \(FEED\) study](#), which will provide Romania with site-specific data necessary for ultimate deployment of the NuScale units.

**“Unlike prior years, we are no longer talking about the global market in the abstract—we now have concrete examples of real demand for these technologies.”**



Romania is not alone in its demand for advanced nuclear. The Czech Republic, on top of launching a tender process for conventional new nuclear build, is also [exploring deployment of SMRs through an agreement with Ontario Power Generation](#) signed in October 2022. Similarly, Poland is actively exploring both large conventional reactors and advanced reactor technologies, which includes [interest by Polish industry in SMRs](#), driven largely by the need to replace coal generation. Moreover,

South Africa is working to open a tender for 2,500MW of nuclear power, partly to help replace its almost entirely coal-based grid and to complement its build-out of solar power. Considering these massive coal replacement needs and growing interest in potential coal-to-advanced nuclear transitions in the US—in part spurred by TerraPower’s decision to deploy its first Sodium reactor at a retiring coal plant site in Kemmerer, Wyoming—there are clear and present opportunities for the US advanced nuclear sector in international markets.

Russia’s invasion of Ukraine has unquestionably made energy security an even greater priority for countries throughout the world, thereby accelerating global demand for clean, firm, and reliable energy sources such as advanced nuclear. Our allies and international partners, particularly in Central and Eastern Europe, are looking to the US for solutions to their growing climate and energy security crises. How can we support US competitiveness in this emerging global market?

- **Consolidate and bolster export financing options:** Considering the upfront investment that will be necessary for all advanced nuclear build projects, it is vital that we have access to a breadth of export financing tools and to coordinate their use effectively to support near-term export bids. US Export-Import (EXIM) Bank, US Trade and Development Agency (USTDA), and US International Development Finance Corporation (DFC)—which gained the authority to support civil nuclear projects just two years ago—will *all have critical roles to play* if we are to be successful in meeting immediate demand. In the longer term, more transformative financing arrangements can be conceived, whether establishing nuclear-specific multilateral development financing entities or exploring enhanced coordination on export financing with our civil nuclear partners. Russian and Chinese nuclear vendors will bring state-backed financing to support export projects, so it is absolutely essential that we have all solutions on the table in order to present a credible and competitive alternative.
- **Strengthen interagency coordination on civil nuclear exports:** Our prime competitors for international nuclear markets, Russia and China, are vertically integrated and will offer “one-stop shops” with comprehensive export packages containing financing, fuel supply and repatriation, training and operations, etc. Thus, the federal government has a critical role to play in supporting US advanced nuclear exports and must be fully coordinated in this endeavor. The International Nuclear Energy Act of 2022 includes language on establishing an office on nuclear energy policy within the Executive Office of the President that is specifically tasked with coordinating on international civil nuclear cooperation and exports. In the past, the White House appointed a director on nuclear energy policy within the National Security Council (NSC). Whatever the mechanism, some institutional framework that ensures and strengthens coordination on civil nuclear export issues across all the relevant federal agencies will be crucial.

- **Provide continued funding for advanced nuclear fuel supply:** The historic Inflation Reduction Act (IRA) of 2022 provided \$700 million as a down payment for efforts to develop a commercial high-assay low-enriched uranium (HALEU) supply domestically. HALEU will be necessary as fuel for many of the advanced nuclear reactors that are currently approaching deployment and demonstration. However, additional funding for the US Department of Energy (DOE) HALEU Availability Program will be required to fully kickstart the development of and investments into domestic HALEU alternatives. Not only will a robust domestic HALEU commercial market ensure fuel supply for our advanced reactors, it will also greatly support US export competitiveness and nonproliferation objectives.
- **Redouble efforts to engage internationally on advanced nuclear licensing and regulation:** The US Nuclear Regulatory Commission (NRC) is currently at the vanguard of evaluating and licensing commercial advanced reactors, as it is now engaged in licensing discussions with a growing number of US SMR and non-light water reactor developers. The NRC should build upon its cooperation with the Canadian Nuclear Safety Commission (CNSC) and expand its international engagement to more broadly share lessons learned and best practices on advanced reactor licensing as it continues to work through these issues at home. Increased funding for the agency, both generally and specific to international outreach, will be a necessary step in the right direction and would strongly complement investments made so far in advanced reactor demonstrations, HALEU, etc.
- **Take all necessary measures to stay on schedule with first advanced reactor demonstrations:** The faster we can get our first-of-a-kind (FOAK) advanced reactors online, the faster that they will be available for export markets. While the first US advanced reactor demonstrations are slated to start operating within the next several years, possible pitfalls lie ahead, including uncertainties around HALEU availability for first fuel loads. We should explore any and all measures to avoid potential roadblocks in deployment schedules, with a special emphasis on securing sufficient fuel material so that our pioneering advanced reactor units can start operations on time.

## How to Use This Map

Our map includes several features that will make it easy for policymakers and advocates to find useful information on potential advanced nuclear markets around the world. On the map, every country included in our analysis is marked with a circle. The size of each circle represents the magnitude of the projected increase in energy demand for the corresponding country. The color of each circle illustrates a country's ranking on our 6-stage scale that assesses relative preparedness and motivation for the development of advanced nuclear power. You can find the complete dataset for our analysis [here](#). The map contains seven filters that show:

- A 6-stage scale describing each country’s relative preparedness and motivation for the development of advanced nuclear power.
- Projected percentage growth in national electricity demand from 2018–2050.
- Projected additional electricity demand in TWh for each country in 2050.
- Projected demand from additional demand drivers that are currently nascent markets, or would not be included in the baseline model, including Coal Replacement, Desalination, EV Transition, and electrification of Industry.
- The World Bank’s four Income Groupings: low, lower-middle, upper-middle, and high.
- The 2020 NTI Nuclear Security Index ratings that assess actions related to supporting global nuclear security efforts.
- The 2020 NTI Nuclear Security Index rankings of 46 countries with nuclear facilities to assess actions to protect those facilities against sabotage.

In order to understand the potential global market for advanced nuclear technologies, we set out to determine two things: Where is the opportunity (using new energy demand), and where can nuclear power contribute in a meaningful way (using our “readiness” score)?

We define a country as “ready” for nuclear by considering if it could be a customer for an advanced nuclear supplier and credibly negotiate a purchase agreement with an international supplier country over the timeframe given. We determine this by using a 10-point checklist covering internal institutions and controls such as policy and regulatory agencies, as well as external signals of interest such as engagement with supplier countries and international institutions like the International Atomic Energy Agency. More information on the scoring methodology can be found [here](#).

To estimate future electricity consumption, we use historical data to establish a trend based on income correlations. We then extrapolate this relationship to 2030 and 2050 for each country, using data and forecasts from the United Nations, International Energy Agency, International Monetary Fund, and the World Bank. More information on the electricity projection methodology is available [here](#).

#### TOPICS

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