

Civil Nuclear Trade Initiative

Civil Nuclear Top Markets for U.S. Exports 2014-2015

*An Assessment Tool for Focusing U.S. Government
Resources*



December 2014

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Executive Summary and Findings

The U.S. Department of Commerce’s International Trade Administration (ITA), under its Civil Nuclear Trade Initiative (CNTI), is committed to strengthening the competitiveness of the U.S. nuclear industry by identifying the industry’s trade challenges and commercial opportunities and coordinating public and private sector cooperation to address these issues. As part of the CNTI, ITA committed to develop the Civil Nuclear Energy Top Markets Study, a tool for prioritizing U.S. Government (USG) export promotion efforts to help target limited resources toward the civil nuclear markets and activities most likely to result in U.S. exports. The study is designed to inform decision makers, managers and analysts of key trends, areas of opportunity, and important challenges facing U.S. civil nuclear energy exporters through 2028.

Purpose

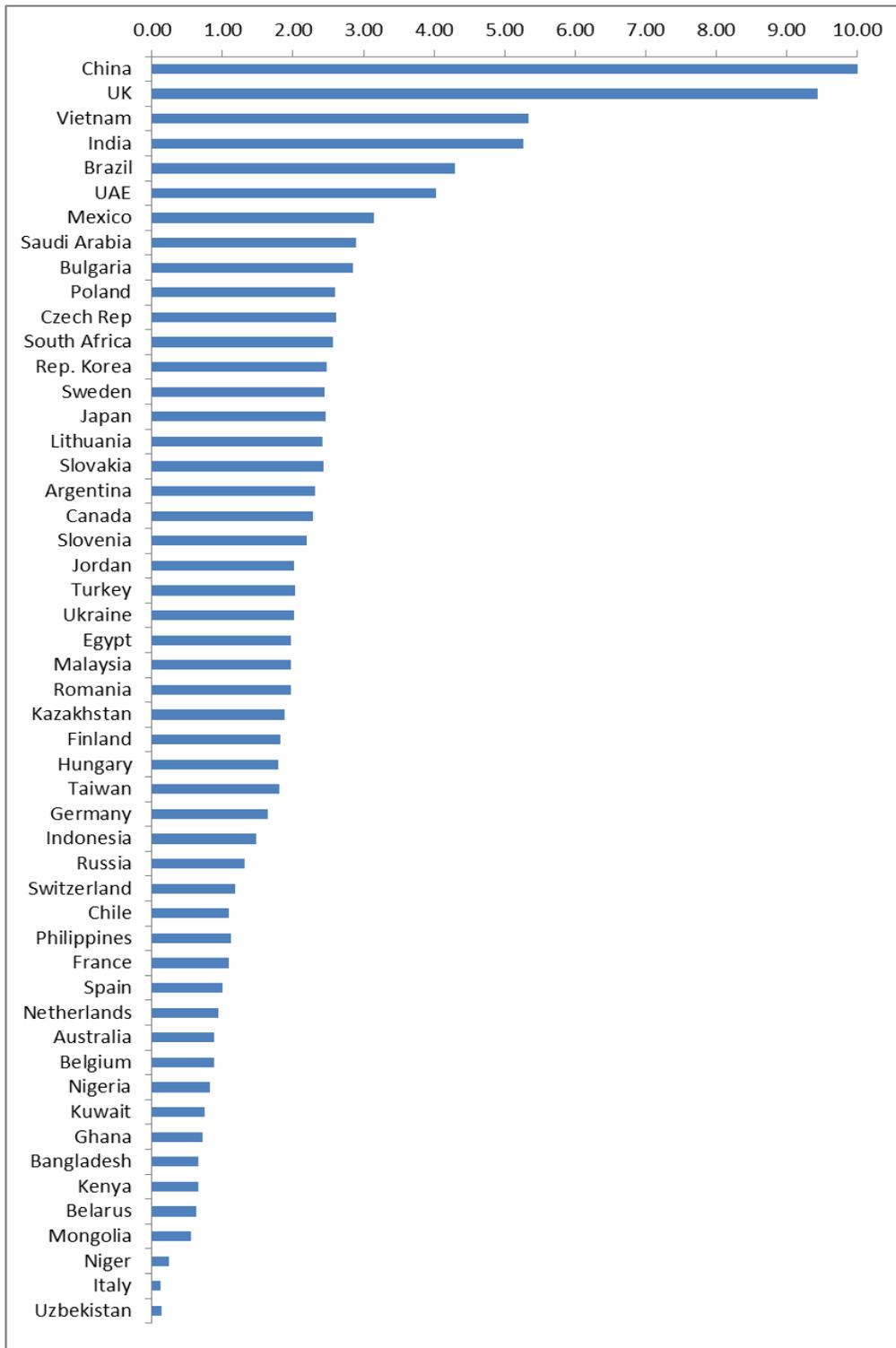
ITA’s Civil Nuclear Energy Top Markets Study recognizes the growing demand for civil nuclear technologies worldwide, and with it, new export opportunities for U.S. companies. Global energy demand growth has intensified concerns about energy security, fuel price stability, and carbon emissions. In response, many national governments are driven to consider building nuclear power plants as a low carbon, domestically produced base-load solution to their electricity needs. Nuclear markets are shifting from the United States and Western Europe, with the notable exception of the United Kingdom, to East Asia, the Middle East, South America, and Eastern and Central Europe. This has important implications for the global nuclear landscape after 2030. The U.S. Department of Commerce estimates the global civil nuclear market to be valued at \$500-740 billion over the next ten years and to have the potential to generate more than \$100 billion in U.S. exports and thousands of new jobs. There are currently 437 nuclear reactors with a combined 376 gigawatt (GWe) capacity operating in 30 countries, and 71 reactors currently under construction in 15 countries.

The intention of this study is to identify best prospect markets where USG activities can most effectively be leveraged to support the success of U.S. companies in the civil nuclear energy sector. It is not intended to be an ordering of priorities for the industry itself, nor is it a direct reflection of industry priorities. The civil nuclear energy industry spans the entire lifecycle of a nuclear power plant and includes reactors, fuel services, nuclear engineering, procurement and construction, and advisory services. U.S. civil nuclear companies represent a broad range of industry subsectors and each has a different set of objectives. Furthermore, it is not the role of the USG to direct industry priorities, but rather to identify where resources can be most effectively leveraged within current legal frameworks to support the already existing export promotion efforts of U.S. companies.

Figure 1: Top 25 Overall Ranking for U.S. Civil Nuclear Exports

1. China	8. Saudi Arabia	15. Japan	22. Turkey
2. United Kingdom	9. Bulgaria	16. Lithuania	23. Ukraine
3. Vietnam	10. Poland	17. Slovakia	24. Egypt
4. India	11. Czech Republic	18. Argentina	25. Malaysia
5. Brazil	12. South Africa	19. Canada	
6. U.A.E.	13. Republic of Korea	20. Slovenia	
7. Mexico	14. Sweden	21. Jordan	

Figure 2: Country Rankings (scored 1-10)



Overview of the Civil Nuclear Market

Role of the U.S. Government

U.S. civil nuclear companies are important innovators of the world's nuclear energy technologies and have more than five decades of experience designing, constructing, up-rating,¹ managing, and decommissioning nuclear power plants. In addition, the United States has one of the world's largest and most efficient nuclear fleets. Despite these strengths, U.S. civil nuclear companies continue to lose significant market share to an ever-increasing number of foreign government-owned or -led competitors, including Russia, Japan, France, China and South Korea.

As competitors grow in influence, the United States' position in the global dialogue has changed. Increasingly, commercial engagement in international nuclear energy projects is becoming a pre-requisite for achieving U.S. nonproliferation, security, and foreign policy objectives. Therefore, ITA has concluded that the USG should play a greater role to help U.S. civil nuclear companies capitalize on global energy demand growth as a way of increasing U.S. exports and jobs, as well as supporting its nuclear nonproliferation, security, and foreign policy objectives.

Unlike its foreign competitors, the USG owns no part of U.S. reactor designer companies. Industry promotion is often fraught with challenges, especially as the USG seeks to provide equitable support and avoid making value distinctions between competing U.S. companies. Furthermore, unlike our foreign competitors, the USG does not provide sovereign backing for its companies, which places them at a competitive disadvantage in the areas of financing, commercial incentives, and liability insurance.

Despite these challenges, the USG is able to advocate and promote the interests of U.S. firms to foreign governments, utilities, and other project decision-makers through letters, public statements and bilateral engagement. Examples of promotional activities include workshops on writing tenders, standards and regulations as well as trade missions to priority markets with company representatives from across the U.S. civil nuclear supply chain. This study is designed to facilitate the identification of where to best exercise USG capabilities so that U.S. firms can capture an increasing portion of the global export market for civil nuclear technologies and services.

Market Categories

Generally, each market can be categorized according to its stage of interest and readiness for a civil nuclear energy program. These categories, in turn, help determine commercial opportunities for that market and the appropriate USG support strategy. This categorization was developed through the use of a flow chart (See Appendix 1) consisting of a series of yes/no questions.

¹ "Up-rating" refers to the process of increasing the licensed power level of a commercial nuclear power plant.

Figure 3: Market Category Descriptions

Newly Emerging Market

- No operating commercial nuclear plants, but clear government support for a civil nuclear energy program and the market is taking tangible steps to develop the necessary regulatory framework, has established sites for its first plant, or is building its first plants.
- Top markets: (1) Vietnam, (2) UAE, (3) Saudi Arabia, (4) Poland, (5) Lithuania, (6) Jordan, (7) Turkey.
- Short-term export opportunities: advisory and legal support services, education and workforce development.
- Mid/long term export opportunities: site selection and environmental assessments; design, construction, and operation; components; fuel.

Existing Market and Expanding Fleet

- Market has one or more operating commercial nuclear plants and interest in expanding its fleet. Expansion has been noted via public announcements, tenders, construction to expand an existing plant or build a new plant, and projected commission dates for new nuclear plants.
- Top markets: (1) China, (2) UK, (3) India, (4) Brazil, (5) Mexico, (6) Bulgaria, (7) Czech Republic.
- Short-term opportunities: site selection and environmental assessments; design, construction, and operation; components; fuels.
- Long-term opportunities: back-end services.

Mature and Maintaining Fleet

- Market has significant experience operating nuclear plants but does not have plans to expand its existing fleet. Political climate favors nuclear power.
- Top markets: (1) Canada, (2) Taiwan, (2) Spain, (3) Netherlands.
- Short-term opportunities: plant operation and maintenance, components, fuels.
- Mid/long term opportunities: back-end services.

Mature Market and Decommissioning

- Market has significant experience operating nuclear plants and is currently decommissioning plants or has announced plans to do so. Political climate does not favor nuclear power.
- Top markets: (1) Japan, (2) Germany, (3) Switzerland, (4) Belgium.
- Short/mid/long-term export opportunities: plant operation and maintenance, components, fuels, back-end services, decommissioning and decontamination.

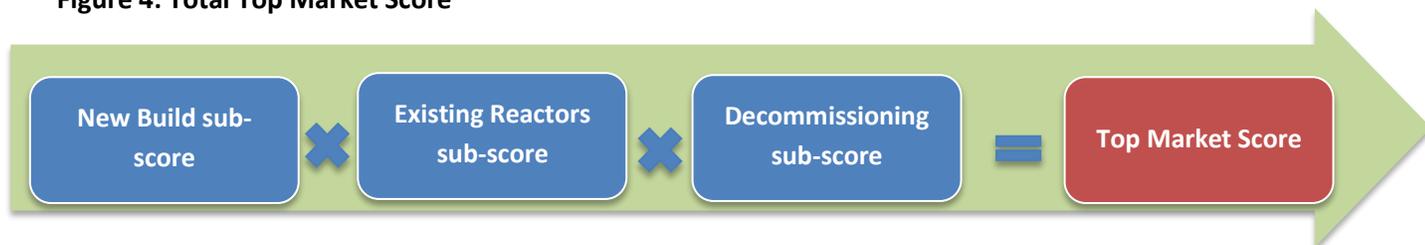
Methodology

ITA’s 2014-2015 Civil Nuclear Energy Top Markets Study ranks 50 countries in terms of their readiness for nuclear energy and openness to U.S. civil nuclear exports. Individual market ratings for exports related to new builds, existing reactors, and decommissioning were assessed on the basis of 19 variables encompassing qualitative and quantitative measures. A detailed description of each variable is located in Appendix 2.

Quantitative data was obtained from a variety of sources including the Energy Information Administration (EIA), Office of the U.S. Trade Representative (USTR), the World Nuclear Association (WNA), the World Bank, the International Atomic Energy Agency (IAEA), the International Energy Agency (IEA), the U.S. Census Bureau, and the U.S. International Trade Commission (ITC). Qualitative analysis was informed by company consultations, U.S. Commerce Department Civil Nuclear Trade Advisory Committee (CINTAC) input, unclassified USG cables, USG analyst expertise, and questionnaires distributed to ITA staff at U.S. Embassies and Consulates in countries that have indicated an interest in expanding or developing their nuclear energy programs.

The total score for a given market is computed by adding together three sub-sector scores—new builds, existing reactors, and decommissioning—that comprise the full spectrum of civil nuclear exports of goods and services (See Figure 4). Each of these sub-sector scores are discussed below.

Figure 4: Total Top Market Score



New Builds

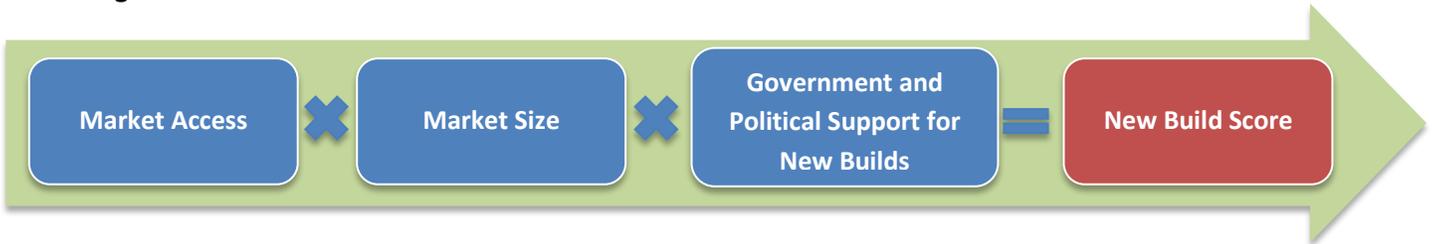
The new build sub-score includes a variety of goods and services that accompany contracts for the construction of new nuclear reactors, including construction equipment, reactor components, fuel for initial core loads, site selection studies, safety training and human resource development services, and regulatory and licensing advisory services. Market opportunities for advanced reactors, such as small modular reactors (SMRs) and high-temperature gas-cooled reactors (HTGRs), are included in this sub-sector.

The new build sub-score is computed by the multiplication of the following factors (see Figure 5):

- Market Access: measures strength of bilateral relationship with U.S., foreign competition, and local content.
- Potential Market Size: score is weighted to measure size of market opportunity.

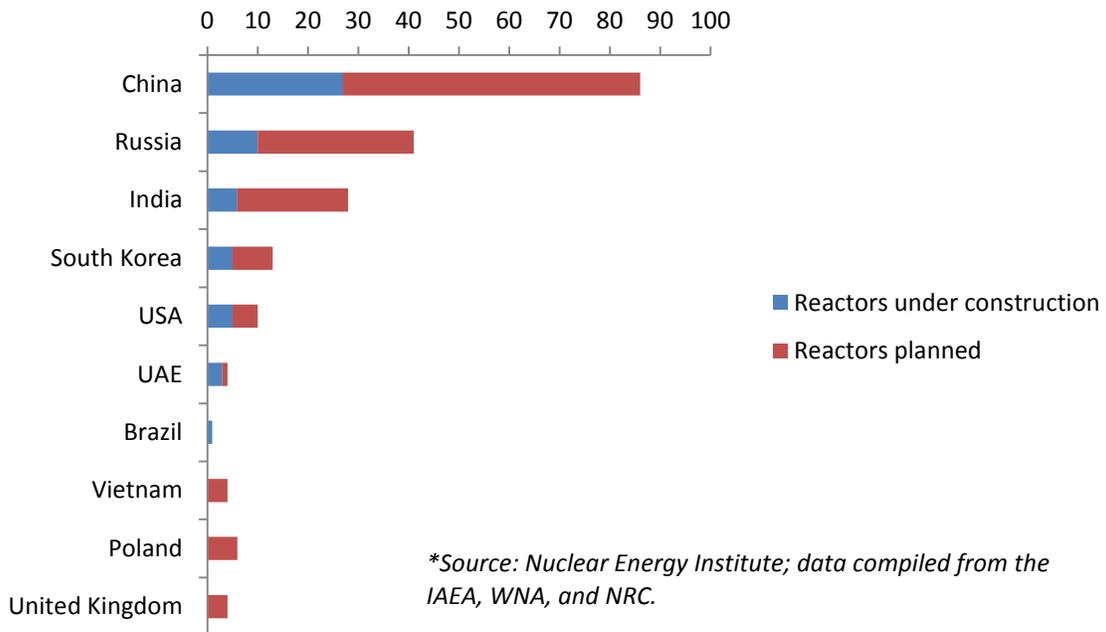
- Government and Political Support for New Builds: measures strength of host-country government support.
- IAEA Milestones Factors: includes measurements for financial fitness, energy drivers, and accession to necessary international agreements.

Figure 5: New Build Score



Each of the four factors above is considered essential for new build export opportunities, such that a zero value for any single factor would negate the prospect of new build exports. This is why a multiplication formula was chosen. Thus, a market that is virtually closed to U.S. civil nuclear exports—such as Russia, due to a robust domestic industry and Russian government policy—or one with publically stated government opposition to new nuclear reactors—such as Germany—would receive scores of zero for new builds, regardless of how well it scores in other factors.

Figure 6: Reactors under Construction and Planned



The new build score is given the most weight in computing the total score due to two main assumptions. First, the new build sub-sector is assumed to have the largest potential for exports, both in dollar value and number of contracts. This reflects the fact that a win for a U.S. reactor vendor often results in numerous additional contracts for U.S. goods and services, engages the U.S. civil nuclear supply chain, and can result in a long-term relationship with the market leading to future projects. This assumption also recognizes that even in cases where a foreign reactor vendor is awarded a new build contract, export opportunities exist through sub-contracts or partnerships with foreign companies, thus adding to the potential value of U.S. exports in the new build sub-sector. Second, the study assumes that USG support is most needed in the new build sub-sector because the chief competition for reactor tenders comes from foreign state-backed companies that put U.S. industry at a competitive disadvantage. This is true for new build contracts more so than existing reactor or decommissioning contracts, which entail far lower financing barriers and often have the benefit of existing corporate relationships.

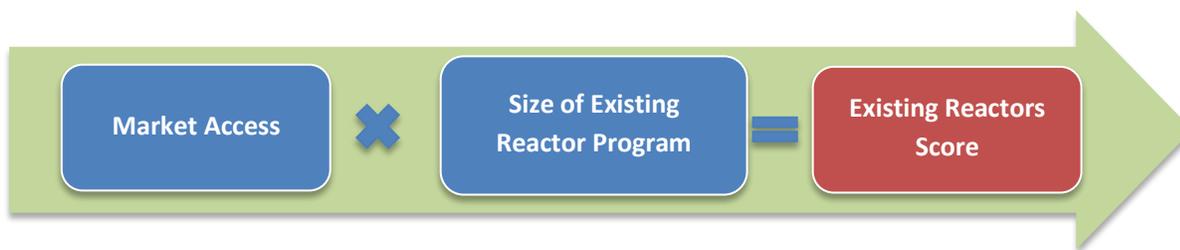
Existing Reactors

Exports related to existing reactor fleets include reactor components, fuel, and a variety of services such as safety training, human resource development, and used fuel management. This sub-sector is assigned the second highest weight for computing the total score.

The sub-score for existing reactors is computed by multiplying two factors (See Figure 7):

- Market Access: includes strength of bilateral relationship, foreign competition, local content requirements, and an assessment of whether the current reactor fleet includes technology that is compatible with U.S. industry expertise.
- Size of Existing Reactor Program: export opportunities assumed to be directly related to size of existing fleet.

Figure 7: Existing Reactor Score



Decommissioning

This sub-sector includes decommissioning and decontamination goods and services and related advisory services. It is given the smallest weight of the three sub-sectors in computing the total market score, reflecting the current dollar value and number of opportunities for decommissioning exports. However,

as reactor fleets age and more countries—whether for political, economic, or technological reasons—decide to shut down plants, the size of this sub-sector will expand. In addition, recent events such as the March 2011 Fukushima accident and subsequent decisions of several nations to shut down reactors early or phase out their reactor fleets have brought about a renewed focus on decommissioning and decontamination export opportunities. This highlights the need for sustained, long-term USG support for export opportunities in this sub-sector.

The decommissioning sub-score is computed by the multiplication of two factors (See Figure 8):

- Market Access: includes strength of bilateral relationship, foreign competition, and local content requirements.
- Decommissioning Projects and Plans: announced or active decommissioning projects.

Figure 8: Decommissioning Score



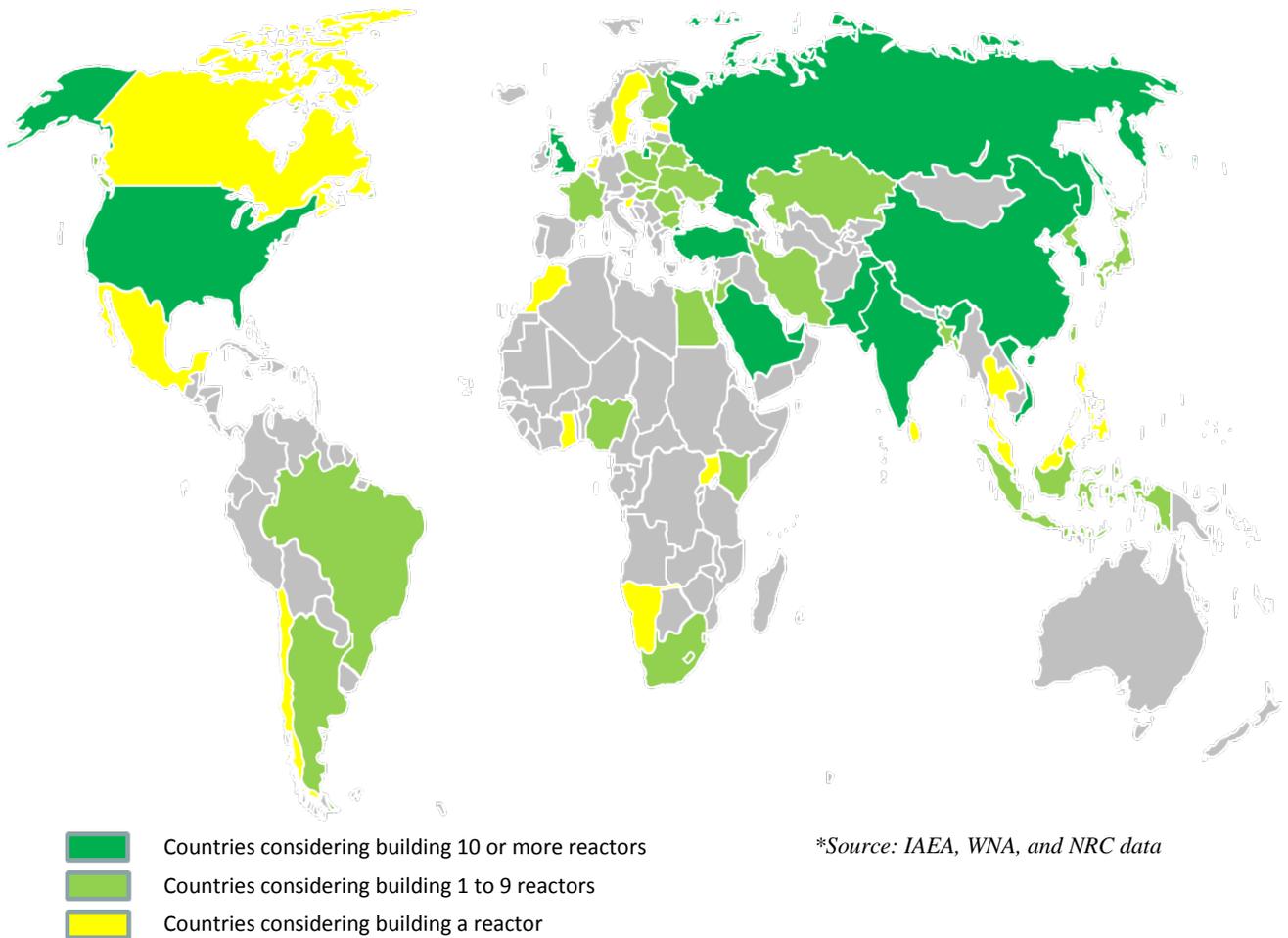
Figure 9: Top 10 Ranking by Sub-sector

<u><i>New Builds</i></u>	<u><i>Existing Plants</i></u>	<u><i>Decommissioning</i></u>
1. China	1. China	1. United Kingdom
2. United Kingdom	2. United Kingdom	2. Japan
3. Vietnam	3. India	3. Germany
4. Brazil	4. Japan	4. Canada
5. United Arab Emirates	5. Ukraine	5. Taiwan
6. India	6. Taiwan	6. Sweden
7. Saudi Arabia	7. Canada	7. Ukraine
8. Mexico	8. Republic of Korea	8. Hungary
9. Poland	9. Sweden	9. Russia
10. Lithuania	10. Russia	10. Switzerland

Country Case Studies

This section includes country case studies that summarize U.S. civil nuclear energy export opportunities and challenges in select markets. The overviews outline ITA’s analysis of U.S. export potential in each market to help improve the effectiveness of USG export promotion programs across each civil nuclear energy subsector. The markets represent a range of countries to illustrate a variety of points – not necessarily the top markets overall.

**Figure 10: Present Intentions toward Building New Commercial Nuclear Reactors
By 2040**



Bulgaria

Overall Rank: 9

Market Type: Existing and Expanding

Sub-Sector Rank

New Builds 12 | Existing Reactors 23 | Decommissioning 13

Bulgaria has two operational reactors at Kozloduy and is currently in discussions with Westinghouse to build additional reactors. The success of this deal will provide significant opportunities for U.S. industry in this market, which has hitherto been difficult to enter due to Bulgaria’s fleet of Russian reactors. Financing challenges remain the chief barrier for new builds. Government instability is also a potential difficulty and could threaten to undo progress made by U.S. industry to enter the market.



U.S. Ambassador to Bulgaria: Marcie Ries

Nuclear Energy in Bulgaria

Bulgaria currently has 2 operational Russia-designed VVER reactors and 4 additional VVER reactors situated in Kozloduy that are permanently shut down. Kozloduy 1-4 are undergoing decommissioning. The Government of Bulgaria (GOB) considered building a new nuclear power station at Belene, but the project was abandoned in March 2012 after several years of negotiations with Russia.

Bulgaria’s National Energy Strategy, published in 2011, indicates Bulgaria is strongly considering extending the life of Kozloduy units 5 and 6 as well as building new units. The main activities in the nuclear energy field are the safe operation of the existing two units (2000 MW

capacity), construction of up to two new reactors at Kozloduy, and construction of a dry spent fuel storage facility.

Public support for nuclear energy is strong in Bulgaria. In January 2013, a public referendum showed that 61% of voters supported the construction of a new nuclear power plant; however, turnout for the vote remained low—21%—making the vote non-binding, but large enough to spark debate and discussion in parliament. A January 2009 gas shortage prompted Bulgarian citizens to take to the streets in support of restarting Kozloduy units 3 and 4. Political movements within Bulgaria have also tied nuclear energy to Bulgaria’s emergence as a technologically advanced nation.

Kozloduy units 5 and 6 are undergoing an upgrade and modernization program. They are currently licensed through 2017 and 2019. Bulgaria's Kozloduy Nuclear Power Plant plc signed a contract with Russia's Rosenergoatom and France's EDF in spring 2012 to begin discussions on extending their lifetimes from 30 to 50 years. In December 2013, Westinghouse entered into exclusive talks with Bulgaria for the supply of a new AP1000 reactor at Kozloduy (unit 7). On August 1, 2014 the two sides signed a shareholders agreement for construction of an AP1000 unit and stated their intention to issue a construction tender within a year. Both sides still need to finalize the financial and technical details of the plan, and would then sign a binding contract in early 2015 for construction beginning in 2016.

Planned Nuclear Energy Projects

Owner: State or shared

Reactor Type: Pressurized Water Reactor AP 1000

Capacity: 1,000MW

Value of Project: \$5.2 billion

Construction Period: Not started

Operation (tentative): 60 years

Kozloduy NPP: New Build EAD, the state-controlled project company, was granted permission by the Bulgarian Nuclear Regulatory Agency (NRA) to select the location of a planned nuclear generation facility. NRA official permission marks the beginning of the licensing procedure for the construction of a new NPP in Bulgaria.

Commercial Opportunities

Services (front-and back-end): Limited opportunities for decommissioning, though Russian technology of Kozloduy 1-4 will make it harder for U.S. companies to play a large role.

Legal and Consulting Services: Many opportunities exist. Several U.S. companies have consulted with the Bulgarian government on Belene NPP. Further opportunities exist for

Kozloduy 5&6 lifetime extension and plans for new construction.

Licensing Support: The Bulgarian NRA is the only state body that can issue, amend, modify, renew, suspend, and revoke licenses and permits for the safe conduct of NPP activities in Bulgaria.

Design, Construction and Operation: Opportunities exist for new construction at Kozloduy.

Components: Moderate opportunities for existing plants. Reactor vessels, core, refueling machinery, turbines, storage equipment, etc. are manufactured in Russia.

Challenges and Barriers

Bulgaria's decision to sole-source Westinghouse for the Kozloduy extension project provides significant opportunities for U.S. industry in this market, which has previously been difficult to enter due to its fleet of Russian reactors.

Current GOB support for nuclear energy is strong and public opinion is supportive, but several obstacles exist that could delay Bulgaria's new build plans or add additional challenges to U.S. industry engagement, including IPR concerns and financing.

Financing new nuclear power projects is a key obstacle for Bulgaria. Bulgarian debt owed to the United States and other countries makes provision of ExIm Bank financing a challenge. Bulgaria receives a low score on ExIm Bank's long term exposure fee level as well as a relatively low score on the World Bank's Ease of Doing Business Indicator.

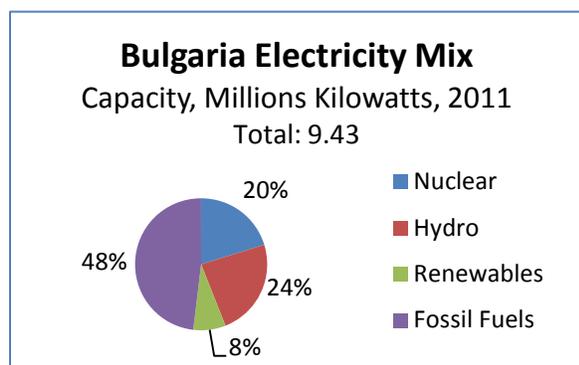
Nuclear Infrastructure

Research Reactor: The Institute for Nuclear Research and Nuclear Energy (INRNE) of the Bulgarian Academy of Sciences in Sofia operated Bulgaria's sole research reactor. The reactor's original capacity was 1 MW in 1959 and increased to 2 MW in 1970 but was shut

down in 1989. Currently the reactor is being modified to operate on low enriched uranium (LEU) at a 2kW capacity. Bulgaria returned its highly enriched uranium (HEU) to Russia in 2003, with used HEU and LEU following in 2008.

Fuel: All front end fuel cycle services in Bulgaria are provided by Russia’s TVEL through Technobexport.

Waste Management: Bulgaria’s State Enterprise Radioactive Wastes (SE-RAW) organization oversees the majority of Bulgaria’s waste management. A 2002 agreement between Bulgaria and Russia provided for payment of US\$620,000 per ton of spent nuclear waste sent to Ozersk, Russia, for reprocessing. Recent funds from the European Bank for Reconstruction and Development (EBRD) have enabled the construction of a dry fuel storage facility (DFSF) for 2,800 VVER-440 used fuel assemblies near Kozloduy. Russia’s Nukem Technologies and Gesellschaft für Nuklear-Service (GNS) mbH partnered to construct the facility. Current plans foresee expanding capacity to accommodate 8,000 VVER-440 and 2,500 VVER-1000 assemblies. The facility opened in May 2011 with the ability to store 5,200 fuel assemblies in 72 casks. The GOB is also pursuing a national low and intermediate level waste disposal facility, to be built on a site adjacent to Kozloduy.



USG Cooperation

123 Agreement: Bulgaria has a 123 Agreement with the United States through Euratom.

June 2013 Legal Review and Legislative Drafting Workshop: The U.S. Department of State’s Preventing Nuclear Smuggling Program (PNSP) and the GOB organized a successful workshop in Sofia to assess how Bulgarian authorities would prosecute nuclear and radiological smuggling cases under existing criminal laws.

Regulatory Cooperation: The U.S. Nuclear Regulatory Commission (NRC) and Bulgaria’s NRA have an arrangement for the exchange of technical information and cooperation in nuclear safety and security matters.

U.S. Export Support: ExIm Bank has supported U.S. civil nuclear exports to Bulgaria with a \$77 million facility in July 2000 for the upgrade of the Kozloduy Nuclear Power Plant.

Additional Agreements	
Non-Proliferation Treaty	✓
IAEA Comprehensive Safeguards Agreement & Additional Protocol	✓
Joint Convention on Safety of Spent Fuel Management	✓
Convention on Nuclear Safety	✓
Convention on Early Notification of a Nuclear Accident	✓
Convention on Assistance in the Case of a Nuclear Accident or Radiological Emergency	✓
Paris Convention Liability Agreement	
Vienna Convention Liability Agreement	✓
Joint Protocol Liability Agreement	✓
Convention on Supplementary Compensation for Nuclear Damage (CSC)	
Organization Membership	
IAEA	✓
Nuclear Suppliers Group	✓
OECD/NEA	
IFNEC	✓
GenIV International Forum (GIF)	

International Engagement

In addition to Bulgaria’s previously noted cooperation with Russia, Bulgarian Energy Holding Company (BEHC)—a 100% state-owned energy holding company—reached an agreement with France’s AREVA in April 2011 as part of Bulgaria’s commitment to developing low-carbon energy projects. The memorandum of understanding (MOU) identifies plans for cooperation on new nuclear projects on the Kozloduy and Belene sites. The agreement also identifies fuel management policies and responses such as spent fuel recycling as well as meeting international standards for nuclear

safety. The agreement provides BEHC access to AREVA’s portfolio of Generation III nuclear reactors, which guarantee higher safety levels.

For more information on commercial opportunities in Bulgaria, contact: Thomas Bruns, Senior Commercial Officer in Sofia, thomas.bruns@trade.gov, Emily Taneva (Commercial Specialist in Sofia, emily.taneva@trade.gov); White House Director for Nuclear Energy Policy Joyce Connery (Joyce_L_Connery@nss.eop.gov); ITA Civil Nuclear Team: Jonathan Chesebro (jonathan.chesebro@trade.gov)

Sources:

CIA World Factbook, United Nations, World Nuclear Association, Asian Development Bank, and USG contacts at U.S. Embassy Sofia

Canada

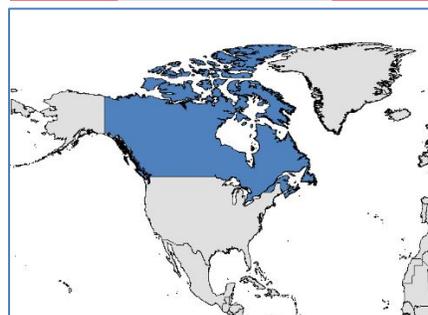
Overall Rank: 19

Market Type: Mature and Maintaining

Sub-Sector Rank

New Builds 35 | Existing Reactors 7 | Decommissioning 4

Canada has 19 operational reactors and six permanently shut down. Plans to build new reactors in Ontario were indefinitely postponed in November 2013. Opportunities for U.S. industry exist in Canada’s ongoing plans for reactor refurbishment and decommissioning. Canada’s robust domestic civil nuclear industry makes market access difficult for U.S. industry, though increasing integration of the U.S. and Canadian civil nuclear industries provides opportunities for export to Canada’s current fleet and Candu reactors abroad.



U.S. Ambassador to Canada: Bruce A. Heyman

Nuclear Energy in Canada

Canada has 19 operational and 6 permanently shut down nuclear reactors. Four nuclear generation stations house Canada’s 19 nuclear power reactors, providing 17% of Canada’s total electricity according to a February 2013 Canadian Nuclear Association report. Nuclear power ranked 2nd in Canada’s 2012 energy mix behind hydro (63%) and ahead of coal (14%).

The four main reactor sites are Bruce Power Nuclear Generating Station (NGS) on Lake Huron (190 km from Toronto), Darlington NGS on Lake Ontario (60 km from Toronto), Pickering A NGS on Lake Ontario (30 km from Toronto), and Point Lepreau NGS in New Brunswick (30 km southwest of Saint John).

All of Canada’s operational reactors are CANDU (CANadian Deuterium Uranium) PHWR-type reactors designed by Atomic Energy Canada Ltd (AECL) of Mississauga, ON, in cooperation with GE. GE also supplies relevant reactor systems including the radioactive combustible loading/unloading in the reactor. In October 2011, the commercial reactor business of AECL was sold to SNC Lavalin, which established Candu Energy Inc. as a subsidiary. The Canadian federal government continues to own and operate other parts of AECL, including the research reactors.

The Canadian nuclear industry is a US\$6 billion industry and is a global leader in uranium mining and fuel supply, reactor exports, and medical isotope production.

Canadian reactors are undergoing an extensive refurbishment program, aimed at enhancing safety, uprating, and extending operational lifetime. To date, seven reactors have completed refurbishment. Large cost overruns and schedule delays with several of these projects have caused operators and investors to reevaluate plans for other reactors, resulting, in some cases, in scaling down the extent of refurbishment or shutting down plants rather than refurbishing them. Plans for refurbishing reactors at Pickering B, Bruce B, and Darlington are under review. Overall the refurbishment project may extend over the next ten years.

Several plants are undergoing decommissioning. The extent of other opportunities for decommissioning contracts will depend on plans for refurbishing Canada's remaining reactors. The first planned closure will occur in 2018.

Canada is not currently planning new reactor builds. In November 2013, the Ontario government indefinitely deferred plans for constructing two new reactors at Darlington, citing a slowdown in electricity demand growth. The leading contenders for the new reactors were Westinghouse (AP1000) and SNC-Lavalin/Candu Energy Inc. (Enhanced Candu-6 (EC6)); both had submitted detailed construction plans, schedules, and cost estimates before the decision to defer construction plans was made.

Additional plans for reactor projects have been pursued by the governments of New Brunswick and Alberta over the last ten years, but since 2011 all plans have been put on hold.

Canada continues to market CANDU reactors abroad in both newly emerging and mature markets; such potential new builds present opportunities for U.S. industry engagement.

Planned Nuclear Energy Projects

Owner: Ontario Power Generation (OPG) (government-owned crown corporation)

Reactor Type: undetermined

Capacity: up to 4800 MWe

Value of Project: N/A

Construction Period: indefinitely deferred in November 2013

Operation (tentative): N/A

Notes: The project has been deferred by the Province of Ontario due to weak forecasted domestic manufacturing demand; the Province of Ontario cited the cost of nuclear energy versus hydropower. Long-term plans are revised every three years and nuclear will be reconsidered depending on demand growth.

Commercial Opportunities

Services (front- and back-end): Opportunities for decommissioning.

Legal and Consulting Services: Limited.

Licensing Support: Limited.

Design, Construction and Operations: Opportunities for U.S. content in CANDU new builds abroad, but no new build plans in Canada.

Components: Moderate opportunities exist for existing plants in Canada and CANDU reactors abroad.

Challenges and Barriers

The chief barriers for new build contracts in Canada are government policies, which have recently deferred all plans for new reactor construction due to weak domestic manufacturing demand. However, even if new construction was approved, it would be difficult for a supplier other than Candu Energy to win new build contracts because of the confidence and synergies resulting from having practically the same supplier for all of Canada's existing reactors, plus the very large integration and local contribution in the design, manufacturing,

installation, commissioning, operation, and maintenance which cannot be matched by other suppliers. Candu Energy and its parent SNC Lavalin have access to high-level decision makers in the provincial and federal governments and is the largest EPC company in Canada.

The same obstacles exist for U.S. exports to Canada's existing reactor fleet, though to a lesser extent. There is a high degree of integration between the U.S. and Canadian civil nuclear industries for goods and services to Canada's reactor fleet and nuclear facilities. There are also opportunities for U.S. content in CANDU reactors abroad, including upgrades to operating plants and new builds. In April 2014, Westinghouse signed an agreement with OPG to cooperate in offering maintenance and refurbishment to existing Canadian NPPs and new NPPs outside Canada.

Energy drivers are another challenge. The Ontario government cited low projected electricity demand as the reason for deferring plans for the Darlington expansion project. Canada's vast reserves of natural gas may further dampen its perceived need for new nuclear capacity.

Canada scores highly in all financial and infrastructure factors and its recent commitment to accede to the CSC liability convention is welcome news.

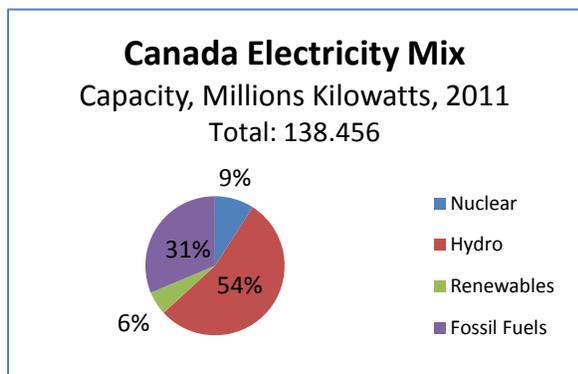
Nuclear Infrastructure

Research Reactor: A 60 MWt WR-1 research reactor was built by GE at Whiteshell Laboratories and started up in 1965. It was used for R&D until it was shut down in 1985. Six other research reactors were built and continue to operate on university campuses. Five of these are SLOWPOKE-2 units, low-energy pool-type reactors designed by AECL with passive cooling and safety systems.

Fuel: Canada is the world's second largest exporter of uranium, accounting for 15% of global output. 15% to 20% of Canadian uranium production is consumed domestically. All Canadian uranium mining currently takes place in northern Saskatchewan. Canada's Cameco Corporation and AREVA Canada Resources Inc. (AREVA) are the majority owners and operators of the uranium mines and mills now in operation. Cameco owns and operates the Rabbit Lake mill and the Eagle Point mine, and is also the joint venture operator of the McArthur River mine and the Key Lake mill. AREVA is the joint venture operator of the McClean Lake mine and mill.

At its Port Hope, Ontario, facility, Cameco has about one-quarter of the Western world's uranium hexafluoride (UF₆) conversion capacity and provides the only commercial supply of fuel-grade natural (unenriched) uranium dioxide (UO₂). The UF₆ is enriched outside Canada for use in light water reactors, while natural UO₂ is used to fabricate fuel bundles for CANDU reactors in Canada and abroad. Two fuel fabrication plants in Ontario process some 1,900 tons of uranium per year to UO₂ fuel pellets, mainly for domestic CANDU reactors.

Waste Management: Canada's Nuclear Waste Management Organization (NWMO), together with AECL, is responsible for storage and disposal of high-level waste. Canadian nuclear utilities and AECL are responsible for low and intermediate-level waste. A deep geological repository for high-level waste was recommended and approved in 2007, with the final repository likely to be located in Ontario, New Brunswick, or Saskatchewan with input/approval from host communities. NWMO expects the repository to begin operation in 2035. Low and intermediate level waste are stored above ground, but a deep geological repository is being planned and built, with operation starting around 2018.



USG Cooperation

123 Agreement: Canada’s 123 Agreement with the United States will expire on January 1, 2030 with rolling 5-year extensions thereafter.

International Engagement

The GOC cooperates with many countries for R&D and commercial engagement and promotion. Most recently, in July 2014, SNC-Lavalin signed two cooperation agreements with China National Nuclear Corporation (CNNC) to jointly develop reactors using CANDU technology, and to collaborate on uranium mining projects in China. The GOC is active in multilateral organizations including the IAEA and IFNEC.

Additional Agreements	
Non-Proliferation Treaty	✓
IAEA Comprehensive Safeguards Agreement & Additional Protocol	✓
Joint Convention on Safety of Spent Fuel Management	✓
Convention on Nuclear Safety	✓
Convention on Early Notification of a Nuclear Accident	✓
Convention on Assistance in the Case of a	✓

Nuclear Accident or Radiological Emergency	
Paris Convention Liability Agreement	
Vienna Convention Liability Agreement	
Joint Protocol Liability Agreement	
Convention on Supplementary Compensation for Nuclear Damage	
Organization Membership	
IAEA	✓
Nuclear Suppliers Group	✓
OECD/NEA	✓
IFNEC	✓
GIF	

For more information on commercial opportunities in Canada, contact: Stefan Popescu (Commercial Specialist in Toronto, stefan.popescu@trade.gov); Cindy Biggs (Principal Commercial Officer in Calgary, cindy.biggs@trade.gov); White House Director for Nuclear Energy Policy Joyce Connery (Joyce_L_Connery@nss.eop.gov); ITA Civil Nuclear Team: Jonathan Chesebro (jonathan.chesebro@trade.gov)

Sources:
CIA World Factbook; United Nations; World Nuclear Association; Asian Development Bank, and USG contacts at Post.

China

Overall Rank: 1

Market Type: Existing and Expanding

Sub-Sector Rank

New Builds 1 | Existing Reactors 1 | Decommissioning N/A

China has the fastest growing nuclear energy program in the world and is the top ranked export market in this study. China is on pace to triple its nuclear capacity to 58 GWe by 2020, and it plans to begin marketing its indigenously designed reactors for export in 2015. Foreign competition for access to the Chinese market is high, and China has become increasingly self-sufficient for its nuclear power technology needs, which will limit U.S. content in exports for new reactors. However, ample opportunities exist for U.S. industry in new builds and all aspects of the fuel cycle.



U.S. Ambassador to China: Max Baucus

Nuclear Energy in China

As of this writing, China has 22 operational nuclear reactors, comprising roughly 19 GWe of generating capacity. Of these, two are Russian VVER models, two are Candu PHWRs, and the rest are Chinese designed PWRs that are chiefly derived from French models.

China has focused on and is expected to continue prioritizing PWR designs in the medium term; opportunities are therefore greatest surrounding PWR reactor sales. It has 26 reactors under construction consisting of several Chinese PWR designs, four Westinghouse AP1000s, two Areva EPRs, two Russian VVER 1000s, and a pebble bed modular high-temperature gas-cooled reactor (HTGR).

In October 2012, China’s State Council passed the Nuclear Power Safety Plan and the Nuclear Power Medium- and Long-Term Development Plan (2011-2020), and former Premier Wen Jiabao announced that China’s new builds must meet third generation safety standards, excluding units currently under construction. In recent years, China has tried to reduce its nuclear capacity target to 58 GWe by 2020 from a previous unofficial target of 80 GWe, but this still represents a remarkable tripling of existing capacity. Also in October 2012, the State Council approved the “12th Five-Year Plan for Nuclear Safety and Radiation Prevention,” in which China delineated its plans to spend RMB 80 billion (\$13 billion) to improve nuclear safety at 41 operating and under construction reactors over the next three years. Such actions in response to the Fukushima accident highlight a perceived need to improve the reputation of Chinese firms on issues regarding safety and

quality as well as the increasing efforts by the Chinese nuclear regulator to enlarge its ranks of experienced personnel to meet rapid expansion.

China has indicated that it aims to become a reactor design exporter and compete alongside established companies for reactor tenders worldwide. Its policy of indigenizing foreign technology, though helping to expand China's reactor design and engineering capabilities, has thus far limited China's ability to export its designs, as its technology transfer agreements—with Westinghouse for the AP1000, for example—prohibit China from exporting indigenized designs below a specified power threshold. China has recently developed two designs for export: the ACC1000/Hualong One (a recent merger of the ACP1000 and ACPR1000 designs) and the CAP1400, which is based on the Westinghouse AP1000 model but scaled to a power capacity allowing China export rights.

China has a vast R&D portfolio that includes all aspects of the fuel cycle. It is pursuing fast reactor, HTGR, small modular reactor (SMR) demonstration projects, as well as expanding its capabilities for uranium mining, enrichment, fuel fabrication, and reprocessing. In nearly all these areas, China is developing its own technology as well as partnering with foreign governments and industry to import technology.

Planned Nuclear Energy Projects

China is targeting 58 GWe of installed nuclear capacity by 2020, and further increases are planned thereafter. Domestic designs will make up the majority of new reactors, but China will continue to engage with U.S., French, Russian, and Canadian industry for others. There are significant opportunities particularly for U.S. firms, given that China has committed to using generation III technology for future builds in the near-term. Several of the planned sites are expected to include AP1000 units and Chinese

authorities were considering AP1000 designs for the deferred inland plants. The Chinese government and state-owned enterprises work directly with international vendors for building new reactors rather than conducting an open bidding process.

Commercial Opportunities

Services (front-and back-end): Opportunities for probabilistic risk assessment and regulatory advisory services.

Licensing Support: Opportunities to support China's National Nuclear Safety Administration (NNSA).

Design, Construction and Operations: Significant opportunities for new PWR plant construction.

Components: Significant opportunities for nuclear pumps and valves, breakers, large forging parts, and other components.

Fuel Management: China is not fully self-sufficient in the upstream market of raw materials used in NPPs. Chinese mines produce 70% of the uranium used in Chinese reactors and Chinese firms have actively acquired mines overseas. Chinese imports of U.S. graphite moderator rods recently increased. China is now the third largest buyer after Japan and Canada of U.S. graphite. Westinghouse is providing first cores for the Sanmen and Haiyang AP1000 units, and although China will take over fuel fabrication at the Baotou facility, there may be room to sell fuel to the Chinese market given front-end fuel cycle capacity.

Challenges and Barriers

Local content requirements are a key barrier for U.S. civil nuclear exports. China has an explicit policy of requiring technology transfer, and it has become increasingly self-sufficient as it gains experience constructing new reactors and other fuel cycle facilities, to the effect that new reactor builds in the near future may contain as much as 85% local content. Although there is strong foreign competition, the size of China's

market is so large and the pace at which it is building new reactors and facilities is so swift that China will remain a strong and dynamic market for U.S. exports for years to come in all areas of the civil nuclear supply chain. Chinese firms have a relationship with Westinghouse, with the first AP1000 builds under construction at Sanmen and Haiyang, but the sites have been beset by delays and problems with components, which may hinder cooperation on future projects.

Chinese Government support for new nuclear builds is strong mainly due to intense pressure to find new sources of clean electricity, and it appears unlikely that government policy will significantly change. Public opinion regarding nuclear energy in China is complex. On the one hand, a few cases of public opposition to new nuclear plants have caused delays or halts to planned projects, most noticeably with the construction postponement at new inland sites. On the other hand, strong public sentiment toward achieving clean air goals may make the public more supportive of nuclear energy. Agencies overseeing nuclear power and the fuel cycle are sensitive to public opinion and have increased public outreach regarding nuclear policy. However, the ability of the public to influence nuclear power decision-making is markedly limited.

Liability is a challenge for U.S. civil nuclear companies doing business in China. China has been drafting its Atomic Energy Law since 1985 and is updating the draft so it is compatible with CSC. China has noted its interest in signing the CSC, and with the expectation of Japan’s ratification and the CSC coming into force, China may have a bigger incentive to ratify.

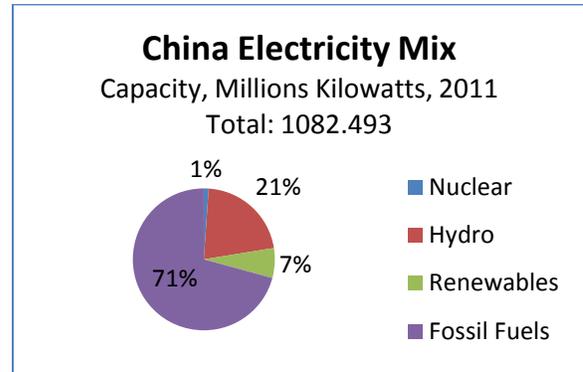
Nuclear Infrastructure

Research Reactor: China has 19 research reactors. The China Institute of Atomic Energy (CIAE) is the leading organization for basic

nuclear science research and runs the China Experimental Fast Reactor.

Fuel: China National Nuclear Corporation (CNNC) is responsible for domestic production; CNNC and the China General Nuclear Power Corporation (CGNPC) are active in overseas development of uranium. More than 2,000,000 tU of potential resources have been identified in China, but current production (1,800 tU per year) cannot meet China’s current and future needs. Even with increased production, China will need foreign imports to meet demand. CNNC and CGNPC import uranium from a variety of countries, mainly Kazakhstan, Canada, and Australia, and have acquired equity in uranium mines in Kazakhstan, Namibia, Niger, and Uzbekistan.

Waste Management: A centralized fuel storage facility has been built at Lanzhou Nuclear Fuel Complex. Regional storage centers are under development. Construction of a geological repository is planned for 2040, to open by 2050. Site selection is currently underway.



USG Cooperation

123 Agreement: China’s 123 Agreement with the United States will expire on January 1, 2016 with rolling five year extensions thereafter.

U.S.-China Protocol on Cooperation in Nuclear Safety Matters: The U.S. NRC and China’s National Nuclear Safety Administration (NNSA) are signatories to this Cooperative Arrangement, which was signed in July 2013.

United States Department of Commerce – International Trade Administration

May 2013 Trade Mission: In May 2013, former DOC Under Secretary Francisco Sánchez led a delegation including senior USG officials from DOC, DOE, ExIm Bank, and U.S. industry to work with the Chinese government on U.S.-China nuclear power cooperation.

Peaceful Uses of Nuclear Technology (PUNT) Agreement: the United States and China meet annually on nonproliferation and nuclear energy cooperation topics, including joint work on probabilistic risk assessment training for Chinese operators.

International Engagement

China has extensive international engagement. It signed an agreement with France’s Areva and EDF in 2013 on reactor development and is taking partial ownership of the planned reactors at Hinkley Point in the UK. China recently signed a deal with Russia for more VVERs at Tianwan and for fast breeder reactors. In July 2014 CNNC signed cooperation agreements with Canada’s SNC-Lavalin and Candu Energy. Both CNNC and CGNPC have also expanded ownership in uranium mines in Africa.

Additional Agreements	
Non-Proliferation Treaty	✓
IAEA Comprehensive Safeguards Agreement & Additional Protocol	✓
Joint Convention on Safety of Spent Fuel Management	✓
Convention on Nuclear Safety	✓

Convention on Early Notification of a Nuclear Accident	✓
Convention on Assistance in the Case of a Nuclear Accident or Radiological Emergency	✓
Paris Convention Liability Agreement	
Vienna Convention Liability Agreement	
Joint Protocol Liability Agreement	
Convention on Supplementary Compensation for Nuclear Damage	
Organization Membership	
IAEA	✓
Nuclear Suppliers Group	✓
OECD/NEA	
IFNEC	✓
GIF	✓

For more information on commercial opportunities in China, contact:

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Sources:

CIA World Factbook; United Nations; World Nuclear Association; Asian Development Bank, and our contacts at Post.

Czech Republic

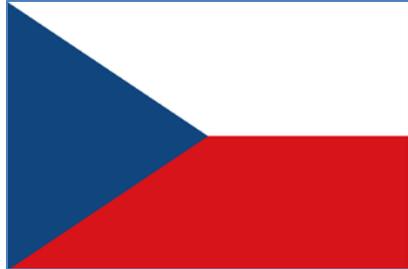
Overall Rank: 11

Market Type: Existing and Expanding

Sub-Sector Rank

New Builds 13 | Existing Reactors 16 | Decommissioning N/A

The Czech Republic has six operating nuclear reactors and plans to build two more. A tender for the new reactors was canceled in April 2014, putting the timing of the country’s plans into doubt. Experience during the tender process has shown that U.S. industry can be highly competitive in this market, despite the preponderance of Russian reactor designs for its existing fleet. Financing and recent policy changes regarding energy subsidies are the main challenges to U.S. exports to this market.



U.S. Ambassador to Czech Republic: Andrew Schapiro

Nuclear Energy in the Czech Republic

The Czech Republic currently has six operating nuclear reactors, all Russian-designed. Four reactors (model: VVER-440 V-213) are located at the Dukovany plant and two (model: VVER-1000 V-320) are located at the Temelín plant. The majority state-owned Czech Energy Works (ČEZ) owns and operates both plants.

In April 2014, the Czech government decided to postpone a tender for two new reactors at Temelín, citing difficulties in setting future electricity price guarantees. Toshiba-Westinghouse and a Russian consortium were the final bidders in the tender, proffering the AP1000 and MIR-1200 designs, respectively.

The Czech government will formulate a new plan and schedule for developing nuclear power that will likely involve launching a new tender and inviting a broader group of countries to bid. ČEZ originally wanted to choose a winner by November 2013, but the date was postponed due the July 2013 resignation of the Czech Prime Minister and cabinet amid bribery and power abuse scandals.

All Dukovany and Temelín units have undergone uprates in the past 10 years, and further uprates are under consideration. The lifetime of the four Dukovany units was extended by 10 years, with the first closure now due in 2025. ČEZ is reviewing plans to extend the lifetimes by an additional 20 years.

Planned Nuclear Energy Projects

Owner: Czech Energy Works (ČEZ)
Reactor Type: PWR
Capacity: 2x 1000+ MWe
Value of Project: Approx. \$10 billion
Construction Period: 2019-2026
Operation (tentative): 2026

Dukovany Plant Extension: A lifetime extension to 60 years is being considered for the Dukovany NPP; a feasibility study is being conducted for building new reactors at the Dukovany plant.

Temelín Expansion: Two new units at the Temelín site are planned to be put into operation in about 2026-2028.

Final solution for radioactive waste management: Proposed construction of a high-level waste repository to start in 2050 and be in operation in 2065.

Commercial Opportunities

Design, Construction and Operations: Tender for two reactors at Temelín has been postponed, but a new plan for reactor development will be published soon.

Licensing Support: The Czech licensing agency (SUJB) may require consulting assistance during the licensing phase of the Temelín tender. However, due to the tender delay, opportunities for such support may not exist until 2015.

Fuel Management: There is potential for a tender for enriched uranium for the first cores of the two proposed new reactor units (3 & 4) at Temelín. Due to the delay in the design and construction tender, this opportunity will be delayed as well.

Waste Management: ČEZ is currently in pre-tender qualification period for the design, licensing, and supply of dual-purpose storage and transport metal casks and related equipment for an on-site dry storage facility for used nuclear fuel.

Challenges and Barriers

Financial challenges and recent political instability are the main obstacles to U.S. civil nuclear exports to the Czech Republic. Westinghouse's high ranking in the Temelín bid selection shows that U.S. industry can be highly competitive in this market, although the postponement may result in the Czech government giving a fresh look to other foreign bidders in the next round. The preponderance of Russian reactor designs for the Czech Republic's existing fleet makes it challenging for U.S. companies to export products/services to support the Czech fleet.

Czech Government support for new nuclear power has become more questionable in the past year. The July 2013 resignation of the Prime Minister and cabinet forced the country to push back its decision on the Temelín tender, and the April 2014 announcement to postpone and rebid the tender introduces more uncertainty regarding the Czech Government's commitment to expanding the Temelín plant. Renewable energy subsidies, enacted by the former government, resulted in spikes in consumer electricity prices and have created a backlash in public opinion toward price guarantees. This experience has made the current government reluctant to engage in a similar scheme regarding new nuclear power. Despite these setbacks, public opinion toward nuclear power has remained favorable in recent years.

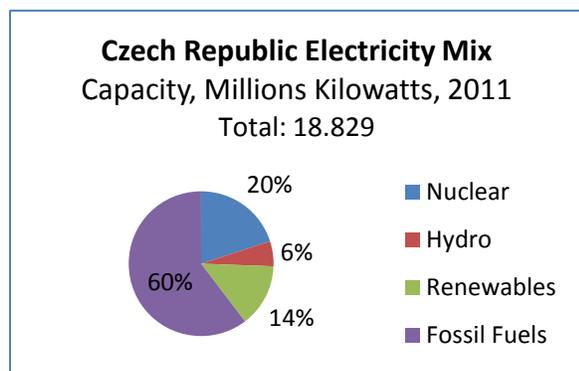
Financing new NPPs remains a significant challenge. The Czech Government has reached out to foreign partners, including the United States and Russia, for assistance in financing its planned new nuclear reactors. Financing pledges will likely be an important component in future tenders.

Nuclear Infrastructure

Research Reactor: The Rez Nuclear Research Institute has two research reactors in operation, and the Czech Technical University in Prague operates a third research reactor.

Fuel: Fuel for Dukovany and Temelín are both supplied by Russia’s TVEL, though Temelín was supplied by Westinghouse until 2010. The Czech Republic’s mine at Rožná—the only operational uranium mine in Central Europe—is nearing depletion, and the government is considering reopening a uranium mine near Jihlava, estimated to have 3,000 to 4,000 tons of uranium ore.

Waste Management: Used fuel storage and management is the responsibility of ČEZ until it is handed over to the Radioactive Waste Repository Authority (RAWRA) for storage in one of three interim dry-storage facilities. RAWRA is in charge of siting and building a high-level waste repository. Construction will start after 2050 with operation beginning in 2065.



USG Cooperation

123 Agreement: The Czech Republic has a 123 Agreement with the U.S. through Euratom.

Joint Declaration on Civil Nuclear Commercial Cooperation: In December 2010, the Department of Energy (DOE) and the Department of Commerce (DOC), together with the Czech Ministry of Industry and Trade (MOIT), signed a Joint Declaration Concerning

Industrial and Commercial Cooperation in the Nuclear Energy Sector.

July 2011 Trade Policy Mission: In July 2011, former DOC Under Secretary Francisco Sánchez led a civil nuclear trade policy mission with 11 U.S. civil nuclear companies to the Czech Republic, Poland and Slovakia.

U.S.-Czech Economic and Commercial Dialogue: DOC-MOIT initiative to increase bilateral business development and trade promotion; facilitate investment expansion; foster innovation; and identify and resolve market access issues.

Civil Nuclear Cooperation Center: In April 2012, DOE signed an MOU on nuclear energy R&D cooperation, and in 2014, it helped establish a Civil Nuclear Cooperation Center in Prague. DOC also maintains an Economic and Commercial Dialogue with MOIT.

U.S. Czech Technical Cooperation Arrangement: The NRC and the Czech Republic State Office for Nuclear Safety (SUJB) are signatories to this Arrangement, which was renewed at the 2014 International Atomic Energy Agency’s General Conference.

U.S.-Czech Implementing Agreement: The NRC has two active research agreements with SUBJ for the sharing and exchanging of information: the Code Applications and Maintenance Program (CAMP) and the Cooperative Severe Accident Research Program (CSARP), signed in 2012. These programs analyze thermal hydraulic modeling and perform severe accident analysis for reactors.

U.S. Export-Import Bank (ExIm) Financing: ExIm is prepared to lend Czech power group ČEZ around half the cost of enlarging its Temelín nuclear power plant if U.S. bidder Westinghouse wins the tender to build it.

R&D Cooperation: R&D workshops, seminars, training activities and academic exchanges are planned through the recently established joint Civil Nuclear Cooperation Center in Prague. The United States has pledged \$500,000 (£319,476) via contributions to the IAEA’s Peaceful Uses Initiative for regional activities to be performed in collaboration with the Center.

Additional Agreements	
Non-Proliferation Treaty	✓
IAEA Comprehensive Safeguards Agreement & Additional Protocol	✓
Joint Convention on Safety of Spent Fuel Management	✓
Convention on Nuclear Safety	✓
Convention on Early Notification of a Nuclear Accident	✓
Convention on Assistance in the Case of a Nuclear Accident or Radiological Emergency	✓
Paris Convention Liability Agreement	
Vienna Convention Liability Agreement	✓
Joint Protocol Liability Agreement	✓
Convention on Supplementary Compensation for Nuclear Damage	
Organization Membership	
IAEA	✓
Nuclear Suppliers Group	✓
OECD/NEA	✓
IFNEC	✓
GIF	✓

International Engagement

The Czech Republic has extensive international collaboration through the Visegrad Group (also

known as the V4), which consists of the Czech Republic, Hungary, Poland, and Slovakia. The June 2013 Warsaw Summit, attended by the countries’ prime ministers, commemorated the tenth anniversary of V4-Japan cooperation. In a joint statement, the parties expressed their intention to further strengthen their ties in a range of areas, as well as recognizing the “attractive opportunities” represented by the V4’s markets for Japanese companies. The participants formally expressed their “great interest in deepening mutual cooperation” in nuclear energy, environment, energy saving and renewable energy, while Japan reaffirmed its “duty” to contribute to worldwide nuclear safety by sharing knowledge and lessons learned from the 2011 accident at the Fukushima Daiichi nuclear power plant.

For more information on the commercial opportunities in the Czech Republic, contact: Hana Obrusnikova (Commercial Specialist, Hana.Obrusnikova@trade.gov); White House Director for Nuclear Energy Policy Joyce Connery (Joyce_L_Connery@nss.eop.gov); ITA Civil Nuclear Team: Jonathan Chesebro (jonathan.chesebro@trade.gov)

Sources: CIA World Factbook, United Nations, World Nuclear Association, Asian Development Bank, and USG contacts at Post

Japan

Overall Rank: 15

Market Type: Mature and Decommissioning

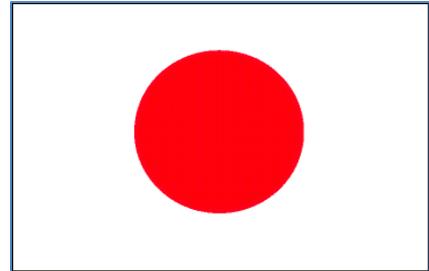
Sub-Sector Rank

New Builds 44 |

Existing Reactors 4 |

Decommissioning 2

Japan’s civil nuclear program has undergone tremendous changes since the March 2011 Fukushima accident. All of Japan’s 48 operational reactors are offline as of late-2014, and the government is struggling to find a politically acceptable plan for restarting them. While new builds do not appear likely in the near-term, viable opportunities for U.S. exports exist for decontamination and remediation services at Fukushima as well as other goods/services for Japan’s existing reactor fleet.



U.S. Ambassador to Japan: Caroline Kennedy

Nuclear Energy in Japan

Japan has 54 operational reactors according to the IAEA Power Reactor Information System (PRIS) database, making up a net capacity of 42.6 GWe, but following the March 2011 Fukushima accident, all reactors were taken offline as Japan revised its nuclear safety regulations. Subtracting out the 6 reactors on the Fukushima Daiichi site, Japan has 48 reactors potentially available for restart.

Loss of nuclear power has caused hardship to Japan’s trade balance, energy security, and economy. To make up for the loss of nuclear generated electricity, Japan was forced to boost imports of oil and gas, and its dependency on fossil fuels rose from 60% before the

earthquake to 90% afterward. As a result, in 2011 Japan had a trade deficit for the first time in over 30 years, and the deficit has increased each year since then. Recent estimates have placed Fukushima related losses for the Japanese nuclear industry at \$50 billion.

Given these challenges, the Government of Japan (GOJ) has prioritized restarting part of its nuclear reactor fleet. The government’s 4th Strategic Energy Plan, released in April 2014, recognized the role that nuclear energy must play in a diversified, secure, and efficient energy supply. Though it did not specify targets for nuclear energy or renewables, it explicitly stated the government’s intention to focus on restarting reactors in the near-term, while also noting the need to reduce dependence on nuclear energy. Several plants have applied for restart but are currently facing legal and public

opinion challenges. On July 16, 2014, Japan's Nuclear Regulatory Authority (NRA) - set up in 2012 to replace the Nuclear and Industrial Safety Agency (NISA) and the Nuclear Safety Commission (NSC) to oversee nuclear safety regulation - approved the restart of the Sendai plant in Kagoshima Prefecture. On November 7, 2014 regional authorities approved the restart, which is likely to occur in 2015.

Aside from reactor restarts, the government's main focus has been the cleanup and policy response to the Fukushima accident. The International Research Institute for Nuclear Decommissioning (IRID) was established in August 2013 to research and develop technologies to assist with nuclear decommissioning, promote cooperation with international and domestic organizations on nuclear decommissioning, and develop human resources for R&D. Over the past year, the GOJ has increasingly sought international assistance to address contaminated water issues at the Fukushima Daiichi Nuclear Power Station and advice on decommissioning and decontamination projects.

Japan is building several fuel cycle facilities in an attempt to achieve commercial-scale capabilities in all aspects of the fuel cycle. Current construction projects include a MOX fuel fabrication plant at the Rokkasho site. After years of delay, Japan recently completed construction of the Rokkasho commercial-scale reprocessing facility, although it has yet to begin commercial operation. Japan has converted several reactors to be MOX fuel bearing and plans to convert others. The government has operated a prototype fast reactor, Monju, though it was recently placed in long-term shutdown and its future is uncertain.

Commercial Opportunities

Services (front-and back-end): Advisory services for decommissioning and

decontamination and assistance with safety upgrades to reactor fleet.

Legal and Consulting Services: Advisory assistance with Fukushima cleanup and public relations in line with NRA guidelines.

Design, Construction and Operations: Limited due to post-Fukushima halt of new nuclear construction.

Licensing Support: Potential for advisory assistance to electric utilities.

Fuel Management: Limited potential.

Waste Management: Limited potential.

Challenges and Barriers

Reduced market access, government policy, and public opinion are significant challenges to U.S. civil nuclear exports to Japan. In its response to the Fukushima accident, Japan has shown a limited inclination to seek help from industry abroad, preferring to keep tight control on managing leaks to contaminated water and other challenges to the decontamination and decommissioning of the site. Recently, Japan has made more of an effort to seek international assistance, which could result in more opportunities for U.S. industry involvement.

The restart of Japanese reactors could produce export opportunities for U.S. goods and services, particularly as Japanese reactors undergo safety improvements and the nation continues to adapt to its post-Fukushima regulatory and safety policies. While the current government is in favor of reactor restarts, opposition from the Japanese public, often acting in tandem with the courts, has caused significant delays, and it is unclear how successful the government's restart policy will be. Even if Japan overcomes these hurdles to revitalizing its civil nuclear program, U.S. content for civil nuclear projects in Japan will be limited due to the strength, experience, and capability of Japan's industry. U.S. industry also faces strong competition from other countries

such as France and Russia for other areas of the fuel cycle, such as fast reactors, MOX facilities, and reprocessing technology.

Japan scores highly in nearly all financial and infrastructure indicators. The November 2014 Diet ratification of the CSC liability regime and the implementing legislation is a positive development.

Despite the above challenges, the U.S. and Japanese civil nuclear industries remain highly integrated and have years of experience collaborating on projects. Japan is and will remain an important partner for the United States in the civil nuclear sector. USG support for U.S. civil nuclear exports is essential, particularly as Japan continues to pursue its post-Fukushima priorities.

Nuclear Infrastructure

Research Reactor: The Japan Atomic Energy Agency (JAEA) manages an extensive R&D program throughout the country and runs several research reactors and experimental test facilities.

Fuel: Japan has no indigenous uranium. Uranium imports come primarily from Australia, Canada, and Kazakhstan; Japanese companies are increasingly taking equity in overseas uranium projects, including in Kazakhstan, Australia, and Namibia.

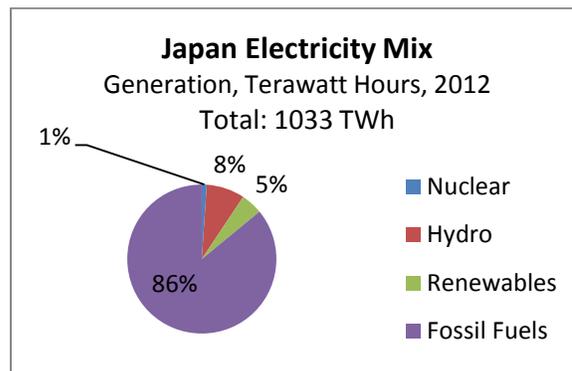
Fuel Cycle: Japan has fuel cycle facilities, though not yet at commercial scale. Japan Nuclear Fuel Ltd (JNFL) operates a commercial enrichment plant at Rokkasho, though much enrichment is still imported. A new enrichment plant in Japan using Russian centrifuge technology is planned under an agreement between Rosatom and Toshiba.

Several fuel fabrication facilities exist to supply Japan’s fleet of PWRs and BWRs and, in a

limited capacity, HTRs, and a MOX fuel-bearing reactor for R&D purposes. A new 600 tU/yr plant is planned by Areva and Mitsubishi Nuclear Fuel (MNF). JNFL is building a MOX fuel fabrication plant in Rokkasho, known as J-MOX, though due to construction delays most MOX is fabricated in France using Japanese fuel.

A commercial scale reprocessing facility at Rokkasho has recently finished construction but is awaiting the start of commercial operation. The Japan Atomic Energy Agency (JAEA) recently announced that it will permanently shut down the Tokai pilot reprocessing plant, which has stood idle since 2006.

Waste Management: Japan’s first high-level waste (HLW) interim storage facility opened in Rokkasho-mura in 1995. A permanent HLW storage facility is part of the 2014 energy strategy. Facility siting is a major challenge.



Note: gross generation, rather than capacity, is shown in chart to show effect of nuclear reactor shutdowns.

USG Cooperation

123 Agreement: Japan’s 123 Agreement with the United States will expire on July 30, 2018 but will remain in force until terminated by either Party.

U.S.-Japan Fukushima Recovery Forum: In February 2014 the U.S. and Japan organized a Fukushima Recovery Forum in Tokyo to identify bilateral activities for the U.S. to assist Japan in its decommissioning and remediation efforts.

U.S.-Japan Bilateral Commission on Civil Nuclear Energy Cooperation (BLC): Established in April 2012, the BLC serves as a forum to foster a strategic dialogue and joint activities related to the safe and secure use of civil nuclear energy and the response to Fukushima. The BLC includes five working groups: (1) Nuclear security; (2) Civil nuclear energy research and development; (3) Safety and regulatory issues; (4) Emergency management; and (5) Decommissioning and environmental management.

Regulatory Cooperation: The U.S. NRC and Japan’s NRA have a long-standing arrangement for the exchange of technical information and cooperation in nuclear safety and security matters. In addition, the NRC and NRA have semiannual Steering Committee meetings to provide direction for upcoming collaborative activities between U.S. and Japanese national nuclear regulatory agencies, facilitate information sharing related to mutually beneficial nuclear safety and security regulatory issues, and incorporate lessons learned from the Fukushima-Daiichi accident.

International Engagement

Japanese government officials have been actively marketing Japanese reactors around the world during diplomatic visits, particularly in regions such as Southeast Asia, Africa, and the Middle East.

In October 2010, Japan and Vietnam signed an agreement for construction of a nuclear power plant in Vietnam at Vinh Hai in Ninh Thuan province. In July 2011, Hitachi was chosen to build Lithuania’s proposed nuclear reactor at Visaginas. In 2011, JAPC signed agreements with Electricity of Vietnam to build 2 nuclear reactors in Ninh Thuan province.

Japan’s civil nuclear industry has extensive ties to U.S. and French industry. Toshiba owns 87% of Westinghouse Electric Company, Hitachi and

GE have a joint venture partnership, and MHI partners with Areva.

Japan engages with many countries on advanced civil nuclear R&D in all parts of the fuel cycle, including laboratory-to-laboratory R&D as well as planning and constructing test and demonstration facilities.

Additional Agreements	
Non-Proliferation Treaty	✓
IAEA Comprehensive Safeguards Agreement & Additional Protocol	✓
Joint Convention on Safety of Spent Fuel Management	✓
Convention on Nuclear Safety	✓
Convention on Early Notification of a Nuclear Accident	✓
Convention on Assistance in the Case of a Nuclear Accident or Radiological Emergency	✓
Paris Convention Liability Agreement	
Vienna Convention Liability Agreement	
Joint Protocol Liability Agreement	
Convention on Supplementary Compensation for Nuclear Damage	
Organization Membership	
IAEA	✓
Nuclear Suppliers Group	✓
OECD/NEA	✓
IFNEC	✓
GIF	✓

United States Department of Commerce – International Trade Administration

For more information on commercial opportunities in Japan, contact: Gregory Briscoe (Commercial Officer in Tokyo, gregory.briscoe@trade.gov); John Fleming (Principal Commercial Officer in Osaka, john.fleming@trade.gov); Takahiko Suzuki (Commercial Specialist in Tokyo, takahiko.suzuki@trade.gov); White House Director for Nuclear Energy Policy Joyce Connery

(Joyce_L_Connery@nss.eop.gov); ITA Civil Nuclear Team:
Jonathan Chesebro (jonathan.chesebro@trade.gov)

Sources:

CIA World Factbook, United Nations, World Nuclear Association, Asian Development Bank, and our contacts at Post

Malaysia

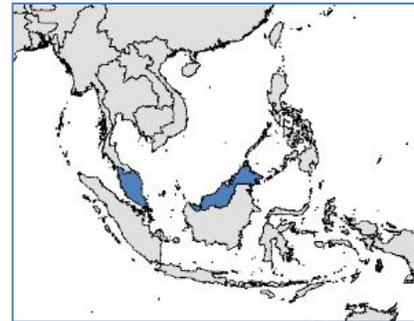
Overall Rank: 25

Market Type: Newly Emerging

Sub-Sector Rank

New Builds 18 (tied) | Existing Reactors N/A | Decommissioning N/A

Malaysia has expressed a strong interest in developing a nuclear energy program and has conducted feasibility studies for building nuclear reactors. If Malaysia goes forward with building nuclear reactors, it would be positioned as a key export market for U.S. civil nuclear companies. The lack of a liability regime and a 123 Agreement are current barriers, but Malaysia is better positioned to overcome financial obstacles than many other newcomer countries given its strong investment climate and ease of doing business.



U.S. Ambassador to Malaysia: Joseph Y. Yun

Nuclear in Malaysia

Malaysia has expressed a strong interest in developing a nuclear energy program but does not have any operational nuclear power plants and is not building any.

The Malaysian government has established a nuclear agency charged with planning for new nuclear power development and has stated its intention to strongly consider nuclear energy as an alternative to coal. Malaysia has hired an international consulting firm to conduct a feasibility study for two possible nuclear power plants/reactors. The feasibility study includes location and technology evaluations. However, plans for a nuclear plant have been delayed several times and are still at the feasibility

stage. If plans went ahead, the contract would be issued around 2018 and construction would not begin before 2021.

In late 2013 Malaysian government officials announced a postponement to Malaysia’s move to nuclear power. In October 2013, Malaysia’s Minister of Energy stated at the World Energy Congress that widespread support did not yet exist for nuclear power and that current plans would be “kept in view” until further notice.

Planned Nuclear Energy Projects

Owner: Government of Malaysia
Operator: Malaysia Nuclear Power Group
Reactor Type: Unspecified
Capacity: N/A
Value of Project: N/A

Construction Period: 11-12 years
Operation (tentative): 2032-2033

Commercial Opportunities

Services (front-and back-end): Human resource training and education; possibilities for future feasibility studies and infrastructure development.

Licensing Support: Potential support for Malaysia’s Atomic Energy Licensing Board.

Design, Construction and Operations: New reactors are under consideration.

Components: Study phase

Fuel Management: Study phase

Waste Management: Study phase

Challenges and Barriers

A lack of strong government commitment to building new nuclear power is the chief obstacle to U.S. civil nuclear exports. Despite some statements in the late 2000s in support of nuclear power development, the Malaysian nuclear program has not progressed beyond exploratory feasibility studies. More recent policy statements have been muted, detailing a more cautious, long-term approach.

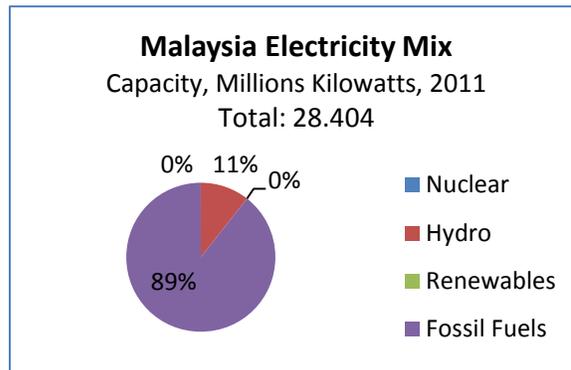
If government support increased and solid plans took shape, Malaysia would be positioned as a key export market for U.S. civil nuclear companies. The lack of a liability regime and a 123 Agreement are current barriers, but Malaysia is better positioned to overcome financial obstacles than many other newcomer countries given its strong investment climate and ease of doing business.

Nuclear Infrastructure

Research Reactor: Reactor TRIGA PUSPATI (RTP), which started operation in 1982, is the only nuclear research reactor in Malaysia.

Waste Management: The Waste Technology Development Centre (WasTeC-Nuclear

Malaysia) is responsible for managing radioactive waste in Malaysia.



USG Cooperation

123 Agreement: Malaysia does not have a 123 Agreement with the United States.

Additional Agreements	
Non-Proliferation Treaty	✓
IAEA Comprehensive Safeguards Agreement & Additional Protocol	✓
Joint Convention on Safety of Spent Fuel Management	
Convention on Nuclear Safety	
Convention on Early Notification of a Nuclear Accident	✓
Convention on Assistance in the Case of a Nuclear Accident or Radiological Emergency	
Paris Convention Liability Agreement	
Vienna Convention Liability Agreement	
Joint Protocol Liability Agreement	
Convention on Supplementary Compensation for Nuclear Damage	
Organization Membership	
IAEA	✓
Nuclear Suppliers Group	

United States Department of Commerce – International Trade Administration

OECD/NEA	
IFNEC	✓
GIF	

For more information on commercial opportunities in Malaysia, contact: Stephen Jacques (Senior Commercial Officer in Kuala Lumpur, stephen.jacques@trade.gov);

White House Director for Nuclear Energy Policy Joyce Connery (Joyce_L_Connery@nss.eop.gov); ITA Civil Nuclear Team: Jonathan Chesebro (jonathan.chesebro@trade.gov).

Sources:

CIA World Factbook, United Nations, World Nuclear Association, Asian Development Bank, and contacts at Post

Mexico

Overall Rank: 7

Market Type: Existing and Expanding

Sub-Sector Rank

New Builds 8 | Existing Reactors 14 | Decommissioning N/A

Mexico has two operational GE-designed BWR reactors at Laguna Verde. For several years, the Mexican government has been interested in building new nuclear reactors, beginning with an expansion of the Laguna Verde plant. If these plans go forward, U.S. civil nuclear companies will be in a strong position to export goods and services due to the long-standing ties companies have forged with Mexico’s program. Opportunities also exist to supply goods and services for the existing Laguna Verde plants.



U.S. Ambassador to Mexico: Ted Osius

Nuclear in Mexico

Mexico currently has two operational GE-designed BWR reactors at Laguna Verde that supply about 4% of the nation’s electricity.

For several years, the Government of Mexico (GOM) has considered building new nuclear power reactors, beginning with two additional units at Laguna Verde. Precise government plans for new capacity remain undefined. Despite being a net energy exporter, Mexico wants to develop nuclear energy in order to reduce its dependence on natural gas.

Between 2007 and 2013, Mexico’s Federal Electricity Commission (CFE), the state-owned electricity company that owns the Laguna Verde

plant, contracted with Spain’s Iberdrola Engineering and France’s Alstom to replace components and uprate both reactors, resulting in a 20% increase in net power capacity. Operating licenses for Laguna Verde Units 1 and 2 will expire June 2020 and April 2025, respectively; CFE is expected to request license extensions, but no formal application has been filed to date.

Mexico’s recent energy reforms – signed into law in August 2014 – call for additional renewable energy generation (which includes nuclear). The reform transforms CFE into a “state productive enterprise” that will sell electricity to the national grid, which could accelerate Laguna Verde expansion plans.

Planned Nuclear Energy Projects

Additional Laguna Verde Reactors: An international tender for two 1,000MW reactors at the Laguna Verde nuclear power site could be released in the next few years. The total project value is estimated at \$11-\$16 billion. Foreign competitors are expected to include companies from Russia, France, Japan, and Korea.

Commercial Opportunities

Services (front- and back-end): Possibilities for feasibility studies and infrastructure development for Laguna Verde expansion.

Licensing Support: Limited opportunities.

Design, Construction and Operations: New reactors are under consideration.

Components: Potential with new reactor builds.

Fuel Management: Limited opportunities.

Waste Management: Potential services for future disposal site.

Challenges and Barriers

Mexico’s potential expansion of the Laguna Verde plant presents a great opportunity for U.S. industry. However, beyond this project, the overall prospect for U.S. civil nuclear exports is limited. Mexico scaled back its nuclear development plans in response to the Fukushima accident, and it has now tentatively committed to building only two additional reactors. Forthcoming details on Mexico’s nuclear energy policy will be needed before a more robust assessment for U.S. exports can be made.

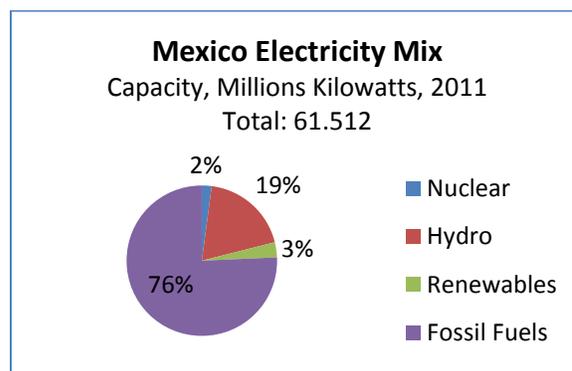
Financing will be a key challenge, as it is for most countries seeking to build new nuclear plants. Mexico’s strong relationship to U.S. industry through the Laguna Verde plant and its good U.S. Ex-Im Bank rating should help with overcoming this challenge.

Nuclear Infrastructure

Research Reactor: Mexico’s National Nuclear Research Institute (NNRI) operates a 1 MWe Triga Mk III research reactor that has been operational since 1968.

Fuel: Mexico’s Ministry of Energy (MOE) delegates the responsibility for uranium mining and prospecting policy to the Mineral Resources Board. 2,000 tons of uranium reserves have been identified in Mexico but have not been exploited.

Waste Management: The MOE is responsible for used fuel storage and disposal. A collection, treatment and storage center for LLW has operated at Maquixco since 1972.



USG Cooperation

123 Agreement: Mexico does not have a 123 Agreement with the United States. A Project Supply Agreement between Mexico, the United States, and the IAEA enables U.S. civil nuclear cooperation and trade with Mexico relating to the Laguna Verde NPP.

Regulatory Cooperation: Extensive cooperation with the U.S. NRC, including: a Bilateral Arrangement for the exchange of technical information and cooperation in nuclear safety and research (renewed in 2012); a Memorandum of Cooperation (MOC) Between the CNSNS and the NRC for Import and Export of Certain Radioactive Sources (2012); CNSNS participation in the Code Applications and Maintenance Program (CAMP) and the

United States Department of Commerce – International Trade Administration

Cooperative Severe Accident Research Program (CSARP) since 2009.

Additional Agreements	
Non-Proliferation Treaty	✓
IAEA Comprehensive Safeguards Agreement & Additional Protocol	✓
Joint Convention on Safety of Spent Fuel Management	
Convention on Nuclear Safety	✓
Convention on Early Notification of a Nuclear Accident	✓
Convention on Assistance in the Case of a Nuclear Accident or Radiological Emergency	✓
Paris Convention Liability Agreement	
Vienna Convention Liability Agreement	✓
Joint Protocol Liability Agreement	✓
Convention on Supplementary Compensation for Nuclear Damage	
Organization Membership	
IAEA	✓

Nuclear Suppliers Group	✓
OECD/NEA	✓
IFNEC	✓
GIF	

International Engagement

Mexico has a science and technology agreement with the United States and Canada. Nuclear energy engagement is primarily with the IAEA.

For more information on the commercial opportunities in Mexico, contact: Francisco Ceron (Senior Trade Specialist, Francisco.ceron@trade.gov) in Mexico City; John Howell (Principal Commercial Officer in Monterrey, john.howell@trade.gov); White House Director for Nuclear Energy Policy Joyce Connery (Joyce_L_Connery@nss.eop.gov); ITA Civil Nuclear Team: Jonathan Chesebro (jonathan.chesebro@trade.gov)

Sources: CIA World Factbook, United Nations, World Nuclear Association, Asian Development Bank, and our contacts at Post

Poland

Overall Rank: 10

Market Type: Newly Emerging

Sub-Sector Rank

New Builds 9 | Existing Reactors N/A | Decommissioning N/A

The Polish government is currently planning to build two nuclear power plants comprising 6 GWe of generating capacity. A recent three-year postponement of the first tender could prove beneficial to U.S. industry since it will give the Polish utility PGE more time to pursue viable financing options, which continue to be the biggest challenge to building nuclear power plants in Poland. To assist U.S. industry, the USG should help steer Poland away from the build-own-operate model, which it has shown interest in pursuing.



U.S. Ambassador to Poland: Stephen Mull

Nuclear Energy in Poland

Poland currently has no operating nuclear power plants. Construction on four Russian VVER units began in the 1980s at Zarnowic in northern Poland, but the project was canceled in 1990.

The Polish government is currently planning to build two nuclear power plants comprising 6 GWe of generating capacity. The first will likely be located in Zarnowic or Choczewo in northern Poland, and the second at a site in eastern Poland. In January 2014, Poland released a revised schedule for its nuclear power program that called for site and

technology selection for its first NPP by the end of 2016. The first unit of the first NPP would begin operation in 2024, with the next 2-3 units being constructed in the following years. The second NPP should become operational in 2035. So far, the Polish government has shown interest in French, Korean, Canadian, Japanese and U.S. designs.

State-owned utility Polska Grupa Energetyczna (PGE) set up the company PGE EJ1 to build and run the new plants. In September 2013, PGE entered into a shareholder agreement with Polish utilities Tauron Polska Energia and ENEA as well as copper supplier KGHM Polska Miedz, wherein PGE holds 70% of PGE EJ1 and the other companies each hold 10%. A follow-on

agreement with similar terms was signed in September 2014.

Planned Nuclear Energy Projects

First Nuclear Power Plant Project

Owner: PGE EJ1 consortium

Reactor Type: undetermined: technology selection by end of 2016

Capacity: 3000 MWe

Value of Project: \$13 to \$19 billion

Construction Period: Unit 1: 2018-2024

Operation (tentative): Unit 1: 2024; Unit 2: 2030

Second Nuclear Power Plant Project

Owner: PGE EJ1 consortium

Reactor Type: undetermined

Capacity: 3000 MWe

Value of Project: undetermined

Construction Period: late 2020s to early 2030s

Operation (tentative): 2035

Commercial Opportunities

Services (front- and back-end): Site characterization and selection, feasibility studies, owner's engineer services, regulatory assistance, infrastructure development, human resource development.

Legal and Consulting Services: Potential for pre-construction services.

Licensing Support: Potential for pre-construction services.

Design, Construction and Operations: By the end of 2016, the Polish government is expected to select the technology for the first NPP. Currently Westinghouse-Toshiba, GE-Hitachi, Areva/EdF, Rosatom (Russia), Candu Energy/SNC-Lavalin (Canada), and KEPCO (Republic of Korea) have shown interest in competing for this project.

Components: None currently

Fuel Management: None currently

Waste Management: None currently

Challenges and Barriers

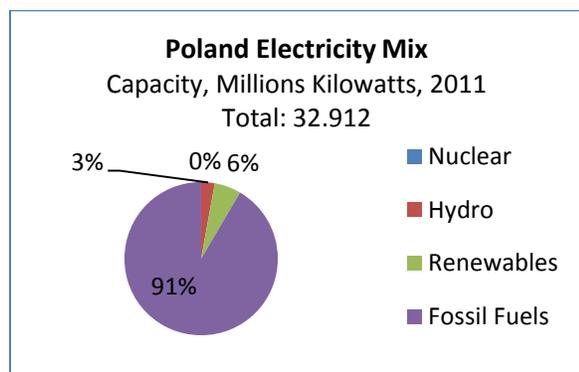
Poland's first reactor tender will attract stiff competition from France and the Republic of Korea—and potentially others—but U.S. industry is well positioned. The recent three-year postponement of the first tender could prove beneficial to U.S. industry since it will give PGE more time to pursue viable financing options, which continue to be the biggest challenge to building NPPs in Poland. Poland's plan to structure its first NPP project using a build-own-operate (BOO) model is a challenge for U.S. industry since it requires multiple companies to bid as a consortium, while state-owned/controlled competitors' vertically integrated industries do not face this challenge. Interested bidder consortia will be asked to include the following in their offers: reactor technology for two or three units with EPC services, operations and maintenance (O&M) support, equity interest of a strategic partner, including energy off-take, ECA or commercial bank financing and fuel supply.

Polish Government support is strong and public opinion is moderately favorable toward the country's nuclear build plans. However, former Prime Minister Tusk publicly acknowledged challenges that his country faces, including falling electricity prices, changes in European energy market regulations, and obtaining an adequate financial model for developing the first NPP.

Poland's ratification of the 1997 Protocol to the Vienna Convention on Civil Liability for Nuclear Damage will help reduce liability concerns for U.S. industry, and its favorable U.S. Ex-Im Bank Long-Term Exposure Fee rating should provide a boost for U.S. industry competitiveness.

Nuclear Infrastructure

Research Reactor: The research reactor Maria, used also for production of medical radioisotopes and operated in Swierk (National Centre for Nuclear Research), is the only operating nuclear facility in Poland.



USG Cooperation

123 Agreement: Poland has a 123 Agreement with the United States through Euratom.

Regulatory Cooperation: In September 2010, Poland’s National Atomic Energy Agency (PAA) signed an Arrangement with the NRC for Technical Information Exchange and Cooperation in Nuclear Safety Matters. The PAA has signed agreements securing access to the Code Applications and Maintenance Program (CAMP) and the Cooperative Severe Accident Research Program (CSARP).

Joint Declaration on Civil Nuclear Commercial Cooperation: In July 2010, the Department of Commerce and Poland’s Ministry of Economy signed a Joint Declaration Concerning Industrial and Commercial Cooperation in the Nuclear Energy Sector.

July 2011 Trade Policy Mission: In July 2011, former DOC Under Secretary Francisco Sánchez led a civil nuclear trade policy mission with 11 U.S. civil nuclear companies to Poland, the Czech Republic, and Slovakia.

U.S.-Poland Economic and Commercial Dialogue: Initiative between DOC and the Polish Ministry of Economy to promote bilateral trade and investment and further bilateral economic and commercial relations.

Additional Agreements	
Non-Proliferation Treaty	✓
IAEA Comprehensive Safeguards Agreement & Additional Protocol	✓
Joint Convention on Safety of Spent Fuel Management	✓
Convention on Nuclear Safety	✓
Convention on Early Notification of a Nuclear Accident	✓
Convention on Assistance in the Case of a Nuclear Accident or Radiological Emergency	✓
Paris Convention Liability Agreement	
Vienna Convention Liability Agreement	✓
Joint Protocol Liability Agreement	✓
Convention on Supplementary Compensation for Nuclear Damage	
Organization Membership	
IAEA	✓
Nuclear Suppliers Group	✓
OECD/NEA	✓
IFNEC	✓
GIF	

International Engagement

PAA is an active participant in the IAEA Regulatory Cooperation Forum (RCF). It has extensive international collaboration through the Visegrad Group (also known as the V4), which consists of Poland, Hungary, the Czech Republic, and Slovakia. The V4 formally expressed their “great interest in deepening mutual cooperation” in nuclear energy, environment, energy saving and renewable energy, with Japan during a 2013 Japan-V4 summit. Japan also reaffirmed its “duty” to contribute to worldwide nuclear safety by

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sharing knowledge and lessons learned from the 2011 accident at the Fukushima Daiichi nuclear power station. Poland had plans to cooperate with Lithuania, Estonia and Latvia to build a new NPP in Lithuania but PGE withdrew from the project in December 2011 citing unacceptable project terms.

For more information on commercial opportunities in Poland, contact: William Czajkowski (Senior Commercial Officer in Warsaw, William.czajkowski@trade.gov); Brenda VanHorn (Commercial Officer in Warsaw, Brenda.VanHorn@trade.gov); Aleksandra Prus, Commercial Specialist in Warsaw, Aleksandra.Prus@trade.gov); White House Director for Nuclear Energy Policy Joyce Connery (Joyce_L_Connery@nss.eop.gov); ITA Civil Nuclear Team: Jonathan Chesebro (jonathan.chesebro@trade.gov)

Sources:

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Republic of Korea

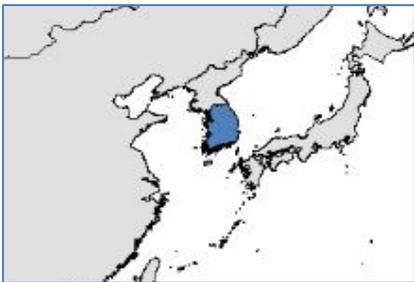
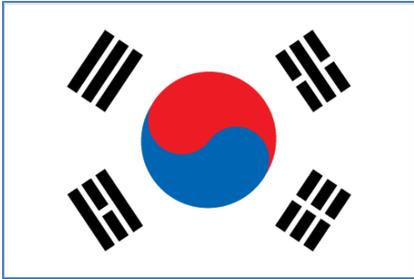
Overall Rank: 13

Market Type: Existing and Expanding

Sub-Sector Rank

New Builds 24 | Existing Reactors 8 | Decommissioning 14

The Republic of Korea (ROK) currently has 23 operational nuclear reactors at four sites. Five reactors are currently under construction, and more are planned, though recent corruption scandals regarding reactor components have caused the government to reduce its new construction target. Since the 1990s, the ROK has exclusively built domestic reactor designs, and it is now actively marketing its APR-1400 for export as a direct competitor to U.S. Generation-III reactors. Many opportunities exist for U.S. exports for the ROK’s existing reactor fleet.



U.S. Ambassador to the Republic of Korea:
Sung Kim

Nuclear Energy in the Republic of Korea

The Republic of Korea (ROK) currently has 23 operational nuclear reactors with a net capacity of 20.72 GWe. Five reactors consisting of an additional 6.87 GWe are under construction. Korea’s reactors are located at four sites (Kori, Wolsong, Hanbit, and Hanul); all new builds are expected to be located at these sites.

From the ROK’s first reactor, which achieved commercial operation in 1978, to the late 1990s, the ROK’s reactor fleet consisted of a variety of foreign designs: six Westinghouse PWRs, four Candu PHWRs, two Framatome (now Areva) PWRs, and two Combustion Energy (C-E, now owned by Westinghouse) PWRs. In 1987, Korea began a ten-year technology

transfer plan with C-E. The resulting design, the OPR-1000, was largely based on C-E’s System 80 model and became the sole design for the ROK’s subsequent new builds. Nine OPR-1000s have become operational since 1998 and one additional unit is scheduled to enter operation in 2014.

The Generation-III APR-1400, based on the C-E System 80+ model, is the successor to the OPR-1000. Four APR-1400s are under construction (Shin Kori 3 & 4 and Shin Hanul 1 & 4) with the first expected to be operational in 2015. One OPR-1000 is also under construction. (Shin Wolsong 2). Korea is marketing the APR-1400 for export, citing its superior safety features, low generation cost per kilowatt-hour, and short construction time, which according to the Korea Electric Power Corporation (KEPCO) has been reduced to 41 months. Three APR-1400s are currently being built in the UAE at Barakah.

A series of corruption scandals in 2012 and 2013 regarding falsified quality assurance certificates for reactor components caused President Park Geun-hye to pledge a review of all 23 reactors and a probe into the state-run Korea Hydro & Nuclear Power Co. (KHNP). A total of five reactors were taken offline temporarily and two that were under construction were delayed while parts that failed testing were replaced. In January 2014, the Korean Ministry of Trade, Industry and Energy (MOTIE) announced its 2nd National Basic Energy Plan which included a reduction of its new nuclear construction goals to 29% of its energy mix by 2035, down from the previous goal of 41% by 2035. This still represents a marked increase in Korea's current nuclear power generation capacity.

The Korea Atomic Energy Research Institute (KAERI) is developing a 100 MWe SMR, called SMART (System-integrated Modular Advanced Reactor) that it intends to market for export.

Planned Nuclear Energy Projects

Construction on six new reactors is planned over the next five years: four at Shin Kori and two at Shin Hanul. Four reactors (Shin Kori 5 & 6 and Shin Hanul 3&4) will use the APR-1400 design and two reactors (Shin Kori 7 & 8 will use either the APR-1400 or APR-1500 design. On November 21, 2014, KHNP signed an agreement with Yeongdeok County for the siting of an additional two-unit plant.

Commercial Opportunities

Services (front- and back-end): None currently
Legal and Consulting Services: Opportunities related to quality control of equipment and material procurement processes.
Licensing Support: None currently
Design, Construction and Operations: Heavily concentrated with local companies.

Components: Heavily concentrated with local companies, but there are opportunities for U.S. firms.

Fuel Management: None currently

Waste Management: None currently

Challenges and Barriers

The ROK's policy of requiring technology transfer and Independent Power Producer (IPP) indigenization has greatly reduced market access for U.S. industry, particularly for new builds. Korea was once a premier destination for U.S. civil nuclear exports, as U.S. reactor vendors joined those of France and Canada to supply Korea with 14 of its first 15 reactors. Korea now exclusively relies on indigenous designs for its new reactor builds, and the amount of local content for these reactors has become high. Recently, Korea's growing capabilities and export ambitions have turned it into a direct competitor with U.S. industry for exports to third countries, most noticeably with the UAE, where in 2009 a Korean consortium beat out GE-Hitachi and Areva for the Barakah tender.

Korea's civil nuclear program has served as a model for China, whose program includes a similar strategy of technology transfer and indigenization. One of the chief differences is that China's plans for new nuclear energy are so vast that it is still seeking foreign vendors to supply some of its new build capacity, albeit with high local content. Korea is no longer seeking foreign reactor technology.

Despite Korea's achievements in self-sufficiency, U.S. industry has strong ties to the ROK civil nuclear market, and there are still ample opportunities for exports of goods and services. Westinghouse and other U.S. suppliers are providing \$2 billion in components and technical support for the UAE's Barakah NPP. More recently, several U.S. companies won contracts with KHNP for reactor components and technical advisory services for re-

verification of equipment and material procurement processes following the false certification scandal.

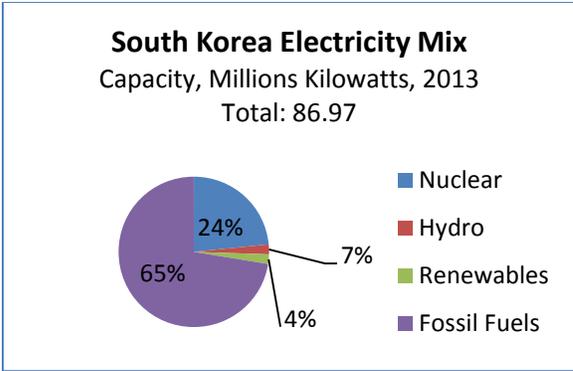
ROK Government support for nuclear energy remains high despite the recent counterfeit parts scandal. Official targets for future nuclear generating capacity, though reduced from a year earlier, still represent strong growth of nuclear power in Korea for years to come, and plans for exporting do not appear to be diminished. Korea scores highly on all financial indicators. However, liability continues to be an issue. Despite efforts by USG and industry, Korea has not yet agreed to adopt the CSC or other liability regimes. The December 12, 2014 announcement by the ROK’s Nuclear Safety and Security Commission (NSSC) that it is increasing the amount that must be covered by liability insurance to KRW50 billion (US\$50 million) to KRW500 billion (US\$500 million) per site is a positive development. This revision to the enforcement decree of the ROK’s Nuclear Liability Act will take effect on July 1, 2015.

Nuclear Infrastructure

Research Reactor: KAERI has a 30 MWt research reactor that started operation in 1995. It is the basis of the research reactor South Korea is exporting to Jordan.

Fuel: Most of the fuel for Korea’s reactors comes from overseas. Korea has a small quantity of uranium deposits, and mining is now planned beginning in 2015; the ROK has limited fuel fabrication capacity.

Waste Management: Low and intermediate-level waste is stored at each reactor site. Construction on a central disposal repository at Gyeongju was completed in June 2014 and is schedule to be operational in the near future. The Korea Radioactive Waste Management Co. Ltd (KRWM) was set up in early 2009 as an umbrella organization to resolve the ROK’s waste management issues and waste disposition, particularly to forge a national consensus on high-level waste.



In 2020 nuclear capacity of 27.3 GWe is expected to supply 226 billion kWh - 43.4% of electricity, rising to 48% in 2022—though more recent projections suggest 50% by 2020, with the use of gas strongly reduced. Korea’s 2nd National Energy Basic Energy Plan stipulates that by 2035 nuclear will supply 29% of Korea’s installed capacity.

USG Cooperation

123 Agreement: The agreement was originally set to expire on March 19, 2014 but on April 24, 2013 the United States and the ROK agreed to extend the existing agreement by two years. The two sides are currently negotiating a successor agreement.

Joint Fuel Cycle Study: Started in 2011, this 10-year study examines the technical and economic feasibility and nonproliferation implications of pyroprocessing and other spent fuel management methods.

International Nuclear Energy Research Initiative (I-NERI): DOE R&D program with the ROK that investigates next-generation nuclear systems and fuel cycles.

Joint Standing Committee on Nuclear Energy Cooperation (JSCNEC): Established in 1980, this is a State Department led forum for U.S.-ROK dialogue on nuclear research and other nuclear energy issues.

Regulatory Cooperation: The ROK has a bilateral Arrangement for the Exchange of Technical Information and Cooperation in Nuclear Safety Matters with the NRC; the Korea Institute of Nuclear Safety (KINS) has

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agreements with the NRC to receive access to the NRC’s CAMP/CSARP code sharing programs.

International Engagement

In December 2009, the ROK won a bid to build four nuclear reactors in the UAE worth \$20 billion. Korea is actively seeking other export opportunities for its APR-1400 design and SMART SMR design. Korea is highly engaged with other countries for R&D, training, and resource development. In 2011, it signed agreements with India and Saudi Arabia for nuclear energy cooperation covering joint work on R&D, design, construction, operation, maintenance, and development of NPPs.

Additional Agreements	
Non-Proliferation Treaty	✓
IAEA Comprehensive Safeguards Agreement & Additional Protocol	✓
Joint Convention on Safety of Spent Fuel Management	✓
Convention on Nuclear Safety	✓
Convention on Early Notification of a Nuclear Accident	✓
Convention on Assistance in the Case of a	✓

Nuclear Accident or Radiological Emergency	
Paris Convention Liability Agreement	
Vienna Convention Liability Agreement	
Joint Protocol Liability Agreement	
Convention on Supplementary Compensation for Nuclear Damage	
Organization Membership	
IAEA	✓
Nuclear Suppliers Group	✓
OECD/NEA	✓
IFNEC	✓
GIF	✓

For more information on commercial opportunities in the ROK, contact: Mitch Larsen (Deputy Senior Commercial Officer in Seoul, mitch.larsen@trade.gov); Samuel Shin (Commercial Specialist in Seoul, sb.shin@trade.gov); White House Director for Nuclear Energy Policy Joyce Connery (Joyce_L_Connery@nss.eop.gov); ITA Civil Nuclear Team: Johnathan Chesebro (jonathan.chesebro@trade.gov)

Sources:

CIA World Factbook, United Nations, World Nuclear Association, Asian Development Bank, and our contacts at Post

Saudi Arabia

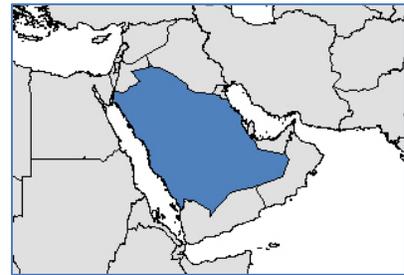
Overall Rank: 8

Market Type: Newly Emerging

Sub-Sector Rank

New Builds 7 | Existing Reactors N/A | Decommissioning N/A

The government of Saudi Arabia has stated it wants to build 18 reactors over the next 20 years and will invest \$80 billion in its civil nuclear program in order to meet growing electricity demand and reduce reliance on hydrocarbons. Saudi Arabia’s nuclear build plans have attracted significant international interest, and U.S. companies expect to have stiff foreign competition in reactor tenders and service contracts. The current lack of a 123 Agreement is a key obstacle to U.S. exports to Saudi Arabia.



U.S. Ambassador to Saudi Arabia: Joseph W. Westphal

Nuclear in Saudi Arabia

Saudi Arabia currently has no nuclear reactors in operation or under construction, but has announced plans to build up to 18 reactors over the next 20 years, constituting about 15% of Saudi Arabia’s projected total generating capacity. The King Abdullah City for Nuclear and Renewable Energy (KACARE) has stated that the country’s goals for developing a civil nuclear program are to meet its growing electricity requirements, produce desalinated water, and reduce reliance on hydrocarbons.

Saudi Arabia hired WorleyParsons in 2011 to conduct an analysis of potential sites and assist with preparing a tender. Three potential sites were short-listed in September 2013.

Saudi Arabia’s nuclear build plans have attracted significant international interest. In September 2013, GE-Hitachi and Toshiba-Westinghouse signed contracts with Exelon to pursue reactor construction in Saudi Arabia. China National Nuclear Corporation (CNNC) and Korea Atomic Power Company (KEPCO) officials have visited repeatedly to discuss nuclear technology and research development. In January 2014, Areva and EdF signed agreements with Saudi Arabia’s Global Energy Holding Company (GEHC) to conduct a feasibility study for a European Pressurized Reactor (EPR).

Planned Nuclear Energy Projects

Owner: GEHC
Reactor Type: undetermined
Capacity: 18 GWe

Value of Project: over \$80 billion (2011 estimate by KACARE)

Construction Period: 2016-2034 (tentative)

Operation (tentative): 18 reactors in operation by 2034.

Commercial Opportunities

Services (front- and back-end): Possibilities for additional site selection and feasibility studies, regulatory assistance, infrastructure development, human resource development.

Legal and Consulting Services: Potential for pre-construction services including regulatory development.

Licensing Support: Potential for pre-construction services.

Design, Construction and Operations: First tender is expected soon. Currently, GE-Hitachi, Toshiba-Westinghouse, Areva/EdF, Rosatom, KEPCO, and CNNC have shown interest in competing for this project.

Components: Opportunities once reactor technology has been chosen.

Fuel Management: None currently

Waste Management: None currently

Challenges and Barriers

Market access is a challenge due to the strength of foreign competition. France, China, the Republic of Korea, and Russia have shown interest in Saudi Arabia’s planned tenders and have signed cooperation agreements for feasibility studies, regulatory assistance, training, and R&D. Saudi Arabia’s nuclear energy plans are ambitious; however, if it follows through on plans to build 16 reactors, U.S. industry will have many opportunities for exports over the next 20 years despite heavy foreign competition.

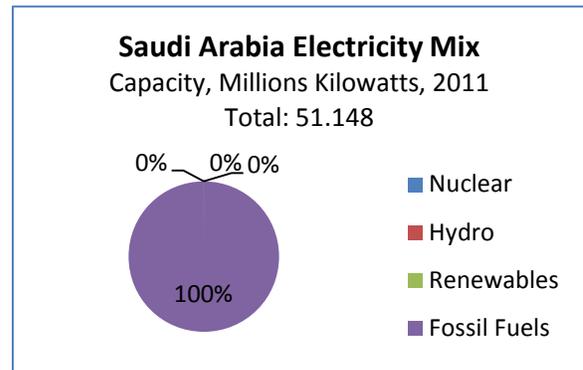
Government support appears to be strong, though the schedule for the country’s first tender has not yet been announced. The government’s recent establishment of a holding

company for ownership of its first nuclear plant and its partnership with Finnish safety authority STUK to set up a Saudi regulatory authority demonstrate commitment to its nuclear program. Delays in funding KACARE have led international observers to question the viability of Saudi Arabia achieving the full extent of its nuclear plans.

Saudi Arabia is party to the 1997 Protocol to the Vienna Convention on Civil Liability for Nuclear Damage, but the current lack of a 123 Agreement dampens prospects for U.S. exports. Saudi Arabia scores high on all financial indicators.

Nuclear Infrastructure

Saudi Arabia has no research reactor and no operating reactors.



USG Cooperation

123 Agreement: Saudi Arabia does not have a 123 Agreement with the United States.

Additional Agreements

Non-Proliferation Treaty	✓
IAEA Comprehensive Safeguards Agreement & Additional Protocol	
Joint Convention on Safety of Spent Fuel Management	✓
Convention on Nuclear Safety	✓
Convention on Early Notification of a Nuclear Accident	✓

United States Department of Commerce – International Trade Administration

Convention on Assistance in the Case of a Nuclear Accident or Radiological Emergency	✓
Paris Convention Liability Agreement	
Vienna Convention Liability Agreement	✓
Joint Protocol Liability Agreement	
Convention on Supplementary Compensation for Nuclear Damage	
Organization Membership	
IAEA	✓
Nuclear Suppliers Group	
OECD/NEA	
IFNEC	✓
GIF	

International Engagement

Saudi Arabia is cooperating with Argentina on a small scale reactor for research and

desalination. In January 2014 Saudi Arabia and Jordan signed a cooperation agreement to advance their respective civil nuclear energy programs. It has signed cooperation agreements with France, China, Finland, and the Republic of Korea and is pursuing agreements with Russia, the Czech Republic, and the UK.

For more information on commercial opportunities in Saudi Arabia, contact: Nasir Abbasi (Principal Commercial Officer in Dhahran, nasir.abbasi@trade.gov); Charles Ranado (Principal Commercial Officer in Jeddah, charles.ranado@trade.gov); WH Director for Nuclear Energy Policy Joyce Connery (Joyce_L_Connery@nss.eop.gov); ITA Civil Nuclear Team: Jonathan Chesebro (jonathan.chesebro@trade.gov)

Sources:
CIA World Factbook, United Nations, World Nuclear Association, Asian Development Bank, and our contacts at Post

Turkey

Overall Rank: 22

Market Type: Newly Emerging

Sub-Sector Rank

New Builds 14 (tied) | Existing Reactors N/A | Decommissioning N/A

Turkey is planning to build eight reactors at two sites, and a third site will be considered after progress has been made on the first two. A Russian consortium was chosen to build the first four reactors on a build-own-operate model, and a Mitsubishi-Areva consortium is in discussions for the next four reactors. Opportunities for U.S. companies have been limited due to unfavorable business practices and financing demands from Turkey’s utility. The potential for U.S. exports will depend on Turkey’s plans for its third plant.



U.S. Ambassador to Turkey: Francis J. Ricciardone, Jr.

Nuclear Energy in Turkey

Turkey currently has no operating nuclear power plants but it plans to begin construction on its first reactor by early 2016. It is planning to build eight reactors at two sites: Akkuyu, on the Mediterranean coast, and Sinop, on the Black Sea coast. A third site will be considered after progress has been made on the first two.

A Russian consortium will build four VVER-1200 reactors at Akkuyu on a build-own-operate (BOO) model to include fuel supply and spent fuel take-back. Russia has pledged to fully finance the project at over \$20 billion. According to the Turkish Energy Minister, the first reactor could enter commercial operation by the end of 2019.

Turkey is working with a consortium led by Japan’s Mitsubishi and France’s Areva to build four Atmea1 reactors at Sinop totaling 4800 MWe. Construction on the first unit could begin in 2017 with operation in 2023.

On November 24, 2014, Westinghouse (WEC) signed an agreement with China’s State Nuclear Power Technology Corporation (SNPTC) and Electricity Generation Company (EÜAŞ), Turkey’s largest electric power company, to enter into “exclusive negotiations” to develop and construct a four-unit AP1000 nuclear power station in Turkey.

Planned Nuclear Energy Projects

Akkuyu Nuclear Power Plant

Owner: Akkuyu NPP JSC (Russia majority controlled as a BOO model)

Reactor Type: VVER-1200 (AES-2006) with a 60-year lifetime

Capacity: 4800 MWe (4 units, 1200 MWe each)

Value of Project: \$20-25 billion dollars; \$1.3 billion was budgeted for 2013

Construction Period: 2015-2023 (four-year construction period per reactor according to recent estimate by Turkish government)

Operation: 2020-2023

Agreement with Russia Regarding Akkuyu:

Russia will be responsible for: obtaining licenses and permits; financing; training of Turkish personnel; design; construction; operation and maintenance; supply of equipment and material; and supply of nuclear fuel. There is a take-back option for the reprocessing of spent fuel by Russia. Turkey is responsible for the allocation of the plant site with its current license without any cost and purchasing electricity according to a Power Purchase Agreement. The Rosatom agreement for Akkuyu also provides for setting up a fuel fabrication plant in Turkey.

Sinop Nuclear Power Plant

Owner: Mitsubishi (Japan)-AREVA (France) joint venture: both companies are state-owned; GdF-Suez would be the operator of the eventual plant

Reactor Type: ATMEA1 with a 60-year lifetime; these will likely be the first ATMEA1 units built

Capacity: 4800 MWe (4 units)

Value of Project: \$22-25 billion

Construction Period: First unit 2017-2023; other units TBD.

Operation (tentative): First unit in 2023

Agreement with Mitsubishi-AREVA Regarding Sinop:

Turkey signed an agreement with Japan in 2013 giving the Japanese government exclusive negotiating rights for building the plant.

Commercial Opportunities

Services (front-and back-end): Limited potential for site selection or other advisory services

Legal and Consulting Services: Moderate potential for regulatory consulting related to Akkuyu project

Licensing Support: Limited potential

Design, Construction and Operations: Opportunities for third NPP site

Fuel Management: None currently

Waste Management: None currently

Challenges and Barriers

Despite Turkey's new build plans, opportunities for U.S. industry have been limited. Turkey's insistence on a spent fuel take-back option for Akkuyu forced out all competitors except the Rosatom consortium that eventually won the bid. For Sinop, Turkey has negotiated directly with countries or companies rather than launch an open bid. These have included Korea and Canada (both of whom withdrew over financing issues), China, and Mitsubishi-Areva, who is now expected to build the plant. The November 24, 2014 agreement between WEC, SNPTC and EÜAŞ is a positive development for U.S. industry participation in Turkey's third plant.

Turkish Government support for new builds is strong, though Turkey is taking a measured pace toward projects beyond Akkuyu and Sinop. A 123 Agreement exists between the United States and Turkey, and Turkey is party to the Paris Convention for nuclear liability.

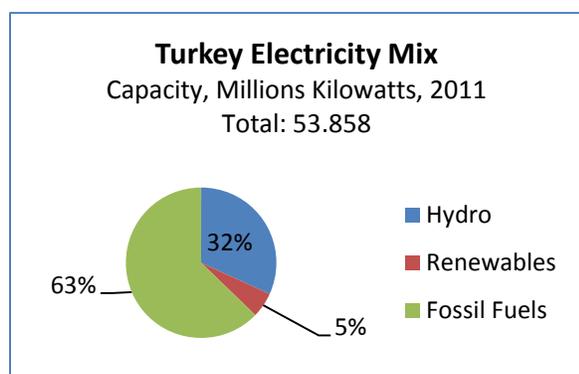
Financing is a challenge. Turkey has limited means for financing nuclear power projects on its own, as evidenced by the BOO model it has agreed to for Akkuyu. Ex-Im Bank financing will be challenging, given Turkey's low score on Ex-Im's long-term exposure fee level.

Nuclear Infrastructure

Research Reactor: Turkey has a small Triga research reactor at Istanbul Technical University. It has operated since 1979 and is regulated by the Turkish Atomic Energy Authority.

Fuel: Approximately 7400 tU of uranium resources are estimated in Turkey. The government is conducting a pre-feasibility study to determine the economic value of developing its resources.

Waste Management: Waste management is mainly limited to radioactive waste arising from the industrial and medical applications of nuclear technologies, and there is a facility for interim storage of these wastes. This storage facility was built and has been operating since 1989, in the ÇNAEM. Compaction, cementation and precipitation processes have been carried out at this facility.



USG Cooperation

123 Agreement: The 123 Agreement with the United States will expire in June 2023 with rolling 5-year extensions to follow.

Regulatory Cooperation: The NRC and the Turkish Atomic Energy Authority (TAEK) signed an Arrangement for the Exchange of Technical Information and Cooperation in Nuclear Safety Matters in 2012.

International Engagement

Turkey has voluntarily agreed to join the EU stress test program, demonstrating Turkey's commitment to the adoption and implementation of rigorous safety standards in the construction and operation of its nuclear power plants. In June 2010 Turkey and South Korea signed a nuclear cooperation agreement, and in April 2012 two such agreements with

China were signed. TAEK is participating in the IAEA-coordinated International Project on Innovative Nuclear Reactor Technologies and Fuel Cycles (INPRO). TAEK also contributes to the studies and projects of the OECD/NEA working groups. Turkey has an observer status for CERN, the European Organization for Nuclear Research and the world's leading laboratory for particle physics. All activities in Turkey are coordinated and sponsored by TAEK. Turkey is a member of the Synchrotron-light for Experimental Science and Applications in the Middle East (SESAME), an international scientific research center under construction in Allan, Jordan.

Additional Agreements	
Non-Proliferation Treaty	✓
IAEA Comprehensive Safeguards Agreement & Additional Protocol	✓
Joint Convention on Safety of Spent Fuel Management	
Convention on Nuclear Safety	✓
Convention on Early Notification of a Nuclear Accident	✓
Convention on Assistance in the Case of a Nuclear Accident or Radiological Emergency	✓
Paris Convention Liability Agreement	✓
Vienna Convention Liability Agreement	
Joint Protocol Liability Agreement	✓
Convention on Supplementary Compensation for Nuclear Damage	
Organization Membership	
IAEA	✓
Nuclear Suppliers Group	✓
OECD/NEA	✓
IFNEC	✓
GIF	

United States Department of Commerce – International Trade Administration

For more information on commercial opportunities in Turkey, contact: Michael Lally (Senior Commercial Officer in Ankara, Michael.lally@trade.gov); Serdar Cetinkaya (Senior Commercial Specialist in Ankara, serdar.cetinkaya@trade.gov); White House Director for Nuclear Energy Policy Joyce Connery

(Joyce_L_Connery@nss.eop.gov); ITA Civil Nuclear Team: Jonathan Chesebro (jonathan.chesebro@trade.gov).

Sources:

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United Arab Emirates

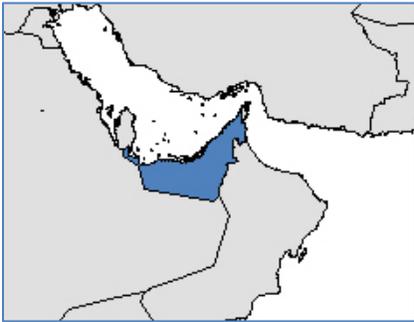
Overall Rank: 6

Market Type: Newly Emerging

Sub-Sector Rank

New Builds 5 | Existing Reactors N/A | Decommissioning N/A

The UAE is currently building its first three nuclear reactors at the Barakah site, and one more will begin construction soon. Despite losing the bid for the Barakah plant to a Republic of Korea consortium, U.S. companies have had a high level of involvement in the UAE nuclear energy program. This promises to remain the case for years to come, especially if UAE builds additional plants. A favorable economic and financial environment, as well as the presence of a 123 Agreement, makes the UAE a highly desirable market for U.S. exports. The chief obstacle is heavy foreign competition.



U.S. Ambassador to the United Arab Emirates:
Michael H. Corbin

Nuclear Energy in the UAE

The UAE is currently building its first three nuclear reactors at the Barakah site, the third of which began construction on September 24, 2014 after the construction license for units 3 and 4 was granted to the Emirates Nuclear Energy Corporation (ENEC); unit 4 will begin construction soon. The reactors are the Korean designed APR-1400. The first will come online in 2017, with a new reactor coming online each year through 2020.

UAE’s electricity demand is growing rapidly at 9% per year, and the country is making strategic investments in new generating capacity. Most of its current electricity generation comes from

fossil fuels and the development of nuclear energy is an attempt to reduce its dependence on oil and gas for domestic consumption. Nuclear energy is expected to make up a substantial portion of the country’s electricity generating capacity by 2030, requiring additional reactors beyond the four at Barakah. The UAE plans to export its nuclear-generated electricity as well.

The Federal Authority of Nuclear Regulation (FANR), established in October 2009, is the country’s nuclear safety and security regulator. In November 2009, the UAE established the ENEC, a public entity, to implement its civil nuclear plans and conduct site evaluations, technology selection, and submission of the construction license application for the Barakah site.

Planned Nuclear Energy Projects

Owner: KEPCO-led consortium

Reactor Type: Type: APR-1400 reactors (4)

Capacity: 5600 MWe (1400 x 4 reactors)

Value of Project: \$20.4 billion, with a high percentage of the contract being offered under a fixed-price arrangement. The consortium also expects to earn another \$20 billion by jointly operating the reactors for 60 years. In March 2010 KEPCO awarded a \$5.59 billion construction contract to Hyundai and Samsung for the first plants.

Agreements with U.S. Industry: Cranberry, Pennsylvania-based Westinghouse is part of the winning KEPCO consortium and is providing major components, instrumentation and control equipment, and design, technical and engineering support services. Virginia-based Lightbridge Corporation has provided consulting services to the UAE on the design, development and management of the key organizations required to implement a nuclear energy program. Englewood, Colorado-based CH2M Hill won a 10-year contract to manage the UAE's nuclear program in October 2008. Paul C. Rizzo Associates, a global engineering and consulting firm based in Pennsylvania, is working on site placement and engineering during the planning process.

Commercial Opportunities

Services (front-and back-end): Significant potential for site selection, regulatory assistance, or other advisory services

Legal and Consulting Services: Limited potential

Licensing Support: Limited potential

Design, Construction and Operations: Opportunities for future NPP sites

Components: Significant potential opportunities subject to choice of reactor technologies

Fuel Management: None currently

Waste Management: None currently

Challenges and Barriers

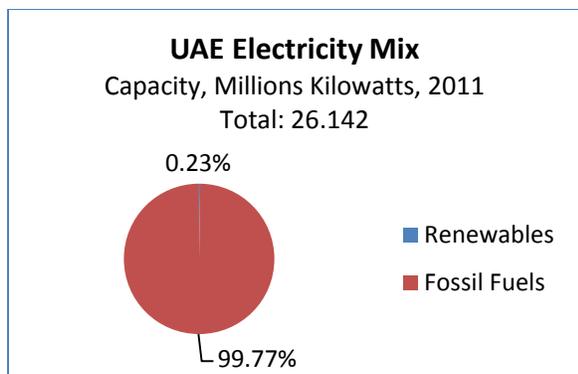
The UAE has moved swiftly and assuredly to implement its nuclear energy program. From the announcement of its first nuclear energy policy in 2008 to the awarding of the Barakah tender to KEPCO in December 2009, to the beginning of construction in 2012, the UAE government has shown strong support for nuclear energy development and has relied heavily on foreign industry for a variety of products and advisory services. Despite losing the bid for the Barakah plant, U.S. industry has had a high level of involvement in the UAE's nuclear energy program. This promises to remain the case for years to come, especially if the UAE builds additional plants.

The UAE scores highly on virtually all infrastructure and financial criteria, and public opinion is highly favorable toward nuclear energy development. The chief barrier to civil nuclear exports is the considerable strength of foreign competition.

Nuclear Infrastructure

Fuel: Fuel will be supplied from abroad. Canada-based Uranium One, UK-based Rio Tinto, France's Areva and Russia's Technobexport (Tenex) will supply uranium concentrates to the UAE; conversion services are to be carried out by Converdyn, Tenex, and Areva; enrichment will be done by Urenco, Areva, and Tenex; and the fuel assemblies will be fabricated by KEPCO.

Waste Management: The UAE is pursuing a national storage and disposal program as well as exploring regional cooperation options for radioactive waste management.



USG Cooperation

123 Agreement: The Agreement will expire January 1, 2030 with rolling 5-year extensions thereafter.

Regulatory Cooperation: The NRC and FANR have an arrangement for the exchange of technical information and cooperation in nuclear safety and security matters.

Barakah Plant Financing: The Ex-Im Bank approved \$2 billion (later reduced to \$1 billion) in financing for the Barakah plant in September 2012 for U.S. sourced components from Westinghouse; most of the financing was approved for coolant pumps and controls.

U.S.-UAE Strategic Energy Dialogue: A newly formed bilateral cooperation framework in the areas of oil production and exports, natural gas, energy efficiency, carbon capture and storage, clean energy deployment, energy-water issues, and civil nuclear cooperation. The first meeting of the U.S.-UAE Strategic Energy Dialogue was held in Abu Dhabi, UAE on June 23, 2014.

Additional Agreements	
Non-Proliferation Treaty	✓
IAEA Comprehensive Safeguards Agreement & Additional Protocol	✓
Joint Convention on Safety of Spent Fuel Management	✓

Convention on Nuclear Safety	✓
Convention on Early Notification of a Nuclear Accident	✓
Convention on Assistance in the Case of a Nuclear Accident or Radiological Emergency	✓
Paris Convention Liability Agreement	
Vienna Convention Liability Agreement	✓
Joint Protocol Liability Agreement	
Convention on Supplementary Compensation for Nuclear Damage	✓
Organization Membership	
IAEA	✓
Nuclear Suppliers Group	
OECD/NEA	
IFNEC	✓
GIF	

International Engagement

The UAE is cooperating with numerous countries in its nuclear program development. It has signed cooperation agreements with the United States, the Republic of Korea, UK, France, Canada, Russia, Argentina, Japan, and Australia.

For more information on commercial opportunities in the UAE, contact: John Simmons (Principal Commercial Officer in Abu Dhabi, john.simmons@trade.gov), Fred Aziz, Deputy Commercial Officer in Abu Dhabi, fred.aziz@trade.gov), Nasir Abbasi, Commercial Officer in Dubai, nasir.abbasi@trade.gov); Shereen AbuGharbieh (Commercial Specialist in Dubai, shereen,abugarbieh@trade.gov); George Messiha (Commercial Specialist in Abu Dhabi, george.messiha@trade.gov); White House Director for Nuclear Energy Policy Joyce Connery (Joyce_L_Connery@nss.eop.gov); ITA Civil Nuclear Team: Jonathan Chesebro (jonathan.chesebro@trade.gov)

United Kingdom

Overall Rank: 2

Market Type: Existing and Expanding

Sub-Sector Rank

New Builds 2 | Existing Reactors 2 | Decommissioning 1

The UK has 16 operational nuclear reactors, 15 of which are expected to be shut down by 2023. The UK is planning to build new nuclear reactors—up to 16 GWe capacity to replace its existing fleet. The UK’s civil nuclear plans have attracted considerable interest from around the world, and U.S. reactor vendors have achieved prominent stakes in the Horizon and NuGen consortiums, which will build up to seven reactors over the next 10 years, including four ABRs and three AP1000s. The UK also is a prime market for decommissioning.



U.S. Ambassador to the United Kingdom:
Matthew Barzun

Nuclear Energy in the UK

The United Kingdom (UK) currently has 16 operational nuclear reactors, comprising 10 GWe of capacity. All but one of these is expected to be shut down by 2023. The UK is planning to build new nuclear reactors to replace its existing fleet. In a July 2013 report, the UK government confirmed its commitment to encouraging 16 GWe of installed nuclear capacity by 2030. UK policy further aims for nuclear power to comprise 45-50% of UK electricity generation by 2050.

France’s EDF Energy is planning to build four EPR reactors at Hinkley Point in Somerset and Sizewell in Suffolk. Start up for the first reactor at Hinkley Point C is expected in 2023, although

construction has been postponed due to the European Commission (EC) review of government subsidies for the plant. China’s state-owned enterprises China General Nuclear (CGN) and China National Nuclear Corporation (CNNC) will take a 30-40% stake of the Hinkley Point C project, and Areva will take 10%. French companies will provide most major components and fuel for the reactors while UK companies will handle up to 57% of construction work.

In October 2013, the UK government announced an investment agreement with EDF Energy for Hinkley Point C that included a 35-year Contract for Differences with a guaranteed electricity “strike price” of £92.5/MWh (\$157/MWh). The EC approved of the agreement on October 8, 2014.

The Hitachi-controlled Horizon Nuclear Power consortium plans to build four GE-Hitachi ABWR

reactors at two sites: Wylfa in northern Wales and Oldbury in Gloucestershire. Construction on the first unit at Wylfa will begin in 2019 with startup in 2025.

The NuGeneration (NuGen) consortium (as of January 2014, 60%-owned by Toshiba and 40% by GDF Suez) plans to build three Westinghouse AP1000 reactors at Moorside, just north of the Sellafield site in Cumbria. The first unit is expected to become operational in 2024.

Three other sites—Bradwell, Hartlepool, and Heysham—have also been deemed suitable for new nuclear power plants, though development plans currently do not exist.

The British Department of Energy and Climate Change (DECC) is currently examining the feasibility of its policy for managing the UK's large civil plutonium stockpile, which involves reuse as Mixed Oxide fuel (MOX) and would require procurement of a new MOX plant. GE's PRISM fast reactor and Candu's EC6 heavy-water reactor have been proposed as alternative solutions to MOX. In January 2014 following the conclusion of a two-year review of disposition options, the UK Nuclear Decommissioning Authority (NDA) said it will take an additional one to two years to conduct further technical studies and that it may seek a "multi-track" approach. Plutonium disposition provides a unique opportunity for U.S. exports but at this point is dependent on UK government policy decisions regarding technology selection.

Small Modular Reactors (SMRs) have been the subject of recent interest in the UK. According to DECC's Science Advisory Group, the SMR systems most likely to achieve early deployment internationally are based on innovative application of LWR technology under development and early deployment in the U.S. There is a window of opportunity for the UK to become involved and for the UK regulator to participate in assessment of the technology so it could be deployed early in the 2020's. The UK

Government is exploring three SMR technologies – NuScale, B&W's mPower and WEC – and expects to select one of these technologies in 2015.

Opportunities in other sub-sectors such as decommissioning exist. For the supply chain, decommissioning is a significant market – almost \$2.4 billion a year – and one that is set to grow. In March 2014, for example, U.S. firm Fluor was part of a joint venture that won a 14-year, \$11 billion contract to decommission ten Magnox power plants and two research facilities.

Existing reactors also present commercial opportunities, specifically in relation to life-extension. The last operating Magnox reactor is due to shut down when its fuel runs out in 2015. This will leave seven twin-unit AGR stations and one PWR, all owned and operated by EDF Energy. EdF Energy is planning life extensions averaging 7 years for the AGR units and a 20-year life extension for its PWR unit. EDF Energy spends about \$600 million per year on plant upgrades to enable ongoing operation.

Planned Nuclear Energy Projects

Hinkley Point C and Sizewell C Nuclear Power Plants

Owner: EDF Energy: EdF majority-owned, 30-40% CGN and CNNC, 10% Areva; French government owns 85% of EdF and 80% of Areva, and Chinese government owns all of CGN and CNNC.

Reactor Type: EPR

Capacity: 3240 MWe (2 units) at each plant

Value of Project: \$25-27 billion per plant

Construction Period: First unit 2018-2023

Operation (tentative): First unit in 2023

Wylfa and Oldbury B Nuclear Power Plants

Owner: Horizon: Hitachi-controlled, other investors TBD.

Reactor Type: ABWR

Capacity: 2760 MWe (2 units) at each plant

Value of Project: \$13-14 billion per plant
Construction Period: First unit 2019-2025
Operation (tentative): First unit in 2025

Moorside Nuclear Power Plant

Owner: NuGen: 60% Toshiba, 40% GDF Suez
Reactor Type: AP1000
Capacity: 3400 MWe (3 units)
Value of Project: \$14 billion
Construction Period: First unit 2019-2024
Operation (tentative): First unit in 2024

Commercial Opportunities

Services (front-and back-end): Potential for back-end services, life extension services for existing reactors, decommissioning, and plutonium disposition

Legal and Consulting Services: Limited potential

Licensing Support: Limited potential

Design, Construction and Operations: U.S. industry heavily engaged in Wylfa, Oldbury, and Moorside plants.

Fuel Management: None currently

Waste Management: None currently

Challenges and Barriers

The UK's extensive plans to build new reactors have attracted high levels of interest from France, Germany, Japan, China, Russia, Korea, Canada, and the United States. Despite heavy competition, U.S. industry has many opportunities for civil nuclear exports to the UK. This has become more evident in the past two years as Hitachi and Toshiba have taken majority stakes in Horizon and NuGen, respectively, and will build up to four ABWRs and three AP1000s at three sites.

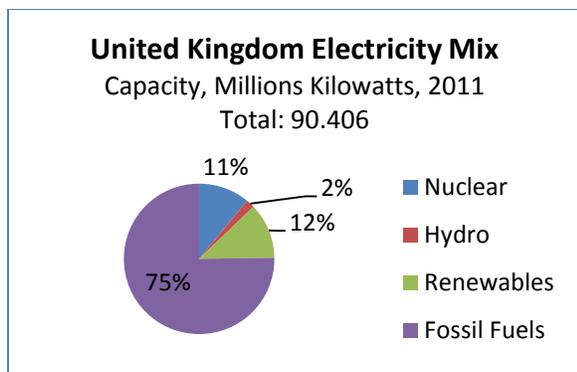
UK Government support has been consistently strong since it adopted a pro-nuclear energy policy in 2006, and public opinion of new nuclear has remained favorable as the UK's plans have become more firm.

The UK Government appeared to have overcome financial hurdles to building new nuclear plants with its October 2013 agreement with EDF Energy for Hinkley Point—an agreement that might serve as a model for other plants. On October 24, 2014, the EC concluded that the proposed financial arrangement for Hinkley Point is compatible with EU state aid rules. This favorable verdict, combined with the UK's strong financial capability for new nuclear, demonstrates positive progress in the nation's pursuit of its nuclear energy goals.

Nuclear Infrastructure

Fuel: Apart from raw uranium mining and uranium ore purification, the UK has independent nuclear fuel cycle capability and offers services to the UK and international markets, although fuel cycle services' capacity has been declining in recent years. The Springfield's conversion plant shut down in September 2014, but the site retains fuel fabrication capacity. Enrichment is undertaken by Urenco at the Capenhurst plant. Reprocessing is at the Sellafield site, but the plant is set to close in 2018 once all contracts have been completed, unless new contracts are negotiated. The UK has had no commercial MOX fabrication since the Sellafield MOX plant shut down in 2011.

Waste Management: The Radioactive Waste Management Directorate (RWMD) is charged with developing plans for a Geological Disposal Facility set to begin operation in 2040. Site selection is expected by 2025.



USG Cooperation

123 Agreement: The United States has a 123 Agreement with the UK through EURATOM. It will expire in 2026 with a rolling 5-year extension from then on.

International Engagement

The UK continues to solicit international partners to achieve its civil nuclear plans. In 2013 it formally gave a Chinese consortium a 30-40% stake in Hinkley Point, and in June 2014 it signed agreements with China that aim to enable Chinese companies to own and operate Chinese designed plants in the UK. Russia has also expressed interest in UK new build investments. The UK has welcomed international investment for decommissioning and operation of its current reactor fleet.

Additional Agreements	
Non-Proliferation Treaty	✓
IAEA Comprehensive Safeguards Agreement & Additional Protocol	✓

Joint Convention on Safety of Spent Fuel Management	✓
Convention on Nuclear Safety	✓
Convention on Early Notification of a Nuclear Accident	✓
Convention on Assistance in the Case of a Nuclear Accident or Radiological Emergency	✓
Paris Convention Liability Agreement	✓
Vienna Convention Liability Agreement	
Joint Protocol Liability Agreement	✓
Convention on Supplementary Compensation for Nuclear Damage	
Organization Membership	
IAEA	✓
Nuclear Suppliers Group	✓
OECD/NEA	✓
IFNEC	✓
GIF	✓

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Sources:

CIA World Factbook, United Nations, World Nuclear Association, Asian Development Bank, and our contacts at Post

Vietnam

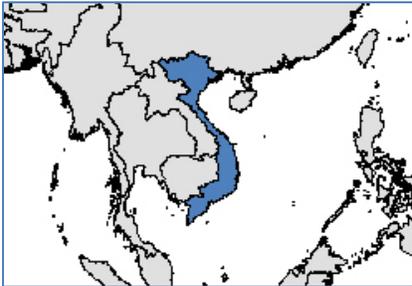
Overall Rank: 3

Market Type: Newly Emerging

Sub-Sector Rank

New Builds 3 | Existing Reactors N/A | Decommissioning N/A

Vietnam has announced plans to build up to 13 nuclear reactors with a total capacity of 16 GWe over the next two decades. Vietnam has awarded contracts to Russia’s Atomstroyexport and a Japanese consortium to each build a two-reactor Nuclear Power Plant (NPP). Russia and Japan’s ability to provide government-backed finance and other incentives has put them ahead of the United States initially, but with the recent passage of the 123 Agreement, U.S. companies will be well-positioned to compete for additional reactor projects and services.



U.S. Ambassador to Vietnam: David Bruce Shear

Nuclear in Vietnam

Vietnam is the first country in Southeast Asia moving forward on developing a peaceful nuclear power program. In late 2009, the National Assembly approved plans to construct Vietnam’s first two NPPs in coastal Ninh Thuan province by 2025 with two 1000 MW units each (these were increased to 1200 MW each in November 2014). The Government of Vietnam (GOV) has awarded contracts to Russia’s Atomstroyexport and a Japanese consortium to each build a two-reactor NPP. Russia has agreed to finance at least 85% of its plant, and Japan will likely finance up to the Organization for Economic Co-operation and Development (OECD) limit of 85% of the project cost. Russia and Japan have a head-start over the United

States in terms of reactor projects in Vietnam, primarily due to both countries’ ability to provide government-backed finance and other incentives.

Beginning with Ninh Thuan 1 & 2, the GOV plans to build eight 1000 MWe reactors by 2027, with one unit coming on line annually from 2020, although these plans will likely be delayed up to four years due to ongoing negotiations on technology and financing. Vietnam has announced plans to build up to 13 nuclear reactors with a total capacity of 16,000 MWe over the next two decades. These announcements present rapidly emerging opportunities for the U.S. civil nuclear industry. Vietnam’s civil nuclear market is estimated to be worth \$10 billion and is expected to grow to \$50 billion by 2030.

Planned Nuclear Energy Projects

Ninh Thuan 1 Nuclear Power Plant

Owner: Atomstroyexport-ROSATOM (Russia): state-owned

Reactor Type: VVER-1000 reactors, later specified as AES-2006 power plants

Capacity: 4 units x 1200 MW

Value of Project: A finance agreement of up to \$9 billion was signed in November 2011 with the Russian government's state export credit bureau, and a second agreement for a \$500 million loan covered the establishment of a nuclear science and technology center.

Construction Period: To begin in 2017 or 2018 as a turnkey project.

Operation (tentative): 2020-2024

Cooperation with Russia: Along with cooperation on Ninh Thuan 1, Russia has agreed to build a new 15 MW research reactor starting in 2017, for operation in 2023. Russia's Ministry of Finance is prepared to finance at least 85% of the research reactor. Russia's policy for building NPPs in non-nuclear weapons states is to deliver on a turnkey basis, including supply of all fuel and repatriation of used fuel for the life of the plant. The fuel is to be reprocessed in Russia and the separated wastes returned to the client country. Additionally, Russia and Vinatom are setting up a Centre for Nuclear Energy Science & Technology for nuclear R&D.

Vinh Hai Nuclear Power Plant

Owner: JINED consortium including METI, nine utilities (led by Chubu, Kansai, and Tokyo Electric Power Company) and three manufacturers (Mitsubishi Heavy Industries, Toshiba, and Hitachi)

Reactor Type: Construction has been delayed beyond the initial plan of 2015, creating uncertainty around the type of reactor to be built. Mitsubishi has suggested that Hokaido's 866 MW PWR Tomari 3 might serve as the reference reactor.

Capacity: 4 units x 1000 MW

Value of Project: \$10 billion

Construction Period: To begin in 2018 or 2019.

Operation (tentative): 2021-25

Cooperation with Japan: EVN signed agreements with Japan Atomic Power Corporation (JAPC) in 2011 for consulting services to help with site selection and a \$26 million Japanese government-funded feasibility study, completed in May 2013, that included technology selection with economic and financial analysis. Japan has committed to train about 1000 staff for Ninh Thuan 2. A financial agreement between Vietnam and the Japanese government is still in negotiation.

Commercial Opportunities

Services (front- and back-end): Current tender for owner's engineering service for Ninh Thuan 1 & 2 projects.

Legal and Consulting Services: Many opportunities for assisting with Vietnam's nascent program, including site selection, licensing, liability, and project management.

Design, Construction and Operations: Currently Westinghouse-Toshiba, GE-Hitachi, and several Japanese companies are competing for additional NPP projects beyond the two announced.

Components: Potential opportunities subject to choice of reactor technologies.

Waste Management: The Russian government has committed to assist the GOV in waste management. In March 2013 JINED organized a workshop to introduce how Japanese NPPs manage waste to Vietnamese ministries and Electricity of Vietnam Corp.

Challenges and Barriers

Vietnam's decision to contract with Russia and Japan for its first two reactor projects presents great challenges for U.S. industry to enter the market since these technologies will be first to market in Vietnam. The GOV has recently courted other countries, particularly the Republic of Korea (ROK), for bilateral civil nuclear cooperation, underscoring the high-level of foreign competition in this market. USG

and U.S. industry remain highly engaged with Vietnam, however, and the conclusion of a 123 Agreement will enable broader and deeper cooperation, strengthening the U.S.-Vietnam bilateral relationship in civil nuclear energy. If the GOV stands by its plans to build 16 GWe of nuclear capacity, U.S. industry will have significant export opportunities.

GOV support for nuclear energy is strong, though its January 2014 announcement to postpone construction of its first two projects for up to four years brings into question the GOV's commitment to meeting its ambitious nuclear energy development goals. If Vietnam follows through with its plans to build additional reactors, U.S. industry will have significant chances to compete for tenders and other contracts.

Liability continues to be a major obstacle. Efforts by the USG and industry to promote the CSC have increased the GOV's awareness of the need for strong liability protections and have resulted in the GOV making tentative commitments to CSC ratification, which would greatly enhance prospects for U.S.-Vietnam civil nuclear trade.

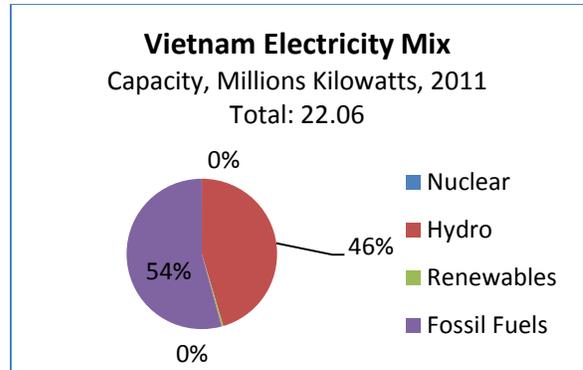
Financial obstacles exist for U.S. civil nuclear exports to Vietnam. Russia and Japan won their construction contracts in part due to the significant financial incentives they offered, including financing deals. Vietnam scores low on both the Ex-Im Bank Long-Term Exposure Fee level and the World Bank Ease of Doing Business Indicator, potentially hampering U.S. industry's ability to offer similar incentives. Additionally, U.S. industry's inability to offer BOO construction, or as Russia has done, to take back and reprocess spent fuel, may disadvantage U.S. industry for future tenders.

Nuclear Infrastructure

Research Reactor: Vietnam has a 500 kW research reactor at Da Lat that has been

operational since 1984. It is operated by Vinatom and was converted to run on low-enriched fuel in 2007 in partnership with the United States.

Fuel: Vietnam's Ministry of Natural Resources & Environment is working with Canadian company NWT Uranium Corp to exploit a uranium deposit in Quang Nam province that is believed to have about 7000 tU in 0.05% ore.



USG Cooperation

123 Agreement: Agreement was signed in May 2014 and came into effect on October 3, 2014.

Cooperation and Information Exchange: The U.S. Department of Energy's National Nuclear Security Administration (NNSA) is involved in 11 programs affiliated with Vietnam and has engaged in workshops on a variety of topics including reactor licensing, nuclear forensics, and nuclear safeguards infrastructure development.

May 2013 Trade Mission: In May 2013, former DOC Under Secretary Francisco Sánchez led a delegation of senior USG officials from DOC, DOE, Ex-Im Bank, and U.S. industry to work with the GOV on bilateral nuclear energy cooperation. A workshop was organized in which U.S. firms shared their experience in nuclear power development with Vietnamese ministries and industry.

Additional Agreements	
Non-Proliferation Treaty	✓
IAEA Comprehensive Safeguards Agreement & Additional Protocol	✓
Joint Convention on Safety of Spent Fuel Management	
Convention on Nuclear Safety	✓
Convention on Early Notification of a Nuclear Accident	✓
Convention on Assistance in the Case of a Nuclear Accident or Radiological Emergency	✓
Paris Convention Liability Agreement	
Vienna Convention Liability Agreement	
Joint Protocol Liability Agreement	
Convention on Supplementary Compensation for Nuclear Damage	
Organization Membership	
IAEA	✓
Nuclear Suppliers Group	
OECD/NEA	
IFNEC	✓
GIF	

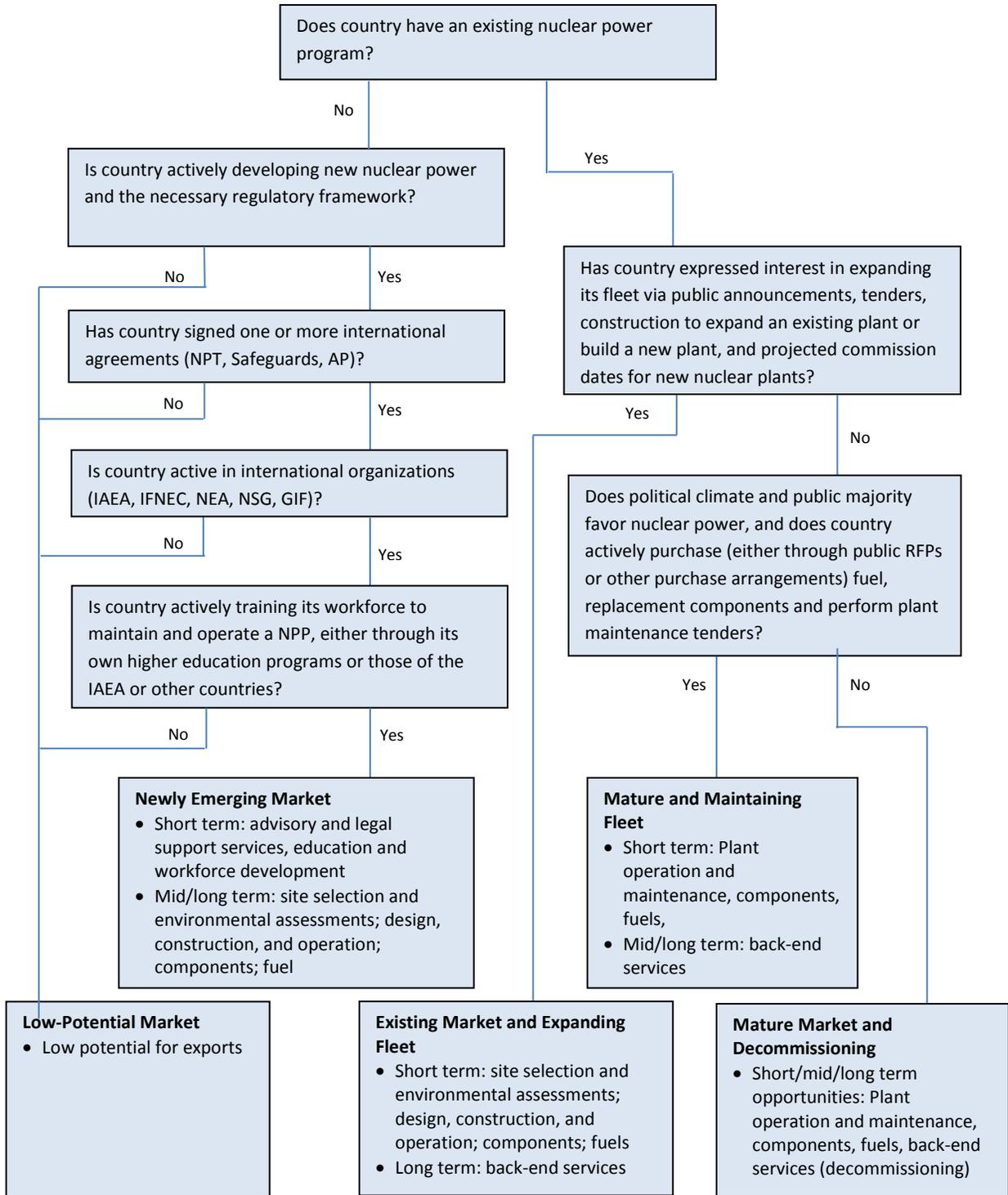
International Engagement

In recent years, Vietnam has signed nuclear cooperation agreements with Russia, France, China, the ROK, Japan, Canada, and the United States. In addition to the reactor deals with Russia and Japan detailed above, Vietnam has asked the ROK to conduct a feasibility study for a possible Korean NPP in Vietnam.

For more information on commercial opportunities in Vietnam, contact: William Marshak (Principal Commercial Officer in Hanoi, William.Marshak@trade.gov); Patrick Wall (Principal Commercial Officer in Ho Chi Minh City, patrick.wall@trade.gov); Tuyet Trees (Commercial Specialist in Hanoi, tuyet.trees@trade.gov); White House Director for Nuclear Energy Policy Joyce Connery (Joyce_L_Connery@nss.eop.gov); ITA Civil Nuclear Team: Jonathan Chesebro (jonathan.chesebro@trade.gov)

Sources:
CIA World Factbook, United Nations, World Nuclear Association, Asian Development Bank, and our contacts at Post

Appendix 1: Market Categorization Flow Chart



Appendix 2: Methodology

Description of variables for new builds:

Category	Variable	Description
Market Access	Foreign Competition	Measures on a scale of high to low the strength of foreign competition for new builds. Assessment takes into account a country’s political relationship with the United States and the likelihood of the market to favor U.S. companies.
	Localization	Measures on a scale of high to low the estimated quantity of localized content for a new build.
Market Size	Number of proposed new builds	Measures number of proposed new builds over the next 15 years.
Government and Political Support	Government Support for New Nuclear Power Plants	Qualitatively assesses strength of government support for building new reactors. Assessment includes factors such as public statements from government officials, program and policy consistency (or, conversely, history of policy changes and delays), interactions of industry and government staff with foreign officials, and political stability.
	Public Opinion	Measures favorability of public opinion toward nuclear power and new builds. Sources include opinion polls and survey results from U.S. Embassies, as available.
	Plans for New Nuclear Power Plants	Assesses official national policies for new builds according to time horizon and steps taken to implement plans. This variable is distinct from that of “government support” above, as this variable assesses official plans, whereas the “government support” variable attempts to measure the probability of a government following through on its plans. For example, a market scoring high in “government support,” but whose national policy envisions beginning new construction more than ten years in the future, will score low in this category.
	Current Construction	Considers whether reactors are currently being built. Current reactor construction will boost a country’s score since it attests to the market’s ability and intention to build new reactors.
Infrastructure, Financial Factors, and Energy Drivers	Liability Framework	Assesses whether a nation adheres to a formal liability regime. Nations adhering to the CSC, 1997 Protocol to the Vienna Convention, or 2004 Protocol to the Paris Convention receive higher

United States Department of Commerce – International Trade Administration

		scores.
	123 Agreement	Assesses whether a 123 Agreement has been signed with United States or is under discussion.
	Projected Electricity Demand Growth	Assesses the scale of increasing demand for electricity over the next 15 years.
	Domestic Energy Availability	Assigns a score, from low to high, on whether a market is a net coal and/or natural gas exporter, a net total fossil fuel exporter, or a net energy importer. A net coal and/or natural gas exporter receives the lowest score because coal and natural gas are direct competitors with nuclear energy, while other fossil fuels compete less.
	U.S. Ex-Im Bank Long-Term Exposure Fee Level	Rates market according to current U.S. Ex-Im Bank Long-Term Exposure Fee Level: http://www.exim.gov/tools/exposurefees/longtermfinancing/ .
	Ability to Self-Finance	Qualitative assessment of a market's ability to finance a new nuclear power plant without assistance from other countries.
	GDP	Rates each market according to GDP in relation to other markets. Higher GDP receives higher score.
	World Bank Ease of Doing Business Indicator	Rates each market according to rank in the World Bank Ease of Doing Business Indicator.

Description of variables for existing reactors:

Category	Variable	Description
Market Access	Foreign Competition	Measures on a scale of high to low the strength of foreign competition for existing reactor contracts. Assessment takes into account the technology composition of existing reactor fleet and gives a higher score for the presence of Western designs.
	Localization	Measures on a scale of high to low the estimated quantity of localized content for contracts relating to existing reactors.
Size of Existing Reactor Program	Reactor Fleet Size	Measures size of existing reactor fleet. Reactors currently under construction are included in this measurement because it is assumed they will become operational within the next 15 years and thus fall within the scope of this report.

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Description of variables for decommissioning:

Category	Variable	Description
Market Access	Foreign Competition	Measures on a scale of high to low the strength of foreign competition for decommissioning contracts. Assessment takes into account the technology composition of existing reactor fleet and gives a higher score for the presence of Western designs.
	Localization	Measures on a scale of high to low the estimated quantity of localized content for contracts relating to decommissioning.
Decommissioning Plans	Decommissioning Plans	Measures the number of reactors that will need decommissioning services within 10 years and opportunities for decontamination services.

Top 50 Overall Markets for U.S. Civil Nuclear Exports

- | | |
|-----------------------|-----------------|
| 1) China | 26) Romania |
| 2) UK | 27) Kazakhstan |
| 3) Vietnam | 28) Finland |
| 4) India | 29) Hungary |
| 5) Brazil | 30) Taiwan |
| 6) UAE | 31) Germany |
| 7) Mexico | 32) Indonesia |
| 8) Saudi Arabia | 33) Russia |
| 9) Bulgaria | 34) Switzerland |
| 10) Poland | 35) Chile |
| 11) Czech Republic | 36) Philippines |
| 12) South Africa | 37) France |
| 13) Republic of Korea | 38) Netherlands |
| 14) Sweden | 39) Australia |
| 15) Japan | 40) Belgium |
| 16) Lithuania | 41) Nigeria |
| 17) Slovakia | 42) Kuwait |
| 18) Argentina | 43) Ghana |
| 19) Canada | 44) Bangladesh |
| 20) Slovenia | 45) Kenya |
| 21) Jordan | 46) Belarus |
| 22) Turkey | 47) Mongolia |
| 23) Ukraine | 48) Niger |
| 24) Egypt | 49) Italy |
| 25) Malaysia | 50) Uzbekistan |

Appendix 3: Subsector Definitions

The U.S. civil nuclear energy supply chain spans reactors, fuel services, nuclear engineering, procurement and construction, and advisory services to meet the needs of the global expansion of nuclear power. Below is further detail on each subsector's specialty.

Advisory and Legal Support Services

This subsector contains companies that provide advisory and consulting services that address the development of legal and regulatory regimes, licensing support, siting, environmental impact analyses, legal advice, and tender writing and development. Standards development and trade association activities are also included within this subsector.

Design, Construction, and Operation

Companies in this subsector are responsible for technology design and engineering, procurement, project management, site preparation, plant construction, and plant operation and maintenance. This subsector addresses all activities in the engineering, procurement, and construction (EPC) phase of a project and also covers utilities that operate plants and companies that provide plant maintenance and repair.

Components

Companies in this subsector are generally manufacturers that seek commercial opportunities throughout a plant's lifecycle, including parts required for operation and maintenance, uprates and upgrades. We delineate this subsector to reflect commercial opportunities for component manufacturers independent of Nuclear Steam Supply System (NSSS) providers.

Fuels

The fuels subsector includes all aspects of the fuel cycle including mining and milling uranium, enrichment, conversion, fabrication of assemblies, refueling, transportation of fuel, and fuel storage.

Back-End Services

Companies in this subsector provide services related to plant decommissioning and used fuel management, including waste management and removal, remediation, used fuel management, interim storage and transportation, geologic disposal and reprocessing, and recycling of plant byproducts.

Appendix 4: Role of U.S. Government Agencies in Civil Nuclear Energy

The U.S. Government supports the expansion of safe and secure nuclear power worldwide through a variety of bilateral and multilateral mechanisms, including areas such as nuclear financing, nuclear trade promotion, safeguards and security of nuclear materials, research and development, and management of nuclear waste and storage. The descriptions below provide more detail on the responsibilities of each U.S. Government program.

Export-Import Bank of the United States (Ex-Im Bank)

Ex-Im Bank is the official export credit agency of the United States. Its mission is to help create and maintain American jobs by supporting the export of U.S. goods and services to international markets. Ex-Im Bank provides working capital loan guarantees (pre-export financing), export credit insurance, and loan guarantees and direct loans (buyer financing).

Ex-Im Bank has provided financial support for numerous nuclear power plants in multiple countries. Ex-Im Bank can provide special extended repayment terms of up to 18 years to support the export of U.S. goods and services required for nuclear power plants. For all financing requests, Ex-Im Bank performs due diligence on the financial, legal, technical, and environmental aspects of the proposed project. In addition, the technical, environmental and safety-related performance of all nuclear projects financed by Ex-Im Bank is monitored through the full term of Ex-Im Bank's financial support.

On June 27, 2013, Ex-Im Bank released its updated Environmental and Social Due Diligence Procedures and Guidelines, which detail environmental and safety guidelines for nuclear power plants (www.exim.gov).

U.S. Department of Commerce

International Trade Administration (ITA)

ITA strengthens the competitiveness of U.S. industry, promotes trade and investment, and ensures fair trade through the rigorous enforcement of trade laws and agreements. ITA works to improve the global business environment and helps U.S. organizations compete at home and abroad. ITA supports President Obama's recovery agenda and the National Export Initiative to sustain economic growth and support American jobs. Several ITA offices support the civil nuclear industry.

Industry and Analysis (I&A) Office of Energy and Environmental Industries (OEEI)

I&A's OEEI is dedicated to promoting trade, investment, and commercial partnerships for the energy and environmental sectors. I&A works to expand trade and investment in these sectors by participating in trade negotiations, organizing trade capacity building programs, and evaluating the impact of domestic and international economic and regulatory policies. OEEI's Civil Nuclear Energy Team works with other USG agencies to develop a public policy environment that advances and promotes civil nuclear engagement with our global trading partners. In October 2008, OEEI launched the Civil Nuclear Trade Initiative (CNTI) to increase the commercial benefits from civil nuclear cooperation with other countries. The CNTI coordinates USG civil nuclear activities through the Atoms for Prosperity interagency mechanism (led by the White House Director for Nuclear

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Energy Policy) and the Trade Promotion Coordinating Committee (TPCC), an interagency task force that ensures the coordination and development of a government-wide export promotion plan.

For more information, please visit www.trade.gov/mas/ian/nuclear/index.asp.

U.S. Commercial Service (CS)

Every year, the CS helps thousands of U.S. companies export goods and services worth billions of dollars to destinations around the world. Located in over 100 cities across the United States and in U.S. Embassies and Consulates in more than 70 countries, its global network of trade professionals is dedicated to opening doors for U.S. business. Whether U.S. companies are looking to make their first export sale or expand to additional international markets, the CS offers trade counseling, market intelligence, business matchmaking, trade promotion events, and commercial diplomacy designed to help U.S. companies succeed internationally.

For more information regarding assistance and in-country contacts, please visit www.export.gov.

Advocacy Center

ITA's Advocacy Center coordinates USG resources in order to level the playing field on behalf of qualified U.S. nuclear business interests as they compete against foreign firms for specific international nuclear contracts or other U.S. nuclear export opportunities. Specifically, the Advocacy Center advocates on the behalf of approved U.S. civil nuclear companies that are competing for nuclear power tenders abroad by garnering support from USG officials as they interact with foreign government decision makers.

For more information about ITA's Advocacy Center, please visit www.trade.gov/advocacy.

Bureau of Industry and Security (BIS)

The Bureau of Industry and Security (BIS) in the U.S. Department of Commerce is charged with the licensing, development, implementation, and interpretation of U.S. export control policy for dual-use commodities, software, and technology. See Appendix 5 (Key Trade Policy Issues in Civil Nuclear Energy, Export Controls) below for more information on BIS.

For more information on BIS, please visit www.bis.doc.gov.

U.S. Department of Energy (DOE)

Office of Nuclear Energy (NE)

NE advances nuclear power as a resource capable of meeting energy, environmental, and national security needs by resolving technical, cost, safety, proliferation resistance, and security barriers through research, development, and demonstration (RD&D). NE conducts civil nuclear energy RD&D to support the safe and reliable operation of the current nuclear power reactor fleet, to develop advanced reactor designs and sustainable nuclear fuel cycles, and to minimize the risks of nuclear proliferation. In all these efforts, NE collaborates with other USG agencies, DOE's National Laboratories, U.S. industry and universities, and international partners. NE has a robust program of international engagement. Bilaterally, NE collaborates on RD&D through a variety of mechanisms, including action plans and working groups, R&D agreements, and the International Nuclear Energy Research Initiative.

Multilaterally, NE cooperates with international partners through the International Atomic Energy Agency (IAEA), the Generation IV International Forum, the Nuclear Energy Agency of the Organization for Economic Cooperation and Development (OECD/NEA), and the International Framework for Nuclear Energy Cooperation. In addition, NE leads the development of international commercial back-end fuel services concepts.

For more information about NE, please visit www.energy.gov/ne/office-nuclear-energy.

NE/NNSA Comprehensive Engagement for Emerging Nuclear Energy Programs

NE also works closely with DOE's National Nuclear Security Administration (NNSA) on an integrated engagement approach to support countries with emerging nuclear energy programs to assist them in developing the necessary nuclear infrastructure, safety, security, safeguards, and emergency response capabilities. NE and NNSA seek to address these issues in a comprehensive way as early as possible in the planning process, before the design and construction of these new nuclear energy systems begin. To this end, NE and NNSA have compiled a list of necessary activities and identified existing DOE training and technical assistance programs that can support a country's specific needs at various stages in the development of its nuclear energy program. NE and NNSA also closely coordinate to support the IAEA's efforts to assist member states in the development of safe and secure nuclear energy programs.

National Nuclear Security Administration (NNSA)

In addition to its cooperation with NE, NNSA, through its Office of Defense Nuclear Nonproliferation, works closely with a wide range of partners to detect, secure, and dispose of dangerous nuclear and radiological material and related Weapons of Mass Destruction (WMD) technology and expertise. NNSA supports the safe and secure expansion of nuclear power by assisting the U.S. Department of State in negotiating Agreements for Cooperation (123 Agreements), reviewing export applications for nuclear-specific and WMD-related dual-use equipment, and controlling the export of unclassified U.S. nuclear technology and assistance. NNSA also engages with the IAEA and other international partners to strengthen civil nuclear safeguards and security infrastructure.

NNSA is also responsible for the management and security of the nation's nuclear weapons and naval reactor programs and responds to nuclear and radiological emergencies in the United States and abroad. Additionally, NNSA federal agents provide safe and secure transportation of nuclear weapons and components and special nuclear materials along with other missions supporting national security.

For more information about NNSA's Office of Defense Nuclear Nonproliferation, please visit www.nnsa.energy.gov.

Office of Environmental Management (EM)

EM's mission is to complete the safe cleanup of the environmental legacy brought about from five decades of nuclear weapons development and government-sponsored nuclear energy research. EM's capabilities include tank waste management, deactivation and decommissioning, nuclear material disposition, and soil and groundwater remediation. EM invests in research and technology development in all of these areas to improve the efficiency and cost-effectiveness of addressing unprecedented environmental challenges. It also collaborates closely with international and U.S. partners in industry, government, academia, and national laboratories to share technical knowledge and best practices for meeting regulatory and site cleanup requirements while protecting human and ecological health.

For more information on EM, please visit www.energy.gov/em/office-environmental-management.

U.S. Department of State

Bureau of International Security and Nonproliferation/Office of Nuclear Energy, Safety and Security (ISN/NESS)

ISN/NESS develops U.S. policy relating to peaceful nuclear cooperation, nuclear safety, nuclear export controls, and the physical protection of nuclear materials and facilities, in furtherance of U.S. nuclear nonproliferation goals concentrating on technical aspects of nuclear technology and the dangers of nuclear proliferation. It works bilaterally, negotiating 123 Agreements and implementing nuclear cooperation programs, and multilaterally, interacting with the IAEA, the OECD/NEA, and the Nuclear Suppliers Group. ISN/NESS also coordinates interagency efforts to implement the Convention on Nuclear Safety and the Joint Convention on the Safety of Spent Fuel Management and on the Safety of Radioactive Waste Management and to promote entry into force of the Convention on Supplementary Compensation for Nuclear Damage and the Convention on the Physical Protection of Nuclear Material.

For more information about the ISN/NESS, please visit www.state.gov/t/isn.

Bureau of Energy Resources (ENR)

ENR ensures that U.S. diplomatic relationships advance U.S. interests in having access to secure, reliable, and ever-cleaner sources of energy. The ENR focus is to manage the geopolitics of today's energy economy through diplomacy; to enable global energy transformation through energy policy that stimulates market forces for alternative energy, clean electricity, development, and reconstruction; and to expand good governance, increase transparency, and improve commercially viable and environmentally sustainable access for the 1.3 billion people without access to electricity and the 2.7 billion people without access to modern energy services.

For more information on ENR, please visit www.state.gov/e/enr.

U.S. Nuclear Regulatory Commission (NRC)

The U.S. Nuclear Regulatory Commission (NRC) is an independent agency charged with oversight of U.S. commercial nuclear activities in order to protect the public health and safety, promote the common defense and security, and protect the environment.

NRC executes this important duty by licensing and regulating the nation's civilian use of byproduct source and special nuclear materials. NRC's regulations are designed to protect both the public and workers against radiation hazards from industries that use radioactive materials.

NRC's scope of responsibility includes regulation of commercial nuclear power plants; research, test, and training reactors; nuclear fuel cycle facilities; medical, academic, and industrial uses of radioactive materials; and the transport, storage, and disposal of radioactive materials and wastes. In addition, NRC licenses the import and export of radioactive materials and works to enhance nuclear safety, safeguards, and security throughout the world.

NRC adheres to the principles of good regulation—independence, openness, efficiency, clarity, and reliability. The agency puts these principles into practice with effective, realistic, and timely regulatory actions, consistent with our organizational values and our open, collaborative work environment.

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NRC supports U.S. interests abroad in the safe and secure use of nuclear materials and in guarding against the spread of nuclear weapons. NRC actively participates in international working groups and provides advice and assistance to international organizations and foreign countries to develop effective regulatory organizations and enforce rigorous safety standards.

NRC has bilateral programs of assistance or cooperation with 43 countries, Taiwan, and the European Atomic Energy Community. NRC's international exchange programs provide joint cooperative activities and assistance to other countries to develop and improve regulatory organizations. Two of these programs are the International Regulatory Development Partnership (www.irdp-online.org) and the Radiation Sources Regulatory Partnership (www.rsrp-online.org).

NRC's information exchange arrangements with foreign regulatory authorities establish the framework for NRC to gain access to non-U.S. safety information that can (1) alert the United States to potential safety problems, (2) help identify possible accident precursors, and (3) provide accident and incident analyses, including lessons learned, that could be directly applicable to the safety of U.S. nuclear power plants and other facilities. They also serve as vehicles for the health and safety assistance that NRC supplies to emerging countries in their efforts to develop and enhance their regulatory capabilities and their nuclear safety infrastructure. Thus, the arrangements facilitate NRC's strategic goal to support U.S. interests in the safe and secure use of nuclear materials and in nuclear nonproliferation both at home and abroad.

For more information, please visit the NRC's website at www.nrc.gov.

Appendix 5: Key Trade Policy Issues in Civil Nuclear Energy

U.S. Department of Commerce Civil Nuclear Trade Initiative:

In December 2008, the Department of Commerce launched the Civil Nuclear Trade Initiative (CNTI) to strengthen the competitiveness of the U.S. nuclear industry as it endeavors to rebuild its manufacturing base by capturing opportunities abroad. The Initiative, developed and administered by the Industry & Analysis (I&A) unit within the International Trade Administration, identifies the industry's most pressing trade challenges and most promising commercial opportunities and coordinates public and private sector efforts to address these issues. The Initiative aims to demonstrate and provide strong USG support for the U.S. civil nuclear industry to create an environment where U.S. companies can compete successfully and on a level global playing field, particularly against the state-owned competition.

The Initiative involves four areas of work:

- 1) The Trade Promotion Coordinating Committee's (TPCC) Civil Nuclear Trade Working Group - an interagency working group that coordinates USG policy and activities affecting U.S. civil nuclear trade;
- 2) Commerce's Civil Nuclear Trade Advisory Committee (CINTAC);
- 3) Trade policy and promotion activities, including among others a U.S. Industry Program at the annual International Atomic Energy Agency (IAEA) General Conference, trade missions to best prospect markets, nuclear standards workshops, and bilateral declarations on nuclear commercial cooperation;
- 4) Stakeholder resources, including a civil nuclear trade web portal ([trade.gov/civil nuclear](http://trade.gov/civil-nuclear)), an on-line nuclear export controls guide, a small modular reactor commercial outlook report and other promotional materials.

Liability - Convention on Supplementary Compensation for Nuclear Damage (CSC):

One of the biggest impediments to nuclear suppliers' pursuit of global opportunities is concern about potential legal liability in the event of a nuclear accident. Nuclear suppliers are reluctant or unwilling to participate in nuclear projects in countries where liability for a nuclear accident is NOT channeled exclusively to the operator of a nuclear facility or in countries where the operator may exercise a right of recourse against suppliers. US nuclear suppliers also are concerned that, in the event of an accident outside the U.S., suppliers, as well as the operator, could be sued in US courts that would apply normal tort law. In all these cases, suppliers would be subject to unlimited liability for which insurance is not available.

The best way to address the concern about potential liability is the establishment of a global nuclear liability regime based on the international nuclear liability principles, including channeling all liability exclusively to the operator and granting exclusive jurisdiction over claims arising from a nuclear accident to the courts of the country where the accident occurs. The IAEA-sponsored CSC is designed to be the basis for a global nuclear liability regime. Specifically, the CSC requires members to have national law consistent with the international principles either through membership in one of the existing international nuclear liability regimes (the Paris Convention or the Vienna Convention) or through adoption of national law consistent with the provisions of the Annex to the CSC. Members of the CSC also must agree to contribute, in the event of a nuclear accident, to an international fund to compensate victims of nuclear damage. Countries with and without nuclear power facilities can become parties to the CSC.

With the approval of the CSC by Japanese Diet in December 2014, Japan is expected to deposit its instrument of ratification of the CSC with the IAEA in early 2015, thereby bringing the CSC into effect 90 days later in mid-2015.

Peaceful Uses of Nuclear Energy Cooperation Agreements—123 Agreements

Nuclear cooperation agreements are required in order for the U.S. industry to export nuclear material, nuclear reactors, and major reactor components. The United States currently has twenty-five 123 Agreements in effect with more than 47 countries (27 through the Euratom Agreement, which includes all member states of the European Union), the IAEA, and Taiwan. 123 Agreements must comply with the requirements of U.S. law, in particular section 123 of the U.S. Atomic Energy Act of 1954 (AEA) as amended, which authorizes agreements for cooperation in the peaceful uses of nuclear energy.

123 Agreements are negotiated by the U.S. Department of State, with technical assistance from the U.S. Department of Energy (DOE) and concurrence from the U.S. Nuclear Regulatory Commission (NRC). DOE negotiates and implements administrative arrangements to the 123 Agreements. The NRC reviews and approves license requests for all nuclear material and equipment to be exported subject to 123 Agreements.

Section 123 of the AEA requires the following:

- Safeguard guarantees for all non-nuclear weapons states on all transferred nuclear material and equipment;
- Full-scope safeguards (non-nuclear weapon states only);
- Peaceful uses assurances;
- Right of return to the United States in the event the other party detonates an explosive device or violates/terminates an IAEA agreement for safeguards;
- No alteration in form or content, including reprocessing and enrichment, without U.S. permission;
- No retransfer without U.S. permission;
- Physical security guarantees; and
- U.S. prior approval of storage facilities for certain types of special nuclear material.

Transfers of components that do not require a 123 Agreement are licensed by the NRC. Nuclear-related dual-use exports, e.g., computers, simulators, detectors, and other dual-use items such as non-nuclear grade graphite for non-nuclear use, are licensed by the U.S. Department of Commerce. For more information, please visit DOE/NNSA's website at <http://go.usa.gov/DxjR>.

Export Controls

Part 810 Licenses

10 CFR Part 810 implements section 57 b. of the AEA, which controls the export of unclassified nuclear technology and assistance. Specifically, section 57 b. of the AEA prohibits any U.S. person from directly or indirectly engaging in the production of any special nuclear material outside of the United States except in cases where the U.S. Secretary of Energy has made a determination that the transfer is not inimical to the interests of the United States. These regulations enable peaceful nuclear trade by ensuring that nuclear technologies and assistance exported from the United States will be used for peaceful purposes.

Part 810 licenses are issued pending the official concurrence of the U.S. Department of State and in consultation with the U.S. Department of Commerce, the U.S. Department of Defense, and the NRC. Countries that would receive the technology transfer may be asked to provide government-to-government assurances that the technology provided will be used solely for civil nuclear activities and not for any nuclear explosive device, or other military purpose, and not retransferred from the territory of that state without prior U.S. consent. Such assurances confirm that the recipient government is aware of the transfer and guarantees that the technology will be used for peaceful purposes. The assurances usually take the form of a diplomatic note through the U.S. Embassy in country to the Department of State, which then provides the assurances and formal concurrence in the transfer to the U.S. Secretary of Energy.

For more information, please visit DOE/NNSA's website at <http://go.usa.gov/DxDm>.

Part 110 Licenses

The NRC has the responsibility and authority under the AEA to regulate the export and import of nuclear equipment and materials. These regulations are codified in 10 CFR Part 110 and apply to all individuals in the United States who export and import nuclear equipment, material, or components subject to NRC licensing authority. Unless the export or import transaction falls under an exemption by the NRC, it must be authorized by an appropriate NRC license. NRC issues two types of export and import licenses: general and specific.

For more information, visit the NRC website at <http://go.usa.gov/DxDJ>.

Dual-Use Civil Nuclear Licensing

The Bureau of Industry and Security (BIS) in the U.S. Department of Commerce is charged with the licensing, development, implementation, and interpretation of U.S. export control policy for dual-use commodities, software, and technology. Dual-use items subject to BIS regulatory jurisdiction have predominantly commercial uses, but may also have military, nuclear, missile, or chemical, biological, and weapons applications. The statutory authority for Commerce to regulate dual-use exports is the Export Administration Act of 1979 and is implemented through the Export Administration Regulations.

For more information, visit the BIS website at <http://go.usa.gov/DY5A>.

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Special thanks to the following individuals for their significant contributions to this report: William Lahneman, Devin Horne, Sarah Batiuk, Jason Portner, Jessica Huang, David Kincaid.