Nuclear Energy and the United States-Mexico 123 Agreement

By Diego Cándano, Sarah Riedel, and Richard Goorevich

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Project and Supply Agreement History

Mexico's nuclear program dates back to the 1950s with research being performed at universities around the country and the creation of the *Comisión Nacional de Energía Nuclear* (CNEN) by presidential decree in 1956 under the conviction that peaceful nuclear energetic and non-energetic applications could contribute to scientific and technological development of Mexico. In 1970, the Mexican Government opened bidding for two 654 Mwe nuclear power reactors. In 1974, an agreement was reached with the U.S. company General Electric to build two boiling water reactors ("BWR"), Laguna Verde I and II, to be located at Alto Lucero on the Gulf Coast of Mexico, 70 kilometers north of the city of Veracruz.

Even though General Electric won the contract to supply Mexico's BWRs, as a matter of policy, Mexico elected not to conclude a bilateral agreement for peaceful nuclear cooperation with the United States, known as a 123 Agreement. Mexico's decision to forgo a bilateral agreement with the United States was threefold: (a) the potential for special influence from the superpower in a bilateral relationship; (b) the imposition of the United States' 1978 Nuclear Non-Proliferation Act (NNPA) which originated safeguards and controls that surpassed Mexico's obligations under the International Atomic Energy Agency (IAEA); and, (c) the desire for Mexico to develop indigenously in the broader nuclear field without constraints. Instead, in order to satisfy the U.S. Atomic Energy Act of 1954, the United States and Mexico agreed on an IAEA Project and Supply Agreement ("PSA"). The IAEA uses PSAs to facilitate nuclear and nuclear-related cooperation, and having such PSAs in place between the United States, IAEA, and third parties (i.e. Mexico) allowed U.S. companies to engage in nuclear cooperation with Mexico through the provisions of the US-IAEA 123 Agreement for nuclear cooperation. During the 1970s, cooperation under a multilateral umbrella rather than direct bilateral engagement was consistent with Mexican foreign policy towards the United States, where bilateral understandings were preferred over institution building and the overall emphasis in the bilateral relationship was one of "protection against the U.S. threat."[1]

From 1963-1974, Mexico, the United States, and the IAEA negotiated two trilateral supply agreements to cover the TRIGA research reactor at the Salazar Center, located outside of Mexico City, including its construction, fuel, and components; as well as the construction of the nuclear power reactor at Laguna Verde, and its fuel. These PSAs were published as IAEA Information

[1] Alcocer Martínez de Castro, Sergio M. "Las relaciones México-Estados Unidos, 1756-2010. Cuatro áreas estratégicas", Norteamérica vol.8 no.2 México jul./dic. 2013.

Circulars (INFCIRC) 52, "The Texts of the Instruments Connected with the Agency's Assistance to Mexico in Establishing a Research Reactor Project" and INFCIRC 203, "The Texts of the Instruments Concerning the Agency's Assistance to Mexico in Establishing a Nuclear Power Facility".[2,3] A third PSA, "Agreement between the International Atomic Energy Agency, the Government of the United Mexican States and the Government of the United States of America Concerning the Replacement of Highly Enriched Uranium by Low Enriched Uranium" was signed in August 2011 and published as IAEA INFCIRC 825, which focused on fuel replacement, exchanging highly enriched uranium for low enriched uranium for the research reactor, TRIGA Mark III, located in Ocoyoacac, Mexico.[4] This overview underscores that Nuclear Energy has been an important part of Mexico's energy strategy. For example, in 2015, nuclear energy accounted for 4 percent of the overall electricity generation in Mexico and the country has plans to build more nuclear reactors by 2028-2030.

Figure 1. Nuclear Power Plant in Mexico

[2] "The Texts of the Instruments Connected with the Agency's Assistance to Mexico in Establishing a Research Reactor Project. IAEA Information Circular 52. https://www.iaea.org/sites/default/files/publications/documents/infcircs/1964/infcirc52.pdf. Accessed on 18 January 2019.

[3] "The texts of the Instruments Concerning the Agency's Assistance to Mexico in Establishing a Nuclear Power Facility". IAEA Information Circular 203. https://www.iaea.org/sites/default/files/publications/documents/infcircs/1974/infcirc203.pdf. Accessed on 18 January 2019.

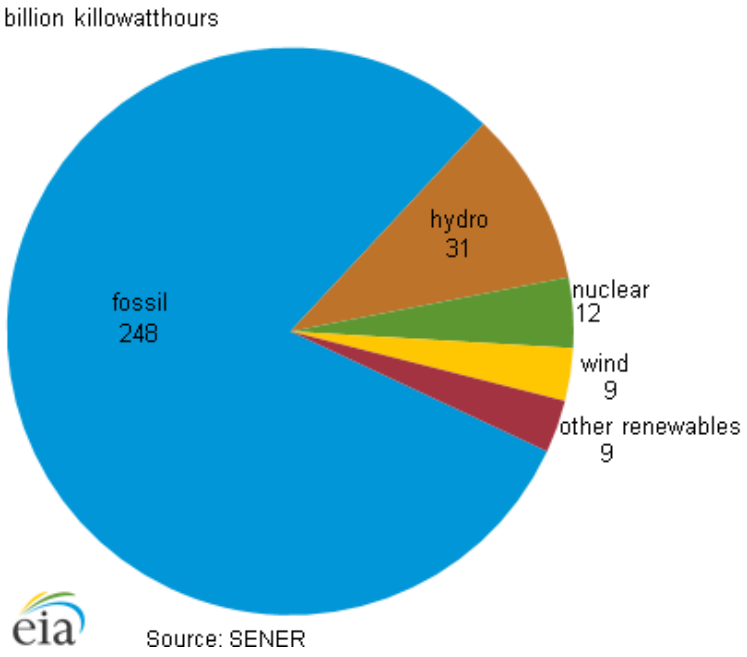
[4] "Agreement between the International Atomic Energy Agency, the Government of the United Mexican States and the Government of the United States of America Concerning the Replacement of Highly Enriched Uranium by Low Enriched Uranium." IAEA Information Circular 825. https://www.iaea.org/sites/default/files/publications/documents/infcircs/2011/infcirc825.pdf. Accessed January 18, 2019.

As a result of the debt crisis and the beginning of different economic policies in Mexico, Mexico's attitude toward the bilateral relationship began to change in the mid-1980s. In 1988, Presidents Carlos Salinas and George H. W. Bush met in Texas with the primary focus on the importance of the bilateral relationship between the two countries.[5] These discussions paved the way for a new era in the relationship between the countries, one with the idea that economic cooperation could lead to mutual benefit. Mexico and the United States began to view one another as partners. Progressively, both countries tied up common interests in a dense set of institutions and formal understandings, none more significant or impactful than the North American Free Trade Agreement (NAFTA), which came into force in 1994.[6]

Mexico's Goals for Electricity Generation

Mexico is rich in hydrocarbon resources and continues to be a leading producer of petroleum. While petroleum is central to its energy policy in both production and consumption, Mexico is heavily reliant on electricity generation from natural gas, primarily imported via pipeline from the United States. According to a 2015 EIA report, "Power plants using fossil fuels provided 72 percent of Mexico's electricity capacity and 80 percent of Mexico's electricity generation."[7]

Figure 2. Mexico's Electricity Generation by Fuel Source, 2015



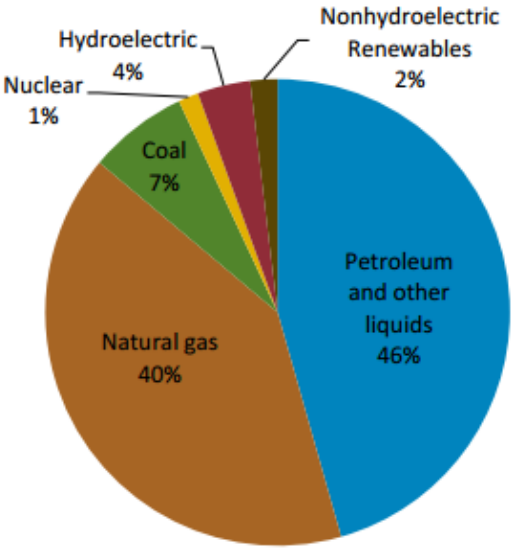
[5] "2 Presidents-Elect Discuss Future of U.S.-Mexican Ties". New York Times. https://www.nytimes.com/1988/11/23/us/2-presidents-elect-discuss-future-of-us-mexican-ties.html. Accessed January 18, 2019.

[6] Schiavon, Jorge A. "La relación especial México-Estados Unidos: cambios y continuidades en la Guerra y Pos-Guerra Fría", CIDE Documento de Trabajo No. 137.

[7] "Electricity". EIA. https://www.eia.gov/beta/international/analysis.php?iso=MEX. Accessed January 18, 2019.

With the 2018 implementation of Mexico's 2013 National Energy Strategy, which covers a 15-year horizon, Mexico's government is focused on two Strategic Objectives: 1) access to energy by the entire population, and 2) provide viability for Mexico's economic growth and extend access to quality energy services to the entire population.[8] To achieve these objectives, four "Policy Measures" were identified: 1) transport, storage, and distribution; 2) refining, processing, and generation; 3) oil production; and 4) energy transition. The fourth objective "energy transition" specifically seeks to provide "economically competitive, technologically innovative and diversified generation, with its contribution to the permanent improvement of local environmental quality and compliance with environmental commitments."

Figure 3. Total Energy Consumption in Mexico by Source, 2015



Source: U.S. Energy Information Administration, BP Statistical Review of World Energy

Similar to other governments, Mexico's energy reform emphasizes diversity of generation as well as compliance with environmental commitments. Currently, Mexico has a target of generating 35 percent of its power from clean sources by 2024. The definition for "clean sources" as defined by Mexican legislation includes cleaner energy sources such as nuclear. Such aggressive clean energy targets are supported by Clean Energy Certificates, which establish for large consumers a minimum level of electricity consumption derived from "clean sources."[9]

[8] National Energy Strategy. https://www.gob.mx/sener/documentos/estrategia-nacional-de-energia. Accessed on January 18, 2019.

[9] Mexico's Renewable Energy Future. Wilson Center. https://www.wilsoncenter.org/sites/default/files/mexico_renewable_energy_future_0.pdf . Accessed January 18, 2019

Unlike other sources of electrical generation, the nuclear sector within Mexico remains closed, as CFE is the only owner and operator of nuclear reactors. While there are only two operating reactors on the Laguna Verde nuclear power plant site, discussions continue regarding the prospects of building two additional units.

What is the United States-Mexico 123 Agreement?

In 2016, the governments of both Mexico and the United States announced an agreement for cooperation concerning peaceful uses of nuclear energy ("Agreement"). It was part of a comprehensive set of bilateral agreements and initiatives on issues including education, trade, travel, climate change and environmental protection, overall energy cooperation, health, and security. Hence, the Agreement must be seen as one of the different components of the functional integration of North America. The final text was signed by both countries in May 2018.[10]

Mexican authorities have described the Agreement as consistent with the long history of cooperation on peaceful uses of nuclear energy between both countries, highlighting cooperation between regulators of both countries and between technical authorities.

The Agreement builds on the existing limited cooperation between the United States and Mexico under the PSAs and establishes the conditions for continued U.S. civil nuclear trade with Mexico. It normalizes the legal, policy, and commercial environment between the United States and Mexico. Under the PSAs, each nuclear transaction from the United States to Mexico was an exceptional case to the legal requirements of the Atomic Energy Act. In addition, where the PSA nuclear cooperation required the explicit consent of the IAEA, as well as Washington D.C. and Mexico City, now the role of the IAEA is also normalized to endorse the nonproliferation and safeguards bona fides of the parties. In other words, whether a State "has good faith commitments to develop only peaceful applications of nuclear energy and thus exercises its rights under Article IV in a manner that is consistent with its other NPT obligations."[11] In general, as set forth in Article 2 of the Agreement, and in accordance with their respective national laws and license requirements, the parties (directly or through authorized persons) may transfer material, equipment, components, and information under the proposed Agreement as they do with any other civil nuclear partner.

This has allowed the scope of the cooperation under the Agreement to be broader than the specific projects of the PSAs. Now, under the Agreement, cooperation can take place in all relevant areas of the civil nuclear energy, including, but not limited to the following:

[10] https://www.gob.mx/sre/en/prensa/mexico-and-the-united-states-sign-nuclear-energy-cooperation-agreement

[11] Seward, Amy, Carrie Mathews, and Carol Kessler, "Evaluating Nonproliferation Bona Fides", in Nuclear Safeguards, Security and Nonproliferation, ed. By James Doyle.

- Research, development, design, construction, maintenance, and training on operation of nuclear power plants, small and medium-sized nuclear reactors or research reactors, and non-power applications of nuclear energy;
- Manufacture and supply of nuclear fuel elements to be used in nuclear power plants, small and medium-sized nuclear reactors, or research reactors;
- Nuclear fuel cycle activities and materials including radioactive waste management;
- Production and application of radioactive isotopes in industry, agriculture, and medicine;
- Nuclear safety, radiation protection, environmental protection, and emergency preparedness; and
- Nuclear safeguards and physical protection.

The Agreement also provides for broader support between the United States and Mexico by encouraging the exchange of best practices for nuclear policy development and the training and development of human resources in the nuclear sector.

Furthermore, and most importantly, the proposed Agreement also obligates the United States to endeavor to take such actions as are necessary and feasible to ensure a reliable supply of low enriched uranium fuel to Mexico. The proposed Agreement would have a term of 30 years, so it envisions a long and productive engagement.

A National Security and Trade Perspective

Engagement between governments in the area of civil nuclear cooperation requires a broad confluence of visions and the policies to effect those visions. This includes having shared views on the importance of nuclear energy in a national and/or global energy portfolio, to partner on nonproliferation.

In the United States, engaging with trade partners on nuclear cooperation brings with it a legal litmus test where the President must make a written determination "that the performance of the proposed agreement will **promote** and will not constitute an unreasonable risk to, **the common defense and security**."

Mexico uses the following three reasons to find the Agreement "positive": 1) it reinforces the trust, prestige, and responsibility of the two nuclear sectors; 2) it provides legal certainty and strengthens the bilateral cooperation framework; and 3) "for national security reasons, nuclear energy remains reserved for the State" and, in that sense, the bilateral agreement will help Mexico contribute to economic and social development in energy matters, but also in the health, environment, and food sectors. Both countries designed and announced the launching of negotiations in 2016 as part of a comprehensive set of policies that highlighted a constructive approach towards bilateral cooperation. Agreement on a final text represented, together with

the United States-Mexico-Canada trade agreement a few months later, a concrete common understanding between both governments achieved in 2018.

Furthermore, in 2012, Mexico joined the United States as a Participating Government of the Nuclear Suppliers Group ("NSG"), an export control regime that develops guidelines for responsible nuclear civil cooperation and links non-proliferation commitments to peaceful uses of nuclear energy. The NSG Guidelines are referenced in the bilateral agreement and the adherence by Mexico and the United States to its principles enables the bilateral agreement.

For Mexico, it was important to highlight the role of enhanced cooperation under the Agreement as part of the environmental goals of the country, "strengthening the nuclear sector under the perspective of environmental protection" and the possibility to have greater access to technology for clean and reliable energy as well as its potential for health and agriculture, among others. This further highlights the view that the Agreement can be part of a robust framework for cooperation in North America.

In 2017, the U.S. Department of Commerce noted that Mexico was the #6 civil nuclear market for United States suppliers. Opportunities for U.S.-Mexican partnership were described as follows:

- Services (front-and back-end): Possibilities for feasibility and site characterization studies, emergency management planning, and infrastructure development for the Laguna Verde reactor expansion.
- Design, Construction, and Operation: Opportunities will be available once new reactors are under consideration.
- Components: Potential with new reactor builds. Some opportunities to provide equipment, design, and engineering services to existing reactors.
- Waste Management: Potential services for future disposal site.[12]

In support of nuclear cooperation is the strength of U.S.-Mexico trade. Mexico is the third-largest trading partner of the United States and "on any given day more than $1.5 billion USD in bilateral trade crosses" the shared border. The total amount of goods and services traded between the United States and Mexico in 2017 was estimated at $615.9 billion USD, with almost none of this being in the nuclear sector due to the lack of an Agreement.[13]

[12] https://www.trade.gov/topmarkets/pdf/Civil_and_Nuclear_Top_Markets_Report_2017.pdf, pages 74-79
[13] https://ustr.gov/countries-regions/americas/mexico

How the U.S.-Mexico 123 Agreement Supports the Strategy of Diversified Nuclear Fuel Procurement

Unlike other sources of energy, the front end of the nuclear fuel supply chain consists of several steps prior to being able to power a nuclear reactor—mining and milling uranium, converting uranium into uranium hexafluoride, and enriching uranium to a higher concentration of the U^{235} isotope resulting in enriched uranium product ("EUP"). Given the lengthy lead times for producing EUP, utilities operating nuclear reactors diversify their fuel supply, sourcing from two or more third parties in order to ensure security of supply. The importance of this diversity stems from the costs associated with supply disruption, which can lead to a longer reactor outage costing on average $1 million USD per day. Worldwide, there are more than 63 operators of nuclear power reactors, with 23 of those operators in North America. Globally, there are only 5 nuclear operators that rely on a single supplier of EUP, and in North America, there is only 1—CFE is the only nuclear operator in North America that relies on a sole source of EUP, with 100 percent of its supply being shipped from Russia to the United States for CFE's fuel fabrication.

The reasons for this sole source supply being that (1) CFE is subject to federal procurement rules, and (2) nuclear fuel is not recognized any differently than other fuel used in electric generation. CFE's federal procurement rules award any supplier meeting various technical criteria 100% of supply to CFE exclusively on the basis of price. For fossil fuels, no one supplier can meet CFE's demand; therefore, diversification inherently exists regardless of the price-driven procurement rules. However, since CFE's nuclear fuel needs can be met by one supplier, application of the same procurement rules for nuclear fuel results in an award to a single vendor and does not permit CFE to factor in security of supply considerations. While CFE has not had a supply disruption in the past few years, CFE faces a huge risk for supply disruption without a back-up plan if Russia were unable to deliver. This is an unusual risk that North American utilities, especially U.S. utilities, are unwilling to take given the ever-changing geopolitical risks that exist today.

Fortunately, both governments have agreed on the text of the United States-Mexico Agreement and the Agreement is waiting to be signed. Once signed, among other things, the Agreement should be a catalyst for CFE to revise its procurement rules to include supply diversification from the United States.

The United States has one producer of low enriched uranium, Louisiana Energy Services, LLC ("LES"), located in New Mexico, less than 250 miles from the U.S.-Mexico border. LES has been in production since 2010 and is uniquely positioned to provide diversification and security of supply for North American utilities. LES delivers to the 3 fuel fabrication facilities located in the United States, which includes CFE's fuel fabrication supplier, Global Nuclear Fuel. Since CFE

already contracts its fuel fabrication in the United States, it makes sense to have at least a portion of its nuclear fuel supply from an EUP supplier located in the United States.

Given that the Agreement obligates the United States to endeavor to take such actions as are necessary and feasible to ensure a reliable supply of low enriched uranium fuel to Mexico, it provides some level of protection to the sole source risk to which CFE is exposed. The Agreement does not specify cost and schedule for such supply. It is important to recognize that the Agreement provides a more than reasonable basis for CFE to believe that the supply of low enriched uranium as part of a thorough, transparent, and diversified supply strategy is encouraged and supported by both the U.S. and Mexico governments.

Recommendations

The importance of the United States-Mexico 123 Agreement is not just limited to potential commercial cooperation, as much as we have identified the importance that normalized nuclear cooperation between neighbors ensures transparency in both governments' commitment to develop, safeguard, and support nuclear power. As with other important partners, we believe that the Agreement itself can be a springboard into broader and significant discussion and cooperation in a very complex bilateral relationship. As such, our recommendations are intended to foster that type of engagement.

1. The establishment of a high-level bilateral engagement arrangement which would allow for both governmental and commercial engagements as specified in Article 2, paragraph 2 of the Agreement.

2. A plan to identify ways for the U.S. Government to meet the commitments in Article 4, paragraph 5 to export nuclear fuel from United States suppliers on a timely basis, including ways to expedite export licensing and timely negotiation/implementation of the Administrative Arrangements.

3. Mexico and the United States should find ways of enhancing nuclear cooperation as part of a strategy towards a clean energy North America with increasing recognition that nuclear energy can play an important role in achieving a decarbonized energy future in many regions of the world.[14]

4. The nuclear industries of Mexico and the United States should share "best practices" associated with nuclear safety, security, and procurement practices.

5. Strengthen the non-proliferation dialogue with governmental MOUs to address nuclear safeguards, physical security and export controls.

[14] http://energy.mit.edu/research/future-nuclear-energy-carbon-constrained-world/.

About the Authors

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Mrs. Riedel serves as Vice President, Marketing & Sales for Urenco, Inc. based in Arlington, Virginia. Urenco Inc. is a wholly owned subsidiary of Urenco Limited, located in Stoke Poges, United Kingdom.

Mrs. Riedel spent the past 10 years serving in various commercial capacities within the nuclear industry, focusing on international and domestic uranium and nuclear fuel trading, uranium mining, and uranium enrichment.

Mrs. Riedel received her BA in both Marketing and Organizational Management from The University of Iowa Tippie College of Business, and her MBA from Georgetown University McDonough School of Business.

Richard Goorevich

Mr. Goorevich is the current Director, Government Affairs for URENCO USA.

He previously spent 24 years at the Department of Energy's National Nuclear Security Administration serving in many roles in the area of Nonproliferation policy development including as the Senior Policy Advisor on nuclear nonproliferation and regulatory issues. Mr. Goorevich also served as the Director of the Office of International Regimes and Agreements where he was responsible for providing technical guidance to the USG on international nuclear affairs, nuclear safeguards, nuclear and WMD Dual-Use export control policies, and international physical protection requirements. He frequently served as a negotiator for US agreements for nuclear cooperation (123 Agreements) and has served as a delegate to the IAEA General Conference and the NPT Review Conference.

Mr. Goorevich was the Chairman of the Nuclear Suppliers Group Consultative Group for 14 years and was a member of the USG's delegation to the NPT Exporter's Committee. His office was also responsible for the issuing of US export authorizations for nuclear assistance, commonly referred to as "810 authorizations".

Prior to joining the Office of International Regimes and Agreements, Mr. Goorevich spent two years working in the Department of Energy's New Production Reactor Program.

Mr. Goorevich received his B.A. in History from Miami University in 1988, and his M.A. in History from the University of Buffalo in 1990.

Diego Cándano

Mr. Cándano, a Nonresident fellow with The Stimson Center, works on nonproliferation and strategic trade issues.

He chaired the Consultative Group of the Nuclear Suppliers Group (NSG) between 2017 and 2019. He represented Mexico in the NSG and the Wassenaar Arrangement after Mexico joined these two export control regimes. Since June 2019 he supports the work of the current Chair of the Consultative Group.

He has been posted to the Mexican Embassy in Austria and has served as advisor on foreign policy to the President of Mexico and advisor for North American affairs in the Mexican Foreign Ministry. He has an MPhil from Oxford on Chinese foreign policy and has published on different topics, including Mexico-China relations and climate.