The Educational Element of Capacity Building, Challenges and Issues;

The Mexico case

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Introduction

- The current population of Mexico is 132,628,138 based on Worldometer elaboration of the latest United Nations data.
- The population density in Mexico is 66 per Km² (172 people per mi²).
- The total land area is 1,943,950 Km² (750,563 sq. miles).
- 83.8% of the population is urban (108,074,410 people in 2020).
- The median age in Mexico is 29.2 years.
Historical development of nuclear in Mexico

• Mexico's interest in nuclear power dates back to the early 1960s.
• In 1966 started the study of potential sites for nuclear power plants.
• In 1969 the CFE (National Electric Company) decided to invite bids for a 600 MW NPP of proven technology.
• In 1976 initiated the construction of the LV NPP with two reactors of 654 MWe net each.
• In 1979 after the Three Mile Island accident in the US the antinuclear groups objected to the project.
• The first unit went into commercial operation in 1990 and the second in 1995.
• At the end of the 1970s and beginning 1980s, Mexico had a national program for the development of its own nuclear technology which was unfortunately abandoned when in 1982 a large amount of oil was found, among other reasons.
Nuclear in Mexico as a part of the power mix

1. Laguna Verde is the only nuclear power plant (NPP) in Mexico.
2. Owned and operated by the CFE on the country's Gulf Coast, it has been generating electricity since 1990, when unit 1 started up. Unit 2 followed five years later.
3. The construction time for both units far exceeded what had been projected.
4. Both units are 775 MWe BWRs supplied by GE.
5. An upgrade to 120% of power was completed in 2011.
6. Nuclear current capacity is 1,608 MW.
7. The National Commission for Nuclear Safety and Safeguards (CNSNS), renewed licenses for 30 years to continue operation until 2050 (Unit -1) and 2055 (Unit-2).
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LV-NPP has a design basis of magnitude 8 Richter.
Mexican National Energy Strategy and Power Outlook

1. The two nuclear plants have had a good operational experience.
2. Nuclear power from Laguna Verde provides 3-4% of Mexico's electricity.
3. The current mix of electricity generation in Mexico is 70% coming from fossil fuels.
4. The report on the potential of Mexico's electricity sector to mitigate carbon dioxide emissions reiterated that the Energy Transition Law specifies that 35% of electricity should come from clean sources by 2024 and for that to reach 50% by 2050.
5. There has long been discussion of expanding nuclear energy in Mexico without a firm policy commitment.
6. In 2022 the Ministry of Energy published three power scenarios for 2050 in which nuclear participation is close to 10,000 MWe, without providing any policy details.
Nuclear in the context of power deployment in Mexico
International cooperation

Mexico is a member of:

• The IAEA-INPRO project: Participating in areas: Economics, Waste Management and Infrastructure.; and projects (CENESO, ASENES, SMRs)

• The World Association of Nuclear Operators (WANO): Inspections to the LV-NPP

• The Ibero-American Forum of Radiological and Nuclear Regulatory Bodies: Projects with the Regulatory Body

• The Latin American Network for Education in Nuclear Technology (LANENT): Projects with the UNAM University, NKM & NUCLEANDO for teachers of secondary.
National initiatives

- The National Council of Science and Technology (Conacyt)
- Universities and Polytechnics
- The REMECIN (Mexican network for nuclear education, training and research)
- The SNM (Mexican Nuclear Society, annual meetings)
- LAS-ANS (Latinamerican section of the ANS)
- Academies of Engineering and Sciences of Mexico
- WIN-MX
- The UPE (Energy Planning Unit of UNAM)
The Role of UNAM as an Educational Element of Capacity Building

- Mexico is among the 48 member states of the IAEA that are considering including nuclear in the energy mix (Ref: PRODESEN* years: 2018 to 2022).
- There is not yet an official nuclear energy program for Mexico, however, the main institutions related to the energy sector are conducting studies to be prepared to contribute to the nuclear program’s phases of decision-making, planning, purchasing, designing or operating.
- As mentioned by INPRO, a highly trained and specialized workforce to support these phases is a key element to a successful and sustainable nuclear energy program.
- Since 2014 Faculty of Engineering of the National Autonomous University of Mexico (UNAM) has been participating in INPRO’s Technical Meetings and Dialogue Forums to get knowledge, capacities, and methodologies to evaluate the sustainability of Nuclear Energy Systems (NES) that can be considered for Mexico.

*PRODESEN is an official document edited yearly by the Secretariat of Energy to publish the power program planning for the future 15 years.
The Role of UNAM as an Educational Element of Capacity Building

Doctorate in Energy Engineering focused on Nuclear Power Systems.

Master in Energy with courses on:

- Reactor Physics Analysis,
- Nuclear Fuel Cycles,
- Nuclear Safety Technology and Human Factors Engineering,
- Probabilistic Risk Assessment,
- Nuclear Systems Modeling,
- Planning of the Power Sector (Application of INPRO tools and Methodologies)

- Electrical, Mechanical, Civil Engineers and others.

Visits to the NPP, and Nuclear Research Institute Irradiator Practices of Reactor Physics in the TRIGA reactor
The Role of UNAM as an Educational Element of Capacity Building

• We are convinced that it is essential to know good practices and lessons learned with respect to capacity building among academia, policymakers, owner/operators, industry, and to become member of the regulatory bodies, from Member States (IAEA) in their diverse phases.

• The UNAM will be apply to become a member of the International Nuclear Management Academy (ANMA)
Benefits

• The SMR is small in power and modular in nature, allowing almost all of its construction in the controlled environment of a factory and subsequent installation on site, module by module.

• Flexibility in power to adapt in regions with less meshed and powerful grids.

• Independent management of the modules for maintenance and refueling, while the others remain in service.

• Less cooling water needs.

• Possibility of having the modules underground to improve their security and non-proliferation, in particular their resistance to air attacks and improve their integration into the environment.

• Lower risk, so very small exclusion area.
Nuclear Sites Selection for SMRs

• High construction costs of nuclear have discouraged the installation of new plants.

• The selection of a site suitable for a nuclear installation is a crucial process. This can significantly affect construction time, costs, public acceptance and safety of the installation over the whole operating time*. 

• Mexico is considering investigating the benefits and challenges of converting Coal and Oil power plants into nuclear SMR plants.

• There is an estimation that the regulatory body requires personnel (at least 10 experts that need to be capacitated for 2 years).

* https://www.iaea.org/topics/siting
Challenges

• Disseminate the benefits of nuclear energy among the population to seek social acceptance (SENER / CFE).
• Prepare a public bid to obtain reliable costs of current SMR technologies and reactors.
• Select the most appropriate technology for the deployment of nuclear energy by CFE.
• Establish the financing of investments necessary for construction.
• Obtain technology transfer agreements with the supplier of the selected technology.
• Have a plan for the management of high-level radioactive waste to respond to the public's question on this subject (SENER / CFE).
• Have the CNSNS approve the Design Certification in a timely manner (SENER / CFE).
Thank you for your attention

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