

## Nuclear Power Controversies in Mexico

### *Controversias por la producción de nucleoelectricidad en México*

<http://dx.doi.org/10.32870/Pk.a10n18.427>

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Received: April 29, 2019

Accepted: January 29, 2020

#### ABSTRACT

This article introduces an exploratory study on controversies that arose in Mexico since the late seventies till the present time due to the nuclear power production. Contextualized in a scenario characterized by the existence of projects that seek to boost nuclear energy and with it, the appearance of new resistant voices that emerged after the Fukushima nuclear accident in 2011. Reviewing literature on controversies, resistance to technologies and contentious politics, we identify key actors and arguments that conforms processes of public discussion regarding nuclear power. Furthermore, we analyze continuities, breaches and the impacts of the opposition in the last three decades.

#### Keywords

Nuclear technology;  
Antinuclear movements;  
Environmental conflicts;  
Energy

#### RESUMEN

*Este artículo presenta un estudio exploratorio de las controversias que emergieron en México desde finales de los años setenta debido al incremento del proceso productivo de la nucleoelectricidad y al surgimiento de nuevas voces de oposición tras el accidente de Fukushima en 2011. A partir de la articulación entre literatura sobre controversias, resistencia a las tecnologías y política contenciosa, se identifican los actores y los argumentos que conforman los procesos de discusión por el desarrollo nuclear en la esfera pública, así como las continuidades, las rupturas y los impactos de la resistencia que se han registrado durante la últimas tres décadas.*

#### Palabras clave

Tecnología nuclear;  
movimientos  
antinucleares; conflictos  
ambientales; energía

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## Introduction

At the beginning of the New Millennium, the promoting sectors of nuclear energy sought to restart the production of nuclear power as this source of energy is presented as clean and capable of mitigating the effects of climate change. One of the central arguments (mainly sustained by organizations like the International Atomic Energy Agency (IAEA), the workers, companies or institutions linked to the nuclear sector) was that nuclear power, different from other sources of energy using fossil fuel, does not produce gaseous emissions that contribute to increasing the greenhouse effect.

In this scenario, the Secretariat of Energy of Mexico (SENER, by its acronym in Spanish) created a committee in 2006 to support making decisions in the subject matter of nuclear energy, with the purpose of analyzing the possibilities to expand the generation capacity of nuclear power and the projects of repowering the two reactors that have been in operation in the country for three decades now at Laguna Verde in the State of Veracruz.

Whilst, in 2007, the Energy Sectorial Program presented nuclear technology as an option for the production of energy, the construction of new power centrals was considered in the energetic reform of 2013 and in multiple projections prepared by SENER. Thus, nuclear power was considered as “key to Mexico regarding its goals for the generation of clean energy for 2024” (Hernandez-Ochoa, quoted by Valencia, 2017). However, the Fukushima Daiichi accident in 2011 (after an earthquake and a tsunami stroke the coast of Japan, causing failures on the reactor cooling systems and the subsequent partial nuclear fusion) attracted the attention to risks associated with the production process of nuclear power, which gave rise to controversies for the development and implementation of the pacific use of nuclear technologies (Rootes, 2016). Although, in Mexico, resistance to the nuclear development after the Fukushima accident was far from being a massive one, it was no exception.

In this framework of public expressions of interest for the nuclear development and the reappearance of voices of opposition, this article presents an exploratory study on the controversies that have arisen in Mexico since the end of the 1960s due to the production process of nuclear power. Special attention is given to the characteristics and peculiarities of the controversies from the identification of actors and arguments that comprise discussion processes for nuclear development in the public sphere in the country, as well as impacts of the resistance of technological processes.

The structure of this article is divided in four sections. The first one presents theoretical-methodological considerations starting from social studies on science and technologies (STs) and the contributions of literature on social movements and contentious politics. With the purpose of promoting a holistic study of the controversies, in the second section, the development and implementation of nuclear technology in

Mexico is reviewed, which would foster the construction of, at least, two power reactors. In the first half of the third section, the origins of discussions around nuclear energy which arose at the end of the 1970s and were visibly noticeable after the Chernobyl accident in 1986 are explored; in the second half, the resistance of the production process of nuclear power in the post-Fukushima scenario is analyzed.

The fourth section presents an update of the discussions on the production of nuclear power in Mexico, which analyzes two lines that are considered to be key by sectors that promote and resist nuclear development: 1) the question on the risk associated to the production process of nuclear power; 2) the problem on the management and the disposal of radioactive waste. Lastly, final considerations are presented which highlight continuity and ruptures of controversies for the production process of nuclear power which have taken place in Mexico over the last four decades.

### **Theoretical-methodological considerations**

Controversy studies on the pacific uses of nuclear technology have become relevant in the research agendas during 1970s and 1980s, in relation with the oppositions recorded against this technology in the global scenario. In the STS field, works like those of Dorothy Nelkin (1982, 1984) were significant for analyzing controversies on the likely environmental pollution as a result of the function of power plants, on the location of nuclear facilities or for the treatment of and disposition of radioactive waste.

When studying these areas which were underexplored until then, the works analyzed the concerns, position, and interests which emerge by the outcome of conflicts, in addition to the role of knowledge and citizens' participation. From this perspective, the study of controversies promoted "a realistic understanding of scientific and technological policies, their social and political context, public impact [...] and the problems arising from the development of public policies in absence of definitive agreements on the potential risks" (Nelkin, 1984).

From these theoretical guidelines, a bibliographical basis is taken on controversies –especially that which deals with the production of nuclear power (McAdam & Boudet, 2012; Hindmarsh & Priestley, 2016; Espluga Trenc *et al.*, 2017)– with Bauer's (2015) concept of resistance to technologies. In this sense, resistance is understood as a way to express positions in the face of technologies, staging the capacity of and freedom of choice of the citizens on decision-making technocratic models, and which may be expressed in a number of ways: that is to say, "the resistance is mind, attitude and action. The resistance is political participation" (Bauer, 2015).

To study the description and analysis of the citizen participation processes on the controversies comprising the Mexican case, theoretical-methodological tools are incorporated on contentious politics and social movements (McAdam, Tarrow & Tilly, 2007), in relation with the number of researches on this field and STS studies which have been enhanced over the past years (Breyman *et al.*, 2017). Likewise, the work is complemented by the analysis on environmental unrest in Latin America and the problems of risk in its multiple dimensions.

As this is a qualitative research, in this article work was done with primary and secondary sources, mainly formed by specialized studies, journalistic articles and institutional communication both of antinuclear organizations and those linked to sectors that promote nuclear development. In addition, this process was supplemented by the field work done during the months of May, June and July 2018, which included visits to the Laguna Verde Nuclear power plant of the National Institute of Nuclear Research (ININ, by its acronym in Spanish) and interviews to workers, consultants and representatives of the nuclear sector, as well as to antinuclear activists who have partaken in resistance actions done in the country.

From criticism on the production of nuclear power in the public sphere, resistance is described and analyzed against the project for the installation of a nuclear reactor plan in the State of Michoacán, demonstrations against the Laguna Verde project, the emergence of questions on nuclear development after the Fukushima accident in 2011, and discussions held among sectors in favor and against nuclear power nowadays.

Before moving forward towards the characterization of the nuclear sector in Mexico, it is necessary to mention that the proposed review is of an instrumental nature. In this sense, as of the release of documentary sources, there are projects presented that would foster the production of nuclear power in the country, which will turn it into one of the leaders in nuclear development in Latin America and into one of the only three countries (along with Argentina and Brazil) with power plants.

## **On the nuclear development in Mexico**

The origins of nuclear development in Mexico date back to research activities on nuclear physics whose development began between 1940 and 1950, driven by a group of researchers in the subject of physics and civil engineering who specialized in the United States and who became referents in these areas, such as Manuel Sandoval Vallarta, Alfredo Baños & Nabor Carrillo Flores (Domínguez, 2012; Azuela & Talancón, 1999). Due to the drive of pacific and civil uses of nuclear technology after the speech “Atoms for Peace”<sup>1</sup> in 1953, the National Commission on Nuclear Energy (CNEN, by its acronym in Spanish) was created in 1956, with the purpose of enhancing the “exploration

and extraction of uranium, the application of radionuclides, radioactive patterns, genetic effects of radiations, plasma physics and reactor physics.” (ININ, 2018).

Years later, in correspondence with an intensive period of political-economic support to nuclear development in the global scenario, the construction of the first nuclear power plant in our country started in 1964. On the selected land, located between the cities of Mexico and Toluca, a Van de Graaff tandem particle accelerator and a TRIGA Mark III<sup>2</sup> research reactor was set in operation, that are currently in operation. Afterwards, the first steps started towards the construction of an atomic power plant; however, envisaged projects were more ambitious.

According to Azuela & Talancon (1999), during the 1960s (in the face of the energetic crisis and the strong dependence on fossil fuel in Mexico) the nuclear program was presented to be a strategic one. In quantitative terms, “installation of 20 reactors – to produce a power of 15,000 MW was stipulated”– [...] while total generation would be a contribution of 29 percent of nuclear power for year 2000”. These projections were made known during a global scenario which was proper from the sectors that promoted nuclear development, signed by the petroleum oil crisis of the 1970s and the strong drive that received the development of an implementation of the production of nuclear power worldwide. In this context, the nuclear power plants of Latin America were no exception: in 1974, Argentina implemented the first power reactor in the region, Atucha I, while Brazil was on the way to the construction of Angra I, that was criticized in 1982 (Solingen, 1986; Adler, 1991).

In 1972, the construction of the first plant in Mexico was agreed using enriched uranium technology, which was to be provided by the US company, General Electric. This triggered a series of discussions inside the promoting sector of Mexican nuclear development, mainly among workers of INEN and the Federal Power Commission (CFE, by its acronym in Spanish), a state company engaged in the production and distribution of power: while the former defended the election of a reactor that would use natural uranium as fuel (a fact which, in accordance to its position, would prevent dependence on a promoted technology and exclusively dominated by few countries worldwide.), the latter had an inclination towards a technology that used enriched uranium, considered as “economically more advantageous and better approved technologically” (Sarquis, 2013).

Finally, the election for enriched uranium prevailed; but the construction process of the Laguna Verde Nuclear Plant extended more than expected and had to overcome a number of obstacles, even economic problems that occurred in the country in the 1970s which became more intense with the 1982 crisis, when there was a notable increase of the external debt, which had an impact in the development of technological capital-intensive projects like the nuclear project. In spite of political and economic ups and downs, Mexico continued advancing towards implementing its first power reactor,

which would be effective in April 1989; however, this journey was not even exempt from questions.

### **Antinuclear mobilizations**

As advances of the project took place in the Laguna Verde Nuclear power plant, questionings arose on the development of nuclear technology, from the end of the 1970s. In 1980, the Mexican Physics Society organized a round table titled “Nuclear energy in an oil-producing country”, whereby members of CFE partook, ININ, political representatives and university professors. In the presentations, positions were identified that may be characterized as antinuclear; that is, which brought arguments to the scene supported from then and to present against the production process of nuclear power. Thus, for example, is the intervention of a CFE worker and director of the political analysis issue *Punto Crítico*, who stated: “other opinions, other facts and problems have come to the scene that have led us to be convinced that nuclear energy is a costly, polluting and dangerous option” (Raul Alvarez, quoted in “Energía Nuclear”, 1981).

The construction projects of an experimental reactors plan in the Lake of Patzcuaro, Michoacán, alerted local dwellers (including the members of the Purepecha people), university professionals, and intellectuals who got organized and questioned not only the installation of a Reactor Engineering Center (REC), but also, and in more general terms, the development of nuclear technology for the production of electricity.

In view of the growing resistance to the project, the Ecologic Defense Committee of Michoacán (CODEMICH, by its acronym in Spanish) was created, which included the support of groups such as the Appropriated Technology Association (ATA) and antinuclear organizations of countries such as Switzerland, Holland, France, Sweden, and the United States (Buerba, 1988; Quadri de la Torre, 1990; Navarro, 1982). Among the arguments supported in opposition to the REC, those aimed to the concept of nuclear activities as being centralized, authoritarian, risky and unnecessary stood out. In this sense, a college female teacher and an antinuclear activist, said that:

there are alternative sources of energy which, in turn, enable less alienable and dehumanized ways of social organization, as handling and controlling them may be within the reach of man. In addition to proposing a greater stimulus to exploration of sources of energy like those already in existence: geothermal, thermohydraulic, et cetera. We believe greater investment ought to be demanded for developed renewable sources of energy, such as solar or wind energy (Navarro, 1982).

In May 1981, after the demonstrations, the board of directors of ININ approved the construction project progress of a reactors center, but they did not discard the



possible location in the State of Michoacán (SUTIN, n. d.). Consequently, in the 1980s, questionings on the production of nuclear power were inscribed in the Mexican public sphere, in such a way that at the National Encounter of Environmentalists held in 1985, “the antinuclear proponents were identified as a movement in Mexico” (Vargas, 2006).

After the earthquake that stroke Mexico City in 1985<sup>3</sup> and the Chernobyl accident in 1986, in line with a growing concern for the environmental question in Mexico and Latin America, the country went on with the process to consolidate the resistance to nuclear development. With its epicenter in Veracruz, where progress was being made for the construction of the Laguna Verde Nuclear Plan, the resistance was replicated in national territory, reaching unseen visibility levels in the public sphere.

In this period, the Mexican Antinuclear Movement was formed, one of the first national networks of environmentalist organizations that were formed in the country (Tetreault, Ochoa & Hernandez, 2012), and the first antinuclear movement of magnitude in the region. As stated by Velazquez (2010), there was an “environmental boom” in Mexico in 1986, featured by diverse environmental organizations, among which were the Ecologist Movement, the Pact of Ecologist Groups and the Group of 100. They were joined by other groups that would be key in the resistance and in the antinuclear movement, including members of the National Coordination Office Against Laguna Verde (CONCLAVE, by its acronym in Spanish), the members of the Palma Sola town and the Antinuclear Committee of Mothers of Veracruz (Garcia, 1999).

The resistance was implemented by means of demonstration actions (which included pacific demonstrations in public spaces, roadblocks, and performance-theatrical actions) and discussions for nuclear development that were settled in the public sphere. Actions like the symbolic condemnation of the nuclear power plant, done in 1987 by more than ten thousand persons and members of about 25 environmentalist organizations, has been catalogued as one of the first demonstrations centered in the environmental question with national coverage in Mexico (Velazquez, 2010).

In addition to presenting the production of nuclear power as a risky and costly activity, as well as harmful to the environment, antinuclear movements held their position against the decision-making models dubbed as technocratic and claimed the opening of public spaces for debate about the convenience of nuclear development in the country.

With regards to the more specific questioning on the project of the Laguna Verde Nuclear power plant, it was held that: 1) the reactor’s technology was obsolete and poorly designed; 2) the plant was built on a line of volcanic failure; 3) it would emit radiation levels with the capacity to have a negative impact on the environment and on human health, even under normal operation conditions; 4) there was no way to achieve a final and

safe disposal of radioactive waste; and 5) the production of electricity of Laguna Verde would be twice as costly as that produced by conventional plants (Garcia, 1999).

In spite of the resistance, construction of the plant moved forward until the first reactor started its operation in April 1989. At the beginning of the 1990s, demonstrations weakened. As stated by Garcia (1999), “in 1991, a number of antinuclear groups had been dissolved. Three years have barely elapsed of the operation of Laguna Verde and many of the participants in the movements were disappointed by the indifference of the Government to their arguments”. Nonetheless, the Antinuclear Committee of Mothers of Veracruz went on with their fight during the years that followed: their members marched on a weekly basis at the central square in Xalapa and sought to have their claims visible. As it is explained by interviewee B, an academic of Veracruz and an antinuclear activist:

This was a lasting, highly continuing movement, but the plant never stopped. And the only ones who endured were the mothers, who continued picketing each Saturday at the central square of Xalapa, with a symbolic demonstration against the nuclear power plant. Even ten years after it was opened. In a continuing fight. And every Sunday, there was a picture on the press about the demonstration. Then it had a symbolic and huge strength (personal communication, 29 June 2018).

In November 1994, the second reactor was set into operation, Laguna Verde II. Although this was no longer a massive resistance, criticism continued: shortcomings and the irregularities of emergency plans in the event of an accident were questioned, as well as the environmental risk and radioactive emissions associated to the production processes of nuclear power.<sup>4</sup> Towards the end of the 1990s, the antinuclear resistance had diminished considerably. Although it existed, even in the words of antinuclear activists, “the fight had worn out” (interviewee A, personal communication, 13 June 2018).

### **Resistance in the post-Fukushima scenario**

Since 2000, the sectors promoting nuclear technology had sought to relaunch the production of nuclear power as it was presented as an option to face global warming. This new drive occurred in a consistent moment with public positions and stances in the face of nuclear power which, as sustained by Prati & Zani (2012), were more positive than in the past; however, unlike what had transpired in the half of the 20<sup>th</sup> Century (when utopic visions that associated nuclear development with a number of benefits for humankind emerged), pro-nuclear sectors reached certain consensus around the presentation of nuclear power not any more as a remedy, but as a necessary option to be considered among diverse sources of electric energy.



In this scenario, which has been conceptualized in terms of “nuclear renaissance” (Wan & Hansen, 2007), several countries reaffirmed their option for this type of energy production. Among them was Mexico, who elected to continue the production of nuclear power in Laguna Verde and prepared several projects to extend its nuclear program.

Notwithstanding, the Fukushima accident in 2011 positioned nuclear energy again in the center of the attention of environmentalist movements, of the public agenda and of massive communication media, which had an impact on the resettlement of controversies and debates in the global scenario (Hindmarsh & Priestly, 2016; Piaz, 2015; Esplugar Trenc *et al.*, 2017). Within the framework of a cycle of environmental demonstrations throughout Latin America (Vara, 2012), new resistance actions took place in Mexico against nuclear technology that brought visibility to questioning in the public sphere. Because of this, there were meetings and public talks to alert on the hazards of nuclear technology, fostered by members of the Mothers of Veracruz, of the Veracruz Meeting of Initiatives and Environmental Defense (LAVIDA, by its acronym in Spanish), of the international NGO and of Greenpeace (Santibá, 2011).

In conclusion, and in the words of a historic, antinuclear activist and referent member of the Mothers of Veracruz, opposition to nuclear development is still sustained by the idea that “there are other energetic alternatives that may supply energy to our country, with less risk, less cost and greater sustainability” (interviewee A, personal communication, 26 June 2018); however, unlike what had happened in the 1980s, the resistance was far from being a massive one. Far from reaching public visibility and settle in the national agenda, antinuclear mobilizations mainly concentrated in the State of Veracruz, its capital and in the vicinity of the plant, at Laguna Verde.

### **Mexico in the face of the nuclear crossroads**

In accordance with the National Energy Balance in 2016, 84.54% of the primary production of electric power came from hydrocarbons (61.97% of petroleum oil, 21.61% of natural gas and 0.96% of condensed hydrocarbons), while the production of nuclear power in the country represented 1.61%. In this scenario of the greatest participation of fossil fuels in the production of electricity, which broadly mirrors the historical situation of the country, there were projects performed for the construction of new power reactors and for extending the life of those who were in operation. After the promoting sectors presented the production of nuclear power as “an opportunity for Mexico” (Mexican Engineering Academics, 2009), the government projected the construction of new power reactors, which would be “a planning process for generation in five years” (Hernandez, 2017, quoted by Valencia, 2017).

Even during the first energetic planning which was prepared in 2012, after the Fukushima accident, SENER assessed an increase in the production of nuclear power “mainly with the purpose of guaranteeing energetic security, of reducing risks associated to volatility of the prices of fossil fuels and decrease GHG<sup>5</sup> emissions” (2012). In the following years, SENER maintained its position characterized in pro-nuclear terms: 1) in 2013, it was stated that, in addition to renewable energies, “another process with a great technological advance, which has shown its capability to cover the curve of the demand for electricity with satisfaction, in spite of strong criticism due to its high risk, is the one derived from nuclear power plants” (2013); 2) in 2014, it was affirmed that “nuclear energy is a source of generation of clean electricity whose characteristics allow the reliable supply of energy and with low environmental impact” (2014); 3) in 2015, possible scenarios were presented, considering both the construction of three new power plants at the Laguna Verde nuclear power plant, like small modular reactors in Baja California Sur, a scenario promoted in the following reports.

Despite the existence of formal projections (accounting for the presence and influence of pro-nuclear sectors in the guidelines of public policies on the production of electric power), over the last years, no specific advance has taken place towards the development and implementation of plans associated to the expansion projects of the production of nuclear power. Even from promoting sectors, that make emphasis on the potentiality of nuclear technology for the production of energy as an alternative to fossil fuels, it is recognized that “the nuclear industry is practically stagnant” (interviewee C, personal communication, 30 May 2018).

Still with an uncertain future of the production of nuclear power (both by actors linked to promoting sectors of nuclear development and by antinuclear activists), two axes at least have been identified that interested and make actors busy, involved in controversies for nuclear development in Mexico: on the one hand, the validity of the option for maintaining or expanding the nuclear sector; on the other hand, the question on handling and disposing of radioactive waste. Indeed, it is in relation with these two axes that this article considers that Mexico is at two crossroads which, at any time, will require of definitions of techno-political order.<sup>6</sup>

### **New plants to diversity the energetic matrix and mitigate climatic change or unacceptable risk?**

In spite of projects outlined by SENER to drive the production of energy, the sectors that promote nuclear development in Mexico sought to consolidate the concept of nuclear power, on the one hand, as a feasible and reliable option for the production of energy and the mitigation of climate change; and on the other hand, as a key option for the diversification of the energetic matrix. This characterization was supported in pronuclear

postulates which accounted for a positioning process of this technology worldwide, in a scenario marked by the increase of the implementation and operation costs of power plants, most of them associated with measures and high standards of security required by the sector. As stated by Bauer (2015), the production of nuclear power energy has stopped being presented as “too cheap to meter”, to turn into a “part of the energy mix”. This concept is not different from the Mexico case. In this sense, a researcher of the National Autonomous University of Mexico, and a historical worker of the nuclear sector says that the production of nuclear power

[...] is an option of the diversification of the matrix because it is important for energetic security [...] because there might be a time when we will not have resources enough to produce the energy we need. Then, on the one hand, there is diversification. On the other, it is clean energy. We have the commitment as a country to produce clean energy, to reduce CO<sup>2</sup> emissions, and we have to comply with this. Right now [...] the construction of three nuclear reactors is scheduled by the end of 2020. And this is not considered to reduce emissions and to be able to comply with our production commitments of clean energy (interviewee D, personal communication, 27 June 2018).

From sectors promoting nuclear development and, in relation with arguments sustained in the international scenario, nuclear power is promoted as a diversification instrument of the energetic matrix and to mitigate the emissions that contribute with the greenhouse effect; however, in spite of the redirection of pro-nuclear arguments, the controversy is far from being settled. On the side of resistant actors, currently identified among members of the academy and of the civil society, especially concerned in the environmental question, there are no substantial changes in the arguments in respect to the questioning held since the end of the 1970s.

The perception and consideration of nuclear technology still prevails as a highly risky, polluting (which, in addition, emits gases that contribute to the greenhouse effect during several stages in the production process), costly and unnecessary technology for the production of electric energy. Additionally, diverging positions are not operable only by the negative and continual claim for the election of decentralized production sources, conceptualized as renewable and environmentally sustainable, among which wind and solar energy stand out. In this sense, the resistance is inscribed among groups characterized by movements in favor of energetic democracy (Hess, 2018).

### **On storage and final disposition of spent fuel**

As stated by Slovic (2000), a large number of people perceive the risk associated to radioactive waste, which is even greater than the perception of the risk during the production of electricity. Although experts in nuclear technology believe that handling

radioactive waste includes a moderate and acceptable risk that may be safely and effectively handled, from antinuclear sectors this activity is perceived and identified as extremely risky and unacceptable.

In Mexico, the concern involved in handling and finally disposing radioactive waste has been identified and designed by antinuclear groups, even before the Laguna Verde reactors began to work (Garcia Gorena, 1989) and it has lasted through today. As stated from nuclear activism, “there is no definitive solution for radioactive waste, nowhere in the world; this means that we are at a bioethical question, because the risk and social wellbeing is not considered, and far less for future generations” (interviewee A, personal communication, 13 June 2018).

Without minimizing the characteristic of radioactive waste to prevail and with a contaminant potential, professionals engaged in the nuclear sector emphasize on the possibility of a “safe and successful” handling sustained in strict controls and procedures associated with the treatment of and disposition of spent fuels and radioactive waste.

For they are like any toxic, chemical or industrial waste that will not decay, they are forever. Moreover, radioactive waste, they are looking for ways to reprocess them, to reduce them. In addition, nuclear energy is the only source of energy that actually confines its waste, that is engaged with and concerned for them. If you take it by volume and generated energy unit, the amount of waste is very low (interviewee D, personal communication, 27 June 2018).

Different from what is happening with other controversial topics in the nuclear field, towards the inside of sectors promoting the existence of questioning and voices of alert with questions and that may even get to discourage the expansion of the sector while no definitive agreements are reached are also seen.

The [scientific/nuclear] community tends to minimize the problem of radioactive waste. This is a pending subject where the research field is highly extensive [...]. Therefore, I am of the opinion that, while no decision has been made, it would be unreasonable to speak of new reactors. The answer that other industries are not taking measures in this respect seems a fallacy to me which deviates your attention, but does not solve anything (interviewee C, personal communication, 27 June 2018).

These diverging positions seek to promote greater research in the area and even to consider alternative production paradigms of nuclear energy. In Mexico (as in the rest of countries with research and power reactors) spent fuels are stored in the vicinity of nuclear reactors in wait for a decrease of radioactivity emission.<sup>7</sup> Currently, the Laguna Verde pools (where spent fuel is stored) are about to reach their peak capacity; therefore, moving to the second storing stage (dry<sup>8</sup>) should be faced in the short term.

## Final considerations

The controversies arising in Mexico since the end of the 1960s around the productive process of nuclear power were of a massive nature and, by the middle of the 1980s, achieved great visibility in the public sphere, which is unprecedented for this type of discussions in Latin America. In a scenario characterized by high levels of opposition to nuclear technology in the world (in relation with the accidents in Three Mile Island in 1979 and Chernobyl in 1986), as by a growing concern for the environmental matter in Mexico and Latin America, the Mexican antinuclear movement pushed resistance to the production of nuclear power with several impacts. Integrated by heterogenic groups of actors (which included both local dwellers, environmentalist organizations, intellectuals and experts in diverse areas of knowledge), the antinuclear movement installed the discussions in the public sphere about the possible negative impacts on human health and on the environment, associated with the development of nuclear technology, which they considered to be highly risky, costly and with a great polluting potential.

These continuities, identified by the international antinuclear fight, were articulated with local specificities of resistance which, in accordance with our demonstration, have contributed to the unheard-of mass demonstrations. On the one hand, it is analyzed that, while by the mid of the 1980s a nuclear plant was in operation in Brazil and two in Argentina, there were no plants in operation in Mexico, in spite of projections dating back to the 1970s; in this sense, the question driven by antinuclear movements on why a power production form considered highly risky is to be incorporated, gained space in the public sphere and contributed to installing the discussion in the political and media agenda.

On the other hand, consideration is seen by resisting actors (despite the identified scarcity of studies in this respect) of the construction of nuclear plants from the standpoint of technological imposition of countries that dominated and exported nuclear technology, like the United States. In this sense, arguments of the resistance enable the nuclear development to be framed in dissimilar terms that were configured in countries such as Argentina (Piaz, 2015) that has sustained its nuclear development as part of the construction processes of local scientific-technological abilities, in relation to the processes seeking autonomy and technological and energetic sovereignty (Hurtado, 2014).

After the loss of the number and frequency of antinuclear demonstrations towards the ends of the 1980s and 1990s in Mexico (related with the implementation of the first nuclear plant and the weakening of the antinuclear movement both in the country and worldwide), the antinuclear resistance regained momentum after the Fukushima accident. This was happening, in addition, at a time when the sectors promoting nuclear development sought to give a new drive to this technology in the country.

As of the analysis of arguments and actors who partook in this new antinuclear demonstration cycle (even when there was scarce participation of citizens and a greater decentralization of the resistance in the vicinity of nuclear facilities), the existence arises of certain continuity in the antinuclear fight in Mexico. In this sense, the intention is to make emphasis on three questions:

- 1) First off, it is possible to affirm that, from the beginning of the 1970s, the resistance has not only been able to encourage discussions on the nuclear development in the public sphere, but it has been key in the processes to form the Mexican antinuclear movement, one of the first movements that has contributed to the emergence of environmentalism in the country and that has driven the visibility of the environmental question in the region.
- 2) The resistance has had an impact on the ways in which the nuclear development has taken place in Mexico, especially, with regards to the claims for the greatest security standards and the preparation of emergency plans in the region of Veracruz.
- 3) The resistance promoted recursive impacts in the collective making of claims, linked to the formation of demonstration networks, the establishment of repertoires of collective action and the consolidation of consensual and shared arguments against the productive process of nuclear power, which has been reactivated after the Fukushima accident in 2011 (and that are intrinsically linked to the resistance of the 1970s and 1980).

Lastly, two structural questions are identified, related with controversies for nuclear development that were settled in the public sphere. On the one hand, the existence of continuities is observed between the promotion periods of nuclear development in Mexico and in the world, among which those occurring in the 1970s until the beginning of the 2000s outstand. Although, different from what is happening in Argentina and Brazil, the Mexican nuclear sector is not presented as a relevant actor in the complex of national science and technology. On the other hand, the emergence of antinuclear demonstrations in Mexico has concurred with the high levels of opposition to this technology in the global scenario. In more general terms, from our analysis it may be concluded that both the promotion of nuclear development and antinuclear demonstrations refract (although with specificities and particular characteristics) whatever is taking place in the international context.

In an uncertain scenario, both by promoting sectors and by people resisting the nuclear development, will Mexico continue its bid for nuclear power production? Shall it keep its plants in operation or select other alternatives, as claimed by antinuclear sectors and environmentalists? More than thirty years of controversies for the production of nuclear power allow us to infer that the decision to continue with the maintenance and



expansion of the Laguna Verde Nuclear Plant shall not be exempted from the resistance of the public sphere. Nonetheless, this is far from being bad news. On the contrary, this is about an expression of the exercise of democracy and of the fight by means of the participation of citizens in decision-making processes which the country shall have to face at any time, which will affect future generations.

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### Interviews

A, Historical member and referent for the Madres Veracruzan group. Interviews conducted in May, June and July 2018.

B, Professor, researcher and former nuclear activist from Veracruz. Interview conducted in June 2018.

C, Researcher of the Nuclear Sciences Institute of the Universidad Nacional Autónoma de México. Interviews conducted in May and June 2018.

D, Professor and researcher of the Universidad Nacional Autónoma de México. Facultad de Ingeniería. Interview conducted in June 2018.

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<sup>1</sup> Mainly linked to medicine applications and to the generation of electric energy without the need to use fossil fuels.

<sup>2</sup> From its acronym *Training Research Isotopes General Atomics*

<sup>3</sup> That fostered the arguments stating the inconvenience of building nuclear reactors in seismic areas and in their vicinity.

<sup>4</sup> The controversy of the denouncements for the acquisition of milk with “very high” levels of radioactivity from Ireland, which arrived in the country after the Chernobyl accident in 1986 joined the discussions for radioactive emissions associated to nuclear power plants in Mexico (Carrillo, 1997).

<sup>5</sup> Acronym which refers to Greenhouse Gases.

<sup>6</sup> We recovered the notion of techno-politics in the terms proposed by Hecht (2001), that is, as a “strategic practice for the design or use of a technology for the construction, embodiment or promotion of political objectives”.

<sup>7</sup> In accordance with the IAEA, only a third part of spent fuel produced in the world is reprocessed, while most part of it is stored in wait for its final disposal.

<sup>8</sup> In this respect, the Deputy Director General of Development and Nuclear Politics of SENER reported that “Mexico [...] is in the final stage of licensing a project to move spent fuel from the fuel pool to a dry storage facility” (Huerta, 2017, quoted at the Senate of the Republic). If this project advances, the country would have a term “in the order of some 50 years to define what it is going to do with the spent fuel”.

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