

Controversy or Consensus: Launching Small Modular Nuclear Reactors in Romania

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Abstract. *The transition towards net zero by 2050 is underway in the European Union, but its country members are divided over their energy strategies. France, Poland, Hungary, Bulgaria, Slovakia, and Romania support nuclear plants as contributing to carbon neutrality, while Germany, Spain, Denmark, Portugal, and Luxembourg oppose (Reuters, 2023).*

The study “Between Stability and Sustainability: Nuclear Energy in Romania's Energy Mix” concludes that Romania can benefit from its nuclear facilities and domestic uranium resources, to consolidate its sustainable energy policy. However, new nuclear capacities may pose considerable challenges, especially in terms of costs (Dumitrescu, 2023).

Unfortunately, rising costs per megawatt hour are the very reason why NuScale, the operator chosen by Romania to deploy six small nuclear reactors by 2027, canceled their US-based flagship Carbon Free Power Project (Fortune, 2023). Nevertheless, the setback in the home country did not prevent Romanian authorities from licensing the NuScale small modular reactor power plant in Doicești (World Nuclear News, 2023).

The watchdog Greenpeace warned about the project's high costs and the long construction timeframe. It was also emphasized that Romania adopted a technology that had never been tested before. In addition, the location of the new plant had been decided without prior consultation from the local community, claimed the NGO (Greenpeace, 2022). According to the journalists, the local community has been divided between those who want new jobs and people afraid of radiations. Reporters made a parallel between the current situation and a formerly failed Chevron shale gas production investment, due to the strong opposition to fracking (Hotnews, 2024).

This paper attempts to determine how a newcomer to the nuclear energy market, with a significant approval setback in its home country, using untested technology, can complete the construction of six small modular reactors in Romania, integrate those into the national grid and win over the public acceptance by 2030.

Keywords: nuclear energy, energy transition, sustainable marketing, public acceptance

Introduction

In 2023, the EU countries agreed on the *Renewable Energy Directive*, which essentially accelerates the transition towards Net Zero by 2025 and incidentally aims at cutting off Russian fossil fuels. The ratio

of renewables in the total energy consumption was set at 42.5% by 2030 (European Union, 2023), a necessary step to reduce CO₂ emissions at 55% by 2030 and achieve carbon neutrality by 2050.

Reaching a compromise was not easy, both nuclear energy and natural gas being the central stage of the debate. France, Poland, Hungary, the Czech Republic, Bulgaria, Slovakia, and Romania supported nuclear plants as contributing to carbon neutrality, while Germany, Spain, Denmark, Portugal, and Luxembourg opposed (Reuters, 2023). Finally, it was decided that nuclear plants could be considered sustainable, provided that they could ‘dispose toxic waste effectively and prevent environmental damage and the construction permit is issued before 2045’ (Fortune, 2022).

The Oxford Institute for Energy Studies explored how nuclear energy could contribute to a more sustainable future and how, by tripling the global installed capacity, it would limit global warming. The study identified concerns about nuclear safety and security, stemming from ‘sociopolitical factors and public perceptions, often influenced by misconceptions or misinformation misinformed public perceptions’. However, the study listed mitigating factors, such as major geopolitical events and international decisions, indicating ‘a shift towards including nuclear energy as an essential component of the energy transition.’ The most recent global event, called the COP28 Agreement, gathered 22 countries who pledged to triple nuclear energy capacity by 2050. Another significant international decision benefiting nuclear energy was the EU Parliament’s inclusion of nuclear “in the EU taxonomy rulebook as a climate-friendly and sustainable technology”. The same study presented SMR as advanced, small-sized and providing ‘attractive economic, safety, and security features’. The material revealed that 80 SMR projects developed in 18 countries, of each 6 located in Romania (Rogner et al., 2024).

When assessing the potential benefits of nuclear plants against their perceived risks, one specific opposing voice stood out in public opinion: the watchdog *Greenpeace*. The NGO filed a lawsuit against the decision of the European Commission to include nuclear energy and fossil gas among renewables. Greenpeace published their legal arguments against nuclear plants being included in the EU taxonomy. Among those, the construction time was considered too long to be operational (10 years), thus hindering the development of other renewable energy sources. Furthermore, nuclear energy was considered ‘not flexible enough to coexist with renewables’ due to its need of a constant supply of electricity or water, to cool reactors, even when less water from rivers would not be available due to droughts. The pollution that nuclear plants could generate because of accidents and their impact on biodiversity was also widely debated. (Greenpeace, 2023).

Literature review

According to stakeholder theory, the sustainability and stability are closely tied to its ability to generate wealth, value or satisfaction for its stakeholders. Primary stakeholders, crucial for fulfilling the organization's mission, may involve local government, investors, suppliers, internal managers and employees, and consumers. Secondary stakeholders consist of political and social entities supporting the organization's mission through endorsement, potentially including the local community, local media, nongovernmental organizations (NGOs), and competitors (Tian, G., et al., 2021).

The environment has been negatively impacted by high consumerism, and downshifting has barely started to be adopted. Sustainable consumption aims to consider the needs of the future generations along with the present expectations. Therefore, using less raw materials could reduce the negative impact of different businesses (Stancu A., 2018).

The implication of public opinion or participation in the debate about the energy transition is underscored by the acknowledgment that social sciences play a crucial role alongside science and technology. Production and consumption involve both technical and social domains, highlighting the critical role of society in the advancement of technologies. Carefully designed public engagement activities provide valuable insights into society's aspirations, knowledge, and concerns, contributing to a culturally sustainable development of energy technologies. The new energy society framework facilitates acceptance, aligning with social representation theory, which views the promotion of alternative energy forms as a social change process embedded in societal values (Odonkor and Adams, 2020).

In the context of nuclear energy, there have been previous studies that demonstrate differences in stakeholders' perceptions regarding the construction of nuclear power plants. For example, a study conducted in Turkey reveals that stakeholders can be divided into two distinct categories based on their perceptions of nuclear energy use. On the one hand, there are pro-nuclear stakeholders, namely the government, pro-nuclear NGOs, business groups, and the local government. On the other hand, there are anti-nuclear stakeholders composed of anti-nuclear NGOs, members of the parliament, local NGOs, and local residents (Aydın, 2020).

The topic of nuclear energy and public reluctance has been debated for a long time. For example, a study from 1975 (Restelli, R., P., 1975) discusses measures that can be taken in the marketing process to promote and encourage nuclear energy. The marketing process for nuclear power plants involves assessing the satisfaction of customer safety needs. The Atomic Energy Commission plays a crucial role in ensuring safety standards and must base the perception of nuclear plants as safe and reliable on solid technical facts. In addition, monitoring contested hearings regarding nuclear plants helps evaluate any significant reduction in hostility. Allocating funds for advertising requires careful consideration. Local energy companies can contribute to the promotion of nuclear power plants through press releases, the keeping of relevant authorities informed, and the establishment of a community engagement.

Climate change has recently become a major topic in the global energy transition debate. Especially after the Russian invasion in Ukraine, within the sustainable energy mix aiming at replacing fossil fuels, nuclear energy is often quoted, with contrasting arguments. "Nuclear power is slow to build, expensive and risky, and it creates radioactive waste. However, it can also avoid emissions produced by generating electricity from fossil fuels", the non-profit organization Project Drawdown, 'the world's leading resource for climate solutions' (Project Drawdown, 2024).

To ensure a more rapid transition towards decarbonization, "businesses must lead the charge, working closely with government, policy makers and NGOs, but it doesn't stop there. Unless the wider population understands the impact their actions have, climate change will always feel too big and too far away" (Carvill, M. et al., 2021).

By applying the triangle theory of change to the nuclear plants, local stakeholders, the nuclear production unit and authorities form a triangle of long-term change that collectively drives further trust in the sustainable agenda (Xu et al., 2022).

This makes the case for designing a sustainable marketing plan to transparently engage stakeholders, present evidence on the risks and benefits, and how their producer engages in socially responsible practices (Richardson, 2019).

The success or failure of a civil nuclear power program is highly dependent on the public acceptance of nuclear technology (Nguyen and Yim, 2018).

Public acceptance refers to the level of agreement or disagreement among the general population regarding the installation of a nuclear power plant in close proximity to its residential

area, indicating their stance or viewpoint on nuclear energy (Hu, Zhu and Wei, 2021). Public acceptance is a key variable in social psychology research and has been defined in various ways. A widely accepted definition describes public acceptance as the favorable reception and active approval of specific events and behaviors. In the context of nuclear energy research, it pertains to the public's approval and support for the development and utilization of nuclear energy (Wang et al., 2020). In the absence of public support, efforts to expand the utilization of nuclear energy could face public opposition, potentially resulting in delays or the outright cancellation of new nuclear power plant construction (Groot, Steg, and Poortinga, 2013).

Public acceptance of nuclear energy is influenced by awareness of benefits and trust in government safety agencies, while the perception of high risks leads to opposition. When perceived risks are considered low, trust in the information provided by government agencies and private nuclear companies increases, potentially fostering the public acceptance of nuclear energy (Cvetkovic et al., 2021). Individuals with significant nuclear expertise are capable of making informed assessments about the risks and advantages associated with nuclear energy, which consequently shapes their attitudes towards it. In contrast, lacking adequate knowledge can result in decisions and opinions being swayed by social trust, with skepticism toward governmental authority potentially fostering a diminished acceptance of nuclear power (Yang et al., 2022).

Most of advantages linked to nuclear energy can be classified as either economic or environmental. Economic advantages include energy security, high electricity production, and the competitive cost of power generation. Environmental benefits mainly focus on diminished ecological impacts, including the promotion of sustainability and lower carbon emissions (Ho et al., 2019). Individuals assess the advantages of nuclear energy based on their inherent predispositions and other cognitive shortcuts when they lack adequate knowledge. Specifically, people tend to trust authorities they perceive as reliable, knowledgeable, and aligned with their own values (Ho et al., 2018).

Some people tend to perceive nuclear energy as a dangerous technology compared to other energy sources. These risk perceptions include the potential occurrence of nuclear accidents, health and environmental hazards, detrimental economic impacts, radiation leakage, and improper management of nuclear waste (Ho et al., 2019). One study conducted in Serbia (Cvetkovic et al., 2021) reflected that most of the questionnaire respondents were worried about possible nuclear accidents. The Fukushima disaster in 2011 rekindled global fears about nuclear safety, reminiscent of past incidents such as Three Mile Island and Chernobyl. This increased concern spurred significant antinuclear movements and influenced nuclear policies worldwide, affecting countries such as the USA, Japan, Germany, and Switzerland (Bian et al., 2021).

Benefit perceptions, gender, and social trust strongly influenced risk perceptions, with no significant impact of science knowledge on nuclear energy. Women tended to perceive greater risks associated with nuclear energy compared to men, possibly due to different mental associations.

Women often associated nuclear energy with negative concepts such as accidents and military use, while men associated it with positive descriptors such as hope and technological advancement (Ho et al., 2018). The public perception of nuclear energy intersects with politics. Additionally, political affiliation and ideology can significantly shape the level of acceptance of nuclear energy among the public (Bian et al., 2021).

Values and lifestyle factors, such as post materialism and a reverence for nature, often align with increased risk perceptions and more unfavorable attitudes towards biotechnology and nuclear energy. On the contrary, an inclination toward science and technology tends to correlate with reduced risk perception and more favorable attitudes (Kristiansen et al., 2016).

Particular convictions about the risks and benefits associated with nuclear energy stem from broader determinants, such as values. Consequently, beliefs about the risks and benefits of nuclear energy serve as mediators in the connection between values and acceptance (Groot et al., 2013).

The Nuclear Energy Sector in Romania overview

While at the EU level the nuclear energy was facing quite a significant controversy, in Romania the situation seems rather calm, however, a more in-depth appraisal would be needed.

First, from the quantitative perspective, information about the actual nuclear production capacity is easily accessible, which speaks for transparent communication between local production plants and their public. The country's Transmission and System Operator, *Transelectrica*, has been presenting the respective live data on its website. By adding and computing the production data during January 1 and December, 31st, 2023, the following production energy split could be shown:

Table 1. 2023 Energy consumption in Romania per source

Energy source	Hydro carbons	Nuclear	Water	Photovoltaic	Biomass	Wind	Coal
Consumption in MW per source	1598	1396	2181	-1	32	1074	832
Total consumption in MW	7112						
Already registered consumption in MW	-1618						
Outstanding consumption in MW	5494						

Source: www.transelectrica.ro.

The above information indicates that nuclear power plants account for a significant proportion of Romania's energy output: 20%, while they rank third among the main energy sources. Water leads the energy production with 31%, followed by hydrocarbons (crude oil and natural gas), which amount to 22% of the overall energy production.

Second, different qualitative materials on Romania's nuclear potential have been consulted on Romania's nuclear potential. The country profile issued by the World Nuclear Association in Romania has mentioned that 'government support for nuclear energy is strong' and has presented historical data on how Romania developed its nuclear energy sources. Thus, the first nuclear power plant construction works were started in Cernavoda, back in 1982, and the commercial operation was launched in 1996. The Romanian state nuclear operator Nuclearelectrica manages the Cernavoda nuclear plant (Nuclear Power in Romania, 2024).

The case of NuScale plant in Romania

In 2019 *Nuclearelectrica* signed a memorandum of understanding with the US-based company NuScale and received a grant of 1.2 million dollars from USTDA to 'identify and assess potential sites for small modular reactors'. NuScale had been established in 2007 and Fluor Corporation, its owner, a global engineering and construction company, achieved revenues of \$15.5 billion in 2023 (Fluor, 2024).

In May 2022, Nuclearelectrica declared that a former thermal power plant located in Doicești had been selected for 'further in-depth surveys and developments'. The company organized an 'information conference' with the Doicești municipality on the technology of small modular

reactors (SMR). According to its website, NuScale plant would “generate 462 MWe of carbon-free electricity and is estimated to create 193 permanent power plant jobs 1,500 construction jobs, and 2,300 manufacturing jobs” by 2030 (NuScale, 2024).

Also in 2022, US President Joe Biden announced an additional grant of USD 14 million for the next development stage of the Romanian NuScale SMRs (Nuclearelectrica, 2024). Since then, the US administration has pledged “to move Europe from coal-fired plants to SMRs”, as shown by the 6 fact sheets and top-level statements supporting the technology (White House, 2024).

The study ‘Between Stability and Sustainability: Nuclear Energy in Romania's energy mix’ reasoned that on one hand, Romania could benefit from its nuclear facilities and domestic uranium resources, for consolidating its sustainable energy policy. On the other hand, new nuclear capacities, such as SMRs, might bring considerable challenges, especially in terms of costs (Dumitrescu, G. 2023).

Unfortunately, the ever-rising costs per megawatt hour were the very reason why NuScale canceled their flagship Carbon Free Power Project, based in the US, while its share price plunged by 40% (Fortune, 2023). However, the setback in the home country did not prevent the Romanian National Commission for Nuclear Activities Control from trusting the new technology and licensing the future NuScale plant in Doicești (World Nuclear News, 2023).

NuScale power plant in Doicești: The power of influence and their interests

By applying the Mendelow power interest grid (Richardson et al., 2015), the NuScale main stakeholders could be grouped in 4 categories, depending on their power of influence against the manifested company interest in that influence.

High power, highly interested stakeholders (manage closely): This group includes the stakeholders with the highest influence on the project, and high importance for its success. NuScale made the best efforts to involve them. Thus, *Fluor and the U.S. Department of Energy (DOE)* were among the most interested parties in supporting the project. Equally interested, on the Romanian side, there were the local companies involved in the project: *Nuclearelectrica and Nova Power & Gas S.R.L.*, that joined forces and established the project company called *RoPower Nuclear S.A.* Then, the US and Romanian regulators were paramount for the very existence of such an unproven technology, SMRs: The U.S. Nuclear Regulatory Commission and the National Commission for Nuclear Activities Control (CNCAN). Once regulators had given their approval, securing financing became crucial, such as the letter of interest issued by *EXIM* and the *US International Development Finance Corporation* for the “potential financial support of up to USD3 billion and USD1 billion, respectively, for project deployment” (World Nuclear News, 2023). To further consolidate the project success, both the *US President* and the *Romanian Prime Minister* got involved and endorsed NuScale. The *Bucharest Stock Exchange* was influenced by all the actions and declarations, in regards with Nuclearelectrica shares. In this group of stakeholders, the local authorities, who were directly interested in the project, should have also been addressed by NuScale with a high amount of interest, but this was not apparent.

Low power, highly interested stakeholders (keep informed): These audiences with high influence were addressed, yet their opinions seemed overlooked by NuScale. For instance, the local media portal *Gazeta Dambovitei* highlighted how the representatives of Nuclearelectrica failed to give convincing arguments in favor of the construction of SMRs in Doicești, by quoting several municipalities during the first information conference: “It seems that you treat our situation in a shallow manner. In addition, we have found only after 2 years that you have already begun your exploration studies for this investment. We are not opposed to progress. But the involved

communities should be considered, before putting the project into motion ” (Gazeta Dâmboviței, 2022). In addition to the *local media and authorities*, the other stakeholders included in this category were the *local landowners and local environmental authorities*, who would ultimately have to issue work permits. Moreover, while two governments, the international financing bodies, and the Romanian authorities were encouraging the Nuscale project, the watchdog Greenpeace was warning about its high costs and long timeframe. The NGO was insisting that Romania had adopted a technology never tested before and that the new plant’s location was decided without the prior consultation (Greenpeace, 2022). To this extent, Nuclearelectrica mentioned on its website organizing one information conference and a working meeting with the authorities in Doicești and the neighboring villages, both in 2022, consequently after the investment decision had been taken (Nuclearelectrica, 2022). A special NuScale audience was the *University of Technical Studies*, where NuScale installed a simulator for the reactor’s control and command room. The company would need highly trained nuclear experts and technicians; therefore, it decided investing into training possible new employees.

High power, less interested (keep satisfied). In this group, the central media and key opinion leaders were engaged by Nuclearelectrica/NuScale and were periodically provided adequate information about the project development.

Low power, low priority (monitor). These stakeholders were not directly involved with the nuclear project, and their reactions were only monitored. The general public could be included in this category, along with different suppliers and contractors, who could become more interested in a later stage of the project.

	High	Interest	Low
High	Key players, manage closely Fluor Corporation shareholders U.S. Department of Energy (DOE). Nuclearelectrica, Nova Power & Gas S.R.L, RoPower Nuclear S.A. The U.S. Nuclear Regulatory Commission National Commission for Nuclear Activities Control (CNCAN) US Export-Import Bank (EXIM) US International Development Finance Corporation US White House, US Embassy in Romania Romanian Government Bucharest Stock Exchange	Keep satisfied. Central Media Key Opinion Leaders	High
Power	Keep informed Local municipality Local landowners in Doicești Local environmental authorities Local media E2 SMR Simulator Greenpeace, other watchdogs	Minimal effort, monitor The general public Logistics and transportation providers Water providers Nuclear waste disposal service providers	Power
Low			Low
	High	Interest	Low

Figure 1. NuScale Stakeholder Matrix

Source: Authors’ own research.

Conclusion

In short, the present research underlined how achieving Net Zero by 2050 required a ‘widespread agreement of all stakeholders including governments, businesses, and communities, to collaboratively drive and support the transition to sustainable energy practices and policies.’ (Rogner et al., 2024). As nuclear power has been recently accepted as part of the solution, its clear advantages, such as its minimal environmental impact, would always be evaluated against longer construction times and higher commercial risks. NuScale Power Corporation, as a provider of proprietary SMR technology, was chosen by Romania as an advanced contributor to the country’s energy transition route, but this decision has not reached a consensus and has enticed controversial reactions, at least within the local community.

Furthermore, public acceptance has been playing a key role in the success or failure of nuclear power programs, such as the NuScale plant in Doicești. It has been influenced by various factors including perceptions of benefits and risk, the trust in central and local authorities, and how the company engaged with its stakeholders. Understanding these dynamics could be crucial in accepting the utilization of nuclear energy in general and of SMRs in particular. To this extent, in December 2022, the Romanian press quoted that Nuclearelectrica had ordered a special poll, with national and local stakeholders, on topics such as “the Romanian perception on SMRs and the partnership with the USA” (Profit, 2022). Since then, the company has refrained from issuing further information about the results of the perception study.

Currently, the national press has revealed that the perception of the local community of nuclear investment is divided between those wanting new jobs and people afraid of radiations. Journalists have made a parallel between the current situation in Doicești and a formerly failed Chevron investment in Pungești, Vaslui county, where the community strongly opposed shale gas production through fracking and stopped the project (Hotnews, 2024).

In terms of national perception, historically, only few questions about nuclear energy were included in an annual opinion larger energy security questionnaire, issued by the Laboratory of Information Warfare Analysis and Strategic Communication. Its last edition was published in 2022 and was conducted on a sample of 1,074 people, which matched the demographics of the country. 70.5% of the sample responded that being allied with the United States represented the best security guarantee for Romania. 53% declared that green energy sources could increase the EU’s independence of energy (LARICS, 2022). Interestingly enough, a similar poll conducted in 2019 had asked specific questions about energy sources, including nuclear power. On that occasion, only 11% of the sample responded that nuclear energy should be encouraged in Romania, compared to 51% who were preferring photo-voltaic and 46% opting for wind energy sources (LARICS, 2019).

Extending the public acceptance research on nuclear energy, from both a local and a national perspective, could suggest to what extent nuclear energy generates consensus, rather than controversy, especially because a public specific survey about the Romanians’ perception on the nuclear energy has not been conducted yet.

Moreover, as the nuclear energy acceptance in Romania has not been systematically investigated, further research projects may indicate which would be the factors leading to SMRs’ public acceptance. Across future investigations, the case of other innovative technologies that failed to obtain license to operate – such as Cyanide neutralization in Roșia Montana or shale gas hydraulic fracturing in Pungești – could bring out valuable insights.

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