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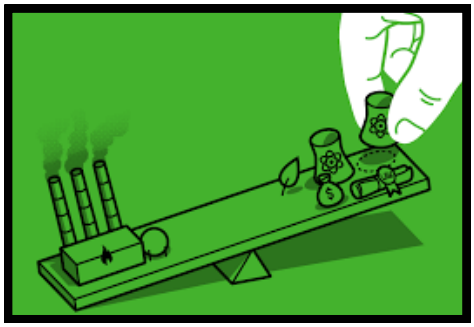
POLICY BRIEF - 11

Nuclear Power for India's Future:

Addressing Public Concerns and Policy Pathways



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ABOUT

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In December 2021, the Ministry of Science and Technology, Department of Science and Technology (Policy Research Programme) made an open call for the submission of Expressions of Interest in STI Policy Research towards the Establishment of the Center for Policy Research (CPR) by the academic and research Institutes In India. After multiple rounds of consultations and review, the DST-CPR at NISER received the final sanction order from the Government of India, Ministry of Science & Technology, Department of Science & Technology, bearing the letter No DST/PRC/CPR/NISERBhubaneswar-2023 (G) (PCPM) dated 29/03/2023. The primary focus of the DST-CPR at NISER is to study the Energy Transition and the secondary focus is to study the Tribal Education, and Innovations for Tribal Education in Eastern India covering Odisha, Bihar, Chhattisgarh, Jharkhand and West Bengal.

SUGGESTED CITATION

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Executive Summary

India's growing energy demands and climate commitments place nuclear power at the center of its sustainable energy strategy. However, public perception remains a major barrier to expanding nuclear energy. This policy brief examines findings from a recent survey of 215 Indians, revealing mixed feelings: while 44.3% support government nuclear initiatives, a large portion remains cautious or uncertain. Key concerns include radiation leaks, nuclear waste management, and links to nuclear weapons. Media influence, gender, educational background, and proximity to nuclear sites all significantly shape public attitudes. Women and rural populations tend to express higher levels of fear, while urban residents show more familiarity and acceptance.

To improve public acceptance, the brief recommends strengthening public education, enhancing transparency, and improving safety communication. Specific actions include distributing accessible educational materials, organizing plant tours, engaging communities in decision-making, and showcasing government efforts to improve safety and risk management. Importantly, building trust through credible information sources and active public participation can reduce perceived risks and increase acceptance.

India's nuclear policy must address both technical challenges and social dimensions. By integrating public concerns into policymaking and emphasizing the environmental and economic benefits of nuclear power, India can secure a more informed, supportive public and realize its nuclear energy potential for a sustainable future.

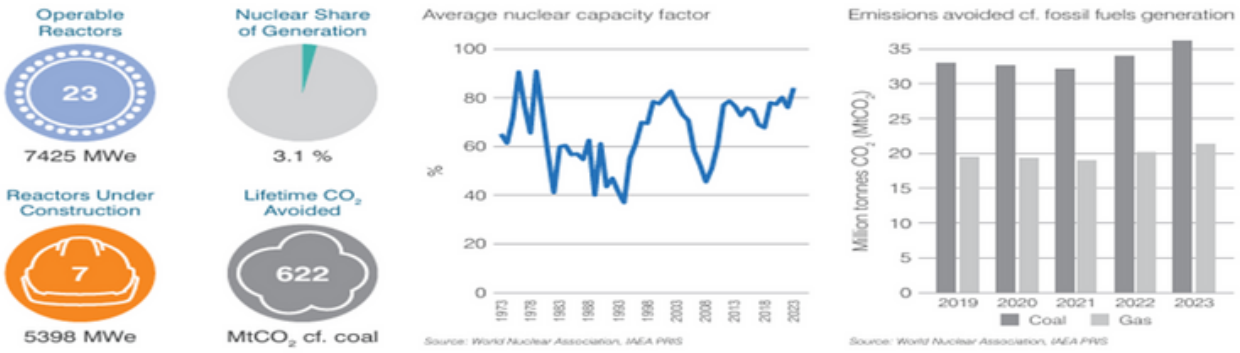
Nuclear Power for India's Future: Addressing Public Concerns and Policy Pathways

Introduction

India has committed to achieving net-zero emissions by 2070, recognizing climate change as a global challenge that requires collective action. Its strategy is shaped by several key factors: its historically small contribution to global emissions, its active efforts toward low-carbon growth, and the need to ensure long-term energy security. India's national goals include sourcing 50% of its electric power from non-fossil fuels by 2030, lowering the carbon intensity of its GDP, and encouraging sustainable lifestyles. A national framework outlines India's low-carbon development pathway, balancing climate action with the country's development needs (Ministry of Environment, Forest and Climate Change, 2022).

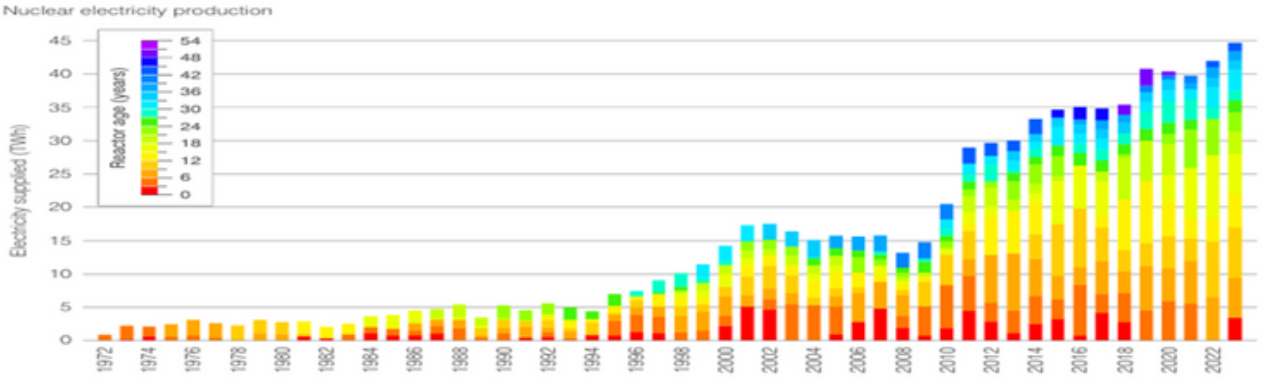
However, India faces significant challenges due to its large and growing population, coupled with rising energy demand (Rousseau, 2021). To meet its climate targets and development objectives, the government plans to expand nuclear power capacity from the current 8.2 GW to 100 GW by 2047. Nuclear energy is seen as a promising solution, and recent legal reforms aim to attract private and foreign investment (Zhu et al., 2015). Yet, progress is hindered by regulatory barriers, financial constraints, public opposition, and safety concerns (Chung & Kim, 2018). Past disasters like Fukushima and Bhopal gas tragedy have amplified public fears, while outdated regulations and high upfront costs make investment difficult (Wu & Huang, 2021; Yuan et al., 2015).

Figure: 1 India Nuclear Energy Production



Source: World Nuclear Association 2024

Figure: 2 Nuclear Energy Production



Source: World Nuclear Association 2024

Current Landscape

India's nuclear power expansion aims to boost energy generation and reduce dependence on fossil fuels. The country plans to partner with foreign players to access advanced nuclear technologies while also developing indigenous reactor designs (World Nuclear Association, 2024). Key upcoming projects include two 1000 MW Light Water Reactors (LWRs) at Kudankulam, Tamil Nadu, and a 500 MW Prototype Fast Breeder Reactor (PFBR) at Kalpakkam, Tamil Nadu, which uses fast neutron technology to generate more fissile material than it consumes.

Currently, India has 6,780 MW of nuclear capacity, accounting for about 3% of national electricity production, spread across 24 reactors at seven sites (World Nuclear Association, 2025). The government has set an ambitious goal of reaching 22,480 MW by 2031 a more than 230% increase. Plans include constructing ten indigenous 700 MW Pressurized Heavy Water Reactors (PHWRs), alongside the Kudankulam LWRs and Kalpakkam PFBR, focusing on self-reliance, safety, and a diverse energy mix (World Nuclear Association, 2025).

Legislative Reforms & Foreign Direct Investment

The Indian government has introduced key legislative reforms to modernize its nuclear energy framework, focusing on improving safety, security, and accountability. Amendments to the Atomic Energy Act (1962) now allow private companies to own, operate, and finance nuclear power plants, boosting foreign direct investment (FDI) in the sector. These reforms also promote public-private partnerships and encourage collaborative international projects (Wang et al., 2018).

Amendments to the Civil Liability for Nuclear Damage Act (2010) address long-standing liability concerns that have deterred international investors. The changes limit liability for foreign nuclear equipment suppliers and establish a nuclear insurance pool to provide financial safeguards in case of accidents (Stoutenborough & Vedlitz, 2016). Together, these measures aim to enhance competitiveness, attract both domestic and foreign investors, and strengthen India's position in the global nuclear energy landscape (Touran, 2025).

Budgetary Allocation

Since its founding in 1954, India's Department of Atomic Energy (DAE) has seen evolving priorities. Initially focused on developing basic infrastructure like fuel reprocessing and research reactors (Cuttler, 2014), nuclear power's contribution remained modest, at just 3,310 MW by 2007. By 2014, funding surged by 70%, with the DAE budget rising from ₹13,889 crore to ₹23,604 crore. The 2025–2026 Union Budget earmarks ₹20,000 crore specifically for developing Small Modular Reactors (SMRs), highlighting the push for advanced technologies and increased private sector involvement, balancing international collaboration with technological self-reliance (Kharecha & Hansen, 2013).

Public Concerns: Safety, Waste Management, and Environmental impact

Public concerns about nuclear energy in India focus mainly on safety, waste management, and environmental impact. High-profile accidents such as Chernobyl (1986) and Fukushima (2011) have fueled anxiety and resistance toward nuclear projects.

India's high population density and environmental vulnerability have triggered protests against nuclear power facilities (Conca & Wright, 2010). Although the Indian government has introduced modern safety measures, regular audits, and alignment with international safety standards, public skepticism remains, particularly regarding the transparency of safety reviews and emergency preparedness. Nuclear waste disposal poses another major challenge, as the highly radioactive material requires secure long-term storage (Bécoulet, 2025).

While India has developed temporary storage solutions, concerns over the transport and storage of radioactive waste persist, with potential risks of soil, water, and air contamination, threatening human health and ecosystems (Zhu et al., 2015b). Despite being a low-carbon energy source, nuclear power can negatively affect the environment through habitat loss, deforestation, and hazardous waste discharge (Zhu, Wei & Zhao, 2016). To address these concerns, the Indian government is investing in advanced reactors with passive safety features and Small Modular Reactors (SMRs) to enhance safety. Clear communication about safety measures and nuclear energy's benefits is essential to building public trust (Ritchie & Rosado, 2020).

Understanding the Public Perception on Nuclear Energy

Public anxieties around nuclear energy can create significant political and social barriers for governments and industry leaders seeking to expand its use. Therefore, understanding public perceptions and addressing these concerns is essential for advancing nuclear energy adoption. To explore this, a study is underway at the National Institute of Science Education and Research examining people's knowledge, opinions, and perceptions regarding nuclear energy, its risks, its role in addressing climate change, and the safety of nuclear power plants.
The survey looks at participants' demographics including age, gender, place of residence, and educational background to capture a broad range of perspectives on the complex topic of nuclear energy. A central focus is on the public's existing awareness of nuclear energy and radiation. Most participants rely on media, schools, and government programs for their information, revealing both knowledge gaps and opportunities for better public education. Self-assessments of nuclear knowledge suggest limited understanding, raising the question of whether targeted education could help improve public trust. The online survey gathered **figure 3** responses from 215 individuals: 65.7% male and 34.3% female.

Among them, 56.9% were urban residents, 16.7% rural, 14.4% semi-urban, and 12% suburban, providing a diverse snapshot of public views. The study reveals **figure 4** that most of the population has at least some awareness of nuclear energy, with only 2.8% reporting no knowledge at all. The largest group (44.4%) describes their understanding as very limited, while 36.1% report having moderate knowledge.
A smaller portion (15.3%) claims good knowledge, and another 15.3% identify as experts. Only 1.4% report excellent knowledge, reflecting a deep and comprehensive understanding of the topic. These results highlight a clear gap between limited and moderate knowledge among the public, suggesting that educational efforts could play a crucial role in improving overall understanding.

Figure: 3 Respondents Prior Understanding of Nuclear Energy

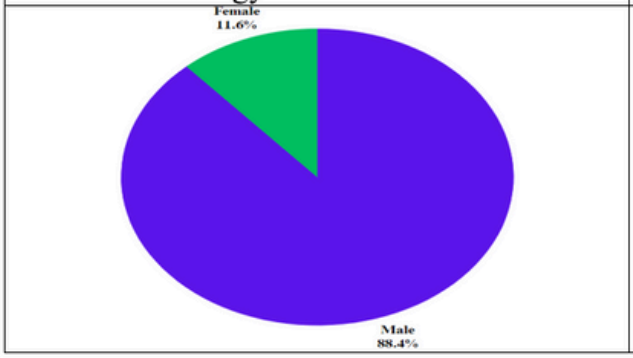
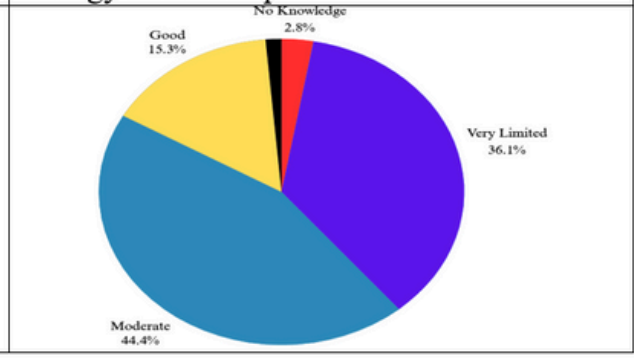


Figure 4 Level of Knowledge on Nuclear Energy of the Respondents



Source: Compiled by the Author

Notably, the fact that only a small fraction lacks any awareness indicates a solid baseline of basic familiarity with nuclear energy in the population. The study suggests that targeted educational programs, particularly aimed at those with very limited or moderate knowledge, could significantly enhance public understanding and potentially increase acceptance and trust in nuclear energy.

The study reveals **figure 5** that only a small percentage of respondents (2.8%) view nuclear power plants as very unsafe, reflecting strong concerns likely shaped by past nuclear disasters or general fears about radiation. A large segment (46.8%) holds a neutral stance, suggesting uncertainty or limited information about the actual risks and benefits of nuclear energy. Public concerns are heavily influenced by historical events such as Chernobyl, Fukushima, and Hiroshima, which continue to shape risk perceptions. Meanwhile, 21.3% of respondents perceive nuclear power plants as unsafe, while an equal 23.1% consider them safe, indicating a divide in public opinion. Only 6% rate nuclear plants as very safe, reflecting strong confidence in current safety measures and technology.

These findings highlight mixed perceptions and point to a clear opportunity for better education and outreach. Providing accessible, accurate information about nuclear energy's safety systems, technological advancements, and risk management could help shift neutral or uncertain views toward more informed positions. Public concerns are heavily influenced by historical events such as Chernobyl, Fukushima, and Hiroshima, which continue to shape risk perceptions.

Most respondents understand the key risks of nuclear energy, including radiation leaks, accidents, and environmental impacts. Concerns over nuclear waste management also emerge, with many viewing it as a long-term environmental threat. The study aims to explore public understanding of global nuclear waste handling practices. **Figure 6** highlights the main risks and concerns the public associates with nuclear energy. The top concern, cited by 42.1% of respondents, is radiation leaks and health hazards, reflecting fears about potential exposure affecting workers, local populations, and the environment. The second-largest concern, at 20.4%, is the risk of nuclear weapons development, showing public anxiety over the possible connection between civilian nuclear programs and military uses. showing public anxiety over the possible connection between civilian nuclear programs and military uses. Other notable concerns include nuclear waste disposal (10.2%), environmental contamination (6%), high construction and maintenance costs (6%), and operational risks (6%).

Figure: 5 Respondents Perception on Nuclear Energy Plants

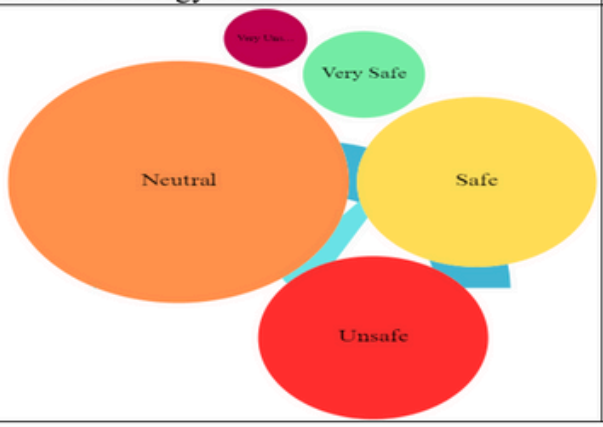
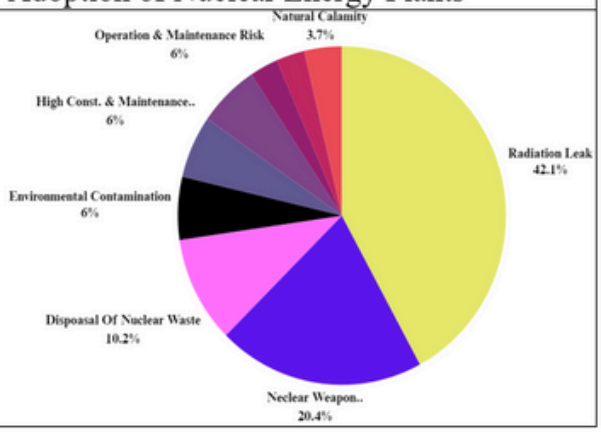


Figure: 6 Respondents Concerns for Low Adoption of Nuclear Energy Plants



Source: Compiled by the Author

Smaller but still relevant concerns, such as human security threats (2.8%) and natural disaster risks (2.8%), reflect worries about nuclear plants in vulnerable or unstable regions.

The debate over nuclear energy's role in fighting climate change remains contentious. While many recognize it as a low-carbon energy source, others remain skeptical due to fears about accidents, waste, and long-term risks concerns shaped by past disasters and public mistrust. The research also explores how media influences these perceptions. Films, news reports, and documentaries often amplify public fears by focusing on nuclear accidents and radiation risks. The study calls for more balanced, factual media coverage to reduce fear and encourage a better-informed public discussion on nuclear energy. The data analysis reveals **figure** 7 that 49.1% of respondents are primarily influenced by media, while family and community opinions shape 20.4% of views. Cultural beliefs or personal values account for 10.2%, followed by formal education and research (7.4%), political or government positions (7.4%), and no external influence (5.6%).

This suggests that media whether news, films, or online content plays the dominant role in shaping public attitudes toward nuclear energy, with family and community also holding considerable sway. Cultural values and formal education exert moderate influence, while political stances have the least impact.

Future research could explore how these influences affect broader decision-making in public policy or personal choices. Trust is a critical factor in shaping public opinion on nuclear energy in India. Many respondents express skepticism, driven by fears of human error, poor regulation, and inadequate safety measures. To address these concerns, improving transparency, enhancing public education, and communicating advancements in reactor design and safety protocols are essential.

Historical events such as Hiroshima, Chernobyl, and Fukushima have left a lasting mark on public perception. However, it is important to distinguish these past disasters from today's nuclear technologies, which feature significantly improved safety, waste management, and risk reduction measures, making modern nuclear power far safer than in previous decades.

Figure: 7 Respondents Influenced by different Platforms

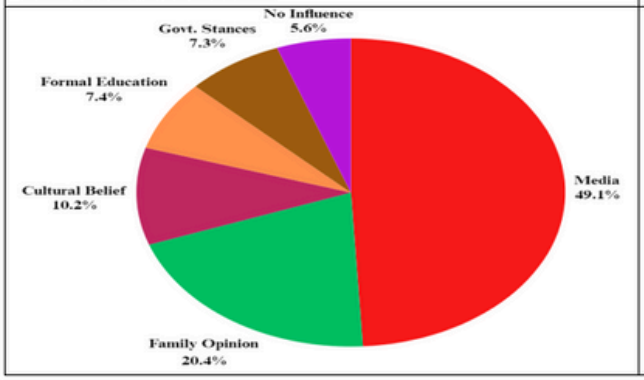
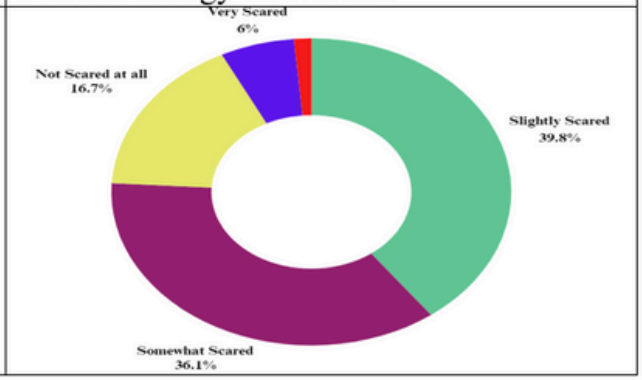


Figure: 8 Respondents Scepticism towards Nuclear Energy Generation



Source: Compiled by the Author

Figure 8 shows that 39.8% of respondents feel slightly scared about nuclear energy and radiation, reflecting general unease, while 36.1% report being somewhat scared, indicating heightened concern. Together, this suggests that the majority hold at least some level of fear regarding nuclear energy. In contrast, 16.7% are not scared at all, showing confidence in safety measures or familiarity with nuclear technology. A smaller group, 6%, are very scared, and 1.4% are extremely scared, likely reflecting anxieties shaped by historic events like Chernobyl or Fukushima.

The research investigates whether public education can reduce fear and shift opinions on nuclear energy. It asks if awareness campaigns and improved waste management could increase public support for nuclear projects. Many respondents express openness to learning more, seeing science-based education as a key to reducing fear. **Figure 9** shows that 46.8% believe scientific education can help ease public anxiety, and nearly 60% overall support education as a core strategy. However, 31.9% remain neutral, uncertain if education alone can change deeply rooted fears, while only a small minority disagrees.

The findings highlight the intricate link between fear, trust, media influence, and knowledge. Education and transparent communication emerge as vital tools for fostering a balanced public dialogue on nuclear energy's role in addressing global climate challenges.

A survey of 215 Indians shows **figure 10** that 44.3% strongly support the government's plan to promote nuclear power as a solution to the country's growing energy demands. Another 39.5% express mixed or cautious opinions, reflecting openness but some reservations. Additionally, 11.4% of respondents remain undecided, while only 4.8% clearly oppose the expansion of nuclear energy. Overall, the majority of participants favors nuclear energy, though many are not yet fully convinced, highlighting an opportunity for further engagement and education. Importantly, the share of those firmly opposed to pursuing nuclear power remains very small. These findings offer valuable insights into public attitudes and suggest that while nuclear energy enjoys considerable support, there is still a need for clear communication, trust-building, and public outreach to address lingering doubts.

Figure 9 Role of Different Awareness Campaign for Nuclear Energy

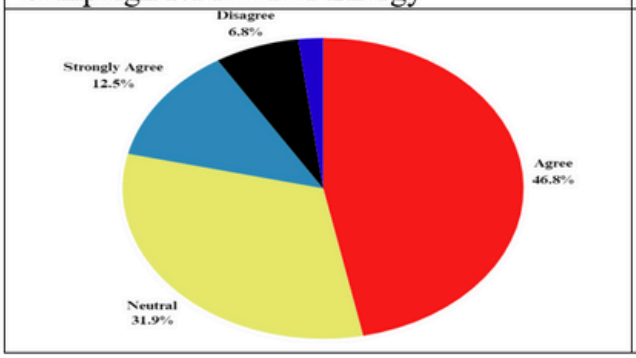
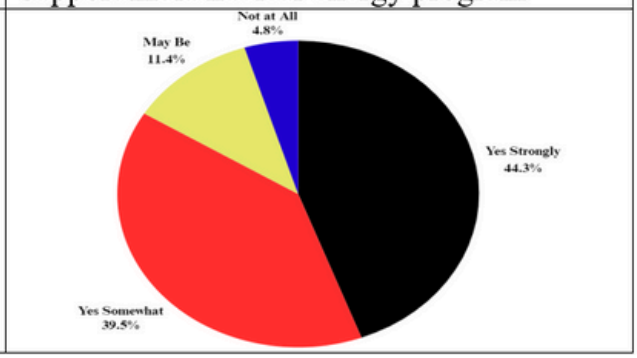


Figure: 10 Respondent Willingness to support India nuclear energy program



Source: Compiled by the Author

The survey underscores both the urgency of meeting India's rising energy needs and the importance of shaping a well-informed public The survey underscores both the urgency of meeting India's rising energy needs and the importance of shaping a well-informed public dialogue around nuclear power's role in the nation's energy future.

Policy Recommendation:

India can effectively harness nuclear power to meet its expanding energy needs and address climate change. To build trust, governments can enforce strict safety regulations, establish clear emergency response plans, and engage the public through open dialogue, interactive forums, and facility tours. Public acceptance is shaped by knowledge, perceived benefits, perceived risks, and opportunities for participation (Ritchie & Rosado, 2020). Gender plays a significant role, with women often expressing stronger opposition due to concerns over safety and environmental impacts.

Educational background, political leanings, and personal experiences with climate events also influence nuclear attitudes (Wang et al., 2018). Trust in information sources and open public discussions are key drivers in shaping perceptions. Urban residents have better knowledge of nuclear technology, safety protocols, and energy needs, viewing nuclear energy as a practical solution for energy security (Touran, 2025).

Rural populations, especially those near nuclear sites, may favor renewable options like solar or wind power. Policy measures such as distributing free informational materials, hosting public welfare events, and integrating nuclear energy topics into school curricula can help build credibility and reduce public perceptions of risk. Historical experiences of a region should guide tailored public engagement strategies to foster balanced and informed opinions on nuclear energy (Wang et al., 2018).

References

- Bécoulet, A. (n.d.). The saga of nuclear energy. In The MIT Press Reader (pp. 1–16).
- Chung, J., & Kim, E. (2018). Public perception of energy transition in Korea: Nuclear power, climate change, and party preference. Energy Policy, 116, 137–144.
- Cohen, B. L. (1983). Breeder reactors: A renewable energy source. Am. J. Phys, 51(1), 78.
- Conca, J. L., & Wright, J. (2010). The cost of energy—ethics and economics. Waste Manag, 10494, 1-13.
- Cuttler, J. M. (2014). Remedy for radiation fear—discard the politicized science. Dose-Response, 12(2), dose-response.
- Einstein, A. (1945) U.S. Department of Energy, & Office of Nuclear Energy, Science and Technology. (n.d.). The history of nuclear energy. In The History of Nuclear Energy.
- Kharecha, P. A., & Hansen, J. E. (2013). Prevented mortality and greenhouse gas emissions from historical and projected nuclear power. Environmental science & technology, 47(9), 4889-4895.
- Lightfoot, H. D., Manheimer, W., Meneley, D. A., Pendergast, D., & Stanford, G. S. (2006, May). Nuclear fission fuel is inexhaustible. In 2006 IEEE EIC Climate Change Conference (pp. 1-8). IEEE.
- Ministry of Environment, Forest and Climate Change, Government of India. (2022). India's long-term low-carbon development strategy.
- Ritchie, H., & Rosado, P. (2020). Nuclear energy. In Our World in Data.
- Rousseau, J.-C. (2021). Nuclear Energy: A Brief History. Encyclopédie De L'énergie, 1–6.
- Stocker, T. (Ed.). (2014). Climate change 2013: the physical science basis: Working Group I contribution to the Fifth assessment report of the Intergovernmental Panel on Climate Change. Cambridge university press.
- Stoutenborough, J. W., & Vedlitz, A. (2016). The role of scientific knowledge in the public's perceptions of energy technology risks. Energy Policy, 96, 206–216.
- Touran, N. (2025). General History of Nuclear Energy. In whatisnuclear.com.
- Wang, S., Wang, J., Lin, S., & Li, J. (2018). Public perceptions and acceptance of nuclear energy in China: The role of public knowledge, perceived benefit, perceived risk and public engagement. Energy Policy, 126, 352–360.
- Wang, S., Wang, J., Lin, S., & Li, J. (2018). Public perceptions and acceptance of nuclear energy in China: The role of public knowledge, perceived benefit, perceived risk and public engagement. Energy Policy, 126, 352–360.
- Wang, S., Wang, J., Lin, S., & Li, J. (2020). How and when does information publicity affect public acceptance of nuclear energy? Energy, 198, 117290.
- Wang, S., Wang, J., Lin, S., & Li, J. (2020). How and when does information publicity affect public acceptance of nuclear energy? Energy, 198, 117290.
- World Nuclear Association. (2024). World Nuclear Performance Report 2024.
- World Nuclear Association. (2025). Nuclear power in the world today. In World Nuclear Association.
- Wu, H., & Huang, L. (2021). Young Chinese people's radiological beliefs significantly associated with their opinions on nuclear power. Progress in Nuclear Energy, 138, 103797.
- Yuan, X., Zuo, J., Ma, R., & Wang, Y. (2015). How would social acceptance affect nuclear power development? A study from China. Journal of Cleaner Production, 163, 179–186.
- Zhu, W., Wei, J., & Zhao, D. (2015). Anti-nuclear behavioral intentions: The role of perceived knowledge, information processing, and risk perception. Energy Policy, 88, 168–177.
- Zhu, W., Wei, J., Zhao, D., 2016. Anti-nuclear behavioral intentions: the role of perceived knowledge, information processing, and risk perception. Energy Policy 88, 168–177.

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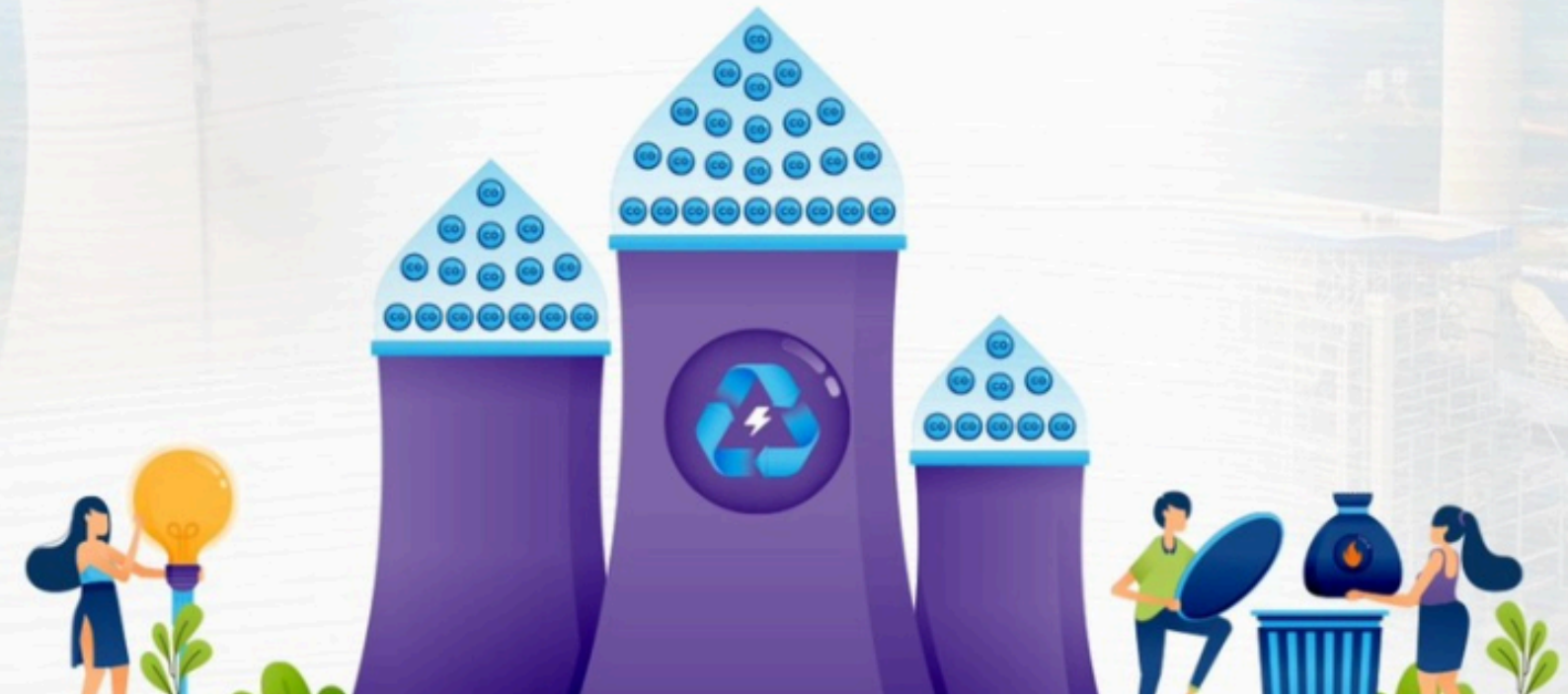

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