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Energy Crisis Implications for Rural and Urban India: 2019 to 2024

Umang Gupta[1], *Vyomkesh*[2]

[1]*Assistant Professor, Gitam School of Business, Gitam University, Bengaluru, Karnataka, India.*

[2]*Assistant Professor, Department of Management Studies, G.L. Bajaj Institute of Technology and Management, Greater Noida, Uttar Pradesh, India.*

Email id: *ugupta@gitam.edu*[1], *vyomkesh3696@gmail.com*[2]

Abstract

Nuclear energy is considered by many modern experts as a renewable energy. This is due to large reserves of thorium in the world and no carbon released in the production of nuclear electricity. In this research we perform qualitative descriptive analysis to find important points which will make protesters of nuclear energy begin a change of heart. The aim is to find important points that will be embedded in action plan solving the energy crisis by means of nuclear energy by public and private players. NPCIL (nuclear power corporation of India limited) has regained new vigor and energy in the wake of growing concerns of energy crisis, air pollution and global warming. The opinions of nuclear energy will be used to set basic layout to allay the fears of protesters and naysayers.

Keywords: *Energy Crisis, Government Campaigns, Self Sufficiency*

1. Introduction

India has taken nuclear energy to the moon. The much publicized and important scientific mission of Chandrayaan 3 has utilized radioactive decay powered nuclear batteries to keep the equipment supplied with power and an operable temperature [23]. Indian navy has been renewed with more budget to spend on nuclear powered submarines [5,9]. This is to guarantee investors in the Indian economy that our navy is capable with the right modern tools to protect merchant ships [3,5]. This is important for international trade and commerce. The government has taken a serious vow to reduce carbon emission and nuclear energy in the form of small modular reactors have become the go to tool for Indian government to provide backup electricity to essential public services in the face of shortages from solar power or wind power and the other such renewable energy sources [4]. Nuclear fission has India riding on new energy wave. Nuclear fusion also has made its presence felt in India with the promising design and deployment of Aditya ST2 in Gujarat [11]. The Aditya ST2 is a stellarator. If placed in the order of most promising to least promising the stellarator design is right in the middle surpassed by the field reverse configuration (FRC) and one step behind stellarator is the Torus design. Although the Aditya ST2 is small in capacity it still proves that our government is ready to invest in nuclear and has been so for past 30 years since the inception the Plasma Research Centre in Gujarat [11,6,10,12]. India has never been the one to even propose the use of nuclear weapons. In the Russia-Ukraine war also president Narendra Modi convinced Russia to practice restrain and control his forces from attacking the Zaporzohria nuclear power plant powering essential Ukraine infrastructure [7]. The only black spot in Indian Nuclear past is the lack of knowledge of general public regarding nuclear energy where they fall prey to rumors and anti-nationalist groups who oppose nuclear power plants to protect their vested interests. It is hence important to promote and invest in nuclear energy to usher in a green and modern Atma Nirbhar India.

1.1 Need of research

The Indian government acknowledges the fact that in order to meet the nation's escalating need for energy services, nuclear energy development has to be promoted in addition to other clean energy technologies [14]. It is important to highlight Dr. Homi Bhabha's thoughts of using atomic energy to enhance human well-being. He outlines India's three-stage nuclear power program, that intends to make use of the nation's nuclear resources to accomplish self-reliance in the area of sustainable energy provision. In terms of supply stability, sustainability of fuel sources, and protection of the environment and ecology, nuclear technology is preferable over traditional methods of producing power. The Government of India's policy planners should be basing their choices on the causal connection between the country's development and the availability of energy. The nation additionally approved a number of nuclear safety conventions and has a strong legal framework for the control of nuclear power. By the middle of the century, nuclear power is expected to account for roughly 25% of all electricity generated [15,16]. The safety of India's Department of Atomic Energy (DAE) nuclear facilities has been brought into doubt due to an array of incidents and accidents of varying severity. Since it is shielded from external scrutiny and has unparalleled access to political power, making it difficult for the public, bureaucrats, or politicians to challenge nuclear policies/ practices.

1.2 Significance of research

Research has been carried out regarding the creation of death conditions surrounding a nuclear power plant in southern India. Three main approaches to this engineering of death condition have been identified: hiring casual workers from low caste communities, offering these workers with inadequate training and safety, and the health risks associated with the allied nuclear industries. There is the necessity of solid evidence and impartial jury trials, as well as the significance of refuting post-truth narratives and media trials which might suppress dissenting opinions [17]. In order to reduce the volume of nuclear waste and avert the need for a geological disposal facility, India has successfully designed and built spent-fuel reprocessing plants, waste management facilities, and the deception of plutonium-bearing fuel for fast reactors. Maintaining compliance with international safety standards and improving the overall safety of the reactors is ensured by working with foreign vendors, incorporating advanced safety features, and continuously improving safety in Indian nuclear power plants [18]. The Indian nuclear program is being developed in three stages. The first stage involves producing plutonium using natural uranium-fuelled heavy water-moderated power reactors. The second stage involves using fast breeder reactors to use thorium resources. Sanctions from wealthy countries following India's 1974 nuclear test, however, presented difficulties for the program. Despite being subject to international, India was able to successfully develop its nuclear power program [19]. The Kudankulam movement is an illustration for non-nuclear movements and other initiatives for justice across a range of challenges. The conflict and disagreement to Kudankulam's nuclear energy program, which represents an outright denial of both nuclear energy and nuclear militarism. The irrefutable link between India's civilian and military nuclear programs highlights the need for further inquiry into the integration of regime theory and IR norm-research into the arms control field [20]. India effectively incorporated a nuclear reactor for the country's in-house nuclear submarine project and has made steady progress in operating nuclear plants for the generation of electricity. To take full advantage of its nuclear power capabilities, India still needs to resolve its issues with the Nuclear Suppliers Group (NSG) with respect to the supply of nuclear fuel [21]. Offering an effective means of guaranteeing long-term energy security, India's nuclear energy industry is vital to the nation's energy security and climate policy agenda. Opportunities and challenges arise from India's foray into the global nuclear energy community. Issues of safety, security, and transparency must be addressed by the formulation of new procedures and laws. To guarantee greater transparency and public participation in the nuclear sector, a revised regime is indispensable. In the below table we present some key facts from our research to highlight how the other means of tackling the 'double challenge' of 'energy crisis' and 'global warming' have been unsatisfactory [24,25,26] as shown in Table 1**.**

Table 1 **Energy slack fulfilment efforts**

Achieve 175 GW of renewable energy capacity	119 GW achieved out of 175 GW. Solar: 62 GW; Wind: 42 GW; Bio-Power: 10.7 GW; Small Hydro: 4.9 GW. Including large hydro: 165.94 GW.
Strive to achieve 10% blending of ethanol in petrol	Ethanol Blending Goal: 10% achieved, aiming for 20% by 2025. Ethanol primarily from grains and sugarcane. Environmental Impact: Reduction in greenhouse gas emissions. Implementation Phases: Gradual expansion to 20% blending. Raw Material Challenges: Reliance on water-intensive crops, supply issues, and price fluctuations. Sugar Industry's Role: Crucial in ethanol production, affected by rainfall patterns and potential export bans.
Supply of piped cooking gas in major Tier 1 and 2 cities	Significant progress with 300 Geographical Areas authorized, covering 98% of the population. Target of 12.5 crore PNG connections by 2030. Over 82% land area and 98% population expected to be covered.
Ensure LPG gas cylinder connection to all poor rural households	LPG coverage increased from 62% in 2016 to 99.8% in 2021. PMUY launched with the aim of providing LPG connections.
Ensure 100% electrification of all households	Information not provided.

1.3 Literature review

It is no surprise that social messaging campaigns can sway public opinion. Government has the capacity to act as an agent of change. The change can help associate negative sentiment with real world ideas such as tobacco smoking, chewing tobacco consumption, alcohol, public defecation and dowry [27,28]. The impact of government campaign regarding the social tabo's has played an incredible role in bringing the topics out from the shadows. Further in our review of literature we find support that a multi-dimensional approach can help government achieve public trust back for a social idea [29,30].

2. Research methodology:

The qualitative descriptive analysis was performed. Content analysis of news media video coverage was performed. This helps us in finding important candidates for the parent variables of the nuclear power positive social marketing problem. The video coverage included Kudankulam nuclear power plant protests, Jaitapur protest, Fatehabad and Gorakhpur protest and other related and relevant nuclear power plant opinions, debates and protests. The second step of research design included association of emotion with the possible parent variables, and further discriminating among the parent variables based on their individual significance. For these two processes were performed. An individual sentiment analysis was carried out of on comments on the video of an actual interview between reputed nuclear scientist and Indian Youtube podcast host. The second process involved performing sentiment analysis on the comments of Indian YouTube podcasts covering the Oppenheimer movie and the importance of nuclear power for India. The Oppenheimer Hollywood movie covers the birth of the atomic bomb in a documentary movie style. Here we merge the data set of nuclear scientist podcast episode with the Oppenheimer podcast episode. If we merge data sets, we get better results [1]. It is expected that a reliable and valid set of findings will be produced from a sample of Indian creators and Indian audience. The audience is largely Indian only. it is expected that a significant portion of non-important variables will get discarded at this second stage of analysis.

2.1 Hypothesis for descriptive statistics

Hypothesis 1: positive social marketing of nuclear power plants will reduce the public mistrust in nuclear power plants.

Hypothesis 2: The Indian public is now ready to trust nuclear power plants as they understand it as a solution to deepening energy crisis.

Hypothesis 3: The Indian public is now ready to trust nuclear power plants as they understand it as a solution to deepening climate crisis.

3. Findings

Table 2 Qualitative descriptive analysis

What is the situation?	N
Close to human habitat	33
Close to water used by humans	11
On fertile farm land	6
Mistrust of people regarding safety of power plant byproducts	53
Who are the actors?	
Ruling party	13
Opposition party	12
Villagers	51
Antinuclear NGOs possibly funded by foreign nations with vested interests	26
What is the process?	
remove the mistrust of public regarding safety of power plant byproducts	9
Violence control by non-violent methods	35
Gain public trust by educating public about exponential design improvements in nuclear power plants	59
What is the learning?	
Hold open for all public meetings	25
Keep location of power plant away from human habitat	53
Provide regular updates for all public to the operational effectiveness of the treatment of power plant by products	25
What is the action?	
Public meetings on open for all stage and debate	75
A roadshow or street play to educate public about the safety of nuclear power plant	15
A roadshow or street play to educate public about the necessity of nuclear power plant	18
What is the performance?	
Increased public awareness about benefits of nuclear power	40
Increased public awareness about the need for energy self-sufficient India(Aatma Nirbhar Bharat)	26
Educate the public about other countries where nuclear power plants have helped in development	18
help the public realize that nuclear power plants will help achieve a better India for their future generation both economically and ecologically	19

It is important to note here Table 2 qualitative descriptive analysis helps us realize that barriers to nuclear power plants not only exist physically but mentally also. The mental barriers of mistrust can be removed by positive social marketing efforts.

Sentiment analysis:

Table 3 N=103

Positive	92
Negative	8
Neutral	3

Sentiment analysis shown in Table 3 for 103 statements from comments on video interview help point out the high scores achieved on the positive side of the scale. This means that the mental barrier of mistrust of public in regards to safety of nuclear power plant can be achieved by its positive social marketing. These results are skewed to the positive side.

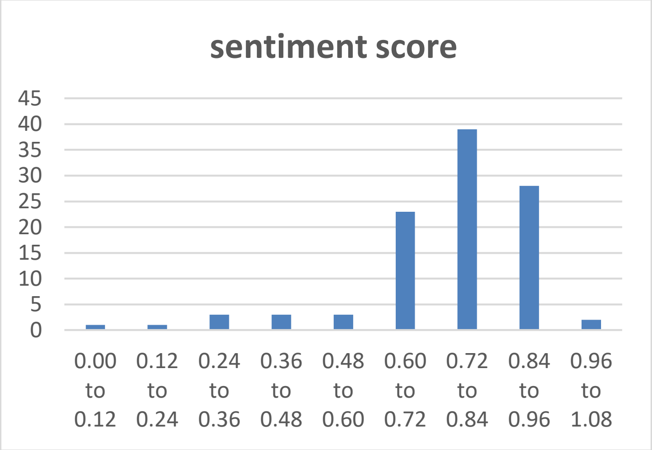

Figure 1 N=103

The findings of this Figure 1 show a very hopeful result. The deviation from mean is significantly strong in the positive direction. This gives us evidence for success in changing public opinion to a stronger adoption of nuclear power plants.

Table 4 N=411

Positive	302
Negative	71
Neutral	38

Similar to findings from Table 4 the scores for 411 sample size are also significantly skewed to the positive side of the scale. These results indicate much prospect for change by positive social marketing efforts for nuclear power plants.

It is evident that the barriers to nuclear power plant are mostly absent from the wordcloud graph as shown Figure 2. This means the negative association of Indian audience has significantly decreased and people are not susceptible to parties and groups with nefarious vested interests who want to sway them to oppose nuclear power plants. The simple truth is that continued announcements of the central government since 2020 till present have only been understood as a much needed and welcome initiative to solve the deepening energy and climate crisis. We can see that even with the context of nuclear power with association as a tool for aggressive diplomacy. The mutually assured destruction (M.A.D) context and the subsequent non-proliferation treaty (N.P.T) outweigh the positive association to benefits of nuclear power plants. [2,6,13]

Figure 2 Wordcloud Graph

3.1 Limitations of research and directions for future research

Declaration of government spending regarding efforts to raise awareness for nuclear power plant safety campaign performed previously were unavailable. If we estimate broadly the Swachh Bharat campaign had a three spending in excess of 500 crores. Future research can find the budget spend on previous campaign and provide revisions for same. There is interference by groups which have ulterior motives in protesting nuclear power plants. Sufficient research consideration need be part of future research design.

Conclusion

Nuclear energy offers thermal power's reliability and effectiveness without releasing carbon dioxide. Atomic force can assist in addressing demand as India's energy consumption soars. India must incorporate nuclear power into its energy mix to attain no net emissions, maintain energy security, and foster economic expansion. Nuclear power has been enjoying a renaissance lately, with several countries looking to build new reactors, relax financing rules for atomic energy, and invest in advanced reactor technologies such as Small Modular Reactors (SMRs). The revision of India's Civil Liability for Nuclear Damage Act (CLNDA) and integration with the Convention on Supplementary Compensation for Nuclear Damage (CSC) would be the most ethical way to resolve the current situation of chaos in India related to enhancing nuclear energy [5,6]. This would transfer all liability upon a nuclear accident to the nuclear plant operator, who would safeguard its interests by relying on an insurance pool for financial security. How existing non-proliferation rules are applied not only keeps India from benefiting fully from the agreement but, more importantly, erodes the primary goal of its negotiation, which was to support India's prominence in building the Asian multipolarity that neutralises China's rise [10-12,23].

References

[1]. De Arriba, A., Oriol, M., & Franch, X. (2021, November). Merging datasets for emotion analysis. In 2021 36th IEEE/ACM International Conference on Automated Software Engineering Workshops (ASEW) (pp. 227-231). IEEE.

[2]. Horlick-Jones, T., Prades, A., & Espluga, J. (2012). Investigating the degree of “stigma” associated with nuclear energy technologies: A cross-cultural examination of the case of fusion power. Public Understanding of Science, 21(5), 514-533.

[3]. BDL expecting orders for laser beam riding missile lbrm from Indian army. (2024, January 24). Retrieved from https://idrw.org/bdl-expecting-orders-for-laser-beam-riding-missile-lbrm-from-indian-army/

[4]. SMRS Indias new nuclear energy hope. (2024, January 24). Retrieved from https://idrw.org/smrs-indias-new-nuclear-energy-hope/

[5]. India UK talk on co development of electric propulsion for warships. (2024, January 24). Retrieved from https://idrw.org/india-uk-talk-on-co-development-of-electric-propulsion-for-warships/#google_vignette

[6]. Exploring the role of nuclear energy in India’s energy transition. (2024, January 24). Retrieved from https://southasianvoices.org/exploring-the-role-of-nuclear-energy-in-indias-energy-transition/

[7]. Kremlin warns of ‘sabotage’ at Ukraine nuclear plant under Russian control. (2024, January 24). Retrieved from https://www.washingtonpost.com/world/2023/07/05/zaporizhzhia-nuclear-plant-sabotage-russia/

[8]. Sweden plans huge investment in nuclear power. (2024, January 24). Retrieved from https://energy.economictimes.indiatimes.com/news/power/sweden-plans-huge-investment-in-nuclear-power/105281314

[9]. Scraps INS-Chakra nuclear submarine navy goes 1 step forward and 2 steps backward. (2024, January 24). Retrieved from https://www.eurasiantimes.com/scraps-ins-chakra-nuclear-submarine-navy-goes-1-step-forward/?amp

[10]. China’s JiangXi to build a fusion fission reactor. (2024, January 24). Retrieved from https://asiatimes.com/2023/11/chinas-jiangxi-to-build-a-fusion-fission-reactor/

[11]. National Symposium for commemorating 30 years of ADITYA Tokamak. (2024, January 24). Retrieved from http://www.ipr.res.in/Aditya30Years/

[12]. Feature India’s activities in nuclear fusion. (2024, January 24). Retrieved from

https://www.neimagazine.com/features/featureindias-activities-in-nuclear-fusion-9640516/

[13]. Lack of raw materials high cost hit biofuel production in Karnataka. (2024, January 24). Retrieved from https://www.deccanherald.com/india/karnataka/lack-of-raw-materials-high-cost-hit-biofuel-production-in-karnataka-2768974.

[14]. Jain, S. K. (n.d.). Nuclear Power in India-Past, Present and Future.

[15]. Grover, R. B. (2013). Green growth and role of nuclear power: A perspective from India. Energy Strategy Reviews, 1(4), 255–260. https://doi.org/10.1016/j.esr.2012.12.010

[16]. Ramana, M. v. (n.d.). CHAPTER 3 NUCLEAR POWER IN INDIA: FAILED PAST, DUBIOUS FUTURE. https://about.jstor.org/terms

[17]. Kaur, R. (2021). Nuclear necropower: The engineering of death conditions around a nuclear power plant in south India. Political Geography, 85. https://doi.org/10.1016/j.polgeo.2020.102315

[18]. Pathak, B. C., Kaushik, C. P., Vyas, K. N., & Grover, R. B. (2022). The status of nuclear power development in India (Vol. 123, Issue 3).

[19]. Gopalakrishnan, A. (2002). Evolution of the Indian nuclear power program. Annual Review of Energy and the Environment, 27, 369–395. https://doi.org/10.1146/annurev.energy.27.122001.083448

[20]. Vanaik, A. (2020). Kudankulam: The Story of an Indo-Russian Nuclear Power Plant. Journal for Peace and Nuclear Disarmament, 3(2), 420–422. https://doi.org/10.1080/25751654.2020.1853930

[21]. Vishnoi, H., & Narayan, S. (n.d.). Nuclear Power in India. www.asiastudies.org

[22]. US bets on small nuclear reactors to help fix a huge climate problem. (2024, January 24). Retrieved from https://m.economictimes.com/small-biz/sustainability/us-bets-on-small-nuclear-reactors-to-help-fix-a-huge-climate-problem/

[23]. Chandrayaan 3 carried nuclear technology to moon what was it used for? (2024, January 24). Retrieved from https://www.google.com/amp/s/www.indiatoday.in/amp/science/chandrayaan-3/story/chandrayaan-3-carried-nuclear-technology-to-moon-what-was-it-used-for-2456584-2023-11-01

[24]. India set to boost power capacity by 31000 MW in FY 24 eyes 900 GW by 2032 Power secretary. (2024, January 24). Retrieved from https://energy.economictimes.indiatimes.com/news/power/india-set-to-boost-power-capacity-by-31000-mw-in-fy24-eyes-900-gw-by-2032-power-secy/105024343

[25]. Did India really achieve its goal of 175 gigawatt of renewable energy by 2022. (2024, January 24). Retrieved from https://scroll.in/article/1041018/did-india-really-achieve-its-goal-of-175-gigawatt-of-renewable-energy-by-2022

[26]. 82 of India’s land area will be covered with piped cooking gas government informs-upper-house. (2024, January 24). Retrieved from https://www.theindianwire.com/news/82-of-indias-land-area-will-be-covered-with-piped-cooking-gas-government-informs-upper-house-329092/

[27]. Reddy, K. S., & Gupta, P. C. (2004). Tobacco control in India. New delhi: ministry of health and family welfare, Government of India, 43-47.

[28]. Gururaj, G., Gautham, M. S., & Arvind, B. A. (2021). Alcohol consumption in India: A rising burden and a fractured response. Drug and Alcohol Review, 40(3), 368-384.

[29]. Patil, S. R., Arnold, B. F., Salvatore, A. L., Briceno, B., Ganguly, S., Colford Jr, J. M.,

& Gertler, P. J. (2014). The effect of India's total sanitation campaign on defecation behaviors and child health in rural Madhya Pradesh: a cluster randomized controlled trial. PLoS medicine, 11(8), e1001709.

[30]. Sadh, A., & Kapoor, P. S. (2012). Save the Girl Child Initiatives in India-A Social Marketing Perspective. Indore Management Journal, 4(3), 18-34.