NUS National University of Singapore
Lloyd's Register Foundation Institute for the Public Understanding of Risk

WHITE PAPER

NUCLEAR POWER: UNDERSTANDING PUBLIC PERSPECTIVES

Key findings from international research on public perceptions of nuclear power and its relevance for Singapore's policy deliberations.

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Introduction

Singapore is considering whether nuclear energy could play a role in its future energy mix, as part of efforts to address the energy trilemma of ensuring secure, affordable and clean energy.

The government has not taken a decision on deployment, but is actively studying the feasibility of nuclear technologies within Singapore's specific geographic, environmental and societal context.

This assessment is taking place against the backdrop of a broader global shift. Nuclear power is undergoing a renewed period of interest in many countries, often described as a "nuclear renaissance."

In March 2026, Vietnam announced an agreement with Russia to construct its first nuclear reactor, reviving a programme that had previously been shelved in 2016.

In Europe, France announced a significant policy shift in 2022, committing to a new generation of nuclear power plants supported by public financing.

Italy has moved in a similar direction, approving draft legislation in 2025 to reintroduce nuclear power, reversing earlier referenda that had effectively banned it.

Japan has also changed course, lifting restrictions introduced after the Fukushima disaster and signalling plans to restart existing plants, extend their lifetimes and consider new construction.

Public attitudes both shape and respond to these policy developments.

Historical precedents demonstrate that public opinion can drive major policy change, as seen in Italy and Germany following the Fukushima accident.

At the same time, public support can shift as governments signal renewed commitment to nuclear energy.

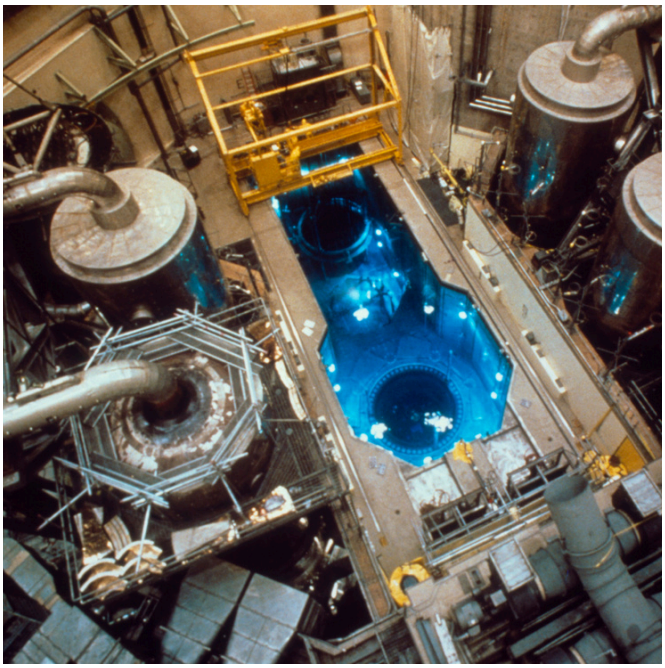
In France, where public opinion has been tracked over more than two decades, there has been a marked reversal in recent years since the government announced the large nuclear investment programme: in 2020, 45% of respondents opposed the construction of nuclear power plants and 29% were in favour; by 2024, this had shifted to 25% against and 48% in favour.[1]

The Singapore government recognises that public support will be critical to any future deployment of nuclear power.

Professor Laurence Williams, Chairman of Singapore's Nuclear Safety Advisory Panel in the National Environment Agency, has emphasised the importance of nuclear energy earning a "social licence."[2]

This requires understanding and responding to public concerns, providing clear and accessible information, and demonstrating trustworthiness through transparent and inclusive processes.

This White Paper summarises key findings from international research on public perceptions of nuclear power and highlights their relevance for Singapore's policy deliberations.



Public perceptions of nuclear power

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Nuclear accidents

Nuclear accidents exert a disproportionate influence on public perceptions of nuclear energy. Across countries and contexts, they dominate how people think about nuclear risk, often overshadowing considerations of routine operations or potential benefits.

A central finding in the literature is that nuclear accidents have a powerful hold on the public imagination.

Events such as Chernobyl and Fukushima are not only remembered as industrial accidents, but as defining global events.

Their impacts extend far beyond their immediate physical consequences, shaping perceptions across generations and geographies.

Part of this influence stems from the imagery associated with nuclear accidents. Studies, particularly from the United States, show that people often associate nuclear accidents with nuclear conflict.[3]

This symbolic overlap means that civilian nuclear energy is sometimes perceived through the lens of nuclear war, amplifying perceived danger even in the absence of any direct connection.

Publics also tend to overestimate the probability of nuclear accidents. Surveys consistently find that respondents describe such events as “likely” or “quite likely”, despite expert assessments that place their probability as very low.[4]

This reflects a broader pattern in risk perception: rare but catastrophic events are systematically overestimated.

Importantly, people do not generally distinguish between older and newer generations of nuclear technology. While experts emphasise significant safety improvements in newer reactor designs, this differentiation is largely absent from public perceptions. As a result, contemporary nuclear proposals are often evaluated through the lens of past accidents.

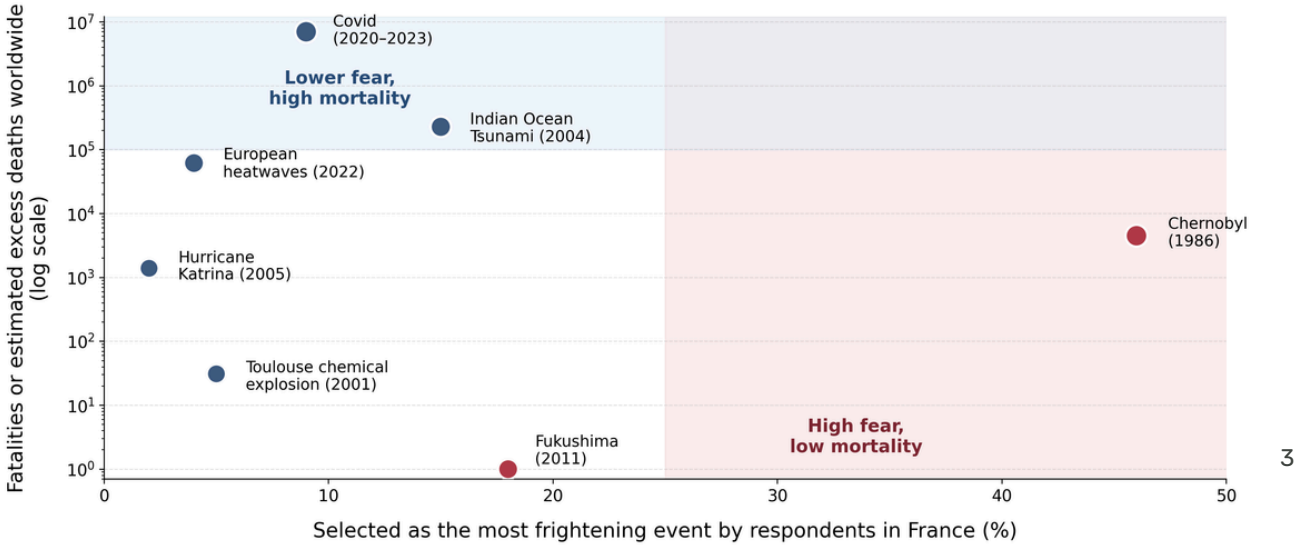
Perceived severity is another critical facet of public perceptions. Nuclear accidents are seen as having extremely severe, long-lasting and potentially irreversible consequences.

Psychological research suggests that risks involving multiple simultaneous fatalities, invisible hazards such as radiation, and long-term health effects are especially feared. Nuclear accidents combine all of these characteristics.

Media coverage and social amplification further reinforce these perceptions, keeping past incidents salient and emotionally charged, leading to nuclear accidents being seen as more frightening compared to other catastrophes which led to vastly more casualties.

Why are we so frightened by nuclear accidents?

The events that frighten people most are not those that cause the greatest loss of life.



Source: ASNR Baromètre 2025 for fear ratings; fatalities are global totals or estimated excess deaths for the selected events. Values shown on a logarithmic scale.

Food safety

Concerns about food contamination are one of the most enduring and emotionally salient consequences of nuclear accidents. These concerns are particularly powerful because they involve pathways of exposure that are both indirect and difficult for individuals to control.

A key feature shaping these perceptions is the slow, invisible and cumulative nature of risk associated with radioactive contamination in food systems. Radioactive substances released into the environment can enter ecosystems and bio-accumulate in plants and animals over time.

When these organisms are consumed, exposure occurs through ingestion, creating a pathway that is both diffuse and ongoing.

Unlike acute hazards, which have clear onset and outcomes, this form of exposure is gradual and difficult to detect, making it especially unsettling.

This combination of invisibility and accumulation heightens perceived risk. Individuals cannot easily observe or verify contamination, nor can they readily assess how exposure builds up over time.

As a result, even very low levels of contamination can be perceived as dangerous, particularly when framed in terms of long-term health effects such as cancer or genetic harm.

vidence from the Fukushima accident illustrates how persistent these concerns can be. Public confidence in the safety of food products — particularly seafood — declined sharply following the release of radioactive materials into the marine environment.

Consumer avoidance extended well beyond the directly affected regions and persisted for years, even after extensive testing demonstrated that most products were within safe limits.[5]

Importantly, these perceptions are not solely driven by measured risk levels, but by how people understand the nature of exposure.

The idea that radioactive substances can accumulate in the body over time reinforces a sense of ongoing vulnerability. This makes food contamination risks particularly resistant to reassurance based on technical data alone.

For Singapore — a major food-importing nation — food risk perceptions could become an important secondary channel through which nuclear attitudes influence public behaviour.

Stigma

The consequences of nuclear accidents extend beyond physical health and environmental damage to include significant social and psychological effects. Mental health concerns following such events often have deeply social dimensions, shaping how individuals see themselves and how they are perceived by others.

A notable example is the emergence of "radiation stigma" following the Fukushima accident.[6] Residents from affected areas reported feeling socially marginalised due to fears — often unfounded — about radiation exposure.

In particular, young women from the region described concerns that they were being viewed negatively, especially in relation to fertility and the potential for genetic harm to future children. Whether or not there is any scientific basis for such concerns, the perception itself carries real consequences.

Weaponisation of nuclear power

A less visible but important concern is the potential for deliberate attacks on civilian nuclear facilities during conflicts. This concern has been brought to the fore in the Ukraine and Iran wars where bombing of nuclear installations presents a major risk.

The Director General of the International Atomic Energy Agency affirmed in January 2026 that the war in Ukraine "continues to pose the world's biggest threat to nuclear safety."[7]

In the United States, research found that many respondents believed nuclear plants increased the likelihood of nuclear-related terrorism.[8] Similar concerns have surfaced in Thailand and Vietnam, suggesting that this association extends across regions to countries considering nuclear power.[9]

An OECD Nuclear Energy Agency study further reported that terrorism was viewed as a major threat to nuclear facilities across most surveyed countries.[10]

These perceptions appear to be influenced by broader geopolitical narratives and general security anxieties rather than by country-specific technical assessments. Trust plays a critical mediating role.

Where confidence in government and regulatory institutions is lower, weaponisation fears tend to be stronger. Even in high-trust environments, however, symbolic associations between civilian and military nuclear technology can persist.

For Singapore — a highly urbanised and security-conscious society — these perceptions may warrant attention in public engagement strategies.

Regular operation of nuclear power plants

While accidents dominate the public imagination, perceptions of routine operations also play an important role in shaping attitudes.

A common belief is that nuclear power plants emit harmful radiation during normal operations, and that this exposure is linked to increased cancer risk. In France, with its large nuclear programme, 50% of people think that nuclear power stations cause cancer.[11]

Although regulatory frameworks are designed to ensure that emissions remain well within safe limits, many members of the public do not distinguish clearly between low-level, controlled releases and high-level exposure associated with accidents.

This reflects a broader tendency to conflate different types and magnitudes of risk.

Health concerns linked to routine operations are therefore often shaped less by empirical evidence and more by underlying anxiety about radiation. The invisibility of radiation as a hazard further contributes to unease, as it is difficult for individuals to assess or monitor exposure directly.

Transport of nuclear materials and waste is another area of concern, and one that is much less widely acknowledged than accidents and normal operations.

People worry about the possibility of accidents during transit, the adequacy of emergency preparedness and training of first responders.

Studies find that people are concerned about living along transport routes, as well as in proximity to disposal sites, and considerable variation among members of the public in their attitudes and preferences.[12] Spatial context matters.

Existing research comes largely from the US and Canada where transport routes may be geographically distant from residential areas.

In a dense city-state such as Singapore, any transport corridor would likely be close to populated zones, potentially amplify perceived vulnerability.

Furthermore, although risks related to transportation are technically distinct from both routine plant operations and waste disposal, for the public, they may form part of a broader, undifferentiated perception of nuclear power risk.

Waste disposal

Concerns about nuclear waste are among the most persistent and emotionally salient. In some contexts, including France, waste disposal emerges as the most salient issue for the general public.[13]

Public apprehension often centres on the long-term reliability of disposal systems and the possibility of future leakage or containment failure.

A consistent finding is that people are reluctant to live near nuclear waste disposal sites. This aversion is comparable to attitudes towards other locally undesirable land uses, such as landfills.

However, some studies find that communities located near existing or proposed storage sites are not always more opposed than distant populations.

Fairness plays a critical role in shaping acceptance. In particular, procedural fairness — whether decision-making processes are transparent, inclusive and perceived as legitimate — strongly influences public attitudes.[14]

Where people feel that decisions are imposed without adequate consultation, opposition, for example to sites for nuclear waste disposal, tends to increase significantly.

Intergenerational considerations are an important dimension of public concern. Many people express discomfort with the idea that nuclear waste will remain hazardous for periods far exceeding human lifetimes, effectively passing the burden to future generations.[15]

This raises ethical questions that are not easily addressed through technical solutions alone. Distributive fairness also matters.

Studies relating to other environmental risks show that concerns arise when certain communities are perceived to bear disproportionate risks without corresponding benefits.[16]

Together, these dimensions of fairness highlight that acceptance of waste disposal is not solely a function of technical safety, but also of governance and process.

Despite its importance, waste disposal often receives less attention in public communication compared to reactor safety or accident risk. This creates a gap between what experts emphasise and what publics are most concerned about.

Benefits of nuclear power

While risks dominate much of the public discourse, perceived benefits also influence attitudes towards nuclear energy.

Energy security is consistently identified as one of the most important perceived benefits.[17]

Nuclear power is seen as a way to diversify energy sources and reduce dependence on imported fossil fuels. For a country such as Singapore, which faces structural constraints in its energy options, this consideration is likely to be particularly salient.

Economic benefits are also widely recognised. These include job creation, industrial development and, in some contexts, a sense of national pride associated with technological advancement. Nuclear programmes are often seen as symbols of scientific capability and modernisation.[18]

However, perceptions of environmental benefits are more mixed. While nuclear energy is a low-carbon source of electricity, publics do not uniformly perceive it as environmentally beneficial.

In some cases, individuals who are more concerned about climate change are less supportive of nuclear power, possibly due to concerns about accidents, waste or broader environmental impacts.[19]

This suggests that nuclear energy is not automatically framed as a "climate solution" in the public mind. How it is positioned within broader environmental narratives may therefore play an important role in shaping support.

Cross-cutting issues

Several cross-cutting factors shape how risks and benefits are interpreted.

Trust is one of the most important determinants of public attitudes towards nuclear energy. At its core, nuclear power requires individuals to transfer responsibility for assessing and managing risk to institutions — including regulators, operators and governments.

Unlike more familiar risks, individuals cannot directly observe or evaluate nuclear safety for themselves.

As a result, acceptance depends heavily on confidence in those tasked with ensuring safety. Furthermore, trust is enhanced by transparency and the quality of information available.[20]

This raises several fundamental questions in the public mind: Are regulatory standards sufficiently stringent?

Do regulators have the expertise, independence and resources required to monitor operators effectively? And are operators themselves competent and trustworthy?

Where the answer to any of these questions is uncertain, perceived risk increases significantly.

Reversals in nuclear policy and the history of cost overruns and delays in nuclear projects may contribute to a perception that large-scale infrastructure investments are inefficient or vulnerable to mismanagement.

These concerns are not specific to nuclear energy, but they can reinforce scepticism towards nuclear programmes, given their scale, complexity and visibility.

Importantly, trust is not static. It can be strengthened through transparency, consistent performance and credible oversight, but it can also be rapidly eroded by accidents, governance failures or perceived lack of openness.

The experience of Japan following the Fukushima accident demonstrates how quickly public confidence can decline when institutional responses are perceived as inadequate.

For policymakers, this underscores that building trust requires sustained effort across the entire governance system. It is not only a matter of communicating safety, but of demonstrating competence, integrity and accountability over time.

Knowledge also plays a complex role. Research distinguishes between objective knowledge (what people actually know) and subjective knowledge (what people think they know).

Higher levels of objective knowledge are generally associated with greater support for nuclear energy.[21]

In contrast, individuals with high subjective knowledge — who believe they understand the issue well — may be more critical or opposed.
Overall levels of objective knowledge about nuclear energy tend to be low.

Many people are unaware of how widely nuclear power is used globally, how many plants exist, or how close they live to nuclear facilities.

This creates space for misconceptions and amplifies the influence of heuristics, media narratives and social discourse.

These findings suggest that improving public understanding is important, but not sufficient on its own. Knowledge will interact with trust, values and prior beliefs in shaping attitudes.

Policy implications

As Singapore considers whether to deploy nuclear power, international evidence underscores that public perceptions will be central to the feasibility and sustainability of any decision.

First, communication strategies should explicitly address the issues that matter most to the public, including nuclear accidents and waste disposal.

Providing clear, accessible explanations of how risks differ across the nuclear lifecycle — including distinctions between routine operations and accident scenarios, and between older and newer reactor designs — may help reduce conflation of risks.

Second, transparency should be prioritised not only in technical assessments but also in decision-making processes.

This includes communicating uncertainties, trade-offs and the rationale behind policy choices. Transparent processes contribute directly to perceptions of procedural fairness, which are critical for public acceptance.

Third, sustained public engagement is essential. This should go beyond one-way information provision to include opportunities for officials to listen to the public, for dialogue and questions.

Engagement processes should be designed to build understanding over time, rather than focusing solely on key decision points and pre-determined discussion topics.

Fourth, trust in institutions must be actively maintained. This requires clear roles and accountability across the regulatory system, transparency about decision-making processes and visible independence and competence in oversight.

Finally, policymakers should recognise that perceptions of nuclear energy are shaped by values as well as scientific facts.

Addressing concerns about distributional issues, intergenerational responsibility, fairness and societal impacts will be as important as communicating technical safety.

Taken together, these findings suggest that earning a durable social licence for nuclear energy in Singapore will depend not only on engineering and regulatory excellence, but also on sustained attention to public understanding, trust and engagement.

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About IPUR

The LRF Institute for the Public Understanding of Risk (IPUR) is the premier institute focusing on public risk perception and communication in Asia, a region which faces acute and growing risks relating to public health, the environment, climate change and emerging technologies.

We investigate what people are worried about, where the gaps are between the public's understanding of these issues and the experts' risk assessment, and what interventions can help to bridge these gaps. Launched in 2017, IPUR was established through funding from the Lloyd's Register Foundation and the National University of Singapore.

IPUR strives to shed light on some of the most pressing societal matters which are subject to uncertainty. By dedicating ourselves to transform the risk communication landscape and enhance the public understanding of risk, we seek to improve lives with maximum impact. Our research is multi-disciplinary and brings together social sciences – psychology, economics, public policy, communications, sociology – with marketing, science and engineering.

Our research spans three main risk domains: Data and Technology, Environment and Climate, and Health and Lifestyle. We partner with government, industry and academia to design and evaluate intervention measures, train professionals and students, develop resources, and organise outreach events, stakeholder workshops and conferences.

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