



# ADAPTIVE POLICYMAKING IN JAPAN: A CASE STUDY OF NUCLEAR POLICY POST- FUKUSHIMA

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**Abstract:** In the aftermath of the Fukushima Daiichi disaster in 2011, Japan witnessed a profound transformation in its nuclear policy. This shift has reduced reliance on nuclear energy, prompting significant implications for governance structures. These implications extend beyond the energy sector, encompassing crucial aspects of contemporary societal challenges such as safety, sustainability, and adaptive policymaking. This paper aims to illuminate the evolution of Japan's nuclear policy, delving into the factors, decision-making processes, and public sentiment that have propelled these changes. Through an extensive analysis of historical policy documents, legislative modifications, and qualitative interviews with key stakeholders, government officials, and industry experts, we seek to address pertinent research questions related to the evolution of Japan's nuclear policy, the driving forces behind this transformation, and its broader impact on governance structures. Specifically, we examine its relevance in addressing contemporary societal challenges, including energy security, environmental sustainability, and public safety. Ultimately, this study provides valuable insights into the interconnected nature of evolving nuclear policies and governance structures, serving as a case study that can inform policymaking and governance strategies for addressing similar challenges on a global scale.

*Keywords: Nuclear Policy, Adaptive Policymaking, Fukushima Daiichi, Governance Structures, Societal Challenges*

## 1. Introduction

The Fukushima Daiichi nuclear disaster in 2011 stands as a pivotal moment in Japan's history, prompting a profound re-evaluation of the nation's nuclear policy. The aftermath of this catastrophic event witnessed a

transformative shift in Japan's approach to nuclear energy, with implications reaching far beyond the energy sector. This paper seeks to delve into the intricate dynamics of Japan's adaptive policymaking post-Fukushima, shedding light on the multifaceted factors, decision-making processes, and public sentiments that have propelled this significant policy evolution.

The decision to reduce reliance on nuclear energy reflects a broader reorientation in governance structures, touching upon critical aspects of contemporary societal challenges such as safety, sustainability, and the adaptive nature of policymaking. Through an exhaustive analysis of historical policy documents, legislative modifications, and qualitative interviews with key stakeholders, government officials, and industry experts, this study aims to unravel the layers of Japan's nuclear policy evolution. By addressing pertinent research questions related to the driving forces behind this transformation, the study aims to elucidate the broader impact on governance structures and their relevance in tackling contemporary challenges, including energy security, environmental sustainability, and public safety.

The rationale for undertaking this study lies in the recognition of the interconnected nature of evolving nuclear policies and governance structures. This case study serves as a valuable lens through which policymakers, scholars, and global stakeholders can gain insights into adaptive policymaking strategies amid complex and unforeseen challenges. By examining the nuanced interplay of factors that have shaped Japan's response to the Fukushima Daiichi disaster, this research contributes to a deeper understanding of how nations can navigate similar challenges on a global scale. In doing so, it seeks to inform future policymaking and governance strategies, offering practical lessons drawn from the Japanese experience in addressing the intricate balance between energy needs, environmental concerns, and public safety in the wake of a nuclear crisis.

## **2. Evolution of Japan's Nuclear Policy**

### **2.1 Immediate responses to the Fukushima Daiichi disaster**

The Fukushima nuclear disaster prompted an immediate response from policymakers, resulting in the temporary suspension of operations for reactors undergoing regular maintenance or those halted in response to seismic events. Subsequently, stringent measures were instituted, necessitating a comprehensive "Stress Test" and evaluation to ascertain a power plant's preparedness for potential natural disasters akin to the catastrophic events of the earthquake and tsunami in 2011.

In the summer of 2011, a nationwide power deficit loomed because of the reduced operational capacity of nuclear power plants across the country. Residents in the Tohoku and Kanto regions of Japan endured scheduled blackouts, while national industries and institutions implemented additional or rescheduled holidays to mitigate peak energy consumption. A collective effort, compounded by the lingering impact of the earthquake and tsunami, the departure of numerous foreign workers and tourists, and favorable weather

conditions, enabled the nation to achieve and surpass a mandated 15% reduction in energy consumption (Kanekiyo & Ishimaru, 2011).

From the perspective of anti-nuclear advocates, the successful navigation of a summer largely devoid of nuclear power conveyed a powerful message about the purported dispensability of nuclear energy. However, juxtaposed against the backdrop of natural disasters, international import bans stemming from concerns about radioactive contamination, reduced tourism, escalated energy supply costs, and imposed energy restrictions, the Japanese economy faced adversity. This manifested in the nation's first trade deficit in over three decades, primarily attributed to a substantial \$US 58 billion (25.2%) surge in fossil fuel imports. In the long term, despite the natural decline in Japan's population, the enduring repercussions of elevated energy costs and constrained supply posed a persistent threat to the economy, potentially leading to profound societal and industrial ramifications, including unemployment and diminished competitiveness (Vivoda, 2012).

## 2.2 Phases in the post-Fukushima nuclear policy evolution

The Fukushima Daiichi nuclear disaster, which occurred in March 2011 in Japan, had a profound impact on global perceptions of nuclear energy and prompted a re-evaluation of nuclear policies in many countries, including Japan. The post-Fukushima nuclear policy evolution in Japan can be broadly divided into several phases:

### a) Immediate Response (2011-2012):

- **Emergency Measures:** In the aftermath of the Fukushima disaster, the Japanese government took immediate steps to contain the crisis, including evacuating residents from affected areas, implementing exclusion zones, and attempting to cool and stabilize the damaged reactors.
- **Nuclear Moratorium:** In response to public concerns and safety considerations, the Japanese government declared a temporary moratorium on the operation of existing nuclear reactors and delayed plans for new nuclear projects.

### b) Policy Reflection and Reform (2012-2013):

- **Energy Policy Review:** The Japanese government initiated a comprehensive review of its energy policy, considering the lessons learned from Fukushima. This process involved assessing the role of nuclear energy in the country's energy mix and considering alternative sources, such as renewables.
- **Nuclear Regulation Authority (NRA):** The NRA was established in September 2012 as an independent regulatory body to enhance the oversight of nuclear facilities and improve safety standards.

### c) Strengthening Safety Measures (2013-2016):

- **Safety Upgrades:** Existing nuclear facilities underwent safety assessments and upgrades to meet new and more stringent safety standards set by the NRA. These measures aimed to address vulnerabilities exposed by the Fukushima disaster.
- **Restart of Some Reactors:** Despite public opposition, the government approved the restart of a few nuclear reactors that met the new safety criteria. The process was slow, and not all reactors were brought back online immediately.

### d) Energy Mix Diversification (2016-2018):

- **Increased Emphasis on Renewable Energy:** Japan committed to increasing the share of renewable energy in its energy mix. Policies and incentives were introduced to promote the development of solar, wind, and other clean energy sources.
- **Nuclear Plant Decommissioning:** Some older and more vulnerable nuclear reactors were permanently shut down, and plans for decommissioning were initiated.

## 3. Driving Forces Behind Policy Transformation

### 3.1 Public sentiment and anti-nuclear movements

Public sentiment played a crucial role in shaping the policy response to the Fukushima Daiichi accident. The disaster generated widespread fear and anxiety among the Japanese population regarding the safety of nuclear power. The perception that the government and the nuclear industry had not adequately addressed safety concerns eroded public trust. There was a growing sentiment that the risks associated with nuclear energy were too high, especially in a country prone to earthquakes and tsunamis.

Anti-nuclear movements gained momentum in the aftermath of the disaster. Grassroots organizations, activists, and concerned citizens mobilized to protest against nuclear power and demand a shift toward alternative energy sources. These movements organized demonstrations, public meetings, and campaigns to raise awareness about the risks of nuclear energy and advocate for a transition to safer and more sustainable alternatives.

In response to public sentiment and the anti-nuclear movements, the Japanese government undertook a reassessment of its energy policies.

One of the key policy changes was a shift away from nuclear power. In September 2012, the government announced its intention to phase out nuclear power and increase reliance on renewable energy sources (Tabuchi, 2012). This marked a significant departure from the pre-Fukushima energy policy, which emphasized the expansion of nuclear power as a key component of Japan's energy mix.

Subsequent policy measures included the establishment of a new regulatory framework to enhance nuclear safety standards, the decommissioning of older and risk-prone nuclear reactors, and a greater focus on

renewable energy development. The Feed-in Tariff system was introduced to promote the use of renewable energy by providing incentives for its production.

#### 4. Addressing Contemporary Societal Challenges

##### 4.1 Energy security in a post-nuclear Japan

The closure of numerous nuclear power plants has precipitated a substantial decline in Japan's energy self-sufficiency rate, plummeting from 20.2 percent in 2010 to a mere 11.5 percent in 2011 (Zhihai, 2019). This figure has persistently remained below 10 percent since, starkly underscoring the nation's vulnerability in comparison to other countries. Because of heightened dependence on foreign energy sources, particularly with over 80 percent of imported oil originating from politically unstable Middle Eastern countries, Japan not only grapples with budgetary deficits but also faces escalating political risks.

Furthermore, Japan's heavy reliance on fossil energy, constituting 94 percent of the energy mix during the 1973 oil crisis, has rebounded to 89 percent in 2016 (*Japan's Vulnerable Energy Supply Situation - The Federation of Electric Power Companies of Japan (FEPC)*, n.d.). This resurgence, driven by the need to compensate for the suspension of nuclear energy, renders Japan susceptible to potential oil shocks, given that crude oil comprises over 40 percent of its energy sources. The attendant ramifications include a considerable surge in electricity prices, reaching a peak in 2014, thereby adversely affecting both industries and households.

Efforts to address the energy crisis by augmenting renewable energy development are constrained by the inadequacy of renewables to substitute for nuclear and fossil energy in ensuring Japan's energy security. Despite a marginal increase in the proportion of renewable energy from 4.3 percent in 2010 to 7.0 percent in 2016, the high costs of equipment such as solar panels pose formidable barriers to achieving universal renewable energy utilization in the near term.

To contend with these challenges, Japan must embark on strategic endeavors to cultivate alternative energy sources. Notably, the rejuvenation of renewable energy emerges as the sole viable solution, given Japan's meager primary energy reserve. While the reopening of nuclear power plants remains impractical due to the protracted decommissioning of Fukushima Daiichi and unresolved displacement issues, a concerted focus on renewable energy represents a pragmatic avenue.

The Strategic Energy Plan, conceived in July 2018, aspires to elevate Japan's energy self-sufficiency rate from 8 percent in 2016 to an ambitious 24 percent in 2030. Yet, the plan's ambiguity and lack of clarity regarding the prioritization of energy policies pose significant challenges. Despite the goal of making renewable energy the predominant power source by 2030, the plan concurrently entertains the prospect of restoring nuclear energy to a 20-30 percent share (Morishima, 2018).



Former Prime Minister Koizumi Junichiro's advocacy for a "zero nuclear energy" stance resonates with those contending that Japan should divorce itself entirely from nuclear energy (Brasor, 2013). Notwithstanding the Fukushima crisis, Japan has been reluctant to decisively abandon nuclear energy, unlike countries such as Germany. The aftermath of the Fukushima incident, however, presents an opportunity for Japan to pivot its energy policy towards accelerated renewable energy development, as indicated by a burgeoning public sentiment aligning with the view that nuclear energy is antiquated and renewable energy is the requisite trajectory.

Nevertheless, instilling confidence in the potential of renewable energy to secure Japan's energy supply necessitates substantive strides in innovation. Exemplifying this imperative is Toyota's launch of the Mirai hydrogen fuel cell vehicle in 2014 (*Toyota Ushers in the Future with Launch of "Mirai" Fuel Cell Sedan | Toyota Motor Corporation Official Global Website*, 2014), emblematic of an automotive industry wherein vehicles serve not only as energy consumers but also as suppliers during emergencies. Such innovative approaches across industries are pivotal for steering Japan's energy policy toward a sustainable and resilient future.

#### 4.2 Renewable energy

The government, in collaboration with utility providers, diligently endeavoured to augment the electricity supply by exploring various avenues. Immediate measures involved reactivating underutilised or mothballed thermal generating plants reliant on fossil fuels, alongside the construction of new facilities. In support of these initiatives, the government eased certain restrictions and extended financial incentives for self-generation of electricity. This concerted effort resulted in a significant surge in the proportion of power generated from natural gas, escalating from 30 to approximately 45 percent. The utilization rate of gas-fired power stations concurrently soared from a mere 50 percent to nearly full capacity at 100 percent.

Simultaneously, the government took proactive steps to expedite the integration of renewable energy sources. A comprehensive feed-in tariff (FIT) scheme, initially intended to curtail fossil fuel-fired power generation, was under development before the earthquake. Approved by the cabinet on March 11, 2011, just hours preceding the disaster, the scheme was subsequently revised to offer more generous incentives. Approved by the Diet in August 2011, the original tariff levels, established in April 2012, particularly favoured solar photovoltaic (PV) installations, offering up to 42 yen per kilowatt-hour (kWh) for a duration of up to 20 years, contingent on installation size. Consequently, most applications, exceeding 90 percent, pertained to solar PV. By April 2013, the end of the inaugural operational year, the government had sanctioned almost 19 gigawatts (GW) of new PV capacity (*Japan Begins Feed-in Tariff Scheme to Accelerate Renewable Energy Promotion / JFS Japan for Sustainability*, 2011).

The overwhelming response led the rate-setting commission to recommend a tariff reduction to no more than 38 yen/kWh in April 2013, reflecting the substantial decline in solar panel costs. Despite this adjustment, an additional 46 GW of capacity was licensed in the ensuing 12 months. However, the actual installed capacity grew more modestly, reaching nine GW by April 2014. It became apparent that some successful license applicants were strategically waiting for further price reductions before initiating approved projects.

Challenges impeding the growth of renewable energy sources extended beyond less favourable tariffs. A 2011 Ministry of the Environment study identified wind power as having the greatest potential in Japan (Mori & Tomotsune, 2011). Nevertheless, wind farms faced intricate environmental impact assessments, and approximately two-thirds of promising onshore areas were situated in the northern regions, straining local grids in the absence of robust interregional connections. By mid-2013, even the incorporation of new PV capacity encountered challenges, with power grids reportedly nearing their capacity to absorb renewable sources.

The issue reached a critical juncture in the fall of 2014 when five out of the 10 regional utilities suspended the review of applications for connecting new renewable capacity to the grid, citing concerns about oversupply and network instability (Duffield, 2016). This predicament was particularly acute in southwestern Kyushu, where certified solar power capacity under the FIT scheme exceeded peak demand. In response, the Ministry of Economy, Trade and Industry (METI) established a working group to determine a formula for calculating the grid's capacity for renewable power. In early 2015, the Agency for Natural Resources and Energy (ANRE) introduced a revision to the FIT scheme, establishing deadlines for constructing approved renewable projects, allowing utilities to limit renewable-generated electricity output on an hourly basis, and expanding the scope of curtailment to facilities smaller than 500 kilowatts (Mori & Tomotsune, 2011).

While these changes were justified as necessary for integrating additional solar capacity, critics alleged that the reforms aimed to restrict renewable energy on the grid to facilitate the accommodation of electricity from nuclear power plants upon their return to service.

## 5. Global Relevance and Lessons

### 5.1 Comparisons with other countries' nuclear policies

In the aftermath of the initial explosion at the Fukushima nuclear plant, Germany swiftly decided to expeditiously decommission its oldest reactors. While this course of action has been characterized by some critics as an excessively precautionary measure, it ultimately resulted in the hastened closure of all remaining reactors by 2022 (*The Nuclear Phase-out in Germany*, n.d.), inflicting substantial financial losses upon the operators. A year before the 2010 disaster, nuclear energy constituted more than a fifth of Germany's electricity generation, concurrently with renewables contributing to 17%. However, in the preceding year, renewables emerged as Germany's predominant power source, commanding a significant 45%, while nuclear

energy's share dwindled to a mere 11%. This transformation underscores the expansive proliferation of solar and wind technologies, propelling Germany to the global forefront as the fifth-largest in installed renewables capacity.

The trajectory towards renewable energy dominance is poised to intensify, with projections indicating a prospective surge to 65% by the year 2030.

In the aftermath of the Fukushima Daiichi nuclear disaster in 2011, Germany made a historic decision that reverberated throughout the global energy landscape. Chancellor Angela Merkel, in response to heightened concerns regarding nuclear energy safety prompted by the Fukushima incident, announced a comprehensive plan to phase out nuclear power in Germany. This marked a substantial departure from the nation's prior commitment to nuclear energy.

The Fukushima Effect prompted nations worldwide to reassess the safety and viability of nuclear energy. Germany, already a trailblazer in renewable energy with its ambitious *Energiewende* (energy transition) policy, faced increased public pressure to completely abandon nuclear power.

Chancellor Merkel's decision, a result of mounting public concern and political pressure, represented a significant policy reversal. The German government opted to immediately shut down eight of the country's 17 nuclear reactors and outlined a plan to phase out the remaining reactors by 2022. This decision sharply contrasted with the previous government's stance, which had extended the operating lives of existing nuclear plants.

The phase-out plan was integral to Germany's broader *Energiewende* initiative, a commitment to transition from conventional energy sources to a sustainable, low-carbon energy system. Key components of *Energiewende* included an augmented focus on renewable energy sources—wind, solar, and biomass—accompanied by energy efficiency measures and grid enhancements (*Energiewende - World Nuclear Association*, n.d.).

Post-Fukushima, Germany substantially increased investments in renewable energy infrastructure, catapulting the country into a global leadership position in wind and solar power capacity. This transition not only spurred innovation and technological advancements but also stimulated economic growth and job creation in the renewable energy sector.

While the decision to phase out nuclear power garnered support from environmentalists and the public, it was not devoid of challenges and critics. Some contended that the accelerated phase-out could lead to energy shortages, necessitating increased reliance on fossil fuels in the short term. Additionally, concerns arose



regarding the economic implications for energy-intensive industries and the stability of the power grid during the transition.

Germany's nuclear phase-out stands as a compelling case study for nations grappling with the role of nuclear energy in their power portfolios. The country showcased that a rapid transition away from nuclear power is feasible with a well-planned strategy and robust investments in renewable alternatives. However, it also underscored the significance of careful consideration of economic and energy security implications during such transitions.

In conclusion, the Fukushima Daiichi nuclear disaster constituted a pivotal juncture for Germany, instigating a decisive shift away from nuclear power toward a renewable energy future. The nation's commitment to the Energiewende initiative not only positioned it as a global leader in sustainable energy but also demonstrated the viability of a nuclear phase-out. As the world contends with the challenges of energy transition and climate change, Germany's experience provides invaluable insights for policymakers aspiring to forge a cleaner, more sustainable energy future.

## 6. Japan's Energy Crossroads: Navigating a Nuclear Revival Amid Global Crisis

The prevailing global energy crisis, exacerbated by the Russian invasion of Ukraine and the resultant surge in commodity prices, has dealt a substantial blow to Japan. As a resource-poor nation heavily reliant on energy imports, the country faces formidable challenges. The repercussions of this crisis have been compounded by blackout concerns in Tokyo, which, coupled with escalating electricity bills, have elicited a perceptible softening of public opposition to the reactivation of nuclear reactors.

In response to these multifaceted challenges, a newly articulated policy by a government advisory panel aims to strategically "maximize the utilization of existing nuclear reactors." This represents a notable departure from the post-Fukushima strategy, which had sought to phase out nuclear power plants. The proposed approach involves expediting the restart of dormant reactors and extending the operational lifespan of existing facilities beyond the conventional 60-year threshold (*Japan Extends Nuclear Reactor Operation beyond 60-Year Cap | NHK WORLD-JAPAN News, 2023*). Additionally, the policy emphasizes the development of advanced reactors to replace those slated for decommissioning.

A palpable sense of frustration, particularly among business leaders, has underscored the urgency of reevaluating the nation's energy landscape. Pledges to attain net-zero carbon emissions by 2050 are viewed as precarious if Japan persists in compensating for lost nuclear power by burning additional coal, natural gas, and fuel oil. The imperative for a comprehensive and sustainable energy strategy is underscored by the historical context: Japan, before the Fukushima disaster, derived approximately one-third of its electricity

from 54 nuclear reactors. Presently, a mere nine are operational, necessitating a reliance on fossil fuels contrary to the trajectory outlined in its environmental commitments.

In December 2022, Prime Minister Kishida Fumio of Japan delineated a comprehensive ten-year roadmap for the nation's "Green Transformation" (GX), encompassing strategic measures to resuscitate the nuclear industry, fortify the national grid, and initiate the implementation of carbon pricing. This intricate endeavor mandates a nuanced equilibrium between considerations of safety, energy security, and environmental imperatives ("NEA Annual Report," 2022).

Japan, being an island nation bereft of abundant natural resources, has historically confronted precarious energy dynamics. A historical reliance on Middle Eastern oil propelled Japan's post-World War II economic ascendancy but proved detrimental during the oil crisis of 1973-74. Subsequently, Japan diversified its energy portfolio by expanding its nuclear fleet, developing liquefied natural gas (LNG), and exploring renewable technologies within the ambit of the "Sunshine Project."

Prime Minister Kishida's administration, in response to recent energy challenges, advocates a reinvigoration of nuclear power. The novel energy-policy roadmap advocates for "maximizing the use of power sources that contribute to Japan's security and are highly decarbonizing," encompassing both nuclear and renewable sources. Although nuclear power constituted approximately 8% of the electricity supply in the preceding year, the government's envisaged targets foresee a resurgence to 22-24% by 2030. Plans have been unveiled to prolong the operational lifespan of reactors from 40 to 60 years and to facilitate the construction of new ones (*Japan Adopts Plan to Maximise Use of Nuclear Energy*, 2022).

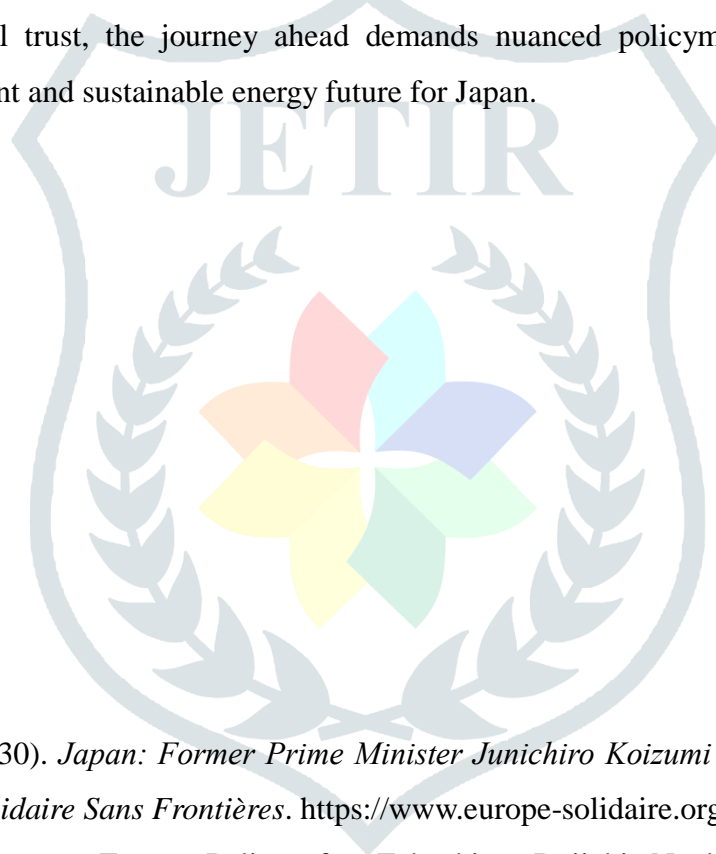
Conversely, the ambitions regarding renewable energy expansion appear notably less ambitious than advocated by some stakeholders. The government envisages a rise in the share of renewables in electricity to 36-38% by 2030, a figure that is slightly over half of the target projected by the European Union. Furthermore, the strategy allocates funds for a substantial enhancement of transmission lines, particularly between the wind-rich but sparsely populated northern island of Hokkaido and the populous centers around Tokyo. However, initiatives to enhance the flexibility and nimbleness of the grid have encountered stagnation. Notwithstanding the commendable move towards implementing carbon pricing, concerns persist that these measures might be insufficient and tardy. Japan's slated carbon tax is anticipated to be enforced only in 2028, potentially at levels insufficient to effectuate substantial impact.

Public sentiment is perceptibly shifting in favor of these policy adjustments. According to polls conducted by Nikkei, a prominent business newspaper, 53% of the Japanese populace supports the reactivation of reactors, contingent upon stringent safety assurances, marking the first instance of majority support in over a decade ("Most Japanese Back Nuclear for First Time Since Fukushima," 2022). Notably, residents proximate to the reactors express a desire to retain them, recognizing the associated subsidies. Nevertheless, a pervasive sense

of mistrust pervades, with a considerable segment opposing reactor reactivation. Notably, in Onagawa, residents have initiated legal action to impede reactivation, citing profound flaws in the government's disaster-evacuation plan.

## 7. Conclusion

Japan stands at a critical juncture in its energy trajectory, navigating the complexities of a global energy crisis and geopolitical uncertainties. Prime Minister Kishida's "Green Transformation" roadmap signals a strategic re-evaluation, emphasizing the revival of nuclear power amid shifting public sentiments and economic imperatives. As the nation seeks to strike a delicate balance between energy security, environmental sustainability, and societal trust, the journey ahead demands nuanced policymaking and a collaborative approach to shape a resilient and sustainable energy future for Japan.



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