Reviewing Nuclear Energy Policies from a Wider Scope in the Japanese Context

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Japan's "S+3E" framework of energy policy cannot accommodate policy discussions of climate change and sustainability

The goal of Japan's energy policy of the past few decades has been to optimize the balance between the three key policy aims, namely the "3Es" or Energy security, Economic Efficiency, and the Environment[1]. Following the Fukushima Daiichi accident of 2011, the importance of "Safety" as a precondition for the realization of the 3Es became more pronounced, and the acronym was duly changed to "S+3E" to denote that safety always comes first.

Historically, a key aim of the "S+3E" framework has been to propel Japan's efforts in domestic nuclear development programs. This can also be inferred from the fact that the obvious conclusion of this policy framework is that nuclear is an optimal energy source for Japan, so long as safety can be assured.

This framework, while succinct and efficient as a tool to break down Japan's energy policy amidst the historic interplay of issues, does not appropriately capture the wider policy discourse relating to emerging issues like climate change, decarbonization and sustainability. In addition, policy debate organized around this framework has generally been restricted because each term (Energy Security, Economic Efficiency and Environment) is effectively defined and understood in the context of an era now passed –an era of GDP growth, demand/population growth, efficiency-oriented, centralized growth poles, with visible, toxic pollution and direct environmental destruction as the counter effects. It is only a slight stretch to say that the 3Es effectively signified Fuel (Oil) Security, Prioritization of Large Industries Based in Metropolises, and Anti-pollution or Conservation. Most of these issues have not lost their

[1] Discourse on the "3Es" publicly appeared in the 1970s, gained traction in the 1990s and was adopted in official policy documents by the early 2000s. Note that Japan's "3Es" differ from the majority of global discourse on the "3Es" on energy, as it does not include energy equity.

significance, however, the global causes and consequences of climate change, with its links to the complex and philosophical agenda of fairness, justice, civilization, modernity and “development”, cannot be adequately discussed within this frame of mind [3].

Hence, the problem that this article would like to raise is that Japan is attempting to promote new energy technologies and innovations based on distinctly domestic, partly outdated and fundamentally incompatible rhetoric. It can be argued that Japan needs to deepen its debate on climate change and sustainability, from which we can expect a renewed policy framework/platform; one that complements or replaces the “S+3E” principles while encompassing broader societal values and addressing the increasingly complex, socio-technical, global-national-local and near-to-long-term risks that Japan faces today.

A society-wide approach to policy discourse encompassing broader societal values is lacking

So far, governmental efforts in tackling climate change have largely focused on econo-technological perspectives, by promoting “green growth” for leading domestic industries. Engagement in society-wide discussions of climate change and sustainability policies, taking into account the diversity of societal values and the breadth of social policy issues has generally been neglected.

One point of reference to understand this shortfall could be the EU’s energy policy, namely the European Green Deal (EGD).

A quick comparison of official communication issued on the EGD versus that of the Japanese Green Transformation (GX) shows that the former has much more diversity in the societal values it upholds. While the GX can be roughly explained as an industrial policy, aiming for “green growth” by kick-starting major Japanese industrial players in the global grabs for decarbonization markets, the EGD touches upon a wider range of societal issues, has visions inclusive of a wider range of stakeholders, and is officially interlinked, in terms of policy framework and budget, to more policy areas. Examples of values that are emphasized in the EGD communication include sustainability, health, inclusivity, biodiversity, responsibility, fairness, transparency, accountability, resilience and circular economies.

Interestingly, a survey of Japan’s official policy papers on nuclear energy shows that plans such as the “Future Nuclear Energy Policy Direction and

Action Guidelines" of April 2023, decided at the cabinet level, or the preceding "Basic Policy for Nuclear Energy" of March 2023, issued by the Japan Atomic Energy Commission, touch upon a wider range of societal values. The health and wellbeing of hosting communities, as well as health and safety infrastructure for the general public are key issues in these documents. Gender and societal diversity are also mentioned, as well as the importance of long-term policy perspectives that take into account the interests and uncertainties regarding future generations.

It can be understood that the recent focus on decarbonization and "green growth", at the expense of other equally relevant social issues is a characteristic of the recent GX initiatives, which further narrowed the already compact scope of Japan's energy policies.

Japan needs to renew its policy framework/platform to be able to address complex policy discussions

There is no room for doubt that decarbonization, in particular the carbon neutrality goal set at 2050, cannot be achieved by "green growth" plans or industry-oriented visions alone. While climate change initiatives led by the Japanese Ministry of Environment adopt a more society-wide approach, such initiatives are insufficient, precisely because they do not overcome the inter-ministerial divide and speak with authority towards the energy and industry sectors. A fundamental solution to this problem requires extensive political, bureaucratic and industrial reforms.

Such a renewed framework is critical not only for rethinking Japan's energy policy as a whole, but also for updating the rationales of nuclear energy development. This is crucial as we approach the 15th year since the Fukushima disaster, and in the wake of renewed high-level enthusiasm for both existing commercial reactors and longstanding-yet-undeveloped reactor concepts.

Rethinking the values and risks of nuclear energy and fuel cycles in Japan from a wider scope:

In the meantime, and in the specific context of nuclear energy policy, a small but meaningful step in the direction stated above could be taken by rethinking the values and risks of present policies from a wider scope. The remainder of this paper aims to illustrate the relevance of such attempts through four examples.

Example 1) Responsibility, accountability and transparency in nuclear energy policy

The first example is deceptively simple: Embrace the wider scope of responsibility, accountability and transparency in nuclear policy. This should start with the question, “To what extent will the state, developers, consumers, or hosting municipalities be responsible to the public for nuclear energy development?”

Historically, the initiatives for nuclear development have centered on “national development” and “national security” narratives, voiced by bureaucratic agencies such as the Ministry of Economy, Trade, and Industry. Electric Power Companies and local hosting municipalities used this logic as a basis for surrecting their “societal responsibilities” to develop nuclear power. These actors did not directly engage with the public, because their “public approval” was deemed obtained through their being requested to cooperate with a national agenda via the government. This arrangement has become controversial over the years, as public trust in the government dropped, waves of privatization fell on the utilities, development lagged far behind schedules promised to hosting communities, and a significant segment of the public became, at best, unsure of whether to go nuclear.

Despite such trends, many in the nuclear industry still demand for “the State to take the lead” in development. The recent hype in official GX documents may seem at first glance to be a return call. However, compared to the past, the State clearly has larger commitments to renewables and grid technologies, and lacks the ability to offer a steady foothold domestically or overseas. Meanwhile, the privatization of the electricity market is only one of the reasons why developers should consider the merits of substantially taking “public relations” into their own hands, and try to find innovative ways to convince consumers that their nuclear products are not the same. The key to such an approach is likely to be found through renewed interpretations of responsibility, transparency and accountability.

Example 2) Resilience, health, justice and inclusiveness in systemic adaptation to climate change

The second example relates to the fact that attempts to understand how climate change would affect Japanese society have been extremely limited so far. The latest Climate Change Impact Assessment Report, published in December 2020 by the Ministry of Environment, shows an astonishing lack of

sufficient studies to assess how climate change would affect domestic industry, energy, commerce, finance, insurance, or medical systems. This severely limits domestic capabilities of climate adaptation.

While nuclear energy systems are no exception, the sector could lead Japan's discourse on sustainability and adaptation by investing in studies and strategies to approach issues of systemic climate risks and climate resilience in energy systems. This includes supply chain effects, effects to industrial safety, disaster and crisis management, medical systems and care labour. Special consideration of justice and inclusiveness, for instance in the amplified or overlapping effects to vulnerable populations, would set a good example for other policy areas. Existing expertise and systemic thought in areas such as radiation protection, risk assessments and risk-informed decision-making, and strategies towards risks and uncertainties may be leveraged as an advantage of the nuclear field.

Example 3) Fair, sustainable, clean, thriving, or innovative - considerations for the economics of reactor design

There is a longstanding argument that nuclear energy is important for "the economy", which refers primarily to GDP growth. However, the recent global arguments on sustainability dictate that it is relevant to take a closer inspection, and widen this argument to include other factors that affect reactor economics. This means diving into the criteria of existing principles of "safety", "security", or "resilience". It means contemplating their interrelations with other values such as "sustainable", "innovative", or "fair", taking into account actual system configurations and implementation scenarios –not just theoretical, engineering concepts. Among the many possible issues, an illustrative example concerns the economics of the existing reactor fleet.

The role of existing reactors can currently be understood as a second string within nuclear energy policy documents. Apparently it is something transitionary which we would be better without, were it not for the difficulties of getting safer, "advanced" and "innovative" reactors online. But what about the Japanese value of "mottainai", which resonates with values of circular economies? Have the economics of reactor-fuel designs really been thought out carefully, taking broader societal concerns into account?

Let us compare the economics of existing large-scale reactors with that of Small Modular Reactors (SMRs). Modular manufacturing, the key to economic efficiency at smaller scales, means that the bulk of investment goes to the

manufacturing facility, with even higher upfront costs than conventional reactors. Securing a project pipeline becomes imperative, and would require a strong hold on overseas orders as well as domestic demand. All of these factors means that SMR manufacturing entails less long-term flexibility and more consequences of delays or defects, rendering the uncertainty of project risks astronomical. In addition, there would probably be no second chance to improve economics for module-manufacturing facilities (as opposed to the anticipated learning effects for reactors which are claimed much more often).

Nuclear finances are tighter than ever, and even overseas cases of corporate power purchase agreements and other forms of project financing, which have been heralded domestically, have yet to be proven feasible. If we look at the present economic and political landscape, large and long-term investment is increasingly difficult to secure, as demand for such finances are soaring due to ambitions of society-scale decarbonization and digitalization. In this regard, the economics of existing reactors starts to make much more sense.

We also do not know how smaller, modular construction and operation would affect the economic benefits to hosting communities, as there is expected to be less construction on site. Would public acceptability really be higher for SMRs, if it meant the supply chain would be more vertically integrated? At the very least, Japanese policy makers should conduct a thorough analysis of implementation scenarios for “next-generation” reactors, to clarify the conditions for such economic comparisons. Since most of the concerns above arise from modular manufacturing, alternatives such as nuclear imports should also be analysed.

The bottom line here is that reactor economy cannot be meaningfully considered from a wider scope without concrete implementation scenarios. The economics of one or two first-of-a-kind small-scale reactors, brought online with extensive governmental support, would differ vastly from the promised economy of market-driven modulated designs.

Example 4) Safety, health, biodiversity and nature-positive - considerations of environmental and health impacts of reactor design

An examination of SMRs can also be relevant to the discussion on health and safety. A key advantage of many SMR designs is that they are safer for people and the environment, due to passive safety designs including “evacuation-free” reactor configurations. This novelty of the approach to safety (as opposed to

incremental improvements in quantitative risk measures) is an important contribution of SMRs.

But this does not automatically mean that SMRs are better in terms of health and the environment, especially when we consider the actual conditions of implementation. For instance, has it really been proven that these "next-generation" reactors outperform their predecessors, when considering not only severe accident risks but also multiple potential hazards throughout their system life-cycles? Several studies point out that certain configurations of Small Modular Reactors (SMRs) may have a larger environmental footprint compared to larger existing designs due to factors such as module transportation and a larger quantity of low-level or non-radioactive waste production [1, 2]. Such features could be even more pronounced if actual implementation scenarios such as domestic facilities for module manufacturing, fuel fabrication, waste management, and distributed siting of reactors are taken more accurately into account, within the Japanese context.

There is also doubt as to whether newbuilds would be feasible in novel sites. Hosting nuclear facilities entails huge political risks, and for a good reason – the burden on the community and the local administration, as well as long-term political relations with neighboring localities, and municipal or national governments are key concerns. There are also political risks at the national level, for politicians as well as other key agencies that have traditionally engaged in nuclear siting policies. Many questions remain: If there are a (potentially larger) number of smaller (or "safer") reactors in the same sites that used to host (potentially fewer) large (or more accident-prone) reactors, how do we evaluate the situation? In terms of absolute risk? The fairness or justness of risk distribution? These are all issues that require careful analysis and consideration.

Conclusion: There will be "no regrets" for reviewing nuclear energy policies from a wider scope

Those who advocate for a continuation or expansion of past nuclear policies often state that the energy circumstances of Japan have not changed substantially, notably the scarcity of domestic resources that can serve as a cheap and stable baseload. While this is certainly true, arguments based entirely on such observations ignore the fact that energy systems are not mere physical artefacts. Geographic material balances are only one aspect; political or economic power balances, trends of governing institutions, market preferences and consumer lifestyles, as well as the more philosophical aspects

pertaining to stakeholders' perceptions of what should be "securitized", what constitutes a "threat", how much risk is "acceptable" or how to evaluate the future also play an important role in shaping energy systems. What this article aims to highlight is that, policy discussions of energy, including nuclear, need to recognize the implicit role that these less material aspects have played in past discourses, and aim for a policy framework/platform that makes the explicit discussion of such values possible.

At the same time, it should be acknowledged that such a framework/platform transcends the borders of nuclear or even energy policy. This is a necessary transgression, as the truly controversial issues of the nuclear debate require a relative perspective, comparing nuclear solutions with other options. The real controversies regarding nuclear policy lie in whether we should expand present capacity, and whether we should operate existing reactors. These issues invoke questions encompassing other energy sources, demand outlooks, societal risks, and future visions. Such factors are outside the realm of what would be considered nuclear energy policy.

On the flip-side, setting up a broad framework/platform for deliberating these key questions may actually aid the speedy management of the most pressing problems in the nuclear field. Radioactive waste disposal, nuclear disaster management, non-proliferation, nuclear security, and what to do with the aftermath of the Fukushima disaster, are all urgent issues with long-term and widespread consequences, and are much less polarized than the pro-/anti-nuclear debate. Hence, if such politicized issues could be given a distinct political framework, where they can be deliberated carefully, based on the broader perspectives of what criteria our energy infrastructure should meet (which will take time), the less polarized issues may become more manageable. This prioritization of less polarized issues is likely to benefit society whichever way the pro/anti-nuclear debate falls.

<References>

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