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Keywords: disaster, Fukushima, nuclear energy, policy change, risk, technology

Abstract

How can large-scale socio-technical disasters prompt policy shifts beyond their local environment? We compare the impact of the Fukushima Daiichi nuclear power plant disaster of March 11, 2011, on subsequent American, French, and German nuclear energy policies. This paper introduces the sensitizing concept of a "shelf life" to identify mechanisms that limited the impact of this disaster in the US and France but that enabled it to travel to Germany. American and French policymakers placed symbolic distance between their nation's nuclear infrastructure and Fukushima by framing the disaster as a contingent and technical problem to be resolved with superior safety preparation. While this technicist orientation can be found in the initial German response, its distancing effects are offset by a conjunction of three mechanisms that moved Fukushima to the center of German society and politics and ultimately created the conditions for a complete phase out of all of Germany's nuclear power generation. This included 1) a renewables energy industry eager to move into the void left from nuclear power reduction, 2) deep cultural and socio-political affinities across the two nations that were expertly mobilized by German anti-nuclear protest organizations, and 3) the unequivocal ethical messaging produced by a high-profile national committee. Taken together, these mechanisms collapsed interpretive and cultural distance between Japanese and German nuclear infrastructures, enabling the shock of Fukushima to ripple powerfully through the German energy grid for generations to come.

"Governments around the globe are seeking cleaner ways to generate power…and most countries are deciding they cannot do without nuclear energy." - *New York Times*, August 2010

"The unfolding crisis…feeds into a resurgence of doubts about nuclear energy's safety — even as it has gained credence as a source of clean energy." – *New York Times*, March 2011

On March 11, 2011, a magnitude 9.0 earthquake—the largest on record in Japan—triggered a sequence of events that lead to a nuclear meltdown at the Fukushima Daiichi power plant. The facility contains six separate nuclear reactor units. At the time of the earthquake only units 1-3 were in operation. Units 4-6 were in various states of cold shutdown. The earthquake set off an automated shutdown sequence of the operating reactor units at the site. The key problem of a shutdown is that nuclear material requires cooling and long-term storage as it decays. The earthquake severed the electrical power lines needed for this cooling process. At first the onsite backup diesel generators provided sufficient power to handle it. Approximately 45 minutes later the plant was hit by several large tsunamis estimated to have reached 15 meters. Subsequent reports suggest that the power plant had a maximum safety design for handling a 5.7 meter tsunami, although warnings of the potential for much larger tsunami waves had been made for well over a decade (Perrow 2011; Wang, Chen and Yi-chong 2013). The impact of the tsunami and the ensuing flood disabled the backup generators, which were located in the basement of the reactor turbines. The flood also severely damaged essential electrical monitoring systems, washed away vehicles, and scattered debris. The plant was left without a significant power source to cool the damaged reactors and radioactive pools of spent fuel. Over the next several days, as the reactor cores lost cooling capability, a combination of steam, hydrogen, and faulty

operating systems led to meltdowns in reactors 1-3 and significant damage to reactor 4 due to hydrogen coming from shared venting ducts with unit 3.

The result was a massive release of radioactive fuel and material onto the Japanese mainland and surrounding ocean. The Japanese Science Ministry estimated radioactive cesium had contaminated 11,580 square miles of land surface and that about 4,500 square miles had radiation levels exceeding the countries allowable exposure rate (1 millisievert per year). In addition to a number of emergency relief employee fatalities and about 20,000 civilian deaths, mostly due to the earthquake and tsunami waves, approximately 300,000 people had to be evacuated from their homes and communities in the 100-mile radius of the meltdown. Subsequent tests by Japanese officials are finding very high contamination rates among people in the area at the time of the meltdown, with unusually high levels of thyroid cancers among children who live near Fukushima, along with elevated levels of other cancers, cataracts, and various brain and heart diseases (Rosen and Claussen 2016). Japan is still reckoning with the ongoing toll on its community relationships, self-efficacy, and economy (Caldicott 2014).

Just before the disaster, numerous articles, like the August 2010 *New York Times* referenced above, referred confidently to the possibility of a global "nuclear renaissance." Leaders and policy elites from the major nuclear power producing nations routinely discussed the central role of nuclear power sources in slowing global climate change. On March 11, 2011, that world changed. Over the last five years there has been much less talk about a "nuclear renaissance" in the post-Fukushima press. However, the "resurgence of doubts" referred to in the second *New York Times* article has also turned out to have a fairly small impact on the global production of nuclear energy. The two largest nuclear power producing nations, the United States and France, have made little meaningful change to their nuclear production, usage, and

overall energy policies. There are two main exceptions. First, there is Japan itself, which suspended its nuclear power production after the disaster, although it has been gradually bringing power plants back online since last August. The other exception is Germany. Shortly after the Fukushima meltdown, the German government announced that it would be shutting down all nuclear power production and fully committing the nation to a renewable energy policy. The Angela Merkel-led CDU government would commit to a dramatic shift from its stated goals for nuclear power production upon coming into office and, instead, return to the policy of its predecessor and rival, the Gerhard Schröder-led SPD-Green coalition nuclear phase out plan.

The post-Fukushima world provides an opportune case for the study of policy change in response to a major socio-technical disaster. It begs the question: How and when do large-scale disasters impact policy beyond the immediate environment within which they occur? More specifically, how did Fukushima Daiichi become a "disaster without borders" (Hannigan 2013) in certain national contexts but not others? Previous studies of the cross-national impact of disasters have suggested that major disasters can become a "focusing event" (Birkland 1998; Birkland 2006) that enable concerted attention to be paid to salient policy issues. Alternatively, disasters can also be mobilized to produce "fantasy documents" that serve as technical planning devices. 'Fantasy documents' embrace a technicist or engineering perspective that provide justification for the continuation of high-risk endeavors like nuclear power generation, despite the impossibility of controlling their risks (Clarke 1999). These divergent reactions raise an empirical question: "What are the mechanisms whereby disasters sometimes yield policy change while other times serve to reinforce the status quo?"

Sociological analyses of disaster have tended to focus on the impact on immediate community, the nearby environment, and proximate stakeholders. As disaster researcher

Kathleen Tierney argues, however, the genre has a tendency to neglect questions related to a disaster's impact on a comparative level (2007). We introduce the concept of a "shelf life of a socio-technical disaster" to focus analytic attention on the mechanisms that transport a disaster event occuring in one time and place to the politics, instituions, and policies of another time and place. A shelf life refers to the recommended time that a perishable product, such as food or drink, can be expected to retain its nutritional and/or display value. Shelf life is determined by factors specific to the object (i.e. banannas will generally have a shorter shelf life than macaroni) as well as distance to market, exposure to heat and light, damage during handling, and contamination. We draw on this analogy not because it maps perfectly to large-scale disasters (disasters are decidedly not simple goods like banannas and macaroni), but because it provides a heuristic that directs our analytic attention toward processes of distancing and timing. The concept of shelf life of a socio-technical disaster calls attention to the ways that it is not only environmental proximity that matters when we consider the impact of a disaster. As our case studies of the United States, France, and Germany demonstrate, it is important to consider the timing of oppositional mobilization, how well this mobilization manages to preserve the relevance of the disaster for domestic politics, and to identify the mechanisms that serve to collapse or expand symbolic distance.

American and French policymakers, along with these nations' energy industry elites and media coverage, expanded symbolic distance by treating the Fukushima Daichii meltdown as a technical dilemma to be resolved with superior safety preparation and power plant precautions. While this technicist orientation is a prominent aspect of the initial German response, its distancing effect was offset by the conjunction of three additional mechanisms that enabled the Fukushima disaster to re-tilt the German policy framework away nuclear power generation and

toward the renewable energy sector. This included 1) industry elites invested in renewable technology who were eager to move into any void left from nuclear power reduction, 2) deep cultural and socio-political affinities across nations that were expertly mobilized by an opportunistic anti-nuclear mobilization for political gain, and 3) the unequivocal ethical messaging by an influential policy committee that offered a stark alternative to the technicist leanings of other committee reports. In short, we argue that the impact of the Fukushima disaster was profound in Germany, but not the United States and France, due to facilitating mechanisms that packaged and preserved the disaster in a way that Fukushima came to be seen as a precursor to inevitable domestic catastrophe.

Socio-Technical Disasters and Social Change

Social movement actors, policymakers, and elite stakeholders such as industry representatives, lobbyists, and advocacy organizations will all seek to exploit a crisis to pursue their strategic goals within a contested field of limited attention and resources (Fligstein and McAdam 2011; Fligstein and McAdam 2012). The scholarship on crisis mobilization has tended to focus on developing independent variables that impact the potential for institutional shifts: the degree of resource mobilization (Jenkins 1983), the relative "openness" of the political opportunity structure (Meyer 2004; Tarrow 1994), or the ability to align interpretive frames that create "resonance" with a receptive audience (Benford and Snow 2000). Although these analyses demonstrate a number of important and even necessary factors for change, they tend to decontextualize mobilization in a way that makes it hard to capture how disaster events can be transposed onto far off locales and diverse policy frameworks.

What is clear is that in the aftermath of a major catastrophe, it is to the advantage of advocates of change to mobilize their efforts quickly and in a fashion that demonstrates that a similar set of events could happen close to home. As Boin and colleagues argue, "crises typically generate a contest between frames and counter-frames concerning the nature and severity of a crisis, its causes, the responsibility for its occurrence or escalation, and implications for the future. Contestants manipulate, strategize and fight to have their frame accepted as the dominant narrative" (2009). Crises have the potential to produce what cultural sociologist Ann Swidler (1986; Swidler 1995; Swidler 2001) refers to as "unsettled times," or a disruption in once taken-for-granted cognitive and behavioral routines.

In a similar vein, scholars have demonstrated that large-scale disasters can serve as "focusing events" that harness the widespread attention, horror, or widespread fear that may be necessary to trigger policy change (Birkland 1998; Birkland 2006). The concept of a "focusing event" tends to push the analysis of a disaster toward cognitive recognition, begging the question of what are the background factors and social contexts that facilitate the cognitive re-framing to occur in the first place. Boin and colleagues suggest that, for starters, a tremendous amount of political and rhetoric work among "potential change agents" must be coordinated:

> Disruptions of societal routines and expectations open up political space for actors inside and outside government to redefine issues, propose policy innovations and organizational reforms, gain popularity and strike at opponents. They create political opportunity windows for advocacy groups challenging established policies, newly incumbent office-holders and other potential change agents (Boin, 't Hart and McConnell 2009: 82).

Not all crises lead to policy change because their impacts are not uniform across historical time as well as geographic, social, and geo-political space. For a disaster to register an impact beyond

the immediate environment within which it's effects are acute,[1] it must be made a social problem with relevance for local players (Hilgartner and Bosk 1988).

Although the vast majority of the popular and scholarly coverage of Fukushima Daiichi documents the events that transpired on the day of the earthquake, the meltdown of the three reactors, and the immediate aftermath, it is important for our analysis not to treat the disaster as a discrete event delimited by time and space. That is, the catastrophe at Fukushima Daichii is an ongoing ecological and narrative event whose environmental, social, and political impact will continue to be felt for generations to come. Rather than a singular event with clear parameters, we consider the Fukushima disaster as an ongoing narrative in two main ways. First, Fukushima will have complex and multi-generational impacts on the health, livelihood, and well-being of the employees of the power plant, surrounding community, and region that were directly impacted by the meltdowns and subsequent radiation spread. Second, it is an ongoing narrative event in the sense that it exists in the geo-political imagination as a large-scale catastrophe that will be rendered and re-rendered through various competing accounts of what happened and their relevance for national energy policy frameworks.

Following the work of Shrum (2014), a fundamental interpretive issue is that no complex socio-technical disaster, from Three Mile Island to Chernobyl to the latest catastrophe in Japan, can speak for itself. Instead, extreme events are processed through analogical reasoning that

[1] For the distinction between acute, or immediately registered, disasters and those that are diffuse, see Thomas Beamish's work on the Guadalupe Dunes oil spill Beamish, Thomas D. 2000. "Accumulating trouble: Complex organization, a culture of silence, and a secret spill." *Social Problems*:473-98, —. 2002. *Silent Spill: the organization of an industrial crisis*: The MIT Press.. Beamish's study provides a quintessential example of a "cresive disaster" that accumulates slowly and goes unappreciated in its scope for a very long period of time (other examples can include gradual economic depressions, famines, droughts, and the like). Nuclear power plant disasters like Three Mile Island, Chernobyl, and Fukushima Daiichi are, in comparison, "tightly coupled systems" Perrow, Charles. 1979 [1972]. *Complex Organizations: A Critical Essay*. Glenview, IL: Scott, Foresman and Company, —. 1999. *Normal Accidents: Living with High-Risk Technologies*. Princeton, NJ: Princeton University Press. in which component failure leads to a cascade of performance problems that tend to be recognized as hazardous for the local environment and denizens very quickly.

requires multiple and ongoing renderings in order to "place" it in an interpretive framework that makes sense within particular socio-political environments. This local sense making highlights some aspects of what occurred while omitting, forgetting, or ignoring others (Frickel and Vincent 2007; Perrow 1999; Vaughan 2004). The key question for our empirical analysis, therefore, is not, "What happened at the Fukushima Daiichi power plants?" Instead, we investigate how Fukushima Daichii was assimilated into particular socio-political realities and the longer term impact of this assimilation on nuclear energy production, use, and policy.

Methods and Case

Our empirical analysis begins with an assessment of how large-scale nuclear power plant disasters have impacted global nuclear power production and use. First, we compiled historical trend data on international nuclear power usage to estimate the overall influence of the largest nuclear power plant disasters (3 Mile Island, Chernobyl, and Fukushima) on international nuclear energy production and policy. Data comes from the annual reports of the International Atomic Energy Agency (IAEA) member state power plants, which includes reports on the total number of plants in operation, plant licensing, plant openings, plant closings, and total percent of nuclear power use by country.

Next, we selected three countries for focused cross-national case study comparison: the US, France, and Germany. We selected the case studies for four reasons: 1) all three are among the largest nuclear energy producers, ranking 1, 2, and 8, respectively; 2) the three nations show divergent policy responses, particularly Germany; 3) documentation of each nation's response is widely available (unlike major nuclear energy producers like Russia, Ukraine, and North Korea),

and 4) the geo-political proximity of Germany and France makes their divergent responses especially relevant.

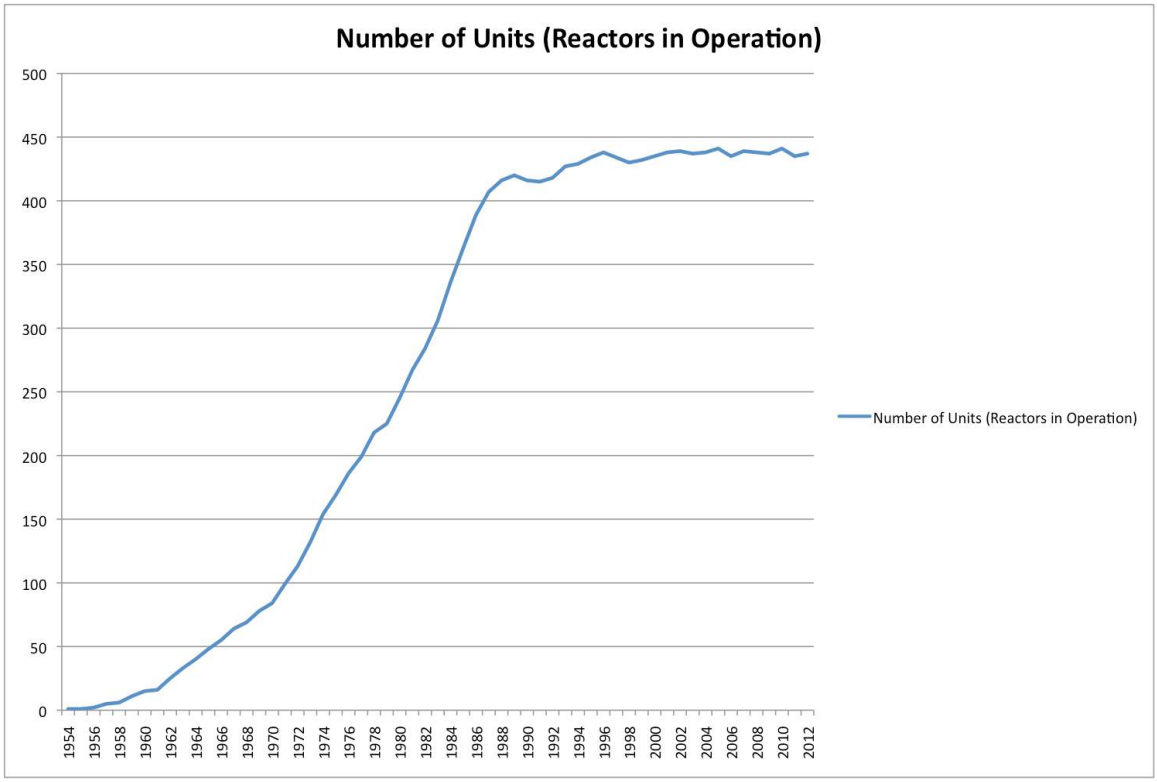
We conducted content analysis of domestic policy reports, safety reports, and other official documents for each country to uncover their account of what happened at Fukushima and how it should, or should not, impact domestic nuclear programs. We developed a coding scheme for causal attributions by pre-sampling a random selection of reports. Once satisfied with the comprehensiveness of the provisional coding scheme, we used it to indicate prevalence of causal attributions across articles and then official reports. We developed supplemental codes inductively during this process. We also draw on secondary sources like news reports to describe institutional contexts in each case, particularly for anti-nuclear movement organizing and the timing of local elections (two factors of enormous importance for understanding the German case).

Cross-National Patterns in Nuclear Energy Production and Use

In this section we present trend data to assess how and when major nuclear disasters of the last sixty years have influenced nuclear power production and use globally. We compiled data from the IAEA's member state annual reports, *Nuclear Power Reactors in the World*. The International Nuclear and Radiological Event Scale (INES) ranks the seriousness of nuclear events on a scale from 1 to 7, with 1 the least serious and 7 a full-scale nuclear disaster. According to this classification, there have been 3 major events. The first, Three Mile Island, occurred on March 28th, 1979 in Dauphine Country, PA. It was rated a 5 on the INES scale, which is an "accident with wider consequences" that involves severe damage to the reactor core, limited release of radioactive material, and possibly related deaths. The second major event was

Chernobyl Power Plant in the Ukraine (then part of the Soviet Union), which occurred on April 26th, 1986. Chernobyl is a 7 on the INES scale, denoting a major accident with substantial release of radioactive material that is likely to involve widespread health and environmental consequences. Third, there is Fukushima Daiichi, which is rated a 7 on the INES scale. The IAEA report includes the number of plants in operation, plant openings, and plant closings from the years 1954 to 2012. *Figure 1* shows the total number of units in operation globally by year.

Figure 1. Total number of units in operation by year

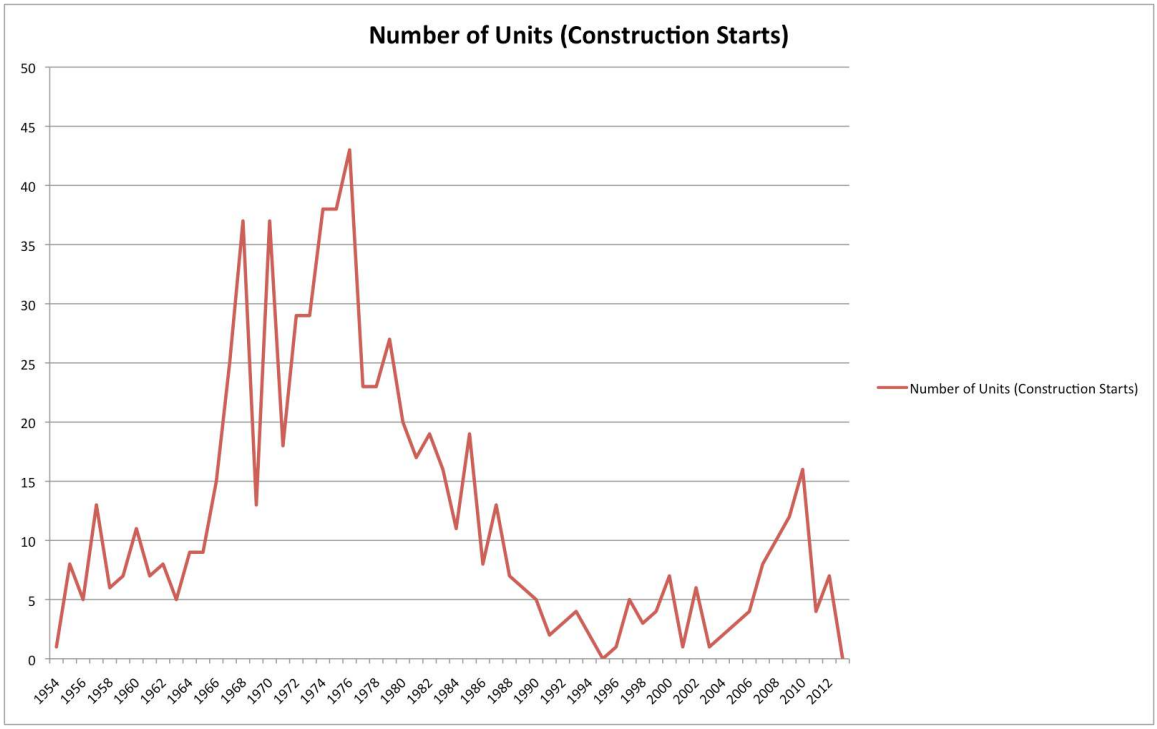


There is a dramatic growth between 1960 and 1990. This growth flattens to about 430 plants for the remainder of the period. We are not yet clear on whether the flattening of the 1990s

represents some sort of equilibrium point due to factors like carrying capacity or market saturation or if the leveling represents the impact of the 1986 Chernobyl disaster.

If we shift from total units in operation to plant constructions, we find two major patterns. First, *Figure 2* shows a high point of nuclear plant construction between 1968 and 1978 with anywhere between 35-40 construction starts. This period is followed by a steep and consistent decline lasting into the mid-1990s with no more than 5 construction starts.

Figure 2. Number of construction starts by year.

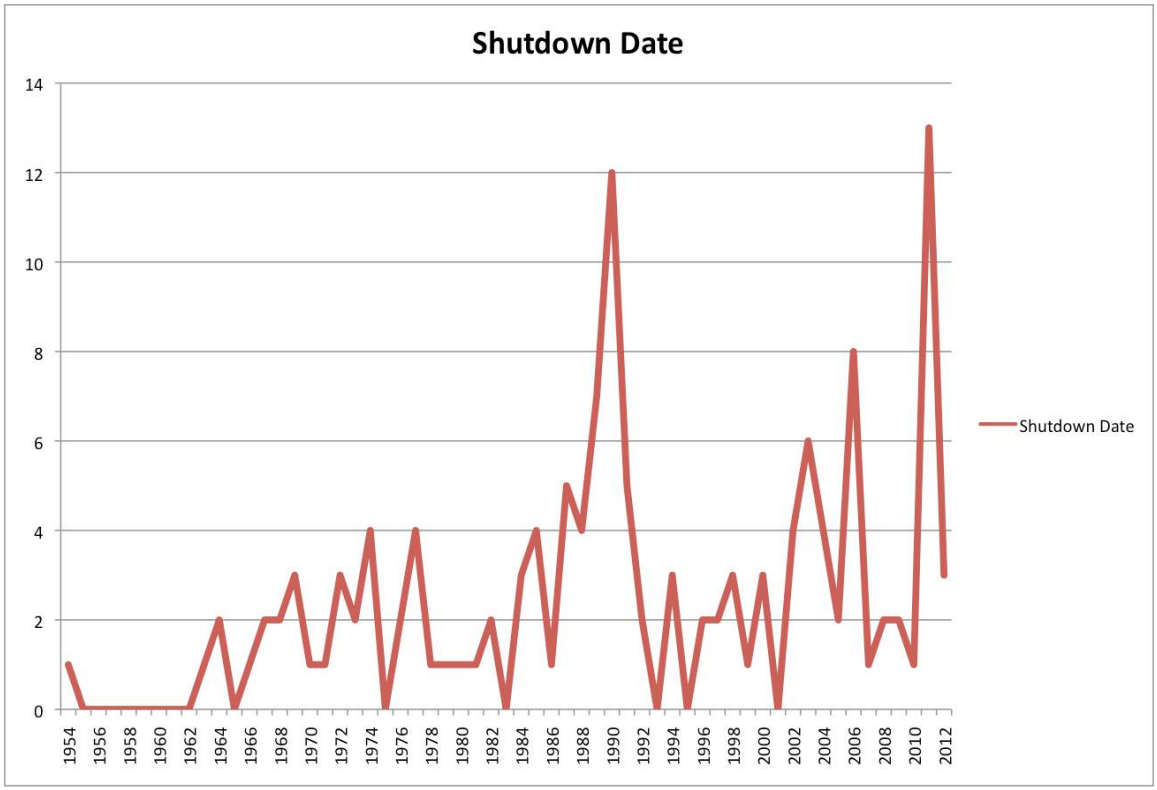


There is, however, a brief increase in plant construction in the early 1980s that slackens after the Chernobyl disaster. We see another brief increase in plant construction in the mid-2000s lasting until the Fukushima disaster. While this is not exactly conclusive evidence, we find it difficult to reason that the timing of these construction patterns are wholly coincidental with the three major

nuclear disasters. The data suggests that there is something like a limited "shelf life" in which the three major nuclear disasters slow construction starts before new construction begins again.

Moving from construction starts to plant closings, we found a moderate effect for the three major nuclear disasters. *Figure 3* shows no change in plant shutdowns following the nuclear accident at Three Mile Island. However, we found a sharp increase in plant shutdowns in the three years immediately following Chernobyl. While there was only 1 shutdown in 1986, there are 28 closings over the next four years (5 in 1987; 4 in 1988; 7 in 1989; and 12 in 1990). It stands to reason that this spike in closings was closely related to Chernobyl.

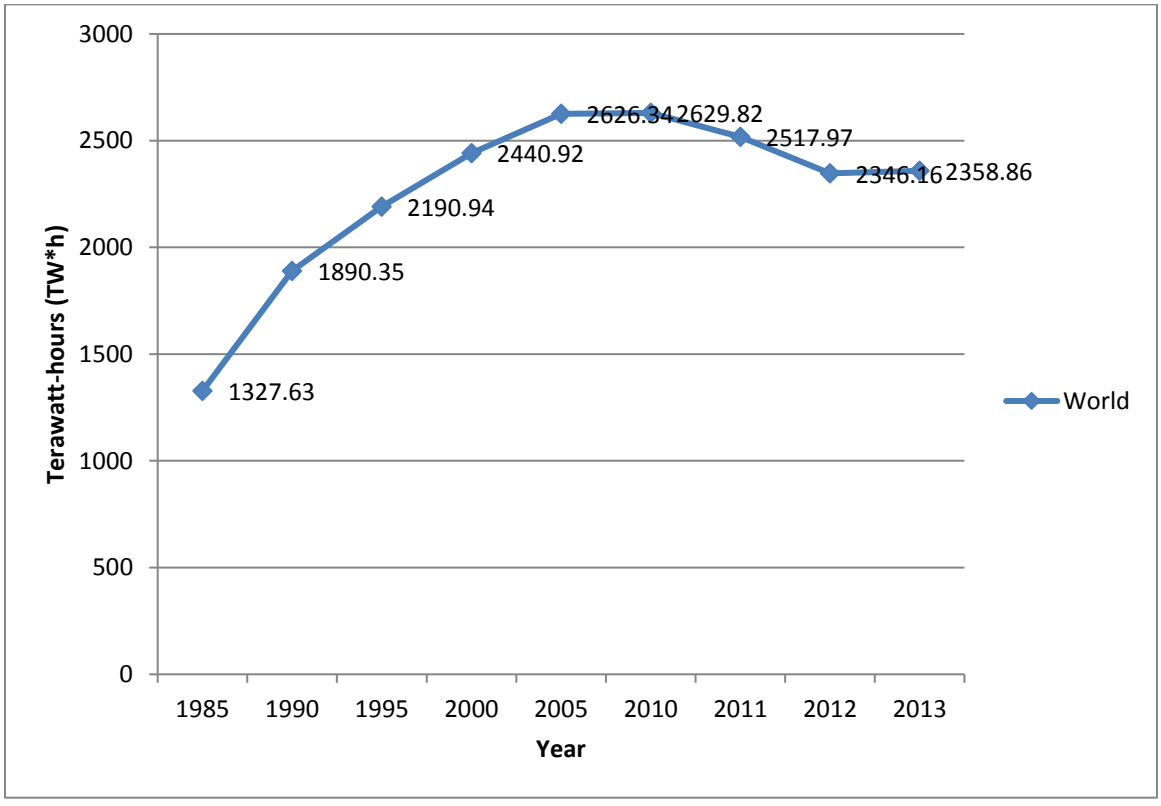
Figure 3. Number of plant shutdowns by year



While it is still early, the three years since the Fukushima accident look remarkably similar to the three years following Chernobyl. There were 13 plant shutdowns in 2011 alone, although most of these occurred in Germany.

In addition to plant openings and closings, we tracked the total production of nuclear energy worldwide. Data only begins in 1985, and so does not allow us to assess the impact of Three Mile Island. Like total units in operation, *Figure 4* shows that major nuclear disasters have had a very slight impact on global nuclear power production.

Figure 4. Total nuclear power output by year

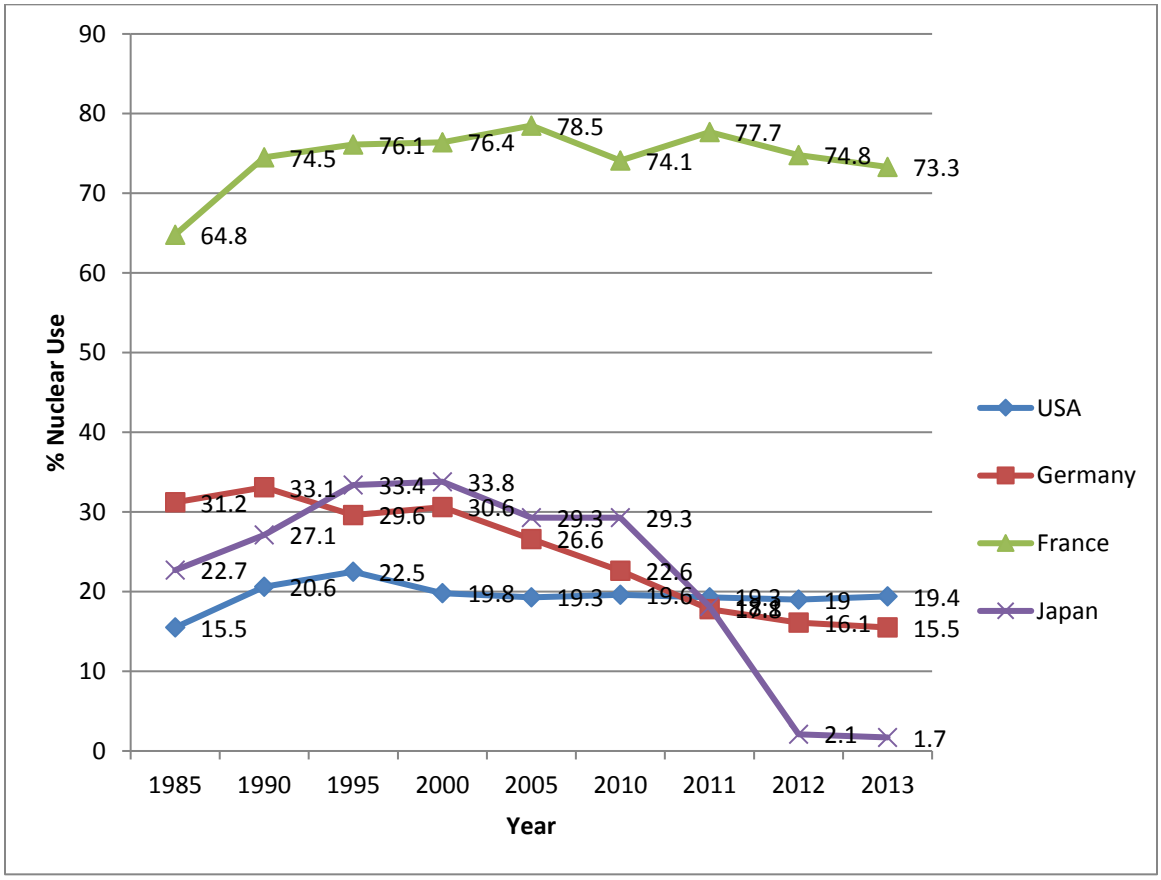


In fact, in the years following Chernobyl the global production of nuclear power climbs—and nearly doubles—until 2010. This is in spite of the increase in plant closings following Chernobyl in *Figure 3*. There is a slight decrease in total nuclear output from the years 2010 to 2012, which

may be due to the Japanese power plant moratorium following Fukushima. In sum, *Figure 4* shows that despite some impact on new plant construction and closings, major nuclear disasters have had very limited overall impact on global nuclear power production.

This suggests that the action in regards to policy change after major nuclear disasters occurs at the level of individual national regimes (particularly plant openings and closings) and not at the global aggregate. *Figure 5* uses data from four countries—the US, France, Germany, and Japan—to capture some of this national-level variation.

Figure 5: Percent of nuclear power use by country and year



In the 5 years following Chernobyl, the percent of nuclear power in use increases in all four countries. The impact of the disaster at Fukushima Daiichi is more varied. Only the US increased

its percentage of nuclear power after Fukushima, although that increase was small at 0.1 terawatt-hours. The impact of the Fukushima disaster on France is similar to the US, although France is unique as the country with the highest percent of nuclear power in use: 73.3% of its total power at the end of 2013. While the use of nuclear energy in France has been relatively consistent since 1985, the share of nuclear energy in use has decreased by 4.4 since the end of 2011. The most drastic impact is on Japan itself, as we would expect. Although not nearly as dramatic, Fukushima had a noticeable impact on the use of nuclear power in Germany. The share of nuclear energy used by Germany decreased 7.1 terawatt-hours in the years following Fukushima.

Post-Fukushima Policy Response in the United States

The United States may have had the most to lose after the Fukushima Daichii meltdowns. It is the biggest producer of nuclear energy in the world. Overall, US government's response did recalibrate some of the links between risk and nuclear safety. However, the US produced policy changes that were limited to safety and reliability of the existing American power plants. There has been no substantive changes in terms of overall production and use of nuclear power.

While there was some grassroots mobilization around nuclear power in the US, it received very little attention from the mass media. In March and April of 2011 there were a handful of protests of US nuclear facilities, most notably in New England, which historically has had the most active anti-nuclear mobilization. This seemed to have an impact on American public opinion. A CBS News poll that asked whether respondents supported building more nuclear power plants showed that 43% of Americans favored additional plants, a figure that was

down from 57% approval of new plant building in 2008 and at its lowest point since the same poll was take shortly after the Chernobyl disaster (Cooper and Sussman 2011).

The US government's official response was swift, measured, and focused almost entirely on technical questions of monitoring the safety of existing nuclear power plants. There were exceeding few questions raised in official reports or government testimonies about the fundamental risks of nuclear power production. We found no evidence that the questions of reducing production levels was ever considered. Instead, the US Nuclear Regulatory Commission (NRC) ordered a series of safety checks and walkthroughs for all US nuclear facilities in the weeks immediately following the disaster. An additional safety report presented 12 overarching recommendations aimed at preventing the most obvious and immediate causes for the Fukushima Daichii disaster, such as storing the backup generators for an emergency cool down in an area that is unlikely to be flooded. The three main policy changes specified, 1) changes for 'beyond-design-basis external events,' 2) increased protection for wetwell vents (which are used to prevent the kind of hydrogen gas buildup that led to the explosions at three of the reactors at Fukushima Daiichi), and 3) additional instrumentation for spent fuel pools[2]. On March 29th, the NRC informed Congress that it would create a senior level task force to investigate the causes of the Fukushima disaster, especially where they might concern domestic nuclear safety. This became known as the "Near-Term Task Force (NTTF)", which issued its analysis of Fukushima on July 12th. A few weeks later, Gregory Jaczko, then chairman of the NRC, testified to Congress by summarizing the NTTF report, stating that the task force "found

[2] The NTTF report noted that in the immediate aftermath of the disaster many plant officials and workers believed that spent fuel pools at the Fukushima plant were dangerously low on cooling water. This led them to direct vital resources to mitigate this problem. The NTTF reports that this belief was incorrect and occurred due to a lack or failure of the instrumentation within the spent fuel pools. The new regulatory policy was aimed at preventing such a lack of information in US nuclear plants by requiring additional equipment and instrumentation for surveillance of spent fuel pools.

that continued operation and continuing licensing activities [for US power plants] do not pose an immediate risk to public health and safety. The Task Force concluded that a sequence of events like the Fukushima Daiichi accident is unlikely to occur in the United States" (NRC Response 8-2: 2). As Jaczko's summary suggests, the NTTF focused on the particular "sequence of events" that produced Fukushima. The report concludes that since this sequence is unlikely to repeat itself, and especially not on US soil, there is little cause for worry. What is notable about this conclusion is the way it is framed and the logic through which its conclusions are made. The task force report focused on a particularly simplistic sequence of events that focused on "natural" factors that could not be avoided. The narrative describes the large earthquake's impact on a station blackout to the tsunami leading to plant meltdowns. It evinces a technically-worded mastery of the obvious. This technicist orientation concludes, not surprisingly, that the particular sequence of events that produced the Fukushima catastrophe is unlikely to recur on US soil.

Rather than seeing such a sequence as a portable case of unpredictable interactions that can transpire within a tightly coupled and complex socio-technical system (Perrow 1999; Perrow 2011), and therefore open up the sort of analogical logic that could extend the shelf life of Fukushima within the US nuclear infrastructure, the NTTF report increases the symbolic distance between the two cases by focusing on specific contingencies in Japan. This was the single most common theme we discovered in our coding of US safety reports, inspection manuals, and Congressional testimonies. Descriptions of what occurred at Fukushima rarely moved beyond the most observable and proximate causes for the disaster—that of a powerful natural disaster that overwhelmed the capabilities of the Japanese plant. On the other hand, we did find a voluminous technical vocabulary to describe the earthquake and tsunami. Terms such as 'severe natural phenomena' and 'beyond design-basis external events' are used

interchangeably and often, trading causal complexity for vague technical terminology. This prolific technical vocabulary reassures readers that a Fukushima on US soil is unlikely and thus places symbolic distance between the Japanese and the US nuclear infrastructures.

The US safety reports play both sides in assessing the risk of nuclear power production. The risk of something like Fukushima occurring on US soil is acknowledged but then just as quickly summarily dismissed. Certain passages would seem to warrant serious questions about safety, such as the NTTF's opinion that "…the NRC's safety approach is incomplete without a strong program for dealing with the unexpected, including severe accidents" (NTTF: 20). In another report to Congress, the NRC chairman reported that most external hazard designs for US nuclear plants were completed in the 1960s and 1970s and few had been revisited since their initial completion. In the post-Fukushima world, one might construe this as cause for fundamental concern about the US nuclear program. Yet never does the NTTF report suggest that US policymakers consider limiting nuclear power production or institute plant shut downs. Instead, the US safety documents repeatedly assure that an event similar to Fukushima would never happen in the US with statements such as, "…in light of the low likelihood of an event beyond the design of a US nuclear power plant and the current mitigation capabilities at those facilities…continuing licensing activities do not pose an imminent risk to the public health and safety and are not inimical to the common defense and security" (NTTF: 18). This distancing is echoed throughout the NTTF report, other regulatory change documents, and in much of the Congressional testimony we have been able to go through.

There are a great many similarities that could have been drawn between the Japanese and US nuclear infrastructures. These similarities reside beneath the surface of the technicist orientation in the reports and testimonies. For example, the NTTF notes that the NRC's

regulatory structure is incomplete and under-enforced; that many US nuclear plants lack a clearly defined Severe Accident Management Guide (SAMG); that many US nuclear plants base their remediation plans on out-of-date data, science, and simulations; and, finally, that many US nuclear plants lack reliable technology to monitor spent fuel pools. All of these areas have emerged as significant weaknesses that contributed to the scale of the Japanese disaster. Nevertheless, the reports serve to limit the shelf life of Fukushima on domestic soil by focusing instead on the most obvious factors that are unlikely to be found in the US case.

Post-Fukushima Policy Response in France

Similar to the US case, Fukushima did impact how the French public, industry representatives, and policymakers re-conceptualized the links between nuclear risk and safety. However, this impact was several limited by the overriding technical orientation of the response.

The meltdowns at the Fukushima Daiichi plant directly influenced activist mobilizations and protest events. Protests in response to Fukushima occurred sporadically from March until November, each claiming around 1,000 to 5,000 participants. Notable protests took place in Paris and in front of the Fessenheim power plant. Similar to the US case, however, these events were largely ignored by the mainstream media in France.

In terms of the government and industry-level response, Fukushima registered a minor shift in terms of nuclear energy policy by leading to policy revisions that emphasized a "hardened safety core" intended to insulate its nuclear power plants from the risk of "extreme natural hazards." What stands out the most in the official reports, investigations, and inspections commissioned by the French government and largely executed by the French nuclear regulator - Autorité de Sûreté Nucléaire (ASN) - is this modest call for safety-oriented reforms.

Some commentators have suggested the potential for change in French nuclear policy on the horizon, however. In July of 2015, France's National Assembly gave final approval to an energy transition bill that reduces French consumption of nuclear power from 75% to 50% by 2025. Although the bill does not close any currently operating plants, it symbolically delivered on President Francois Hollande's 2012 campaign promise to reduce nuclear usage. That said, the bill was framed as an attempt to diversify France's energy supply to include wind and solar, not as a concern with the domestic or international safety of nuclear energy production. The bill and its deliberation did not seem to be directly motivated by concerns with Fukushima or a Fukushima-like disaster.

Based on our analysis of safety reports, press releases, resolutions, and inspection reports, the main causal account given for Fukushima in the French case focused on the "extreme natural forces" that exceeded the design basis for the Fukushima plant. Like our analysis of US government reports and testimony, the French safety documents offer a mostly superficial analysis of the Fukushima disaster—the main culprit was a severe natural disaster that could not be prepared for. Also similar to the US case, French safety reports and recommendations draw on a verbose technical language to describe this culprit. The earthquake and tsunami are talked about as "extreme natural hazards" that exceeded the "design-basis" at Fukushima (IRSN 2012). French policy documents acknowledge the dangers associated with Fukushima but also declare that French nuclear infrastructure is far removed from the forces that submitted the Japanese reactors. By invoking the causal force of "extreme natural hazards," the French policy documents played both sides by acknowledging the dangers associated with Fukushima but also declaring French nuclear facilities safe.

French documents suggest that designing a nuclear facility for every possible natural event is impossible and thus critics of nuclear power are unreasonable. It is in this fashion that the IRSN summary report requested by the European Council mobilizes the uncertainty of earthquake risk to recommend continuing with current nuclear policy: "IRSN notices that the uncertainties concerning the characterization of seismic movements to be considered for the CSAs and the simplified methods for evaluating the seismic behavior of the facilities do not enable the robustness of each facility to be evaluated with a sufficient level of confidence" (IRSN: 5). Consequently, these safety documents recommend the introduction of a "hardened safety core" to mitigate the threat of nuclear power production.

The "hardened safety core" represents the most visible and significant change in French nuclear policy in the years after Fukushima. This additional protection to vital systems is meant to prevent the type of catastrophe that occurred at Fukushima. An important safety report instructs all nuclear operators to "…identify all the "SSC" (structures, systems, and components) that are essential in terms of the implementation of the last lines of defense-in-depth and propose measures aiming to 'harden' them in terms of hazards that go beyond the basis of plant design (IRSN 2012)."[3] On the whole, then, French safety documents acknowledge the risk from 'extreme natural hazards' as unimaginable, unpredictable, and dangerous, while simultaneously proposing the 'hardened safety core' as a technical measure to manage the unimaginable.

Post-Fukushima Policy Response in Germany

While like the US and France, a technicist orientation was certainly present in the initial German response to Fukushima, the distancing effects of this orientation were offset by a conjunction of

[3] Institut de radioprotection et de sûreté nucléaire (IRSN)—a technical support organization to the ASN.

three mechanisms that packaged and preserved Fukushima for the German socio-political context. This included 1) a renewables energy industry sector eager to move into the void left from nuclear power reduction, 2) deep cultural and socio-political affinities across nations that were expertly tapped into by a highly opportunistic anti-nuclear mobilization, and 3) the unequivocal ethical messaging by an influential German policy committee that provided the ideological cover the Merkel regime needed to change its energy policy stance.

The German energy industry had begun to transition toward increasing renewable sources on its energy grid, and had moved away from its dependence on nuclear, over the preceding decade. A key mechanism in Germany's response to Fukushima involves powerful industry actors with vested interests in making a transition toward an emphasis on renewable energy technologies. Much of the infrastructure for a broad transition toward renewable sources like wind and solar power had been expanding in both the consumer and business markets for much of the decade preceding the Fukushima disaster. Spearheading this trajectory was the 2002 nuclear phase out plan passed by a coalition of the German Social Democrat and Green parties led by then Chancellor Gerhard Schröder. The plan stipulated that no new nuclear plants would be constructed and that all existing plants would be phased out by 2022 (Winter 2013). A key feature of the phase out plan was that the energy shortfall from eliminating nuclear would come from renewable sources. The overall plan is known as "energiewende" or "energy transition." In the decade before Merkel assumed office, the proportion of the German energy supply derived from renewables steadily increased, doubling from 10% in 2005 to 20% in 2011. The rate of increase escalated even more after Fukushima, with 25.1% of the electrical supply coming from renewables in 2012. Total energy consumption from renewables has followed a similar trajectory, rising from under 2% in the 1990s to well over 10% by 2014. Germany is also now

the home of several of the world's largest clean energy producers, such as Enercon, Nordex, and Siemens. A profitable elite sector of the energy industry was therefore well positioned, both in terms of infrastructure and policy trajectory, to move relatively quickly into a void left from the reduction of nuclear power. The renewable energy industry in the United States and France was not nearly as well developed before or in the aftermath of Fukushima and thus did not offer as serious policy alternative.

In 2010, Chancellor Angela Merkel and her center-right coalition government revoked the phase-out plan by extending the licenses for German nuclear power plants an average of 12 years and some longer (Gross 2011; Winter 2013). The controversial new policy reinvigorated the anti-nuclear protest movement in Germany. In fact, a wave of anti-nuclear activism and public protests were launched in the months immediately preceding the March 2011 disaster in Japan. In the days following the Fukushima earthquake and the eventual meltdown of the nuclear power plant, the Green Party paired with activist organizations to take advantage of the symbolic resonance of the disaster for political gain. Their ability to do so, however, requires a bit of background history in modern Japan-German international relations.

Historians have noted the long-standing political ties and cultural affinities that connecting the development of the modern Japanese and German nation states. These ties reach back to the "Japanese Restoration" of 1868 to 1912, in which then Emperor of Japan Meiji employed foreign government advisors in his attempt to modernize Japan. Meiji was especially fond of German consultants, and many of the reforms introduced in Japan during this period were based on German educational, legal, and constitutional models of governance. The legal statue for these reforms were drafted in direct consultation with "oyatoi gaikokujin" or "hired foreigners," many German officials and jurists. In 1900, these ties were halted as Japan aligned

itself with Britain and later declared war on Germany in 1914, fueled largely by German imperialist incursions into South-East Asia. The two nations re-formed with the famous “Axis” alliance of World War II. Their shared geo-political fate was sealed by their joint status as occupied nations in the aftermath of the Axis defeat to the Allies in WWII. Japan and Germany rebuilt their post-war economies and manufacturing in parallel, eventually becoming the third and fourth largest economies in the world, respectively. Germany remains Japan’s largest trading partner in Europe and Japan is Germany’s second largest trading partner in Asia behind China. A wide variety of trading pacts and cooperative agreements have deepened Japanese-German relations over the last few decades, along with bilateral cultural exchange programs.

German anti-nuclear movement and Green Party political actors were able to tap into this deep seated socio-political connection between the two nations in order to make the Fukushima Daichii disaster a pressing reality within Germany. Activists and party leaders asked that local political candidates make a clear choice - either support Merkel’s abandonment of the Schröder plan or stand with the victims of the Japanese nuclear meltdown. For example, German Green Party leaders Claudia Roth and Cem Özdemir told German media the day after the Fukushima earthquake that the Japanese disaster demonstrated "that nuclear power is an uncontrollable, highly dangerous technology, even in a high-tech country like Japan that is equipped to handle all possibilities." The message mobilized the German imaginary of Japan as a “high tech country” on par with Germany’s engineering mastery in order to point out the “uncontrollable” nature of nuclear technology.

On March 12th the Green and Social Democratic Party (SPD) were able to mobilize approximately 60,000 people to form a 27-mile human chain between two German nuclear plants. The human chain was widely covered by the local, national, and international media.

Some protestors wore radiation safety suits and other eye catching costumes. Protesters held "Smiling Sun" flags reading "Nuclear power – no thanks!" The timing of the human-chain protest could not have been better. It had been planned well before the Fukushima disaster occurred, although it is unlikely it would have been nearly as large were it not for the meltdown. What is more, the protest occurred in the Baden-Württemberg region of Germany, precisely where Chancellor Merkel's Christian Democratic party was facing a difficult election in two weeks' time.

A large number of anti-nuclear protests ensued in the weeks following the human chain, further drawing media attention and symbolically connecting the Japanese disaster to German nuclear energy policy and the impending state elections. Media coverage in Germany contributed to the growth of this connective tissue. In an analysis of newspaper coverage just before and after Fukushima (between February 28 and April 10, 2011), Kepplinger and Lemke (2015) found that German newspapers covered the Fukushima disaster much more extensively than did French newspapers (as well as newspapers in Switzerland and United Kingdom). According to their study, German papers covered Fukushima's relevance to domestic nuclear energy at a much higher rate (211 cases of German stories focusing on German power plants, as opposed to just 50 stories in French newspapers focused on French power plants). *Figure 1* presents comparative data from this study on media coverage in the days and weeks following Fukushima in the major newspapers of Germany, Switzerland, France, and the United Kingdom. What is striking in their findings is the extent to which the newspaper coverage in Germany covered the immediate aftermath of Fukushima in a way that "broached the issue" of domestic nuclear energy in connection to the Japanese disaster.

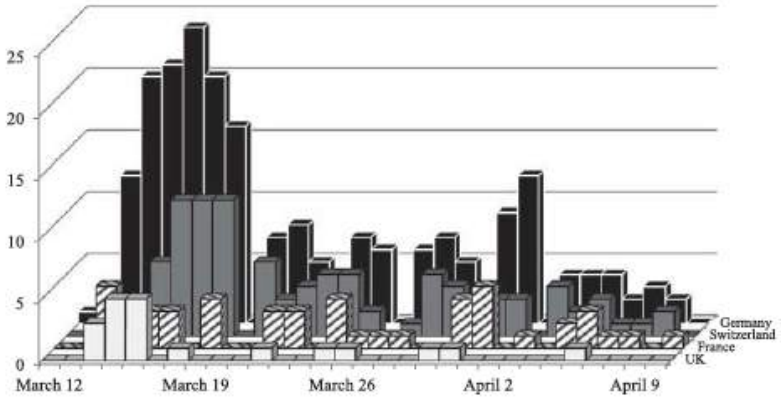


Figure 1. Broaching the issue of domestic nuclear energy: Number of articles referring to domestic nuclear energy.
Note. Articles referring to domestic nuclear energy (see Table 3) in the country of publication after the disasters in Japan (March 12, 2011 to April 10, 2011). Two comparable prestige newspapers per country (Germany: *Süddeutsche Zeitung, Frankfurter Allgemeine Zeitung*; Switzerland: *Neue Zürcher Zeitung, Tagesanzeiger*; France: *Le Monde, Le Figaro*; United Kingdom: *Times, Guardian*).

In short, the protests in Germany and popular newspaper coverage contributed to the development of thick symbolic links between the Japanese disaster and domestic politics. These links were strengthend in the coverage of the ensuing state elections.

Merkel's initial public response to the disaster at Fukushima was to distance German nuclear power plants from their counterparts in Japan in a very similar fashion to what we found in the American and French cases. Merkel emphasized the unique and contingent features that produced the Japanese accident. Immediately after the earthquake, Merkel told reporters,

> "We know how safe our plants are and that we do not face a threat from such a serious earthquake or violent tidal wave…But we will learn what we can from the events in Japan, and in the coming days and weeks will follow closely what the analysis yields."

However, the anti-nuclear forces were able to counteract this distancing by gaining coverage in the German press in a way that expanded the coverage of Fukushima to German nuclear infrastructure and energy policy. In particular, Green Party candidates began to make strides in

the ensuing Baden-Württemberg state elections. This was not only a key election for Chancellor Merkel to maintain her current coalition but was also symbolically important in a broader sense. The state was a longtime stronghold for the conservative Christian Democratic Union. The state party was led by CDU Minister-President Stefan Mappus, who had strongly supported the rollback of the nuclear moratorium. His position became a central issue in the election, with the Greens seeking to capitalize on the unrest in order to tilt a close election (they would ultimately succeed).

It was within this uncertain electoral context that Chancellor Merkel and her ruling party made the shrewd decision to back off their previously announced energy plans. On March 14th and 15th, as the crisis at Fukushima Daiichi slowly worsened, Merkel announced the government's policy reversal. Merkel and the Bundestag, Germany's federal parliament, jointly decided to immediately shut down 7 of their oldest nuclear reactors (Lutz 2012). The shutdown was first discussed as a 3-month moratorium on the previous extensions of nuclear reactors in Germany. In this time, there would be safety checks on all NPPs (Winter 2013). Consider how Merkel's announcement contrasted to her earlier statement from just days before:

> "We can't simply continue as normal. The events in Japan teach us that something that by all scientific benchmarks was considered impossible can actually occur...If in a highly developed country like Japan, a country with high safety standards and safety requirements, nuclear consequences from an earthquake and a tsunami can't be prevented, this has consequences for the whole world, it has consequences for Europe and it has consequences for us in Germany."

The two Merkel statements, if juxtaposed to one another, captures a general theme running through much of the German policymakers' responses to the Japanese disaster. Instead of posing

the Fukushima disaster as an isolated and far away event that underscores the superiority of domestic nuclear safety measures, as is the case in the US and French reports, time and space are condensed such that the Japanese experience speaks directly to the German reality. Similarities to Japan as a "highly developed country…with high safety standards" are emphasized.

On May 17th, the German parliament called for comprehensive safety reviews of all German nuclear facilities. This request was passed to the Federal Environment Ministry (BMU) and the Reactor Safety Commission (RSK), who were responsible for drafting the guidelines and requirements for the safety review. Next, the Bundestag appointed an ethics committee on May 4th to explore the broader implications of Germany's national energy policy.

This committee, it would turn out, produced a document that would provide the third key mechanism for the German policy shift. The unequivocal ethical messaging by this committee provided the Merkel regime the political cover to announce its new energy policy. On May 29th the ethics committee reported to Chancellor Merkel, recommending that nuclear power should be phased out entirely. After negotiations that went through the night with her coalition government, Merkel announced on May 30th the permanent shutdown of the 7 oldest reactors and that the German government would return to the earlier 2002 plan to phase out all nuclear power use by 2022 (Gross 2011; Winter 2013).[4] On June 30th, the Bundestag passed final legislation for this phase-out plan by a margin of 513 to 79. Thus far, 9 of 17 nuclear power plants have been permanently shut down. The policy shift has reduced nuclear power in Germany from 22.6% of domestic energy at the end of 2010 to less than 16% in 2015.

[4] As of 2011 Germany had 17 nuclear facilities. 7 of the oldest reactors were immediately shut down on March 15th and an additional reactor—the Kruemmel plant—had already been in a state of shutdown due to technical difficulties. The remaining facilities will be gradually phased out according to the original plan from 2002.

The existence of a previously institutionalized nuclear phase out, coupled with a well-developed renewable energy industry sector eager to increase their imprint on the German energy grid, made Merkel's rapid policy shift a viable option. This policy history made the Merkel policy shift imaginable, and a condition of infrastructural possibility, in a way that it was not in either the US or French cases. Protest mobilization combined with favorable newspaper coverage, both in terms of the sheer number of stories and in terms of content that tied the Japanese disaster to German nuclear power plants, framed an event that was geographically far as culturally near. The well-mobilized anti-nuclear protests in Germany took advantage of fortuitous timing to organize a protest event the caught the imagination of the public with striking images of protestors linking hands across the German countryside. Finally, the unpopularity of nuclear power use in Germany, thanks largely to its protest legacy, combined with regional elections in which the ruling party was vulnerable and viewed as on the side of the nuclear industry, conspired to make the return to the shutdown plans of Merkel's predecessor a highly attractive option.

It is striking, however, that the safety reports produced by the Reactor Safety Commission (RSK) in Germany echo many of the themes in their American and French counterparts. The RSK issued a full safety report titled "Plant Specific Safety Reviews in Light of Fukushima" that focused on the most obvious causes of the Fukushima disaster: natural disasters, earthquakes, flooding, sustained loss of power, potential loss of water supply, and organizational preparation for emergency situations. Like the US and French counterparts, the RSK report frequently discusses 'beyond-design-basis' events and makes reference to the Fukushima plant being poorly designed in regards to tsunami preparation. Overall, the RSK report declared German nuclear facilities to be much safer than their Japanese counterparts and

recommended no major shift in nuclear policy in the wake of Fukushima. There is little in the German safety reports to suggest that a different course of action would be taken from the US or France. If safety were the primary concern in the evaluation of nuclear energy policy then we would have expected each country to follow the same course of action, as they all call for measured and modest safety improvements. The policy shift in Germany mobilized a different set of questions that moved beyond safety from an engineering perspective and ask, instead, a prior question, which is whether the risks involved in generating nuclear power are worth their potential global costs.

The Ethics Commission Report, which Merkel has credited for providing the guideline for her phase out policy, focused on this prior question - whether or not nuclear energy generation can be worth the risk in the first place. Nuclear advocates in Germany claimed that the Ethics Commission was set up from the start to provide political legitimacy to their policy backpedal. There is likely some truth in this accusation, since it does seem highly likely that Merkel and her party returned to the accelerated nuclear phase out plan in the hopes of improving their numbers in the impending state elections, as a way of essentially undercutting the Green Party's main oppositional advantage. Regardless, the Ethics Commission for a Safe Energy Supply was established with the explicit directive of assessing the future of nuclear energy in Germany. It was headed by former United Nations Environment Program executive director and ex-German environment minister Klaus Töpfer and its membership included famed German sociologist Ulrich Beck, well known for his critical analyses of "world risk society." At the initial presentation of the report (which had been leaked to German media weeks before, so its content did not come as a surprise), Merkel said the government would use the commission's recommendations as a "guideline."

This relatively short, 49-page report titled "Germany's Energy Transition—A Collective Project for the Future" outlined the feasibility, consequences, and potential plan for gradually phasing out nuclear energy. From its initial statements, it frames the Japanese disaster in terms of its relevance to domestic issues: "The disaster at the Fukushima nuclear power plant in Japan has once again placed the question of whether the use of nuclear energy can be justified at the centre of political and social debate" (8). The report's conclusions are unequivocal, "The withdrawal from nuclear energy is necessary and is recommended to rule out future risks that arise from nuclear in Germany (p.4)." The industry realignment toward renewables institutionalized by the *energiewende* is a strong resource in the report, leaned on repeatedly. For example:

> "Germany has alternatives available: electricity production from wind, the sun, water, geothermal energy, biomass, the more efficient use and increased productivity of energy, as well as the climate-compatible use of fossil fuels. Changes to people's lifestyles also help to save energy if these respect nature and are sustained as a basis for supply."

Also of note is the way that the report poses closing down its nuclear power plants as a test of international strength in which Germany is the leading actor:

> "The international community is following Germany with great interest to see if it succeeds in withdrawing from the use of nuclear energy…The German economy gains its strength from its creativity and ability to manufacture products to the highest possible standard of quality. An increasingly large share of companies orients their business portfolio towards sustainable economic management. The withdrawal from the use of nuclear energy offers this many more opportunities. Science in Germany is in an excellent position and can be relied upon to provide further significant innovative and highly-efficient solutions for the energy transition." (5)

The appeal plays on German nationalist pride, identification with, and reputation for quality manufacturing, technological ingenuity, and scientific might.

Rather than distancing the disaster in Japan from the domestic context by focusing on ways in which German plants are better designed or safer than the ones in Japan, or less likely to face the same sequence of events that occurred at Fukushima, the Ethics Commission report collapses distance by treating the Japanese disaster as an example of what could go wrong in Germany:

> "The risks of nuclear energy have not changed since Fukushima, but the perception of the risks has. More people have become aware that the risks of a major accident are not merely hypothetical but that such a major accident can actually happen. As a consequence, the perception among a significant section of society has been reoriented to the reality of the risks…the fact that the reactor disaster occurred in a high-tech country like Japan. This has caused people to lose faith that such an event could not happen in Germany. This applies to both the accident itself and the long period of helplessness in the subsequent attempts to get it under control…the fact that the disaster was triggered by a process that the nuclear reactors were not "designed" to withstand. These circumstances shed light on the limitations of the technical risk assessments. The events in Fukushima have made it apparent that such assessments are based on specific assumptions, for example on seismic safety or the maximum height of a tsunami, and that reality can disprove these assumptions" (11-12).

Whereas official documents in the US and France might acknowledge the risk associated with nuclear energy—and sometimes even acknowledge the unpredictable nature of that risk—they tend to move quickly from these concerns to the salve of safety measures. In Germany, the

Ethics Commission report contributed to a more fundamental recalibration of the nature of nuclear risk. The report has several sections devoted specifically to recalibrating risk by facing the unique nature of nuclear failures:

> "The categorical rejection of nuclear energy evaluates the potential for catastrophe, the burden for future generations and the possibility of nuclear radiation that will damage our heritage as being so far reaching that a trade-off of the risks should not be permitted. From this perspective, the damage from a nuclear disaster lies outside of the area that can potentially be assessed in terms of the balancing of interests…There is a methodological reason for this: whereas in normal strategies to deal with limited risks such as road or building safety it is assumed that the damage actually occurs and that lessons can in turn progressively be learnt to make precautions, this step of the learning process is ruled out for nuclear plants…The risk can then not be deduced from experiences with real accidents because the consequences of a nuclear disaster in the worst case scenario are unknown or can no longer be assessed. These consequences cannot be confined either in geographical, temporal or social terms. Consequently, it is concluded that nuclear technology should no longer be used in order to rule out instances of damage" (13-14).

The Ethics Commission Report suggested that if the risk from nuclear energy cannot be calculated and measured it also cannot be controlled. From here, the commission concluded that nuclear energy is inherently unsafe and should be abandoned.

Conclusion

The story of Germany's decision to phase out nuclear power suggests why it is that large-scale disasters can be difficult to port across different socio-poliitcal landscapes and policy

frameworks. Well-organized and well timed anti-nuclear protests drew sustained media attention toward the connection between the Fukushima Daichii and German nuclear power plants (the adage that "luck is what happens when preparation meets opportunity"[5] seems applicable here). Savvy to the long-standing ties characterizing Japan-German relations, social movement actors were able to enroll media coverage in making the Japanese disaster a pressing domestic issue for German society to consider. Looming elections and a groundswell of popular unrest with the ruling party's nuclear policy made Merkel's shift a feasible alternative from a realpolitik perspective. It was also feasible from a infrastructural standpoint. Germany had developed its renewable energy sector over the previous decade under the Schröder plan, resulting in industry elites looking to take advantage of opportunities to fill the void of any shortfall in the energy grid.

In addition to savvy protest mobilization and industry readiness, our analysis has also pointed to the importance of the interpretive framing contained within government safety reports and policymaker proceedings. Nearly all of the government safety reports in the US, France, and Germany echo the superficiality of early newspaper accounts of the Fukushima Daichii meltdown accident. They avoid causal links that move beyond the fact that the meltdown was the result of a horrific and rare natural disaster. In this way, the safety reports and testimony used to justify policy reactions in the US, France, and Germany serve rhetorical and political purposes more so than explanatory ones. These safety reports are best understood as "fantasy documents" that serve to justify ongoing activity rather than prepare for risks (Clarke 1999). Rather than mobilize the most reliable indicators of what happened, or to use the disaster to take a worst case

[5] This adage is typically attributed to Seneca the Younger, although is probably only loosely based on the following passage from his *On Benefits*: "The best wrestler...is not he who has learned thoroughly all the tricks and twists of the art, which are seldom met with in actual wrestling, but he who has well and carefully trained himself in one or two of them, and watches keenly for an opportunity of practicing them."

scenario approach to disaster mitigation (Clarke 2006), the safety reports provided a technical but also highly constricted and contingent accounting for the Fukushima disaster. This, in turn, served to distance the potential impact of the disaster on the local scene.

It is only in the German case that we find a different kind of commission report. The German Ethics Commission report more fundamentally re-conceptualized the risk of nuclear power in a fashion that repeatedly transposed Fukushima to the domestic context. Instead of concluding that risk is inevitable and therefore nuclear power plants should continue, as the French and American reports do, the German Ethics Commission concluded that nuclear risk is inevitable and therefore in need of a phase out. The "inevitability thesis" of nuclear risk was mobilized to shorten the shelf life of Fukushima within the US and France whereas it is used to demonstrate why the risk to Germany was too great to justify the status quo. It was ethicists, not technicity, empowered with a directive to assess not just questions of *how* but also *if*, who were able to conclude that the risks of nuclear power cannot and therefore should not be adequately calculated. Rather than imagining a better managerial scheme for nuclear power, the German ethicists opened up a viable space for imagining a nuclear-free Germany.

The unequivocal message of the German ethics report would not have been enough to transform nuclear energy policy absent the other mechanisms we have identified. Thus, our analysis suggests that transposable "variables" that help to explain policy change – such as political opportunity structure, resource mobilization, and vested interests - are highly important to a general understanding of how, when, and where substantive policy changes are likely to occur. Our analysis of the shelf life of the Fukushima nuclear disaster places emphasis on the local sensemaking work that needed to occur in German for these variables to be activated. Rather than allowing the Japanese disaster of March 11, 2011, to remain something that

happened “over there” and “to them,” recent policy changes look poised to preserve the shelf life of the disaster at Fukushima Daichii for generations of German citizens to come.

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