Renewables and Vested Interests in Japan and China

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Abstract

The paper suggests an answer as to why policies favoring renewables are implemented in some countries rather than others, with the empirical material gathered from Japan and China. The theoretical framework combines Joseph Schumpeter and Mancur Olson. It emphasizes the importance of structural change to long-term economic growth, but that vested interest structures may easily restrain the growth of new industries, like renewables. Typically, vested interest tied in with old industrial paradigms, seek to preserve their advantage, securing for themselves favorable regulations and institutions. These do however not necessarily fit new and upcoming industries. The paper compares and contrasts the very different experiences of Japan and China. Japan has some of the world's strongest vested interests, but has still been able to foster a successful solar industry (but failed within wind power). Meanwhile, China has found itself in a situation where the rapid increase in demand for energy has enabled very promising efforts within renewables to grow alongside continued increase in the capacity of the non-renewable power sources. The cases both support the theory, suggesting that vested interest structures serve as powerful influences on energy policy.

INTRODUCTION

Japan and China have faced rather different prospects over the past few decades. This is the case with respect to economic growth, but also, it is the case with respect to renewables. While for long perceived as the world's front-runner in energy efficiency and solar cell technology and implementation, the Japanese lead has evaporated, and in many areas it has been caught up with by other major industrialized countries. China on the other hand, with some of the world's most polluted cities and waterways, is also the country that expands the fastest within almost all kinds of renewable technologies and industries.

Japan is small and densely populated, with almost no natural resources of its own to satisfy its energy requirements, but wealthy after decades of successful industrialization. China is a huge country, with the largest population in the world, abundant in a number of natural resources, still poor, but with growth rates so enormous and persistent that satisfying its energy demand over the next couple of decades will be a major headache, with potential impacts on the entire planet. There is a lot to learn from analyzing these countries comparatively. In a world where peak oil provides us with an ever more difficult challenge in providing the world with energy, climate change makes it imperative that sooner or later, this energy is sustainable rather than fossil. Thus analyzing renewables with a view to shedding light on why renewables are doing so much better in one country than the other, may prove valuable insights. The proposition made here, is that we need to understand the vested interest structures of a country in order to understand its energy policies.

Japan is a country famed for the strength of its vested interests. The picture is however quite mixed. Solar PV has succeeded in working with the vested interest structure and achieved partial success, at one time having the most successful solar panel industry in the world (alas, no longer). In contrast, wind power has received very little support. It has been kept persistently on the periphery, not finding favors with the government bureaucracy and being fought by the electric power companies. The Japanese vested interest structure points strongly to why the difference between solar and wind in Japan has been so marked.

Also, Fukushima shows the potential effects of an external shock on a country's vested interest structures. The 1973 oil crisis brought energy security back onto the Japanese political agenda. Energy became scarcer, far more expensive, with most of it arriving from areas that were geopolitically sensitive. This created a serious energy rethink, giving rise to a host of energy policy initiatives and changes. Disastrous as Fukushima was, it has signaled another major energy policy rethink, and one that demonstrates that external events can often be powerful triggers in shaking up a gridlocked system.

In contrast, China has been in a situation where very rapid increase in energy demand has enabled very promising efforts within renewables – although unlike Japan primarily in wind rather than solar PV – growing alongside a continued increase in the capacity of non-renewables. In China, despite the existence of powerful energy companies and state-owned enterprises (SOEs), the promotion of renewables has at least since 2005 been defined as a national priority. With some notable exceptions, the state has been able to control its vested interests, and regulatory frameworks forcing power companies into allowing renewables onto the grid have allowed for rapid growth particularly in wind power. Over the past couple of years, within solar PV the focus has also shifted towards domestic installations, away from the exports only focus of previous years. Yet, while the paper concludes that China does currently not have a major vested interest problem, and that the lack of these, in combination with near insatiable energy needs , have fueled the growth in renewables, it also warns that so far China has done the easy part of the job. As of yet, no major structural change has taken place. Instead, expansion is benefiting everyone in the energy sector, regardless of energy source. And so, while a number of institutional and regulatory reforms have kept on improving the situation for Chinese renewables, the paper also warns that Chinese decision-makers have so far not had to make choices that to any major extent have gone at the expense of other powerful energy actors. Thus, the paper warns that with the current institutional and industrial structure, vested interest problems may easily appear in the future if Chinese decision-makers do not actively seek to avoid them.

The theoretical section outlines a framework combining Joseph Schumpeter and Mancur Olson. It emphasizes the importance of structural economic change for long-term growth and development, and that in order for structural change to occur, it is crucial that the state succeeds in controlling its vested interests, and preventing them from restraining the growth of new industries by securing for themselves favorable regulations and institutions at the expense of the overall economy. This framework is applied to Norway, Japan and China. It shows that in Norway, prospects for industrial success in renewables is modest, because of the influence of the vested interest structure on the economy, in Japan that it all depends on which renewable industry you look at, as the vested interest structure clearly favors solar. And in China, that vested interest problems have so far been only moderate, enabling the state to promote renewables more forcefully than in most other countries.

THEORY AND METHODOLOGY

An obvious starting point for an analysis of renewables is the assumption that the ambitiousness of a country's renewable energy policies mirrors the seriousness of its energy problems. Countries with major unresolved energy problems should be expected to have more ambitious renewable energy policies. And if a country has an abundance of primary renewable energy resources, this should also make it more likely to prioritize renewables. Thus, countries with unsolved energy problems, including energy-security, have more ambitious renewable energy policies. This is a conclusion that can be found in among others Eikeland and Sæverud (2007).[1]

1 For an excellent survey of drivers promoting renewable energy, see Marques et al. (2010).

In contrast to this, the vested interest perspective is embedded in a theoretical framework that is focused on the importance of structural economic change. In a day and age where there are no longer any cheap and abundant sources of energy present, the promotion of renewables could be perceived as something that everyone should agree to. At some stage in the future a transition away from fossil fuels will necessarily have to take place.[2] And particularly since Fukushima, the notion that nuclear power could provide a way out of our combined energy and climate problems has looked distinctly more dubious, among other things triggering an *Energiewende* in Germany.[3] Thus, a turn towards renewables might seem inevitable.

This however is not a given. In fact, even if renewables are expanding on a very rapid rate, their share of total primary energy supply is likely to remain virtually unchanged for decades still to come,[4] both because of starting from such a low base, and because with increasing overall energy demand, renewables may grow healthily in terms of absolute figures while still not increasing their overall share. No immediate structural transformation is on the horizon. Also, there are very obvious reasons why renewables do not make much of an impact in terms of shares of energy supply. Structural change is a thorny and tenuous process for the simple reason that it always implies both winners and losers. It means the rise of some industries, but at the same time the demise of others. And hence, processes of structural change are something that vested interest groups are loath to embrace (Mokyr 1990). Which also means that structural change can be hard to accomplish (De Long 2000). The industries that have the potential to rise during a period of structural change are typically new industries, that is, industries that do not have powerful interests backing them, industries that have not yet organized to form special interest organizations, industries that do not have the backing of powerful parliamentary representatives, etc. Against this, the industries that stagnate have typically been there for a long time. They have had ample time to organize, they have access to political networks, they may have succeeded in forming an institutional structure beneficial to their needs and peopled by bureaucrats eager to accommodate them. In other words, there is no level playing field. Politically, economically, and

2 Experts deviate considerably with respect to when peak oil will be reached, or indeed if it has already been reached. Daniel Yergin (2011: 236pp) is fairly sanguine about this, commenting that on a number of occasions in the past, we have thought that peak oil had been reached, only for technology to improve and new discoveries to come onto the market. Thus, the world's proved oil reserves have kept on increasing. Taking unconventional sources into account, there is no such thing as an immediate peak oil. Michael Klare (2012) agrees that technically the world is still awash in oil. However, the easy oil is almost all gone. What is left is hard-to-reach, hard-to-refine, "tough oil". Over the next 25 years these "easy oil" fields will lose 75% of their productive capacity, which also corresponds to 75% of current crude oil output. Which means that to the extent that the future is fueled by oil, every pretense of this being a cheap and abundant source of energy should be abandoned.

[3] China is one of the countries that have *not* been deterred by Fukushima, ramping up its nuclear capacity. It is quite small compared to its reliance on coal and petroleum, though.

[4] Klare (2008) suggests that because of the increase in energy demand, the 87% share of fossil fuels in the energy mix will not have dropped by much by 2030. This despite for instance wind power capacity having grown by more than 20% a year since 1997 and the US and Europe now adding more power capacity from renewables than they do from conventional sources (2008, 2009) (EWEA 2010; REN21 2010; WWEA 2011).

institutionally, the already established industries have all the advantages. And for that reason, structural change may not happen in any specific country, even if the time is otherwise ripe.

In any political economy there are a number of vested interests seeking to preserve the status quo. Among the most powerful of these we find the energy companies. These are often more capital-intensive and longer lasting than regular industrial structures,[5] giving rise to labels as techno-institutional complexes (TIC) – large technological systems embedded through feedback loops between technological infrastructure and institutions (Unruh 2000). Once locked in, they are not easily replaced. Hence, today's oil (and coal) companies are the biggest industrial giants on the planet,[6] part of a TIC that perpetuates a fossil fuel-based infrastructure, exacerbated by government subsidies and institutions, resulting in "carbon lock-in". It typically takes strong political action, beyond mere market mechanisms, to displace a TIC and implementing a new energy structure. And so, altering the energy structure at the expense of the old and established energy actors is likely to meet with resistance.

Theoretically this chapter rests on Joseph Schumpeter (1942, 1983) and Mancur Olson (1982). It blends Schumpeter's evolutionary economics and emphasis on long economic waves and 'waves of creative destruction' with Olson's focus on vested interests as something that can either hamper or benefit processes of structural economic change. Schumpeterian economics and Schumpeterian growth heavily emphasizes the importance of structural economic change. Without structural change, we would all still be hunter-gatherers, or farmers and fishermen. Hence, there is something inevitable about the rise of some industries coupled with the demise of others. Industries rise and fall, and nations rise and fall with them. Schumpeterian growth also heavily emphasizes technological progress. One of the major reasons why particular industries rise, is because they provide society with new and more efficient ways of doing things, hence providing society with tangible and long-lasting benefits. And they fall because what was once technologically revolutionary becomes commonplace and then obsolescent as society invents other means and technologies by which to solve its problems and challenges. Hence, in the Schumpeterian world, there is the steady rise and fall of industries, linked to technological progress.

Mancur Olson (1982) provides us with a mechanism to understanding Schumpeter's waves. Olson makes the observation that in the long term rigidities silt up in the economy. Without major shakeups taking place, the economy will gradually become ever more inefficient. The rigidities have to do with the vested interest structure. Vested interests seek to wrest power away from elected policy-makers, and will in extreme cases have so much power that politics for all practical purposes is reduced to propagating the interests of the most powerful vested interest groups. It may obviously be that the interests of vested

5 Energy structures can of course also be industrial structures. There is no doubt that there is an oil *industry*. And so, the distinction is somewhat artificial. Still, there are certain kinds of industries that primarily exist because they provide fuel for other industries, as opposed to providing goods *per se*, and these are the ones here being treated as energy rather than industry.
6 Of the world's 12 largest companies, 6 are fossil-fuel providers, one is an electricity company, and 4 are car manufacturers (Bradford 2006).

interests groups overlap the interests of the nation, but quite often this is not the case, and particularly so during periods of structural change.

Historically, waves of structural change have occurred with 50-60 year intervals (e.g. Bairoch (1982), Cameron and Neal (2003), Hobsbawm (1969), Landes (1969; 1998), Gilpin (1981), Modelski and Thompson (1996), Rostow (1978)). Since at least the Industrial Revolution, industrial waves with core industries rising and others stagnating and falling have provided the dynamic of the world economy: Cotton textiles fueling the early Industrial Revolution, iron from the early 19th century onwards, chemicals was one of the main drivers of the late 19th century so-called Second Industrial Revolution. Consumer durables, most notably the car industry boosted the economy from the early 20th century onwards, whereas the mid-to late 20th century has seen a wave of growth based on progress made in information and communications technologies. While there may be disagreement on exact periods and core industries, there is an ever greater consensus on the importance of structural change on vested interest, and on creative destruction, as well as on the institutional mechanisms behind these changes (e.g. Acemoglu and Robinson 2012; ; Ferguson 2012; Mokyr 1990; North, Wallis, Weingast 2009).

The industrial waves have to a major degree coincided with structural energy change (Ayres 2006; Freeman and Louçã 2001; Reinert 2007). The discovery and exploitation of a new and abundant resource that is rapidly becoming far cheaper has occurred in a symbiosis with industrial change, structural change within industry and energy fueling each other. We witnessed the end to inanimate sources of energy driving the economy with the Industrial Revolution, this shift reaching its completion with the coal, steam and the iron industry. The Second Industrial Revolution would soon have lost oomph if not for breakthroughs in electricity production. The consumer durables revolution and the rise of the car industry would have fizzled out without the oil industry. And – and this is a conceptually more contentious case – the ICT revolution was completely contingent on breakthroughs in computing power.[7]

It may convincingly be argued that we are today facing another structural change in the energy system. The once cheap and abundant resource of energy, and now all-important for a century – oil – is no longer cheap, and not as abundant. Furthermore, for other reasons, notably climate change, there are additional incentives to pursue energy paths that involve the active exploitation of other and renewable sources of energy, bringing us back full circle to sun, wind and water.

The primary purpose of this paper is to look at the extent to which vested interests influence Japanese and Chinese renewable energy policies. That renewables has struggled in Japan, which imports virtually everything, is interesting. Based on Eikeland and Sæverud (2007) (countries with unsolved energy

7 The obvious reason why this is more contentious, is that no new source of energy *per se* was discovered. It has been suggested that the late 20th century is a case of nuclear power that never took off, thus we're still rooted to a system based on fossil fuels. On the other hand, the latter part of the 20th century saw growth fueled by breakthroughs in ICTs. These were not breakthroughs leading to major new manufacturing industries. Rather, they lead to growth in the services. And hence, the need for physical resources and a new energy system was limited. What it did require was a radical new *re*source, namely microelectronics and the microchip.

problems should be the primary success stories when it comes to renewables), Japan should very much be expected to be a front-runner. This is only partially true. In solar power, it used to be. In wind power, it never was, and may never be, although Fukushima constitutes a strong potential re-think of Japanese energy policy. Showing how solar and wind are situated very differently inside the Japanese vested interest structure goes a long way towards explaining the differences between the two. China to a far greater extent conforms to Eikeland and Sæverud. It has major energy needs, as well as considerable wind and solar resources. Thus, their rapid expansion in renewables is as expected. But it also lends strength to the vested interest approach: In Japan, wind challenges the existing vested interest structure far more than solar. In China it is the other way around. Here, wind power is the preferred solution, whereas solar PV up until the very last couple of years has been primarily an export industry. Part of the reason has to do with the industrial structure, with wind power dominated by state-owned companies (SOEs), whereas solar PV has been dominated by private actors. The lower level of economic development in China compared to for instance Japan has also meant that solar PV has had less of an appeal to private customers here than elsewhere. Thus, wind is to a greater extent favored than solar. Still, even here the vested interest structure on fairly regular basis prevents wind from being as seamlessly included as one would wish for. Despite impressive growth figures, there are a number of hurdles that need to be negotiated.

Vested interest structures is obviously not the sole relevant variable. Also, it is a difficult one to operationalize. In general, it is difficult to *a priori* determine the relevant vested interests of a society or the relevant policy areas and issues that these interests influence. Also, vested interest structures consist of more than just concrete interest groups seeking to influence concrete issues.[8] However, with a specific policy-area and a limited time-period, as here, the main actors are more easily defined (see also Moe 2009b; 2012). In the following, I use a combination of Mill's (1904) method of indirect difference, the historical method and interview methods. The methods add to each other and enables us to make valid inferences, even in a study with only three cases. The Chinese case is based on literature studies. For Japan, in addition to this, a series of interviews have been made with leading experts on renewables, within both academia and industry.

JAPAN: SOLAR ON THE INSIDE, WIND ON THE OUTSIDE

Deciphering the vested interest structure is key to understanding Japanese energy policy. This structure consists of an iron triangle encompassing the bureaucracy, LDP and business interests, in particular those

8 Concrete interest groups are part of the structure, but it also consists of the institutions that have sprung up around the main vested interests and of the routines or rules of thumb that these operate according to. It is the existence of an entire vested interest structure that makes structural change so hard to accomplish.

of the electric utility companies.[9] Insiders are systematically protected, at the expense of outsiders (e.g. Katz 2003). Politics is inherently opaque, part of which stems from one of the most powerful bureaucracies in the world and from strong bureaucracy-business links. These became pathological in the mid-1970s, resulting in endemic vested interest problems (Emmott, 2009; Katz, 2003; Schlesinger, 1999). Today, what persists is a system where government is weak, the bureaucracy (in particular MOF, METI and MoFA) exceptionally strong, politicized, and with close business ties.

The close business ties means that government ministries treat the main industrial interests sorting under them as their "clients". The ministry sees it as its task to further the client's interest. For METI, the biggest client is the electrical utility companies. This gives the utilities major power. What also preserves a "harmony of interest" is the low civil service retirement age (55 years), resulting in prominent civil servants "retiring" to top-jobs in those companies that they were dealing with as civil servants. It is thus in the bureaucrats' personal interest to foster a good relationship with the client.[10] It leads to METI giving strong preference to the utilities in matters of energy policy. Also, the relationship between the utilities and the LDP has been tight, with a long history of pork-barreling and policy concessions to the utilities (DeWit and Tani, 2008; Grimond, 2002; Emmott, 2009; Engler, 2008; Luta, 2010).

Since 2003, the main Japanese policy instrument for phasing in renewables has been the Renewable Portfolio Standard (RPS), obligating the utility companies to supply a certain share of their electricity from renewables. At a lowly 1.63% of electricity output by 2014, the utilities had no problem fulfilling this (IEA, 2008:154).[11] Respondents blamed the low RPS on the influence of the utilities. In 1999, a collaborative effort between Diet members[12] and the environmental NGO ISEP, led to an unsuccessful Diet initiative to introduce a feed-in tariff (FIT). It was fought by METI and the utilities and never passed. Instead, METI proposed the RPS. The 2001-02 political fight over the RPS was protracted and politicized, but ended with the utilities and the METI mainstream winning out (DeWit and Tani, 2008; Maruyama et al., 2007). The tug-of-war caused profound consternation within METI as it was perceived as an outside rival for power (the Diet) seeking to wrest energy policy-making away from it. It led METI to become very territorial about energy policy and made it politically very hard to put renewables back on the agenda (Iida, 2010; Maruyama et al., 2007).

By 2008-09 it became obvious that four decades of near uninterrupted LDP rule was ending. The DPJ came to power in September 2009, explicitly vowing to break up the iron triangle (Japan Times, 2009). This caused great concern within METI. Thus, attempts were made to pre-empt the DPJ. METI with

[9] Sakakibara (2003) talks about an iron triangle of interests upholding the existing structure, making it very hard for rival industries to rise. It consists of the LDP (currently out of office), the bureaucracy (primarily METI) and business interests, and makes structural change both difficult and cumbersome.
[10] This is known as *ama-kudari*, or "descent from heaven".
[11] Germany for instance had a 2010 target of 12.5%, with 45% by 2030. China has set a goal of 16% by 2020. The DPJ came to power with a goal of increasing the RPS to 10% within 2020, but until Fukushima, this goal seemed far-fetched (DeWit and Iida, 2011).
[12] The "Federation of Diet Members for Promoting Natural Energy".

extreme haste launched its own FIT proposal. Quoting Iida and DeWit (2009), it was a "half-baked scheme cooked up by METI's internal politics and client-list of vested interests," and a proposal constructed by people strongly against any FIT. This is the FIT that was implemented. Whereas the DPJ plan was more comprehensive, the METI scheme gave almost exclusive preference to solar, and applied to surplus power only. In October 2009, the Denjiren (the Federation of Electric Power Companies of Japan) stated that it would do anything to restrict the FIT, meaning no smart-grids and keeping renewables beyond solar out (DeWit, 2009). While the FIT has now been redesigned, there is little doubt that METI sought to pre-empt a more comprehensive scheme.

Instead, the bureaucracy (and the LDP) always preferred nuclear. In 2005, Japanese nuclear R&D amounted to twice that of the other 25 IEA countries combined and 61.4% of total Japanese energy R&D. Since the 1960s, Japan has also been extremely committed to fast-breeder reactors.[13] Of total Japanese energy subsidies (1970-2007) nuclear received ¥9.7 trillion ($120 billion) vs. ¥1.7 trillion ($20 billion) for renewables (DeWit and Iida, 2011; Iida and DeWit, 2009; Oshima, 2010; Pickett, 2002; Schilling and Esmundo, 2009). In METI's 2010 revised Basic Energy Plan (AEEC, 2010), future energy needs were to be met by the construction of 14 nuclear plants by 2030 with nuclear up from 30% of electricity supply to 50%. And the Denjiren welcomed the new DPJ administration by stating that nuclear is the key to Japan's energy future and that the DPJ must respect the continuity of important national policies (FEPC, 2009).[14]

In METI's 2006 "New National Energy Strategy" the two demand-side focal points were energy efficiency and nuclear (Luta, 2010), despite long-standing public skepticism. Japan is one of the world's most earthquake-prone states, with accidents, scandals and lucky escapes.[15] This has led to rampant NIMBYism, with huge compensation costs to various actors before nuclear can be installed in someone's neighborhood.[16] Hence, electricity remains expensive, but as compensation costs are not part of official estimates, the official cost of nuclear electricity is artificially low. Most likely, wind would be competitive if compensation costs were included (Iida in Japan Times, 2007).

RENEWABLES

[13] In the 1968 Long-Term Plan, the first fast-breeder reactor (FBR) was scheduled for the early 1980s. Japan has spent ¥1 trillion ($12 billion) on a prototype (Monju). However, after 50 years of (largely unsuccessful) research, the first actual FBR is still not expected until 2050 (Asia Times, 2011a).

[14] The Denjiren also explicitly attacked DPJ's goal of reducing GHG's by 25% (1990-2020), implicitly rejecting policies employing renewables to meet future climate commitments (FEPC, 2009).

15 Pre-Fukushima, the 2007 Niigata earthquake was the most obvious recent example, causing radioactive leaks at the local nuclear power plant. Other accidents have involved a sodium leak at the Monju FBR (1995), a fire at the Japan Nuclear Cycle Development Institute waste facility (2003), a critical accident at Tokaimura (1999), as well as scandals over cover-ups of safety inspection procedures (2002) (Scalise, 2004).

16 Two examples: Fukushima prefecture has received a total of ¥188 billion ($2.3 billion) in subsidies and Fukui prefecture (14 nuclear units) more than ¥324 billion ($4 billion) since 1974 (Japan Times, 2011a).

Among the different types of renewables, METI's preference for solar power is strong. For the utilities, solar is certainly a lesser evil. The 1970s oil crises led to the realization that Japan was exceedingly vulnerable in terms of energy security and that an over-reliance on Middle Eastern oil might jeopardize Japanese economic growth. One of the responses was an effort to develop alternative sources of energy. Thus, up until the early 2000s solar was favored by the state. It was also an attempt at linking industrial and energy policies, drawing on traditional Japanese strengths in the manufacturing of high-technology equipment. To METI and NEDO, the success of solar gradually became a matter of prestige, largely synonymous with the success of METI/NEDO itself. While solar has challenged the existing vested interest structure to a far lesser extent than wind, and thus suffered far less opposition on the part of the utilities, it is unlikely that it would have risen without bureaucratic support. This it received. In terms of influence, solar is a minor player compared to the utilities. But compared to wind, it enjoys a kind of partial insider status, both from the way it has been able to work within rather than against the existing vested interest structure, and because of the support it enjoys inside METI and NEDO, suggesting an institutional bias for wind over solar (Bradford, 2006; DeWit and Tani, 2008; Kimura and Suzuki, 2006; Schreurs, 2002; Yergin, 2011).

Solar photovoltaic (PV) has benefited from major government R&D going back to MITI's 1974 "Sunshine Project". Initially, the goal was about energy as much as industry, seeking to provide a substantial amount of non-fossil energy by 2000, as well as result in industrial applications for domestic use and exports (Broadbent, 2002; IEA, 2008; Kimura and Suzuki, 2006). The budget was increased considerably after the 1979 oil shock. This coincided with MITI losing faith in solar thermal, which had been the program's original mainstay. As MITI wanted to retain their budget, a total budget that had increased by more than 200% would from 1981 onwards go primarily towards solar panels instead. PV thus acquired stable and abundant funding from the failure of solar thermal. A new agency, NEDO, was established in 1980, and a legal framework for fostering renewables was hammered out. By 1990 solar were to supply 5% of total energy demand, 7% by 1995 (targets were never fulfilled) (DeWit and Tani, 2008; Kimura and Suzuki, 2006).

In parallel with the Sunshine program several companies contributed R&D of their own, although the government's commitment was most likely a more important stimulant. It created an assurance that this was a field that would receive persistent funding at a stage where no commercial profits were yet to be had.[17] Industrial experiences from semiconductors were applicable also to solar cells, as both contained silicon. In a Schumpeterian industrial twist, the companies that eventually succeeded were not the giants. NEC never joined the program and Hitachi and Toshiba withdrew at an intermediate stage. Their perception in the late 1980s was that market opportunities were not developing fast enough and that solar panels would always remain a niche. Thus, they were leapfrogged by smaller companies, and SHARP, Sanyo and Kyocera instead went on to become the core of the Japanese solar panel industry.

17 True, NEC started researching solar power in the 1950s, and SHARP had since 1963 dominated a minute commercial market for solar panels for lighthouses and satellites, but without the Sunshine program there would have been few incentives to get involved.

They also organized to form the Japan Photovoltaic Energy Association (JPEA) (Kimura and Suzuki, 2006; Yergin, 2011: 535).

Lobbying helped remove crucial regulatory barriers. For instance, rooftop solar panels used to be classified as "power generation facilities", requiring an Electrical Chief Engineer for each and every panel installed, but momentum was not created until a series of newspaper articles and TV-shows started addressing the regulatory problems. Grid connection was another problem, as the utilities insisted that solar was unstable, refusing to allow actors they could not directly control onto the grid. Also, the utility companies were uninterested in contributing to a market that they considered marginal. It took a four-year (1986-90) NEDO demonstration project to persuade them of the stability of PV, along with gently impressing upon them that if push came to shove, they would be forced to give in. As the market for solar power has kept on growing, the relationship with the utilities has improved even if solar still only provides 0.1% of present-day Japanese electrical consumption (Kimura and Suzuki, 2006; Saga 2010).

Another breakthrough was the 1995 Seventy Thousand Roofs program. It created major industry growth and rapidly falling prices, both from technological progress and economies of scale. It also essentially meant a 50% subsidy on the cost of installed residential PV systems. The JPEA lobbied heavily for this (Bradford, 2006; Kimura and Suzuki, 2006). The subsidy expired in 2005, partly because METI had earlier assured MOF that the subsidy would only run until self-sustained growth was achieved, and partly because of a general swing in favor of market-based policies, initiated by PM Junichiro Koizumi (2001-06). In 2005, three of the five biggest solar panel manufacturers were Japanese (Broadbent, 2006; IEA, 2008; Kimura and Suzuki, 2006; DeWit and Tani, 2008). Since then, Japan has lost its number one position. In 2005 it led to a 35% slump in the number of applicants for residential PV subsidies, at pretty much the stage that the market took off globally. Japan no longer has the world's largest installed capacity of PV, and Sharp in 2007 lost its position as the world's largest producer of solar panels. It is currently only the 6th largest PV producer, with a dwindling market-share. Japan now controls only 9% of the market, down from more than 50% in 2004 (Roney, 2010). A subsidy was reintroduced in January 2009, and a feed-in-tariff (FIT) in November 2009. And in the wake of Fukushima, a comprehensive FIT was introduced in August 2011 (DeWit 2012c). NEDO has upgraded its 2020 target for PV installed capacity from 14GW to 28GW. EPIA (2010; 2012) considers this achievable, but it does require considerable growth, without realistically being enough to regain first place.

The preference for solar over wind has not been for cost-effectiveness reasons. METI (2010) estimates the cost of wind power at ¥9-14/kWh (¢11-17), as opposed to ¥49/kWh (¢60) for solar PV.[18] But PV has also been a commercial strategy, drawing on the supply industry to create new exports, whereas wind was always about power supply only. While initially an energy security strategy, it was also always a

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18 International figures from REN21 (2010) suggest somewhat lower costs. Typical energy costs for wind power would be ¥4-7/kWh as opposed to ¥16-40kWh for rooftop solar PV. In comparison METI's estimate for nuclear power is ¥4.8-6.2/kWh, although Iida (Japan Times, 2007) asserts that the real figure, once a number of omitted costs have been included, is more often above ¥10/kWh. DeWit and Kaneko (2011) suggest at least ¥15/kWh.

strategy that harbored long-term export potential. Still, it took 20 years for commercialization to happen. By 1993, cumulative government investments had reached ¥600 billion ($7.5 billion), with almost no commercialized technologies to show for. NEDO and MITI were under strong political pressure for the program to be commercially successful. A full subsidy and deployment program for solar seemed like the only solution (Bradford, 2006; Kimura and Suzuki, 2006). Thus, in order to prevent the failure of a program that had been heavily funded, funding was scaled up instead of down. The subsequent success of PV, as well as the urge for MITI/METI to keep justifying its existence by pointing to industrial success stories of its own creation, made it vital for them to ensure that solar receives beneficial terms. METI considers solar a success, and NEDO's pride in Japan as the world's number one in solar panels has been palpable (e.g. NEDOBOOKS, 2007). Several respondents (e.g. Iida, Kimura, Tomita, Yamaguchi) pointed to prestige as an important reason why Japan in 2009 re-introduced the subsidy.[19] From a cost-effectiveness angle, this may not have been sound business. From a political point of view it was.

The relative success of solar shows how much easier it is to break through if the industry is able to work within existing industrial and institutional structures, that is, when the vested interest structure actually works *for* it. The success of solar PV has been accomplished relatively frictionlessly – without changing any major institutional, industrial or organizational structures. At several critical junctures the nascent industry could have fallen by the wayside. First, MITI asked for a big budget, assuming that a big project would be taken more seriously and more easily becoming a permanent budget feature. At the next big juncture – the lack of major progress in solar thermal – MITI shielded the budget and received a huge increase because of the 1979 oil shock, then funneled it into PV. As the utilities were reluctant to let solar onto the grid, NEDO's four-year pilot to demonstrate the suitability of the system forced the utilities to give in. (The utility companies could have shut solar out, which would have left solar thermal for water heating the only realistic market niche.) The JPEA cooperating with sections of NEDO and MITI, and boosted by public pressure, successfully pushed regulatory change. When focus was cast on the lack of technologies brought to the market, MITI used the amount of money already spent to argue that Japan should fund deployment as well. Thus, solar at important junctures had major players fighting for it and committing to it, at the expense of existing actors in the Japanese energy-industrial complex. Yet, the Koizumi administration's strong focus on market-mechanisms was one reason for the removal of the subsidy. And while certainly favored over wind, it is a minor player compared to the utilities and the nuclear lobby. One respondent described PV as METI's "pet". It has some influence, and quite a bit of protection, but there is never any doubt who is in charge.

In comparison, wind power has been the ultimate outsider. Wind power accounts for less than 0.3% of total generation capacity, as compared to 26% in Denmark, and more than 15% in both Portugal and Spain. In Germany, four states meet more than 46% of their electricity needs with wind (Inoue and Miyazaki 2008; REN21 2012:14). Here, the problem is the flip side of the vested interest structure that

19 However, Iida (2010) adamantly states that the re-introduction of the solar subsidy had little to do with visions of Japan as number one and far more with Japan in 2008 hosting the G8 summit and wanting to show for some kind of policy achievement.

solar has benefited from. There are no major interests speaking on its behalf, and while wind turbines ought to be a promising area of industrial success, few industries perceive of it as a natural extension of existing activities. At roughly ¥100 billion ($1.2 billion) a year, the Japanese renewable energy budget is of a decent size, but the vast majority is spent on PV (Maruyama et al., 2007).

Granted, a subsidy system was enacted in 1997, incurring half the construction cost for the local government and one third for the private company. And while hardly comparable to the leaders, wind power capacity increased at a reasonable pace, from 136MW in 2000 to 2501MW in 2011. Regulatory change in 2007 ground installation to a halt, setting most companies back a year, and 2008 saw the financial crisis. Hence, the 2010 target of 3000MW was long unreachable. Installed capacity in 2010 was only 197MW, compared to almost 7GW in the US and more than 17GW in China. Most of the 1300 wind turbines are scattered around the far north and south, away from major population centers (Engler, 2008; GWEC, 2008; Inoue and Miyazaki, 2008; Maruyama et al., 2007; WWEA, 2012).

Yet, wind has never flourished in Japan. Among the most important reasons is that to a much greater extent than solar it challenges the existing framework: In terms of industrial policy, solar was a better fit. The customers of solar PV were individual households (and businesses), and it was easier to create discreet products sold to individual customers. MITI always saw a greater potential for commercialization from solar, and so unlike wind, solar fit into MITI's strong preference for high-tech export industries. And so, if a distinction were to be made between energy and industrial policy, wind power in Japan belongs almost exclusively to the former. It is about increasing energy supply. Solar policy was always energy *and* industrial policy.

Solar PV and windmills supply their power in a different manner. Solar PV is typically installed on rooftops on individual buildings. Since houses are already grid-connected, the solar panel is automatically connected (at least ever since the NEDO demonstration project).[20] A windmill is typically set up away from the grid, begging the question of who should pay for the cost of connecting it. Because there has been no unbundling of electricity into transmission and generation, the electric utility companies can essentially shut wind power out from "their grid". This they cannot with roof-top solar.

Quantitatively, one wind power unit (a windmill) provides far more energy to the grid than one rooftop solar panel. Thus, wind provides more power per energy unit and requires a bigger investment in terms of grid lines. But the grid is weaker in the country, where most windmills are located (GWEC, 2008). With solar, each power generator is too small to affect the grid by much. Also, they are typically located in populated areas, where the grid is already strong. What several respondents suggested (Mortensen, Osada, Ueda) was that for Japanese wind the most important issue is priority access to the grid. Without this, wind power cannot grow, almost regardless of other regulatory changes. For short, the degree of structural change required is far greater than for solar.

20 99% of the PV systems installed in 2009 were grid-connected, 95% of those residential PV systems (EPIA, 2010; IEA, 2010b).

The main problem is that the 10 electric utilities – each with a regional monopoly – strongly oppose this. And they usually have enough influence in METI to get their way. For the utilities to let wind power into the grid seen as acquiescing to a process of liberalizing the entire electricity sector, which they have fought tooth and nail for 15 years. They have no interest in letting rival power producers in. Wind power is produced by independent power generators, which essentially means that they are competing against the utilities. The utilities buying electricity from wind power generators is like making a contribution to the enemy. Thus, the opposition against wind is far stronger than against solar.

And so, the problem runs deeper than merely having no major interests speaking for it. METI has its obvious policy divisions. Yet, none of these speaks for wind power, whereas solar certainly has its support group. Even NEDO in the 1990s concluded that large-scale wind power was unfeasible. Moreover, there are powerful interests blocking wind, most prominently the utilities and the nuclear industry. According to Iida (in Engler, 2008), they "act as regional monopolies, functional monopolies, and political monopolies. They are rule makers, and they make an effort to exclude wind power from their grid," limiting wind energy to 2-3% of the electricity flowing on the grid.

Whether genuine or merely excuses, wind power has met with a number of objections from the utilities. One is that Japanese weather conditions are particularly difficult, with choppy winds and seasonal typhoons. Between 2004 and 2007 several turbines were severely damaged, leading to new safety standards, the J-class windmill, and a new building code classifying wind turbines taller than 60 meters as buildings. This made the application procedure complicated, expensive and lengthy.[21] A Japanese wind power application takes from two years and upwards before a windmill is installed. The similar process in the US might take 3-4 months (GEWC, 2008; Mortensen). This makes it hard to achieve profitability. Mortensen suggested that in order to become more attractive for wind power, Japan should accept international standards. Instead, standards are unashamedly national. It was however widely agreed that using wind conditions as an argument is primarily an excuse. Wind conditions do not present insurmountable technical obstacles. Thus, the Japanese market is not particularly interesting. In 2009, total installed capacity was a mere 180MW, divided between 10 to 20 customers. In comparison, Mitsubishi Heavy Industries in 2007 landed a single US order for a total generation capacity of 1363.4MW (Iida, 2010; JCN Network, 2007).

The primary objection of the utilities is however the variability of the power source. If the power source is unstable and unreliable, the utilities cannot afford to admit much of it into the grid. To solve the intermittency problem, the utilities advocate battery storage rather than channel the electricity directly to the grid. Batteries however, easily increase the costs by 50 per cent, in some cases even doubling it, making it more or less impossible to return a profit (Alternative Energy, 2006; DeWit and Iida, 2011; Engler, 2008; Greentechmedia, 2008). The argument is backed up by a reference to the peculiarities of

21 Mortensen (2009) added that the new framework is biased in favor of Japanese manufacturers as it draws on inputs from domestic producers only, with no foreign manufacturers included in the hearings (which they would have been in the EU).

the grid system. In a large, integrated European-wide grid, temporal and spatial fluctuations in the power supply of wind even themselves out. In Japan, the population is less than a third of the EU, and it is not connected to any foreign grid from which it may draw in case of crisis. More importantly, the grid is not very integrated. The country is divided into 10 regional monopolies with only weak inter-grid connections. Japan does not even run its grid on the same nationwide frequency, the south-western part running on 60Hz and the north-eastern on 50Hz. This makes the vulnerability and reliability argument of the utilities more credible than in most countries. It also means that major wind power expansion requires greater infrastructural investments than would solar (Alternative Energy, 2006; Kaya, 2009).

Still, most of the respondents (e.g. De Wit, Iida, Lund, Mortensen, Okumura, Tomita, Yarime) felt strongly that this argument is overplayed. One pointed to the ease with which power was transferred between different power regions and companies after the 2007 Niigata earthquake. Also, typical claims about the reserve capacity of the utilities being significantly lower than in Europe rests on accounting techniques whereby capacity under maintenance and potential capacity imported from other regions is excluded. Thus, the genuine reserve capacity is less critical than the utilities admit to. Two other respondents suggested that the grids are far better connected than the utilities claim, and that regulating the grid so that renewables is given priority access, but subject to temporary removal in case of crisis, would be a fairly seamless way of improving the conditions of wind power. In a situation where wind will realistically not go beyond 1-3% of total electricity production, existing inter-grid connections should suffice.[22]

FUKUSHIMA

For years, Japanese energy policy was grid-locked, with no internal dynamic triggering change. With Fukushima, a shock big enough to affect the entire political system occurred. It is not obvious that change will result as a consequence, but there is now a possibility that this will happen.[23]

The immediate effect of Fukushima was for 10 GW of generating capacity, or more than 20% of present nuclear generating capacity (roughly 49GW), to go offline. At times, all of Japan's nuclear reactors have been down for repairs or maintenance, depriving Japan of pretty much all of their nuclear electricity generating capacity.

(Asia Times, 2011d; DeWit and Kaneko, 2011; Japan Times, 2011b; Morton 2012).

Rolling blackouts were avoided, but only because of the public's exemplary compliance with a host of power-saving measures.[24]

22 Arguments have also been made that wind requires more space than solar, and that land is not only at a premium, but hard to expropriate. While true, most respondents felt that this is still not the real reason for lagging behind.

23 Similar accidents, not to nuclear, but to other industrial facilities in the 1960s were among the reasons why Japan went from "polluter's paradise" to one of the world's cleanest countries (e.g. Broadbent, 2002).

But external shocks can create windows of opportunity. A number of polls have shown a clear majority of Japanese citizens to be in favor of phasing out or even immediately shutting down Japan's nuclear capacity. TEPCO has just started its own solar power plant, with more planned. Thus, while it is too early for final outcomes, energy policy is subject to a serious rethink. Former PM Naoto Kan declared that within 2020 renewables should account for 20% of electricity production, and he made the passing of a general FIT, extended to all renewables, a condition for his resignation as PM.[25] It passed in August 2011 (asahi.com, 2011a; Bloomberg, 2011; DeWit and Kaneko, 2011; Japan Times, 2011c; RenewableEnergyWorld.com, 2011).[26] The extent to which this will be continued is unclear. Yoshihiko Noda, who replaced Kan as PM seemed more favorably predisposed towards nuclear, among other things delaying the nuclear phase-out date that the DPJ set in their energy policy plan from 2030 to before the end of the 2030s.[27] Further, this is a plan that will be up for review every three years, as part of the Basic Energy Plan. Thus, it is not impossible that the plan could be scrapped altogether as early as 2015, as the LDP, which at least in the past has been distinctly more in favor of nuclear than the DPJ, has now been voted back in power. The LDP of today does however certainly seem to be less gung-ho about nuclear now than in the past. For the nuclear industry, Shinzo Abe should still be a better PM than Noda.

Fukushima has made the ease with which the utilities get away with regulatory fraud, and the collusion between the utilities and the regulator, abundantly clear. Previous minister of trade and industry, Banri Kaieda stated that METI still stands at the center of reforming energy policy. And METI has downgraded nuclear from the core of energy policy to now form one of three pillars (including energy efficiency and renewables) to the Japanese energy system. However, for long one of the main stumbling blocks has been the power companies. A METI report in the summer of 2012 recommended unbundling, but the 2012 Basic Energy Plan, in which this proposal would have to be adopted in order to come into effect, is late (Japandailypress 2012). While the electric utilities are fighting this tooth and nail, signals emanating from Tokyo suggest that unbundling is going to happen, even with the current LDP administration.

For renewables, one of the most promising developments post-Fukushima has been the passing of a comprehensive FIT. It passed in August 2011 and came into effect on July 1 2012.[28]

(asahi.com, 2011a; Bloomberg, 2011; DeWit 2012c; DeWit and Kaneko, 2011; Japan Times, 2011c; RenewableEnergyWorld.com, 2011).

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24 Electricity consumption dropped by 9% compared to 2010 (RenewableEnergyWorld.com 2011).
25 It still contains a bias in favor of solar as the rate for solar energy will be roughly twice as high as that for other renewable energy (Bloomberg, 2011).
26 The LDP and Keidanren went against it, resulting in a compromise whereby energy-intensive industry is given an 80% discount on any increase to their electric bill due to the FIT.
27 The IEA considers the lifespan of a nuclear reactor to be roughly 40 years. Three reactors are more than 40, 16 will be more than 40 and another 17 more than 30 by the end of the decade (Japan Times, 2011a).
28 The LDP and Keidanren went against it, resulting in a compromise whereby energy-intensive industry is given an 80% discount on any increase to their electric bill due to the FIT.

At ¥42/kWh the rates for solar PV are more than twice the German rates and more than three times as high as in China, and the initial effect has been well beyond what was expected (DeWit 2012c). However, the rates for renewable energy will be decided by the trade and industry minister in consultation with other experts and ministers, and subject to revision in three years. Thus, it is hard to know whether or not these rates will stand, and while the FIT has led to major new optimism in the renewables industry (although more so for solar than wind – PV is projected to account for 80% of the new installed capacity over the next decade), it is too early to know what will happen (asahi.com, 2011b; Asia Times, 2011b; 2011c; Bloomberg, 2011; DeWit 2012a; 2012b; Huenteler et al. 2012:7).

The other concern is China. Since 2009 PV prices have fallen dramatically (often by as much as two thirds), and less because of technological improvements than because of Chinese manufacturers flooding the market. The very generous Japanese FIT might thus easily end up subsidizing large-scale Chinese imports rather than stimulate the domestic solar industry. The domestic industry will most likely benefit too, at least short-term, but if the FIT is set so high that it triggers the same kind of PV boom and bust-cycles that we have seen in several European countries of late (notably Spain and Italy, but also France, the Czech Republic and to some extent Germany), a Japanese bust will leave the low-cost Chinese manufacturers standing while making life for high-cost Japanese ones with razor-thin profit margins very difficult (Asano 2012; Ernst & Young 2012:30; Huenteler et al. 2012:9).

While Fukushima will contribute to more rapid deployment of renewables, energy expert Paul Scalise warns that the main problem may easily be transmission and distribution and that improving the grid will require major investment (ACCJ 2011; Scalise, 2010). In the short term LNG will be the biggest winner. TEPCO already has 25.8GW of gas-fired generating assets. This is the quick and dirty stop-gap solution, and the politically easy one. But it is also an expensive one. In March 2012, Japan experienced its first trade deficit since 1980, among other things because of fuel imports soaring (up from ¥17.4 trillion in 2010 to ¥21.8 trillion in 2011, and from 3.6 to 4.6% of GDP). It also lends itself to the continued dominance of the utilities. Thus, the crisis could be a window of opportunity for renewables. Public opposition to nuclear power makes the installation of new capacity politically impossible, thus the gradual phasing-out of old nuclear plants, with no replacements being built is the likely default option, with the gap in power filled by thermal, including a considerable potential increase in coal consumption, and gradually renewables. Yet, energy policy-making power is still located within METI (and the MOF). This is realistically where attitudes toward nuclear and renewables must change before energy policy will (ACCJ, 2011; Adams 2012; DeWit 2012b; DeWit and Kaneko, 2011; Ernst & Young 2012; Frei 2012; Hayashi and Hughes 2012; Terashima 2012).

CHINA: NO STRUCTURAL TRANSFORMATION, BUT FAST FORWARD EVERYWHERE.

The Chinese case conforms far better to Eikeland and Sæverud (2007). China has major unresolved energy issues and is fairly abundant in certain renewables. Thus, we should expect China to be a frontrunner in the development and implementation of renewable technology. And so, in wind power it more or less doubled its capacity six years in a row, in 2010 surpassing the US in terms of total installed capacity, with 44GW, before growth slowed somewhat in 2011, with capacity still increasing to 62GW. In solar PV, in terms of installed capacity Chinese figures are by no means equally impressive. For many years, PV for all practical purposes existed as an export industry only, and it is only over the past couple of years that growth in domestic PV installations has picked up (although dramatically so, to the extent that the goal for PV installations is now 50GW for 2020 as opposed to only 9GW for 2015). Instead, China is the largest solar PV production in the world, supplying 45% of global demand, as well as some of the largest companies.[29] It also accounts for 65% of global installation of solar water heaters (Liu et al. 2011; Liu and Goldstein 2013; REN 21 2010). Thus, in both wind and solar, growth in one shape or another, has been explosive. And in targeting wind power as one of the growth industries to bolster China through the present world economic crisis (Wang 2010; Zhang et al. 2010), China explicitly targeted a renewables industry as a new growth sector. In fact, among the "new strategic and emerging industries" singled out in the 12th Five-Year Plan, we find both wind and solar (as well as for instance biomass, clean-energy vehicles, high-speed rail, energy-saving, but of course also nuclear), promoted to replace the "old pillar industries", among which we find coal and oil (Lewis 2013). Renewables was never really a policy issue until 2005, but following extensive reshaping of the regulatory framework (2005-06), progress has been very rapid. The results have been impressive, and they have been fast.

While this conforms to Eikeland and Sæverud (2007), in many ways renewable expansion might be taken for granted as long as Chinese economic growth remains strong and energy demand keeps soaring.[30] It can also easily be argued that China is still primarily picking low-hanging fruits. Solar PV has up until recently been more or less exclusively an export industry, with a minuscule impact on Chinese energy supply. In the US, 45% of new electricity capacity installation came from wind. In China only 6%. And despite impressive growth figures, renewable electricity capacity as a share of total electricity capacity actually fell by 1.37% between 2005 and 2007. In 2008, the share of wind energy to total electricity was only 0.4% (Denmark 25%, Germany 8%), and coal, which still accounts for 70% of primary energy consumption will remain the dominant source of energy for decades to come (Andrews-Speed 2012; Liu and Kokko 2010; Wang et al. 2010; Zhang et al. 2010). Thus, at the moment, we are not really witnessing an energy *transition* in China. Little structural change has occurred. Rather, the pattern is one of more energy, but from all kinds of sources, and of energy efficiency, where China is still lagging far behind the frontrunners.[31] So, while impressive improvements have happened, as long as no major structural change is occurring, the state does not have to make political decisions that to any major extent go at the expense of existing vested interests. In that sense, it is still hard to judge for sure the real strength of Chinese vested interests.

[29] It should however be noted that world market leader Suntech Power, recently went bankrupt as a consequence of the market glut, essentially created by the Chinese industry itself.
30 Projected to rise by 45% between 2009 and 2020 (Zhang et al. 2011).
31 Its energy intensity in 2006 was 2.5 times the world average and 7.2 times that of Japan (Zhang et al. 2011).

Yet, things have certainly happened. The 11th Five Year Plan (2006-10) explicitly targeted a 20% reduction in energy intensity, and despite economic growth that far exceeded the original projections, the final result was an impressive 19.06%. In the 12th Five Year Plan (2011-2015) a 16% reduction target has been listed. The share of coal is supposed to drop from 70 to 62% of TPES, with the carbon intensity of the economy reduced by 40-45% (by 2020, from a 2005 base) (Guo and Zusman 2012; Price et al. 2011). Future targets are also impressive, fueled by several factors: One is the increasing realization that China is one of the countries that will be hit the hardest by climate change. Another has to do with energy security. While the domestic energy supply reliance is currently above 90% (mainly due to domestic coal mining), it is unlikely to remain this high unless China can considerably ramp up its renewable energy production. A third reason has to do with the perception that these are potential growth industries, and that there are major industrial and economic spoils to be had for China (Lewis 2013; Wang 2010; Zhang et al. 2010).

While China is seemingly headed for the sky in terms of renewables, two major challenges must be overcome. The first has to do with the underdeveloped grid network, the second with the lack of coordination between different actors and different branches of government as well as the opacity of the system. While there have been no major vested interest problems up until now, these are challenges that will require tough decisions involving a number of powerful actors with overlapping areas of responsibility. In a future where Chinese growth rates can no longer keep everyone happy, there is certainly a major potential for Chinese vested interest problems as well.

RENEWABLES

While Japan pre-Fukushima seemed lukewarm on renewables, and heavily influenced by vested interests, on the face of it this has not been the case in China. While the interest of the state in renewables is recent, there is little doubt that it is firmly behind the expansion of renewables (e.g. Han et al. 2009; Wang 2010). Prospects for wind have been bright for quite some time already, whereas the past couple of years have also seen an upswing in the favors of solar.

Prior to 2005 renewables was not much of a policy issue. Granted, China has a history of wind going back at least to the 1970s and as such is one of the earliest countries to have sought to industrialize wind energy. The first wind farm was connected to the grid in 1986 (Han et al. 2009; Xu et al. 2010; Zhang et al. 2010). Yet, prior to 2005, these were either very small wind turbines or pilot projects. And by 2003, China was nowhere close to fulfilling its 1GW of wind power target. 2003 was a first turning point. The VAT on wind power was halved to 8.5% and a number of duties reduced or removed. Yet, while capacity doubled between 2003 and 2005, it is only with the 2005 (implemented in 2006) Renewable Energy Law (REL) that wind power has taken off, with installed capacity more or less doubling every year since then. Sinovel and Goldwind are today among the 5 biggest turbine manufacturers in the world. The REL obliges the grid companies to purchase wind power (although whether this is a strict legal obligation is unclear) and the power companies to supply it, which has been crucial.

Starting in 2003, the Wind Power Concession Program introduced a tendering system whereby power companies would bid for concessions provided by the central government.[32] While this system worked well enough in the sense of stimulating competition, it had glaring weaknesses. In a country dominated by SOEs, budget restrictions are often soft.[33] And when wind power concessions typically go to the lowest bidder, there is a serious potential for underbidding. This potential for underbidding has been accentuated by the fact that the state has actively promoted the development of local wind turbine manufacturers. There are now more than 60 of these (up from only 6 in 2004), and so the supply of wind turbine units has greatly outstripped the demand. This has had two consequences. First, receiving a concession that you cannot fulfill because of underbidding, means that the power company receiving the concession will seriously underinvest in the wind farm, as it may not have the financial resources to construct and operate it at the price of the bid. Second, since SOEs have laxer budget restrictions than private firms, including foreign companies, they can underbid more seriously. 97% of the concessions have gone to SOEs (Han et al. 2009; Liu and Kokko 2010; Ru et al. 2012; Wang et al. 2010; Xu et al. 2010; Zhang et al. 2010; Zhang et al. 2011; Zhao et al. 2012).

A FIT was introduced in 2006, but to biomass only. However, the weaknesses of the concession program has become ever more obvious,[34] and in 2009 it was for all practical purposes abandoned, giving way to something resembling a FIT, whereby the country is divided into four regions with government-set benchmark prices. While too early to tell, this should in principle reduce market entry-barriers. Initial impressions seem favorable. A lack of coordination and cooperation between different government agencies remains a problem (Liu and Kokko 2010; Zhang 2010; Zhang et al. 2010).

The Chinese wind power market has a few peculiar characteristics. The halved VAT was criticized as stimulating imports rather than domestic production and R&D. Thus, tariffs were raised on smaller turbines, leaving tariffs low on large turbines where technology-wise China has been lagging. This is another characteristic of the market. While the market is dominated by SOEs (more than 80% of installed capacity), the technology gap means that foreign multinationals have been relied upon for the largest turbines. Chinese wind power is still dependent on importing technologies and systems and suffers from a lack of qualified researchers and engineers. However, ever since 2007 domestic manufacturers supply more than 50% of the market, where only a few years earlier 75% of all turbines were imported. Sinovel has produced 5 and 6MW turbines. Goldwind has tested off-shore turbines and is the first Chinese wind power company to rely wholly on itself for R&D. The old and established SOEs (27 companies) have been

32 Since 2005, projects of less than 50MW can be decided locally (Xu et al. 2010).
33 In addition to the tendering system, there is also a more typical command-and-control system of government contracts, whereby proposals are sent to the NDRC (Han et al. 2010). The concession system was introduced in order to create more competition.
34 Introducing a 70% local content requirement as an additional criterion was used to water-down the worst side-effects of underbidding (Zhang 2010)

able to draw upon a history of manufacturing in heavy machinery, electric power generation equipment and aeronautics. But turbines produced by smaller firms (also SOEs) do not have the same technological, efficiency or utilization levels. These firms supply the market for smaller turbines, and are protected by tariff barriers. Finally, a number of multinationals, like Vestas, Gamesa, Suzlon and General Electric, have set up operations in China.[35] For the largest turbines, these are the dominant firms. While the situation is certainly improving, it is still a problem that most domestic turbines are small and not competitive, and that the technical expertise is weak. Domestic turbines are also less reliable, and the wind power industrial chain still not as complete as in Europe. However, progress has been extremely rapid, to such an extent that in 2009 local contents requirements were scrapped, no longer protecting local producers. Growth is expected to continue at a very rapid pace for a long time still. Projected targets have been beaten time and again, and at 62GW as of the end of 2011, the installed capacity has already passed the projected 2020 target of 30GW set as recently as 2007, and now ramped up to a more challenging 200GW by 2020 and 1000GW by 2050. Moreover, the first offshore farm was constructed in 2010. For now, 24 offshore wind farms have been approved in the 12th Five-Year Plan. With a projected potential of 550GW it is not inconceivable that offshore wind might provide 50% of the electricity needed in the coastal regions by 2030. So far, a slightly more modest target of 30GW has been set for 2020 (Hong and Möller 2011; Hu et al. 2013; Lewis 2013; Liu and Kokko 2010; Ru et al. 2012; Zhang 2010; Zhang et al. 2010; Zhang et al. 2013; Zhao et al. 2012; Xu et al. 2010).

Solar PV has fallen in the shadow of wind power. Based on geographical and weather conditions, China should have near unlimited possibilities within solar. The growth of the Chinese PV industry has been extremely rapid, but consumer products for domestic use have up until recently accounted for a very small share of its activities. Instead, the German FIT in particular has provided a huge market for Chinese PV. 90% of Chinese solar cells are exported abroad, and 95% of the revenues of now bankrupt Suntech were derived from markets outside of China (Liu and Goldstein 2013; Yergin 2011:580; Zhang et al. 2012). And so, by 2010 Chinese companies controlled 45% of the world market for solar PV, up from only 3% as late as 2004.

However, the financial crisis has not only reduced European demand in general, but also led to less generous FITs. This made Chinese leaders realize that dependence on foreign markets means vulnerability. Thus, from 2008 to 2011, installed capacity has increased more than 20-fold, up from 145MW to 3GW (still measly compared to Germany's almost 25GW), and future targets have been continuously shifted upwards, and now stand at 9GW by 2015 and 50GW by 2020. China will within very soon have one of the largest domestic markets for solar PV in the world. Thus, in 2009 both the Solar Roofs and the Golden Sun programs were initiated. The former subsidized capital investments in PV, the latter was a demonstration program, supporting demonstrations of key technology (Chinese authorities think that PV will be competitive on price within 5-10 years). Further, the NEA has initiated a FIT for

[35] By the end of 2009, the Chinese market consisted of 70 wind-turbine manufacturers: 29 SOEs and state-holding enterprises, 23 private enterprises, 10 foreign-owned and 8 joint ventures (Zhao et al. 2012).

solar, with concession bidding for large-scale on-grid projects. In addition to this, the Ministry of Science and Technology supports R&D in universities, research institutions and firms. Still, compared to other countries, public budgets for R&D in PV are minuscule compared for instance to those of Germany and the US, and far behind Japan and Korea as well. China may not have come exceptionally far in terms of domestic PV installations, but it currently holds almost half of global production capacity, and hosts a well-developed PV industrial chain with more than 50 solar cell and 300 solar module companies as well as having abundant resources of quartz sand and silica (EPIA 2012; Grau et al. 2012; Huo et al. 2012; Liu and Goldstein 2013; REN21 2012; Wang 2010; Zhang 2010; Zhang et al. 2011; Zhao et al. 2011).

Why China prioritized wind over solar in the first place has a lot to do with technology. Compared to wind power, the technological entry-barriers in solar PV (and modules) have been far smaller. The technologies are fairly familiar, and compared to wind, production is labor- and energy- rather than capital-intensive. This means that international competitiveness was fairly easily reached. This is something that happened without much direct policy support from the Chinese state. Prices for PV have dropped by 75% since 2008, mainly because of massive supply from Chinese manufacturers and a drop in demand from European countries ever since the financial crisis, and not because of technological progress. It has certainly reduced the profitability of the industry, but as labor costs are lower in China than in most competitor countries, Chinese manufacturers can supply solar cells at prices 20-30% lower than the competition (Zhang et al. 2012). And consequently, at the moment 9 of the top 15 PV manufacturers are Chinese. However, Chinese companies are not shielded against the competitive pressures. Wafer-thin profit margins may be hitting non-Chinese manufacturers harder, but the recent bankruptcy of Chinese giant Suntech Power shows that even the Chinese are not immune to the glut that they have themselves effectively created. Reports speculate that some of the Chinese manufacturers have been losing $1 for every $3 of sales in 2012 (NY Times 2013). Which is something that will inevitably lead to bankruptcies in the long run.

VESTED INTERESTS?

Taking current growth rates both within wind and solar in account, vested interests seems insignificant. Instead, China seems to conform to the image of Eikeland and Sæverud (2007), whereby countries with large unsolved energy needs and major renewable resources are the ones with the most ambitious renewables policies. The answer is more complicated. For a number of reasons it is however hard to gouge the actual strength of Chinese vested interests. The Chinese economy may be a market economy, but it is till to a far greater extent than Western economies characterized by command and control rather than market incentives, and it is still heavily populated by SOEs. The SOEs account for the large majority of Chinese energy actors, including wind power, where they represent more than 80% of the installed capacity. In wind power, the state is actually heavily involved: It commissions wind power projects, it operates wind farms, and through the SOEs it produces the manufacturing equipment (Liu and Kokko 2010). Thus, the state keeps interacting with itself, and it is not easy to determine who the actors, and thus the potential vested interests actually are, as well as how strong they are. One might obviously conclude that because the state is so heavily involved, the whole vested interest problem has been eliminated. The state has achieved some kind of economic-industrial rationality that Western economies can only hope for, eliminating interest battles. But that would be a fallacy.

The first point to make is that this in many ways is the name of the game in Japan as well. The often widely praised (and sometimes ridiculed) Japanese bureaucracy has a number of different policy divisions. METI is no neutral actor, and its relationship with select industries is close and protective. There is no obvious reason why an economy consisting of SOEs would have a substantively different relationship with an otherwise very opaquely institutionalized system. Instead, one could easily make the argument that the flurry of SOEs with lax budget restrictions make inefficiencies more glaring, the relationships with the state potentially more incestuous, and even more based on personal relationships (rather than profit calculations) than in other countries. Also, with personnel going back and forth, tending towards a harmony of interest between state and business, there is no reason why this would make for a political economy in which industrial decisions were more rational and less biased than elsewhere. While this is mostly conjecture, empirical evidence from other countries suggests that this is an environment in which vested interests often thrive, and where mobility, institutional flexibility and openness to change is replaced by a social order that shelters the actors that are already on the inside of the system (e.g. Acemoglu and Robinson 2012; Ferguson 2012; Moe 2009a; North et al. 2009).

Secondly, the SOEs dominating the wind power market are not primarily wind power companies. Instead, they are power companies relying primarily on thermal, oil and nuclear, and have branched out into wind because the state forces every power generation company to have a certain amount of non-hydro renewable power (5%) in their energy portfolio (Liu and Kokko 2010). This is a major difference from Japan, where the wind power companies have suffered from being in competition with the electric utilities. Being part of a bigger company could mean that wind is being sheltered from the forces that it is being exposed to in Japan. But it could also have the opposite effect. If the energy companies taking on wind do this only because the state mandates it, as a plight and not a business opportunity, it could lead to the neglect of wind (and solar) and to the power companies only fulfilling minimum requirements instead of pushing developments. Thus, what has happened on a number of occasions in the past – since the SOEs control the entire wind sector – because of their lax budget restrictions, SOEs have been able to underbid non-state owned competitors, often to such an extent that the winning tender price has gone below normal profits rates, leading to low quality installations as a way of rescuing profits from the wind farm (Zhang et al. 2013).

Third, while Chinese wind power installation figures are highly impressive, maybe as much as one third of the capacity is not grid-connected. Add to this that the operating efficiency is less than half of what it is in the US, and we should not paint a rosier picture of China than can be justified. In 2011, both the US and China had 47GW of grid-connected wind power. However, whereas the US got 120TWh from its 47GW, China only managed 74TWh (Schuman and Lin 2012; Wang et al. 2010; Zhang et al. 2013). Grid-connection is a problem in solar as well. The American company First Solar in 2009 signed a contract whereby they by 2019 will have built the largest solar plant in the world, in Inner Mongolia at 2GW and 600 square kilometers. Inner Mongolia is prime area for wind power as well, but it is also an area where grid connections are notoriously weak. Another example is Jilin province in the far north-east where the nearest city is 300 kilometers away from the wind farm, and the nearest 220kV line is 150 kilometers away. While much attention is given to state-of-the art large-scale wind turbines, poor integration between the wind farm and the grid is a far bigger obstacle to future growth (Wang et al. 2012). Amendments to the REL, meant to improve the grid connection of wind power, were implemented in 2009, and NEA in 2011 implemented regulations to prevent wind power curtailment (Lewis 2013; Schuman and Lin 2012). Thus, there is awareness of these problems, and attempts are made at working around them. The political economy of Chinese renewables still leaves much to be desired, though.

This leads to a fourth and related point, which to some extent supports a suspicion that the embrace of wind from the power companies and the grid companies is somewhat half-hearted. As in Japan, one of the problems, although on a far greater scale, is the quality of the grid system. With most of the wind resources in the north and the northwest and the major population centers in the east and southeast, the transmission challenges are formidable. Unlike in Japan, the 2005 REL specifies that renewable energy has priority access to the grid, and that the grid company is responsible to bear losses incurred as a consequence of problems connecting renewable energy to the grid. Without this, grid companies would most certainly have resisted the introduction of renewable energy onto the grid. Still, the grid companies have been very reluctant to fulfill their obligations and a number of power companies and grid companies have not met the designated targets. The main concern is akin to the one faced by renewables in Japan, namely that renewable electricity fluctuates to such an extent that it destabilizes the net. Curtailment of wind-generated electricity in 2011 led to the top 10 wind provinces losing 17% of their projected generation, or a total of 6TWh. And so far, there have been no reported cases of penalties being imposed on any of the grid companies for non-compliance. Further, a fourth of Chinese renewable projects are being delayed in connecting to the grid. And even the FIT subsidies have typically been delayed by 6 to 9 months after the electricity has actually been generated and sold. The grid companies have also been reluctant to make heavy investments in transmission infrastructure. The monopoly of the State Power Corporation was dismantled in 2002. As of today there are five state-owned power generators and two grid companies. For practical purposes the two grid operators still function as de facto regional monopolies. This may easily be the biggest barrier against the expansion of renewables, and the building of transmission lines in coordination with the development of wind power must be one of the main priorities for the future. A unified power grid network is not scheduled until 2020, and at the moment, China for all practical purposes consists of seven independently operated grids (Jiang et al. 2010; Schuman and Lin 2012; Wang 2010; Wang et al. 2010; Zhang 2010; Zhang et al. 2013).

Without any market competition, the grid companies have had no incentive to expand the grid (building infrastructure is costly, most renewable plants are located far away, and renewable energy is also more costly than coal-based electricity, thus renewables reduce the operating profits of the power companies, somewhat similar to in Japan).[36] A spokesman for one of the grid companies even declared that wind should remain at 8-10% of total electricity demand (Wang 2010). Which is much compared to Japan, but not compared to a host of European countries. Despite the REL, there are "few regulations and instructions on how to connect wind power to the grid" (Zhao et al. 2009:2887). Wang et al. (2010:1875) state that "it is commonplace for grid enterprises to refuse or delay building or expanding grids to connect to renewable power plants". Some renewable plants have ended up building the grids themselves, even if this explicitly contradicts the REL. Thus, it is quite evident that vested interests are present also in China.

Fifth, China is to a far greater extent than Western countries still characterized by command and control than market incentives. And while the tendency is certainly one of more markets and less command and control, the consequence up until now has been to targets being set for *installation* rather than electricity *generation* (or for that matter the *utilization* of the electricity), as witnessed among other things by the large proportion of off-grid installations. Power quotas for generation are now being implemented, which is a large step forward as it provides incentives to generate electricity and for grid companies to connect and transmit rather than just installing (Schuman and Lin 2012; Zhang et al. 2013). Also, the high volume of subsidies has stimulated mass production rather than technological improvements. Little of the money invested in renewables is flowing into innovation. Policies are geared towards boosting capacity instead of towards stimulating technological progress, and the communication between the central government and the provinces is bereft of bottom-up input. Thus, goals and targets are being imposed on the provinces with little guidance as to how they should be fulfilled. The focus on capacity rather than technology and the fact that growth in renewables is heavily dependent on subsidies also means that success is becoming ever more costly. Subsidies for renewables (wind, biomass, solar PV) are paid for through a surcharge on electricity levied on consumers. In 2006 it was RMB0.001/kWh, and it has now (2011) been raised to RMB0.008/kWh. This however is not enough to cover the expenses of the subsidy, and the shortfall increased from RMB1.4 billion in 2010 to RMB22 billion in 2011, and will keep increasing unless the FIT comes down or the surcharge goes up.[37] Solar currently has the highest FIT, and is also expected to grow the most rapidly over the next decade (at least percentagewise). Thus, reductions to the solar FIT may easily happen. Between 2002 and 2008, wind power subsidies increased 17-fold. It is not obvious that this can continue. A further problem is that the FIT that has been implemented does not include a tariff degression formula, as found in most

[36] In terms of construction costs, wind power is about twice as expensive as a coal plant in terms of Yuan per kilowatt, whereas the running hours of a wind power farm is also only half that of coal-fired plants. On top of that, the tax on coal-fired power is 0.07 yuan/kWh compared to 0.173 yuan/kWh for wind power (Zhao et al. 2012).

[37] Schuman and Lin (2012) report a projected RMB710 billion in subsidies for the entire 2011 to 2020 period. In comparison, Germany in 2011 paid a total of €13.6 billion for all forms of renewable energy through its FIT, which might easily rise to as much as €18 billion by 2013 (Asano 2013). RMB710 billion equals roughly €90 billion, thus over a ten-year period, this is clearly less than the German subsidies. It should however be noted that these subsidies are driven more by solar than by wind, and that Germany has installed 25GW of solar PV capacity in contrast to China's 3GW, and that China's expenses will most likely increase more rapidly. Also, Germany is now reducing its FIT because it is simply getting too expensive.

Western systems. Instead, it simply states that the government will adjust the tariff based on changes in investment capital and technological improvements, making for a lack of predictability compared to in most other countries (Hu et al. 2013; Schuman and Lin 2012).

Also, the lack of an explicit technology focus (as opposed to capacity) has also meant that in terms of R&D in renewables, China is lagging. Despite making major leaps forward, there is limited innovation in the wind power industry. Chinese firms are still not on a par with the top Western companies, and quality control is an issue. With rapid expansion has also followed ever more quality problems, and reports of quality and technical problems with domestically produced wind turbines, also from the most prominent Chinese producers, like Sinovel, Mingyang and Goldwind have become frequent (Hu et al. 2013; Klagge et al. 2012; Wang et al. 2012).[38] Part of the problem most likely has to do with poor planning and oversight and collusion between political and economic elites. Part of it also has to do with poor craftsmanship, a low-skilled workforce and from a lack of technical expertise (Klagge et al. 2012). Wang et al. (2012:87) proclaim that the present innovative capacity is probably not enough to sustain the industry, and that a shortage in human capital is becoming ever more evident.

Sixth, and finally, the institutional structure is opaque. Energy regulation in China is inherently confusing. Responsibilities are overlapping, authority is diffused throughout the system, and there is a lack of clarity with respect to the interpretation and implementation of energy measures. This is something that will easily give rise to bureaucratic in-fighting and to vested interests playing institutions against each other and hiding inefficient policy away inside an institutional structure that defends the status quo and is incapable of adapting to changing circumstances or making major decisions. The argument has been made that China needed a Ministry of Energy in order to unify and coordinate laws and regulations on energy production, conversion, distribution, consumption and pricing. This did not happen. Instead, in 2008 a bureaucratic reorganization led to the formation of an Energy Bureau, headed by a government Minister as well as an Energy Commission. These jostle for power and responsibility with the NDRC (National Development and Reform Commission), SERC (State Electricity Regulatory Commission) and the energy companies. The reorganization probably represents and improvement, but it is unlikely to have energy policy coordination problems disappear. There is also NEA (National Energy Administration), which is the only state-level institution specializing in advanced wind power technology and equipment. However, the energy companies have as much influence as NEA. In addition to this comes the problem that even with transparency on the central level, at some stage decisions will have to be implemented locally. And so, there have been an array of coordination problems between the state and the local level,

[38] This includes serious technical issues: Blade and shaft fractures, generator fires, gearbox failures (Klagge et al. 2012).

even if the 2009 amendment to the REL dealt with some of these (Jiang et al. 2010; Liu and Kokko 2010; Schuman and Lin 2012; Zhang et al. 2013; Zhou et al. 2011).[39]

All this said and done, there is no arguing that the Chinese state has exhibited a very different attitude towards renewables, wind power in particular, than Japan. Renewables has very much been deliberate government policy. What this suggests is that also in China, the vested interest structure plays a considerable part of the story, particularly so with respect to the construction of gridlines. However, it is hard to gouge its exact strength, for the reason that economic growth in China is so strong that growth in renewables would have happened no matter what. But there is little doubt that the lack of a well-functioning grid network is a serious problem, even if the current impressive installation figures serve to disguise this fact. And there is also little doubt that there are serious differences of interest with respect to the construction of a national grid network. The division of authority and responsibilities between half a dozen agencies, the only partial introduction of market mechanisms, as well as the fact that national laws still have to be locally implemented, means that there is ample room for vested interests to influence politics in ways that were not intended. And these are problems that are likely to persist and grow unless political action is taken, first because renewables will keep growing at a very healthy pace and thus exacerbating already existing frictions, and second, because it is unlikely that Chinese growth remains at present levels for that much longer: In a world where Chinese growth is no longer so strong that China can essentially prioritize everything (thus, not really prioritizing…), interest battles will become fiercer and more pronounced, and genuine policy-choices will have to be made. China has powerful energy industries, and in other countries, these have not only been allowed to put their stamp on national energy policies as well as the institutional framework, but also in many ways become concrete obstacles to energy reform and to the rise of alternative sources of energy, like renewables (e.g. Sovacool 2009; Moe 2010; 2012)

Still, the proof is in many ways in the eating of the pudding. It is hard to attack Chinese renewables policies when the end result has been as impressive as it has, and in such a short amount of time. It can also come as no surprise that a country that is still a developing country has a far smaller market for solar PV than does Japan. Electricity from solar PV is far more expensive than electricity from other sources, including wind, and this is bound to be a bigger obstacle in a developing country. And so, up until 2011, PV generation costs were simply deemed too high for a FIT. This is however rapidly changing. In 2011 China was for the first time the biggest PV market outside of Europe, and with forecasts of 4-5GW of annual installations over the next couple of years, possibly increasing to an annual 10GW by 2016, China will dwarf the Japanese market, which should reach 3-3.5GW by then. In terms of installations, only the US and possibly the German markets might rival the Chinese even in the more or less immediate future (EPIA 2012). And it should also be noted that in solar thermal heaters, China has long been the world's number one. So, while the expansion of renewables to a large extent is driven by a steadily increasing

[39] Among others the 50MW loophole, whereby wind farms smaller than 50MW would not require more than local approval, which led to a flurry of 49.5MW wind farms popping up, without gridlines being planned, larger wind farms being split into 49.5MW components, etc. (Schuman and Lin 2012; Zhang et al. 2013)

demand for energy rather than a purposeful attempt at structural change, growth both in wind and in solar has accelerated following government attempts to improve the regulatory and institutional framework. It is most likely true that renewables policies in China started out as industrial policy, with an eye to energy security as well, rather than as environmental policy. The onus on growth, as in installations rather than generation, is one of the things pointing to this, whereas solar PV started out as an export industry only. Over the past few years it has however become ever clearer that renewables is also seen as part of an air pollution, green industry and technology development, energy intensity and carbon emissions strategy (Liu and Goldstein 2013; Zhang et al. 2013).

I am not here able to make any assessment as to whether it is easier to cope with vested interests in a country dominated by the state than by private actors. The prevalence of SOEs makes for a very interesting difference with Japan. While one might easily hypothesize that the state in a country like China has more leverage and can act more decisively, especially when the industrial actors are somehow owned by the state, opacity does not normally make for good governance, and the lack of clarity about who the actors are, their preferences, and the responsibilities of different institutions and jurisdictions makes for a system that can be easily abused. It is normally a more fertile breeding ground for vested interest influence than a more open system (e.g. Moe 2007; 2009a). Yet, the fact that China has listed both solar and wind as among their "new strategic and emerging industries", industries that are set to replace the so-called "old pillar industries" including oil and coal (Lewis 2013), is certainly a good sign.

CONCLUSIONS

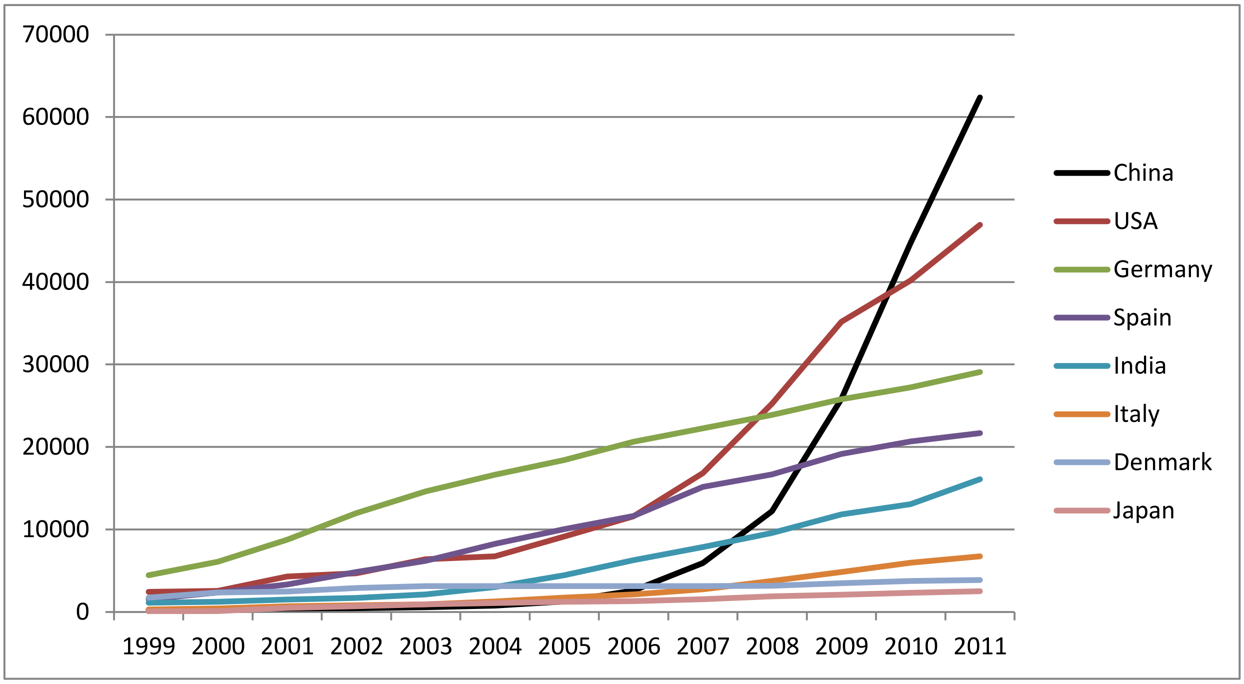
Between Japan and China, lately China is the only one to have purposefully targeted renewables on any large scale. Japan used to be a leader, by virtue both of its status as the world's most energy efficient country and from its prowess within solar PV. In both these areas, progress has stalled, even if solar is now developing rapidly once again. And on wind, Japan has been a complete laggard. Fukushima may provide Japan with an opportunity to re-focus its efforts in renewables, but it is still early days with respect to this.

In Japan, the vested interest argument is easily applicable. And with the resistance of the electric power companies, it has resulted in solar being massively favored over wind power. Wind power poses much more of a challenge in terms of structural change. As long as wind power companies for all practical purposes compete against the utilities, a battle they at least prior to Fukushima would always lose, solar is bound to be the renewable industry of choice, despite its cost disadvantages. The vested interest structure, with no particular interests speaking out for wind, but where both solar and the utilities have sections within METI looking out for them (the utilities by far the more powerful one, though) sees to it that energy policy remains business as usual: Wind is neglected, solar receives certain benefits, whereas the electric utilities have most of the power and influence. Following Fukushima, this could be in the process of changing. Energy policy is at least subject to a very serious rethink, and the end result is not obvious. It represents a window of opportunity, and the voices speaking out for renewables – including wind – are now a lot stronger and more plentiful. So is the skepticism against nuclear, which was the default solution of the bureaucracy to all of Japan's energy problems. While things may change, right now the question is more one of *how fast* nuclear power will be phased out rather than *if* this will happen. For now, this means the temporary (and potentially prolonged) increase in thermal power, and for the future the potential phasing in of renewables on a far larger scale than before. At this stage it is however, still too early to make more than speculative predictions.

China may at first glance conform more to the prediction that unresolved energy problems and an abundance of renewable energy resources (Eikeland and Sæverud, 2007) govern energy policy rather than vested interest structures. In one sense this is true. China could easily be seen as the archetype of a country that should do, and does, well in renewables. However, the vested interest argument is an interesting one here as well. One of the reasons for the rapid increase in the implementation of renewables is the conscious targeting by the state, among other things seen in the erection of a new regulatory and institutional framework, after which growth has been formidable. But despite the growth, there are numerous problems with the Chinese renewable energy structure, one allowing for considerable potential vested interest abuse. The Chinese weaknesses in this area actually bear some resemblances to the Japanese. But in China, wind is the renewable industry of choice rather than solar. While it is not favored over solar to the extent that solar has been over wind in Japan, the expansion of wind power capacity has so far dwarfed the expansion of solar PV. This is not because of any major institutional preference by the state, but because the structural changes required in China have been bigger with respect to solar than with wind. In Japan, solar has benefited from delivering their power directly to the households, which are already grid-connected, and at prices which the utilities have had to accept. In China, with a far weaker grid-line system, a far poorer economy where the installation of expensive solar panels is something that will be met with far more modest demand, and where the electricity price of solar has up until very recently been far above that of other power sources, solar PV is an industry that has grown from exports rather than domestic demand. In contrast with Japan, Chinese power companies have branched out into wind power. Thus, wind power does not compete with these companies, even if the enthusiasm with which the power companies advocate wind power can sometimes be questioned. Also, according to the REL, grid companies should bear the cost of connecting wind to the grid. This means that there is less legal and institutional room for vested interests to block the expansion of wind power, despite their sometimes considerable reluctance to fulfill their legal obligations in terms of expanding the grid network. The prevalence of SOEs with lax budget restrictions makes for a very opaque institutional and regulatory environment, which is typically an environment in which vested interests thrive. The eagerness with which the state has promoted renewables has made for rapid growth, but has led to little structural change, as total energy demand has soared to such an extent that renewables account for little more in terms of total primary energy supply today than it did 20 years ago. As an export strategy (solar) and in terms of adding to the energy supply this has been a success. But if the expansion is driven primarily by economic growth, and not coming at the expense of other sources of energy, then it remains to be seen how renewables will fare compared to other energy industries once the Chinese economy (inevitably) starts slowing down and budget restrictions become tougher. So far, not many tough choices have had to be made, simply because most of the cracks in the institutional and regulatory framework have been papered over by growth. Thus vested interest problems remain maintainable, for the simple reason that in a situation where everyone grows, there is no need for vested interests to fight hard for their interests. But one day that may happen, and while regulatory reform has been a success, there are a lot of problems still remaining, and a lot of potential for festering vested interest problems even if for the foreseeable future, renewables will continue to expand unabated.

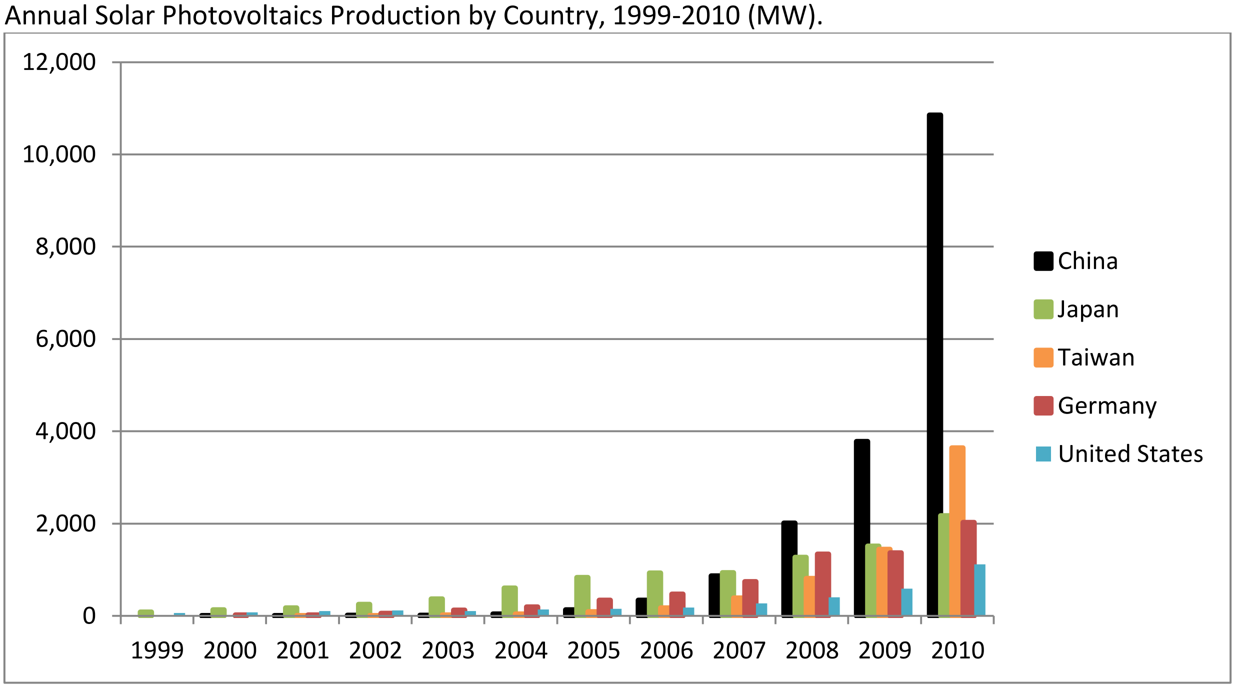
Both Japan and China demonstrate the usefulness of the vested interest argument, but in different ways. What should however not be doubted and cannot come as any surprise is that no matter the strength of the vested interest structure, the greater the eagerness with which the state provides renewables with beneficial conditions for growth, the more likely the country is to succeed in expanding the installation of renewables and its share of the overall energy mix.

Cumulative Installed Wind Power Capacity, select countries, 1999-2011 (MW).



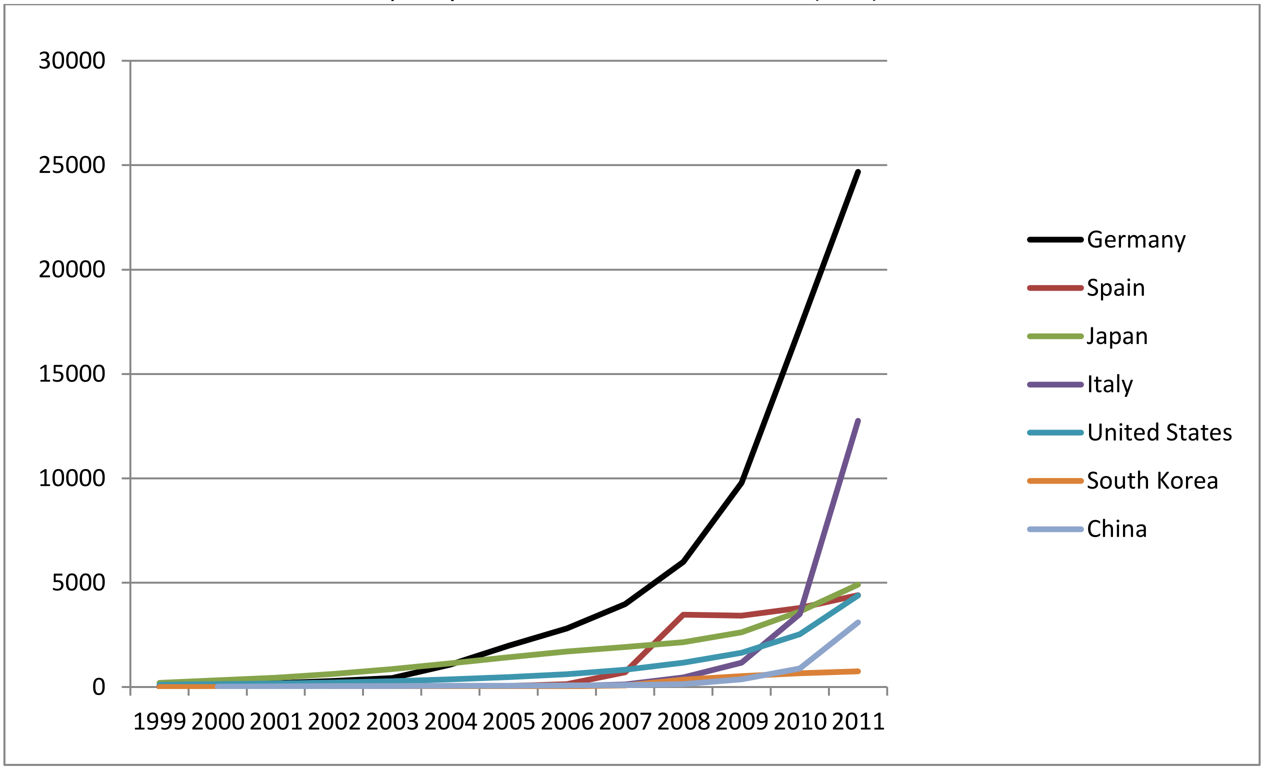
Sources: EWEA (2012) GWEC (2005; 2012), IEA (2001), WWEA (2012).

Annual Solar Photovoltaics Production by Country, 1999-2010 (MW).



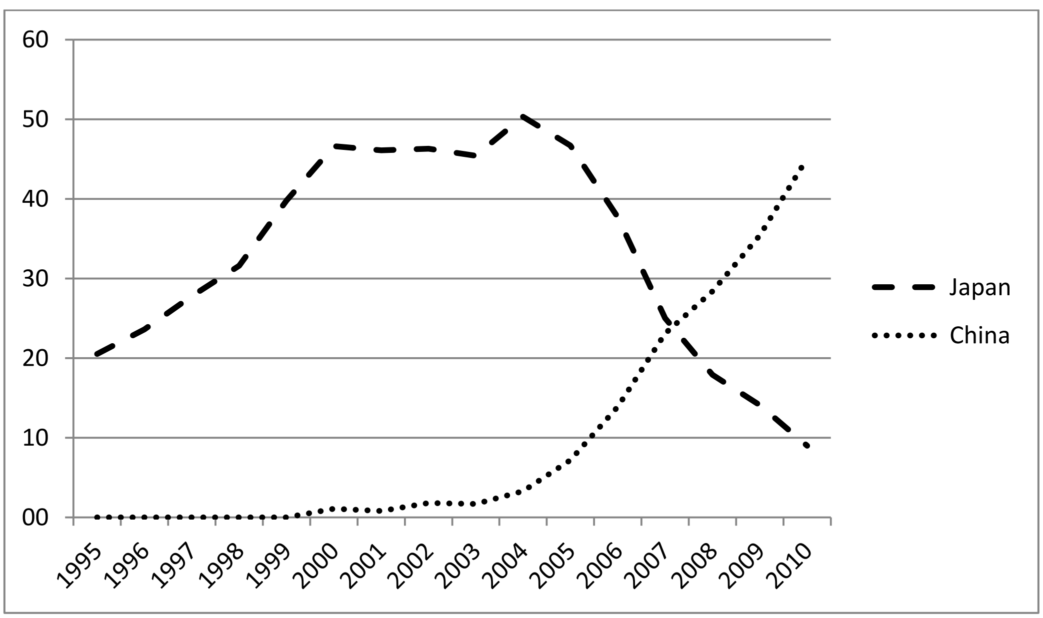
Source: Roney (2010), Wikipedia (2013).

Cumulative Installed Solar PV Capacity, select countries, 1999-2011 (MW).



Sources: EPIA (2012), IEA (2010b), REN21 (2012)

Solar Photovoltaics Market Share, 1995-2010



Sources: Figures calculated from Roney (2010) and Earth Policy Institute (2011).

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