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"Promotion of Renewable Energy Sources in Germany and the EU in the Light of Their Energy Security Concepts – Objectives, Strategies, Challenges and Problems: Lessons to Learn for Japan?"

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Introduction

Between 2000 and 2008, international oil prices have quintubled up to US$147 until last summer. In November 2008, the International Energy Agency (IEA) warned in its new annual "World Energy Outlook 2008" that the world's energy system "is at a crossroads" and that current worldwide trends in energy supply and consumption "are patently unsustainable" for environmental, economic, and social reasons. The IEA has demanded nothing less than a "global energy revolution" that is yet not taking place.

Globally, the rise of the new powers China and India and their rapidly increasing energy consumption have increased traditional energy security concerns, and have highlighted the scarcity of conventional oil and gas reserves. In 2008, for the very first time, non-OECD energy demand was higher than that in the OECD economies. In addition, rising exploration, production, refinery and transportation costs, combined with growing concerns about the high concentration of the remaining oil and gas resources in the Persian Gulf have all transformed the traditional global energy security structures. Recently, concerns about energy security have extended to natural gas, which increasingly is used to produce electricity and increasingly traded internationally.

By 2030, the world needs up to 40% more energy than in 2006. China and India will account for more than 50% of the increase in global energy demand in this timeframe. Collectively, non-OECD countries will account for 87% of this increase. Consequently, their share of world energy demand will rise from 51% to 62%, whereas the percentage for OECD countries will decrease from 49% to just 38%. Even at its more optimistic "450"-Scenario (following the needs of the global climate protection goals and the target of mitigating the climate change to 2° Celsius by 2030, the IEA's annual "World Energy Outlook" till 2030 forecasts the share of global Renewable Energy Sources (RES) that won't surpass more than 22% (Reference Scenario: 14%). With other words: the world's energy supply security will still be based to 78% on fossil fuels (oil, gas and coal). But with oil prices rising, and costs of RES are declining, RES are becoming increasingly competitive to fossil fuels and nuclear power in the future. Meanwhile, the IEA has become much more optimistic about the prospects of both concentrated solar power and photovoltaic solar power at least beyond 2030. It expects now that it could supply up to a quarter of global electricity production in 2050.

The following analysis will focus on the EU's and Germany policies for expanding RES in their respective energy mix till 2020/2030. A special focus will be paid to their overall energy objectives and strategies, in particular to the role, problems and challenges of expanding RES in their concepts for energy (supply) security in the mid-term perspective till 2030 and beyond. In this light, I will offer some lessons to learn and to share between Germany, the EU and Japan.

The Role and Perspectives of RES in the EU's Common Energy Policy

The EU's long-term strategy for energy supply security needs to cope with uninterrupted physical availability of energy products on the market, at a price which is affordable for all private and industrial consumers. At the same, the EU needs to balance its future energy supply policies with

growing environmental concerns in the light of the objectives of the Kyoto-protocol. Energy policy is to be aimed at a careful balance between all three parameters of the energy triad: security of supply, competitiveness and environmental sustainability.

In March 2007, the European Council under the German Presidency has agreed on an integrated climate and energy policy with an 'Energy Action Plan' (EAP). As part of the world's most comprehensive energy action plan (containing 17 individual measures) on climate protection and energy supply, the EU-27 were able to agree on a set of tasks and targets, including by adopting three 20% goals as legally binding targets in its so-called "20-20-20 Programme" by 2020:

- Energy efficiency should be increased by 20% across the EU;
- The goals of the Kyoto protocol should exceeded and carbon emission should be reduced by 20% by 2020 compared to 1990 (if other industrialized countries such as the USA, India and China commit themselves to similar policies, the EU would be willing to reduce emissions by 30%);
- Additionally, a 20% share of the energy mix should be generated from RES (presently 9%) and 33% in its electricity sector.

The EU's new "Directive on Renewable Energy" of April 2009 has set specific national targets for all Member States, thus that the EU will reach a 20% share of energy from renewable sources by 2020 and a 10% share of renewable energy specifically in the transport sector. It has also improved the legal framework for promoting renewable electricity, requires national action plans that establish pathways for the development of renewable energy sources, creates cooperation mechanisms to help achieve the targets cost effectively and establishes the sustainability criteria for biofuels. At the same time, the EU is focusing to improve energy efficiency and conservation. In July 2009, for instance, the European Commission adopted four "ecodesign" regulation to improve the energy efficiency of industrial motors,circulators, televisions, refrigerators and freezers that will save the equivalent power consumption of Austria and Sweden.

The present and future development of the EU's integrated energy and climate policies, however, are hampered by the fact that the 27 member states have a very different national energy mix as well as energy policies, strategies ande priorities. Moreover, hitherto only few members have implemented attractive strategies for renewable energy sources. Nonetheless, the EU has made progress by adopting various actions plans for achieving its goals by 2020, including for a more rapid expansion of renewable energy sources. In its view, the growth of renewables also stimulates employment in Europe, the creation of new technologies and improves its trade balance.

As part of its European Energy Programme for Recovery with a budget of almost €4 billion, the EU is not only funding new gas and electricity interconnectors of gas pipelines and grids as well as Carbon Capture and Storage (CCS) projects, but also new offshore wind projects with a budget of 0.565 billion (14% of the total budget) in the Baltic and North Sea.

According to the latest forecasts, the EU will exceed its targets to produce 20% of its energy from RES by 2020 and 30% by 2030, despite the fact that not all 27 members may fullfill their national traget plans. At present, Spain and Germany are considered to top the European league for RES, surpassing their target plans. With new policies underway mto fullfill the 20% target of RES by 2020, they will als provide a net effect of about 410,000 additional jobs and 0.24% additional gross national product (GDP).

In the forthcoming years, offshore wind power will play the main role in expanding RES. Given the ongoing construction and newly planned offshore windparks, their total capacity may soon exceed 50,000 MW – equivalent capacity of 50 nuclear power stations. Their total output would be roughly 190 TWh – equal to total electricity consumption in the Netherlands and Belgium combined. But these prospects depend on the ability of industry to reduce the costs significantly and the willingness of gvernments to provide strong political support.

Another major challenge and top priority concern remains the increase of the share of RES in the transport sector as well as in the energy efficiency of engine and vehicle technologies. Despite great improvements in car efficiency, GHG-emissions have significantly incresaed in the period from 1990-2008, because of the great expansion of the European car fleet.

Figure: SUMMARY OF MEMBER STATES' PROGRESS IN DEVELOPING RENEWABLE ENERGY

			Electricity			Biofuels		
	2006 share (%)	2010 target (%)	recent growth	progress made	2007 share (%)	2010 target (%)	recent growth	progress made
Austria	61.6	78.1	😐	☹	4.2	5.75	☺	☺
Belgium	3.9	6	☺	😐	1.1	5.75	☺	☹
Bulgaria	6.8	11	😐	☹	4.8	5.75	☺	☺
Cyprus	0.0	6	☹	☹	0 (2005)	5.75	☹	☹
Czech	4.1	8	😐	☹	0.5	2.5	😐	☹
Denmark	25.9	29	☹	☺	0.1	5.75	😐	☹
Estonia	1.5	5.1	😐	☹	0.1	5.75	😐	☹
Finland	26.5	31.5	☹	☹	0.1 (2006)	5.75	😐	☹
France	14.3	21	😐	☹	3.6	7.0	☺	😐
Germany	12.6	12.5	☺	☺	7.4	5.75	☺	☺
Greece	8.8	20.1	☺	☹	1.2	5.75	☺	☹
Hungary	3.7	3.6	☺	☺	0.2	5.75	😐	☹
Ireland	8.6	13.2	☺	😐	0.6	5.75	😐	☹
Italy	18.3	22.5	☺	😐	0.5	5.75	☹	☹
Latvia	40.4	49.3	☹	☹	0.1	5.75	☹	☹
Lithuania	3.9	7	😐	☹	4.4	5.75	☺	☺
Luxem-	3.7	5.7	😐	😐	1.5	5.75	☺	😐
Malta	0.0	5	☹	☹	1.1	1.25	😐	☺
Nether-	7.9	9	☺	☺	2.0	5.75	☺	😐
Poland	3.1	7.5	😐	☹	0.7	5.75	😐	☹
Portugal	31.2	39	☺	☹	2.5	5.75	☺	😐
Romania	28.1	33	☹	☹	0.8	5.75	😐	☹
Slovakia	16.0	31	☺	☹	2.5	5.75	☺	😐
Slovenia	28.3	33.6	☹	☹	0.8	3.5	😐	☹
Spain	19.1	29.4	😐	☹	1.1	5.75	😐	☹
Sweden	52.3	60.0	😐	😐	4.0	5.75	☺	😐
UK	4.6	10	😐	☹	0.8	5.0	😐	☹

Source: Eurostat 2006: share of energy from renewable sources as a percentage of final energy consumption with normalised hydro generation (including consumption of the energy branch for electricity and heat generation and distribution losses).

Source here: COMMUNICATION FROM THE COMMISSION TO THE COUNCIL AND THE EUROPEAN PARLIAMENT, The Renewable Energy Progress Report: Commission Report in accordance with Article 3 of Directive 2001/77/EC, Article 4(2) of Directive 2003/30/EC and on the implementation of the EU Biomass Action Plan, COM(2005)628, {SEC(2009) 503 final}, Brussels, 24 April 2009, COM(2009) 192 final.

At the same time, the EU is debating after the failing Copenhagen summit of December 2009 whether it should not adopt a more ambitious 30% GHG reduction target by 2020 instead of its present 20% goal of 2007 once the conditions are met by 2020. Previously, the EU committed itself for a 30% target only in the case when other major economies take on their fair share of the effort under the Kyoto agreement. While the costs for its 20% target in 2008 were estimated at at least €70 bn a year, now it is estimated by just €48 billion annually. The 30% target would cost just €3 billion more (0.2% of GDP) more than the 20% target is estimated today. Under such a 30% target, the cap on the EU-Emission Trading System would be set at 34% below the 2005 level instead of at 21% below as now under the 20% target. While the European industry and some member states are still against the 30% target because offers to lose its competitiveness against other major economies, the EU also needs to prepare its long-term objectives, as it has promised together with the other developed countries to achieve a 80-95% reduction of GHG emissions by 2050. Such a decision may also lead to a more rapid expansion of RES before 2030. However, a faster expansion of RES is depending on significant technological innovations in storing electricity and overcoming the intermittent nature of RES and, therewith, the baseload problems.

Germany's Policies for Expanding RES

Germany's own "Integrated Energy and Climate Programme (IEKP)" of 2007 strongly favours expanding RES in order to restrict its national import dependency of oil and gas as a "state-of-the art, secure and climate-compatible supply of energy"-strategy. In its view, the expansion of RES can substitute fossil fuels by expanding them to 30-35% proportion of power generated and 14% in the heat sector by 2020. Its main instrument is the feed-in-tariff-system (EEG) for RES, which has often been lauded and copied all over the world. As a result of the consistent and early promotion of RES in Germany, many German companies have become world leaders in their fields. German technology suppliers possess valuable long-time experience from the realisation of both national and international projects and in the development of customised solutions.

On 5 December 2007, the German government annouced its "Integrated Energy and Climate Programme". The adopted measures were aimed to prove that climate protection is both affordable and compatible with economic growth. On July 1, 2008 the German Chancellor Angela Merkel announced an ambitious policy strategy to curb GHG-emissions up to 40% percent by 2020. Accordingly, energy producers should increase energy efficiency by 3% each year to make energy conservation the core of her energy and climate protection policies. While her initiative has been welcomed by environmentalists, it has heavily been criticized by the energy industry. But as a former environmental minister during the Kohl-era, she feels clearly been committed to give environmental policies a more prominent part to her Christ Democratic Union's party's policy program.

In 2009, RES supplied around 16% of the gross electricity consumption and 10% of total final energy consumption in Germany, thereby preventing the emission of around 112 million tonnes of CO_2 annually. Total investments in the RES sector reached a record total of US$17.7 billion. It was thus able to avoid the economic crisis to a large extent. More than 300.000 people now work in this sector – around 8% more than in the previous year. The transfer of RES know-how, the promotion of foreign trade and the facilitation of international development cooperation are an important part of Germany's industrial policies to develop new markets and opportunities, and, therefore, are also part of the "Renewables - Made in Germany" initiative. Thus Germany's government has actively supporting the worldwide dissemination of cutting-edge German renewable energy technology and know-how since 2002 and in setting up the International Renewable Energy Agency (IRENA) as well as the International Carbon Action Partnership (ICAP). But these new energy policy and climate protection objectives have also created new major problems, conflicts of goals and contradictions in its integrated climate and energy policy.

Climate Protection versus Economic Competitiveness

In order to reduce its GHG-emissions up to 40 percent till 2020, the German industry and private people need to invest some 313 bn Euro for climate protection during the next 12 years. The implementation strategies seek to balance the climate protection targets with its future economic

competitiveness and realistic modernization efforts of the private industry and its citizens alike. In this context, economic experts have increasingly criticised the high subsidies for solar electricity, which have contributed to finance jobs in the solar industry of Japan and other countries rather than in Germany itself. No other country in the world is subsidizing the solar electricity so much like Germany. German consumers need to pay 62-100 billion Euro subsidies during the next 20 years – three times the present declining per-capita subsidies of hard coal in Germany. Given its inefficiency with Germany's weather by contributing to just 0.6% of the national electricity consumption of 2009, experts have called for a 30% reduction of these subsidies. However, a recent government decision has agreed only to reduce those subsidies to around 16% annually by 2011 due to federal party interests. But even this 16% reduction is still under discussion due to the fact that many small and mid-sized companies are not threatened by reducing the PV FIT too drastically. Furthermore, the solar industry benefits from an "own consumption bonus" that is de facto reducing the planned decrease the 16% reduction to just 3-4%.

Furthermore, the Economic Ministry doubts that Germany won't be able to fulfil the targets of mitigating climate change without shrinking economic growth and losing jobs. Indeed - without providing higher subsidies for older buildings, those climate protection targets will be difficult to achieve for two reasons. Firstly, even with higher subsidies for private house-owners, it is still doubtful whether the necessary investments in energy efficiency technologies (in average, house-owners need to invest at least 45,000 Euro) with higher rentals (realistically only up to 11%) can be made in times of already rising energy and living costs. Secondly, it remains especially uncertain whether older house-owners will pay for new expensive credits for modernizing their houses and flats in order to improve energy efficiency when they will benefit financially only in 20 years or even later.

Most recently, even Germany's feed-in-tariff system has been criticized as its support mechanism has been counterproductive, only resulting in massive expenditures that show little long-term promises for stimulating the economy, protecting the environment, or increasing energy security. Although Germany has the worldwide second-largest installed wind capacity globally,also the biggest PV market and is home to several leading solar energy companies, the overall share of RES remains negligible. Berlin subsidizes a worker in the photovoltaic industry with up to €175.000. In many ways, the EEG fails to support more innovation (i.e. to stick to mono-crystalline cells instead to develop thin-film cells).

Climate Protection Versus (Gas) Supply Security

During the last decade, Germany's energy policies have often been idealistic, ambitious, provincial and over-optimistic at the same time. On the positive side, Germany has long been a leader in the area of RES in order to reduce carbon emissions and phasing out nuclear energy. As the world's biggest wind-power systems (producing 37% of all systems and components worldwide), it is benefiting more than others from the current global expansion of wind-power and other RES. The previous red-green coalition government stipulated targets of a 4.2% of RES in primary energy consumption (PEC) by 2010, and 10% in 2020. As the result of its Renewable Energy Sources Act, RES already accounted for 5.8% of the Primary Energy Consumption (PEC) and 12% of electricity generation in 2006. The German Ministry for Environment, Nature Conservation and Nuclear Safety (BMU) hopes to achieve 16% of PEC and 30% of electricity generation by 2020. However, these goals create new problems for Germany's base load supply and economic efficiency.

Furthermore, it does not answer the question where the rest of the energy demand will come from and to which extent the plans for phasing out nuclear energy will increase the dependencies on gas imports from Russia or from the unstable Middle East – and, therewith, threatening Germany's future energy supply security. The recent government decision of giving up the 10% biofuel target as the result of the worldwide crisis of food prices and increasing global criticism of being too costly and ineffective has put even more pressure on realising the ambitious German and EU climate protection goals until 2020. In the mid-term perspective, however, second generation of biofuels, comprised of plant waste such as straw or crops that do not compete with the food production, offers a way out of the present problem. As a consequence, the German government now aims to compensate the biofuel targets by expanding wind-power even more. Although the expansion of RES strengthens Germany's supply security in general, a further expansion of wind-power will lead

to even higher gas consumption and imports (from Russia) because the reserve capacity (when the wind is insufficient) will rely primarily on gas turbines.

The future overall supply security and energy policy options had already been limited by its decision to end its domestic hard coal production until 2018. Although the decision does not imply another exit strategy from the overall coal production, it will make Germany even more dependent on energy imports. The government decision is based on the assumption that the principal conditions of the worldwide coal markets (cheap prices versus other fossil resources and a stable availability of coal worldwide) will not change in the next decades. However, as new studies in Europe and the US as well as trends over the last years are indicating, this assumption might be an over-optimistic scenario, which even ignores present strategic developments on the global coal markets.

By emphasizing the need for a national, European and global policy on climate change, it created the impression for the public to give up the declared need to preserve the balance in the triangle of objectives in energy policy and to subordinate energy policy to environmental protection and climate change policies as a single determining factor. Meanwhile, the anti-nuclear movement of the 1970s and 1980s has developed into a new anti-coal movement that is calling for an end of coal as a national energy resource at all. In addition to the exit strategy for nuclear power, it would further narrow down the national energy mix. Consequently, it may also lead to higher gas imports from Russia and weaken its national security of energy supply.

But given the fact that Russia itself is facing a gas crisis and has officially announced to rely much more on the expansion of coal and nuclear power in order to compensate its unanticipated rising of domestic gas consumption and to maintain its gas export obligations, Russia will produce even more GHG-emissions (i.e. CO_2) as the result of Germany's unwillingness to modernize its coal plants and by raising Germany's gas imports from Russia. As the net result, by relying even more on gas consumption in the case of drastically lowering its coal consumption, Germany might find it easier to achieve its emission reduction plans in the light of the EU's newly declared targets, but simultaneously will undermine its major policy objectives of its *global* climate protection strategy by promoting higher CO_2 emissions in Russia. Furthermore, the German Energy Agency (DENA) and the Industry have repeatedly warned that without a large-scale modernization of Germany's existing and particularly older energy plants, an electricity gap may developing till 2012, which will increase up to 12,000 Megawatt (equivalent to 15 large energy plants) by 2020.

An Energy Architecture Based on 100% RES? – Perspectives till 2030/2050

Switching to an energy architecture that is based to 100% on RES appeared until recently rather as unreliable, too expensive (given the inherently nature of intermittent nature of sun and wind that requires large numbers of conventional power stations need to be kept on stand-by in case of a shortage) requires too many complicated changes to infrastructure and may even create new environmental problems. But some new studies of PriceWaterhouseCoopers, McKinsey and the European Climate Foundation (ECF), which had been sponsored, inter alia, by Shell, RWE, EON and Siemens, have highlighted a scenario that a "decarbonizing Europe" by 2050 is (theoretically) possible at virtually no extra cost. But this vision depends on the following pre-conditions and necessary steps undertaken by the European governments and the industry:

- Significant policy changes;
- Substantial investment (€100 bn by 2030);
- New market structure, whereby all EU and African countries need trade energy in real time;
- New infrastructure and approaches to planning, incl. for smart grids/super-grids;
- Creation of regional power systems (i.e. unified EU-African power system) based on concentrating solar power (CSP) plants and networks of efficient high-voltage direct current HVDC) grids;
- Rapid scaling up of all RES;
- Production of electricity at the most suitable sites.

This 100% scenario thus is based on the assumptions of (a) importing electricity from North Africa (based on the €400 bn DESERTEC-poject), (b) on a breakthrough in geothermal power, (c) interconnected national transmission grids or a European super-grid based on a "patchwork quilt" by linking the different RES of various national RES programmes into "combined renewable power plants" in Europe (like the North Seas Offshore Grid-Initiative/NSOGI), and (d) a large shift towards electrical applications in heating and transport. Besides many economic, regulatory and technical problems, the main challenges are of political nature. Any unified EU-(North)African power system will make the EU dependent on large amounts of electricity imports from North Africa – a politically highly unstable region which hosts some of the most dangerous Al Qaida terrorist groups and where the political and economic cooperation between the regional states is rather low as the result of political mistrust and underlying tension and conflicts. As long as a breakthough in storage technologies has taken place, the import of those large volumes of electricity from North Africa to Europe makes the EU highly vulnerable to electricity disruptions with potentially cascading transnational and transregional effects. These concerns will even increase as the future reliable electricity supply is also been challenged by rising major safety and security concern in the light of growing asymmetric cyber threats as well as the lack of safety and security of energy control centers (SCADA-systems) and of smart grids needed for the expansion of RES. In addition, one should not overlook that national and vested interests on both sides could also be a major source of opposition to those projects – whose realisation should be the priority for North Africa itself for the time being until the storage problems of electricity have been solved.

Lessons to Learn for Japan and Other Countries

Given Japan's lower energy self-sufficiency compared with other nations as well as its higher and still growing oil import dependence on the Middle East and in particular the Persian Gulf, the present situation in regard to Japan's energy security is even more complicated and of raising concern than in the case of the EU-27. Despite of continuous efforts of improving energy efficiency and expanding nuclear power since the 1970s, it has remained heavily dependent on primary energy imports which stands at around 80%. At the same time, Japan has lost its previous technological leadership role of RES as probably the most energy efficient country worldwide and together with Germany a leader in fighting global climate change. In addition to the rise of new major energy consumers such as China and India, the end of an era of "cheap oil" (increasing scarcity of conventional oil and gas resources, rising exploration, production, refinery and transportation costs), the expected expansion of RES and LNG vis-à-vis a renaissance of nuclear power and coal on the global market, worldwide trends of a resource nationalism and an increased role of state players in oil and gas markets as well as new global climate protection and resource governance policies are all challenging and transforming the traditional global energy governance order and its institutions as well as regimes. But these strategic trends also offer more reasons for expanding RES in Japan, in particular when the uncertainties of nuclear power as the "wildcard" of its national energy policies are taking into account.

In the light of the EU's and Germany's policies for RES, Japan needs to take into account the great positive perspectives of the global expansion of RES as well as the inherently unsolved technical, financial and in particular political challenges as following:

- Promoting RES with subsidies, but decreasing them in time;
- Don't underestimate the time, costs (subsidies) as well as new safety and security threats (Cyber attacks) and demands on the way to a new energy/electricity market architecture;
- Financing R&D programmes for key technology innovations (i.e. storage technologies):
- Restore tax credits/incentives for solar and extend to wind power;
- Enact German style Feed-in-Tariff (FIT)-mechanism "of limited duration" for producers of RES (i.e. 5% reduction in guaranteed price every year encourages technological innovation and efficiency gains);
- Diversify Japan's national R&D budget away from nuclear power (currently more than 60% of this budget goes to NP) and more toward biomass, solar, wind, wave, and geothermal; and

- Setting more ambitious targets for electricity utilities to utilize biomass, wind and solar power by 2020.