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One year after Fukushima – Germany's path to a new energy policy

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1.) Quotation by Michael Süß, CEO of the Energy Sector and member of the Managing Board of Siemens AG

"The transition to a new energy policy is the project of the century for the Germans. It's the right thing to do, and it's feasible. But in terms of implementation, most of the work still lies ahead of us. The tight schedule and the requisite grid expansion present the biggest challenges. And other countries are closely observing how Germany is tackling them."

2.) One year after Fukushima – A snapshot of the power supplies in Japan today

- Of the 54 nuclear power plants that supplied about 30 percent of Japan's electricity before March 11, 2011, only two are still in operation today.
- Fourteen of Japan's nuclear power plants were damaged by the natural disaster or subsequently shut down as an emergency measure. Thirty-eight were taken offline for maintenance required by law. The two power plants still in operation will be removed from the grid for maintenance in March or April. At that point, Japan will be virtually nuclear-free.
- To date, none of the power plants that were shut down have received permission from the relevant local government authorities to be recommissioned. Discussions are still taking place at the political level as to the conditions under which a return to operation could be approved.
- The fact that the power supply is functioning despite the tremendous loss of generating capacity is primarily due to reduced electricity consumption across the country and the recommissioning of fossil-fired power plants that had no longer been in operation.
- Japan is currently close to its capacity limit for power supplies. Another major earthquake or other failures or incidents would cause substantial problems.
- The catastrophe at Fukushima resulted in a change in thinking regarding energy policy in Japan. Before March 11, 2011, the government was planning to greatly expand the share of nuclear power in the power mix – from 30 percent to 50 percent. Experts assume that the Japanese government will reduce the share to below 30 percent while expanding renewable energies. The first concrete results regarding a new energy policy are expected in the summer of 2012.

3.) One year after Fukushima – Germany's new energy policy

- In addition to the phase-out of nuclear power by 2022, the new energy policy also includes the following aims defined by the German government: Slash greenhouse gas emissions 80 percent by 2050; increase the share of power generated from renewable energies to 80 percent; and cut primary energy consumption 50 percent (all compared to 1990).
- To meet these aims, Germany's entire power supply system must be overhauled. A capacity of 20 gigawatts (GW) currently being supplied by nuclear power plants must be generated elsewhere within ten years.
- The investment volume is expected to total approximately €20 billion annually (lead scenario of the German Federal Ministry for the Environment, Nature Conservation and Reactor Safety

[BMU]). Investments must be made in modernizing the power plant fleet, building new power grids and expanding renewable energies.

- In the wake of Fukushima, the German government declared a nuclear moratorium in March 2011. As a result, eight nuclear power plants with a combined capacity of 8.5 gigawatts (GW) were taken offline, reducing the country's generation reserve capacities accordingly. The gradual phase-out of the remaining nine nuclear power plants with a total capacity of about 12 GW is to be completed by 2022.
- On June 30, 2011, the German parliament approved the so-called energy package and thus all of the laws essential for implementing the energy concept.
- In September 2011, Siemens announced that the company would in the future have no further involvement in the nuclear-specific aspects of nuclear power plants.
- On October 19, 2011, the German government approved an energy monitoring process. The aim is to continuously review to what extent the implementation of the energy policy decisions taken in summer of 2011 are in line with the objective of an environmentally friendly, reliable and affordable energy supply.

The shift to a new energy policy has already greatly changed the situation, according to Germany's Federal Association of Energy and Water Industries (BDEW):

- Due to the earlier-than-anticipated shutdown of eight nuclear power plants, the share of nuclear energy dropped from 22 percent to 18 percent.
- The share of renewables in the energy mix rose from 16 percent in 2010 to roughly 20 percent in 2011 (BDEW). Above all, photovoltaic capacities expanded appreciably in 2011, climbing from 17.3 GW to 25.8 GW and contributing 3 percent of the power mix in 2011, or one percentage point more than in 2010.
- Lignite-fired power plants also generated more electricity, accounting for a share of 25 percent (2010: 23 percent). Bituminous coal (19 percent) and natural gas (14 percent) remained stable in terms of their share of the energy mix (BDEW).

The transition to a new energy policy is well underway – but holds many challenges

- If we implement the transition intelligently, the opportunities for Germany and the companies located there clearly dominate. Resource and energy efficiency and technological progress are pointing the way to future-capable structural change, and the solutions that are being developed for these purposes could be export hits in the future.
- Risks include
    1) Bureaucratic hurdles and delays in planning and approval processes;
    2) A lack of investment incentives and a lack of planning reliability – here we must define the course for the coming decades, because the necessary investments are of a long-term nature;
    3) A threat to the global competitiveness of German industry in the event that energy costs are too high. The important thing here that the shift to a new energy policy does not

result in a value-chain exodus.

- However, the transformation of the energy system can be a model for other countries. The aim must be to show that an export-oriented industrial country with a high share of renewable energies is globally competitive and can penetrate new markets with innovative and highly efficient technologies.
- There are several ways to transform the energy system. The focus can be on gas power plants or renewables. Depending on which path is chosen, the price of electricity would increase by an estimated one to four cents per kilowatt hour. The middle road would be a scenario in which the renewable energies and the grids are massively expanded and, moreover, fluctuations in generation from renewables are compensated for by means of additional gas power plants and energy storage capacities.
- The goals of the transition to a new energy policy must be reached at costs that are economically acceptable in order to avoid endangering existing industrial value chains. These include, in particular, energy-intensive primary industries such as metals manufacturing and the chemical and building materials industries. They must not be forced out of Germany because energy costs are too high. How high the costs for transforming the energy system will ultimately be depends on how the transition is implemented and how quickly it takes place.

- No proactive monitoring is actively accompanying the implementation of this transition; rather, the process will be "retrospectively" monitored.

The transition to a new energy policy in Germany is feasible. Yet most of the work still lies ahead of us!

- There are issues like the prevention of capacity shortages:

  → The shutdown of the seven oldest German nuclear power plants and the Krümmel nuclear power plant reduced the country's generation reserve capacities by roughly 8.5 GW. Until new power plants are operational, there is a risk of shortages that would have to be compensated for by imports or the activation of old fossil power plants.
- The backbone of Germany's power supplies will continue to be fossil fuels. Combined cycle power plants (CCPP) guarantee secure power supplies: They can be ramped up in just a few minutes when sun and wind sources ebb. Over the long term, coal will remain an important pillar of power supplies worldwide, since coal reserves are so vast and electricity produced with coal is so cheap. The challenge here is to make coal-fired power generation more efficient and cleaner.
- CO_2 can be separated from power plant flue gases, stored and utilized.
- But one must also focus on efficiently implementing and adapting Germany's Renewable Energy Act (EEG), since an efficient EEG is the key to the successful expansion of renewable energies.
- At the same time, renewable energies must be made competitive. If roughly half of the electricity in Germany is to be produced from renewables as early as 2030 (and around 80 percent by 2050), then they must be competitive even without subsidies so the price of electricity doesn't explode. The goal must be to make a kilowatt-hour of wind power as cheap as from coal.

- Thousands of kilometers of power superhighways have to be built:

  → The modernization and expansion of power grids is the key to reaching the goal set for renewable energies – within Germany itself as well as between countries in the EU. The current grids are the major bottleneck hindering the integration of more renewables.

  → In order to transport electricity produced from renewable source to consumers, dena – the German Energy Agency -- says we will need around 4,000 kilometers of new high-voltage power lines. We already have the means and the know-how to transport electricity produced from wind power plants in the north down to the south without substantial losses.

- Power grids also must get smarter. Whether they have solar, wind, biomass or small cogeneration units in the basement, the previous consumers of electricity are increasingly also becoming producers. As a result, we need smart grids that effectively balance supply and demand and ensure grid stability.

- Not only must grids be modernized and expanded, but storage capacity also must be increased to handle fluctuating feed-ins from renewable sources and maintain grid stability. The necessity for energy storage capacity is already apparent today when industry demand plunges and wind and solar plants produce far more electricity than needed. These temporary overcapacities – such as on weekends or holidays – lead to negative electricity prices on the energy exchanges for a number of hours each year. As a result, exchange participants actually receive money for the electricity they use rather than pay for it. A number of interesting and highly promising storage solutions are being pursued, such as electrolytic plants that produce environmentally friendly hydrogen with the excess electricity, store the hydrogen, and reconvert it to electricity when needed.

- Energy saving is also an important component of the new energy policy. After all, the cleanest electricity is that which is not consumed. When it comes to energy savings, the potential is enormous in all areas:

  → Industry: The savings potential for electric drives used in industrial production is huge. By using the most advanced technologies already available, power consumption can be slashed by some 60 percent.

  → Buildings: Buildings account for about 40 percent of the world's energy consumption and roughly 20 percent of its greenhouse gas emissions. Modern building technologies can reduce the energy use of buildings by up to 50 percent.

  → Household appliances: Nearly 40 percent of private power consumption is for appliances. There is also enormous potential for saving here: The latest generation of appliances cut consumption by more than half compared to appliances sold in the 1990s.

- Power demands must be aligned with supplies. So-called Demand-Management-Systems specifically reduce consumption when supplies are low and electricity prices are high. This effectively eases burdens on the power grid.

- Intelligent financing solutions must be offered. This is especially important for communities and cities on tight budgets. In its buildings business, Siemens packages energy saving contracting with a financing model that frees the customer of any initial investment. The customer subsequently pays installments from the energy cost savings.

- On the political level, we must more closely coordinate all measures with our neighboring countries and establish a joint energy policy framework within the EU.

- Because the countries in Europe ideally complement one another: Sun-drenched Spain could deliver cheap solar power, and the United Kingdom could supply excess wind power from the North Sea.

- This also applies to Germany. The energy strategies and political approaches of the individual German states must be better coordinated in order to avoid inefficiencies.

Above all, the new energy policy must also be a general mindset! There can't be bitter battles over every single power pylon!

- One major hurdle for the new energy policy is the lack of acceptance by the general public. A "yes" to renewable energies and a "no" to power transmission lines simply don't go together.
- We must convey to people that the sustainable, secure, economical and non-nuclear power supplies they want can't be achieved without additional infrastructure.
- It's intolerable that each pylon be fought over. Naturally, it's important that the public have a say in the planning of larger infrastructure projects. But it's also essential to have decisions and legal security within a given period.

Siemens is a strong partner for the new energy policy

- Our company will be a driving force for the new energy policy. We are the only company worldwide that offers all technologies necessary for implementing the policy. We are working on making renewable energies competitive. We build power superhighways for ensuring low-loss transmission over hundreds of kilometers. We are developing power storage systems as well as smart grids and highly efficient gas-fired power plants that can be quickly ramped up. We are working on the capture and industrial use of CO_2 from coal-fired power plants. And we offer a great variety of solutions for saving energy and using it more efficiently in industrial plants and buildings, for electromobility and in household appliances.
- The new energy policy is being supported by many projects in which Siemens is participating and that were already under way prior to March 11, 2011.
- Such as wind power projects. By the end of 2015, eight offshore wind farms will be operating with Siemens wind turbines in the North Sea and Baltic. Their total generating capacity of around two gigawatts is enough to supply more than two million households with clean electricity. For these installations, Siemens is drawing on its great expertise and experience in the field of wind power. Whether it be on- or offshore: To date, the company has installed around 10,600 wind turbines with a total capacity of just under 16 gigawatts worldwide. In the meantime, the wind turbines from Siemens, the world market leader in offshore power, are built in the company's Wind Power plants in Denmark, the U.S. and China.
- Siemens links such wind farms directly or via connecting hub platforms with the mainland grid. By 2015, high-voltage, direct-current (HVDC) power lines will transport around three gigawatts of Siemens-generated wind power from four North Sea offshore platforms to the German mainland.
- In May 2011, Irsching 4, the world's most efficient combined cycle power plant with a gas turbine made by Siemens began commercial operation in Irsching, Bavaria. Over 60 percent of the energy in natural gas can be converted here to electricity, with a net capacity of 560 megawatts, enough for providing a major city like Berlin with electricity. And due to their especially fast ramp-up times, such highly efficient power plants can also be used as back-up solutions for quickly compensating for fluctuations of renewable energies in the grid.

4. Fukushima's impact on energy policies worldwide

The devastating catastrophe in Fukushima on March 11, 2011 spurred the worldwide debate on the importance and security of nuclear power plants. Germany drew the consequences from this disaster and officially decided to exit completely from nuclear power by 2022. A comparison of a few countries shows, however, that reactions to the catastrophe have been extremely diverse.

China:

- China currently has a total of 14 nuclear power plants in operation, 25 are already under construction, and others are being planned.
- In March 2008, China's National Energy Administration announced plans to increase the nuclear share of the country's energy mix from around two percent to roughly five percent by 2020. In other official reports, they even speak of a nuclear share of 16 percent by 2030.
- However, the catastrophe in Fukushima had the effect that all existing nuclear plants and those under construction were checked for safety, and new guidelines for the security of nuclear power plants were formulated. Yet nothing has really changed in regard to the fundamentally positive view of nuclear power that was approved and propagated prior to Fukushima. China is planning a nuclear power capacity of 60 GW by 2020, 200 GW by 2030 and 400 GW by 2050. By 2030, China will be the second biggest producer of nuclear power after the United States.
- China's goal is to drastically sink the level of its greenhouse gas emissions with the help of nuclear power.
- Today, coal-fired power plants generate around 80 percent of China's electricity.
- At the same time, however, China is already the world's biggest wind energy market. The country plans to have installed a total wind capacity of 150 gigawatts (GW) by 2020 – which corresponds roughly to the entire renewable and conventional power plant capacity currently installed in Germany. Above all, wind energy on the coasts is to be utilized. According to the current Five Year Plan (2011-2015), around 11.4 percent of the entire energy used in the country should come from non-fossil energy sources by 2015. In 2010, the share was 8.3 percent. To reach this ambitious goal, the country also plans to build 200 new hydroelectric power plants with a total capacity of 120 gigawatts in the mountainous and subtropical southwest part of the country.

USA:

- The United States is the world's biggest producer of nuclear energy. The national authorities list 100 nuclear power plants, and these facilities generate one-fifth of the country's electricity.
- Since the reactor meltdown at the Three Mile Island plant in March 1979, no new plant construction has been approved, until recently.
- Despite Fukushima, the United States Nuclear Regulatory Commission recently approved construction of two reactors in the state of Georgia. A further 20 nuclear power plants are awaiting approval.
- The further development of nuclear energy is a key United State's energy policy. With the help of this energy source, the government wants, above all, to end its dependency on oil imports and to lower its greenhouse gas emissions.

France:

- Today, France is the world's second biggest producer of nuclear power. 58 power plants produce roughly 75 percent of the country's electricity. Two additional power plants are planned respectively currently under construction.
- At present, the French government is planning to extend the operating life of the nuclear power plants beyond the currently valid period of 40 years.

Switzerland:

- Five nuclear power plants are currently operating in Switzerland and generate around 40 percent of the country's electricity.
- By 2034, the country plans to have shut down all nuclear power plants.
- One possible alternative for compensating for these closings would be to massively develop renewable energies.