

Contemporary Worldwide Energy Policies – An Example of German Energy Transition

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Abstract

The following paper is giving an outlook on the contemporary energy situation in Europe. The nuclear disaster in Japan in 2011 had a bid impact on the global energy policy. Some countries have already changed their energy conception by switching from nuclear energy to renewable energy sources, some countries are on their way of rethinking it. This paper is introducing the Germany's model of energy transition as a pioneer in this field.

Keywords: Nuclear energy, Fukushima, renewable energy, energy transition, innovation, technology, global energy policy, electricity market, energy prices, energy production.

1. CURRENT ENERGY SITUATION

1.1 Fukushima – The nuclear disaster in Japan

On March 11, 2011, in Japan occurred the largest nuclear accident since Chernobyl (1986). One of the strongest earthquakes ever measured in northeastern Japan triggered a tsunami. The earthquake and tsunami collapsed several cooling systems in the Japanese nuclear power plant Fukushima. It came to meltdown in three reactors. Substantial quantities of radioactive material were released. According to Greenpeace, this case was not comparable in its course to the nuclear catastrophe in Chernobyl, where the graphite reactor had been burning for days and thus released a lot of radioactivity into the atmosphere. But the dramatic thing about Fukushima is first, that there were several meltdowns and second, the capital Tokyo is only 250 kilometers away. The population density around Fukushima is 20 times higher than in 1986 in the Chernobyl region. Global mass media described Fukushima as “Japan’s darkest day” (SPIEGEL Online)¹, „Japan is facing its greatest crisis since the second world war” (Guardian)², “Fukushima: Fallout of fear” (Nature)³.

1.2 Consequences for the international energy policy

The nuclear disaster in Japan had far-reaching consequences not only for Japan, but also for many other countries. So, decided *Germany* (2011) and *Switzerland* (2011) the nuclear power phase-out. In *China* and in *Japan* can be seen a rethinking in the direction of accelerated energy transition. Many other countries, such as *France*, *Russia*, *US* are continuing to use the nuclear energy. France, the country with the most nuclear power plants in Europe, keeps its nuclear power. Share of nuclear energy in energy production in 2017 in France was approximately 72%. In comparison in Germany it was 11,6 %. *Russia* wants to build a total of 26 nuclear reactors by 2030. In the US there is also no broad debate started on re-evaluating nuclear power.

In the 21st century the world must master a double challenge. On the one hand, the global warming due to high CO₂ emissions. A key reason for this is the dependence of modern industrial companies on fossil fuels. On the other hand, finiteness of crude oil, which has enabled the present prosperity. Nuclear energy has been propagated for long period of time as CO₂-free, safe and cheap solution to global energy problems. According to the International Energy Agency [2], conventional crude oil production peaked in 2006. These two factors must be regarded by the climate and energy policies of

¹ [SPIEGEL] <<https://www.spiegel.de/panorama/gesellschaft/fukushima-katastrophe-japans-dunkelster-tag-a-820581.html>> (09.06.2019)

² [The Guardian] <<https://www.theguardian.com/world/2011/mar/13/japan-tsunami-earthquake-power-cuts>> (09.06.2019)

³ [Nature] <<https://www.nature.com/news/fukushima-fallout-of-fear-1.12194>> (09.06.2019)

the future. [1] Such questions as energy security, competitiveness, climate change mitigation as the energy transition is progressing. For this purpose, the European Union adopted the *European climate and energy framework 2030*, which contains important information (also legislative packages of the European Union) on the future direction of European and national climate and energy policies. According to it [3], the EU has set itself the aim of cutting EU greenhouse gas emissions by at least 40% by 2030 from 1990. Also, the proportion of renewables in the final energy consumption of the EU is to rise to 32% and EU primary energy consumption is to be cut by 32.5% compared with a reference scenario.

According to the statistic "*Number of operational reactors in nuclear power plants worldwide by country in January 2019*"⁴ published by German statistics database Statista, the United States with 98 reactors (in operation) takes the first place in this ranking. It is further followed by France (58) and China (45). Among the first ten countries are also Japan (40), Russia (36), South Korea (24), India (22), Canada (19), Ukraine (15), United Kingdom (15). Germany has 7 reactors in operation. The statistic shows the number of operational reactors in nuclear power plants worldwide by country. Operable means that the nuclear power plants with the associated reactors are connected to the electricity supply network.

According to another statistic „Distribution of worldwide energy production by energy source in 2016“⁵, which shows the worldwide energy consumption, *crude oil* is the world's current largest energy source (32%). From oil is produced not only one third of the world's energy, but it also accounts for the largest share of worldwide energy consumption. To the most consumed energy sources belong also *coal* and *natural gas*. As the amount of nuclear energy in global energy consumption is decreasing, the amount of renewable energy sources on the other hand is growing. The renewable energy source *hydropower* generates only around three percent of the world's energy. The regions with the highest energy consumption are Asia and the Pacific region and with the smallest is Africa. According to different prognosis the global primary energy consumption will continue to rise until 2050.

2 GERMANY AS PIONEER OF THE ENERGY TRANSITION

2.1 Energy transition

Following nuclear accident in Fukushima in March 2011, Germany decided at a rapid pace to accelerate the phase-out of nuclear power by 2022. After long years of discussions, it was decided on 30 May 2011 to phase out nuclear power. Eight nuclear plants were shut down immediately and the remaining nine will be phased out by 2022. The sequence of shutdown is the following: 2015 Grafenrheinfeld, 2017 Gundremmingen B, 2019 Philippsburg 2, 2021 Grohnde, Brokdorf and Gundremmingen C and 2022 Isar 2, Neckarwestheim 2 and Emsland. Renewable energy is determined as the cornerstone of future energy supply. This set of policy instruments is commonly known as the energy transition (ger. "*Energiewende*"). The German term "*Energiewende*" was first contained in the title of a 1980 publication by the German Öko-Institut, calling for the complete abandonment of nuclear and petroleum energy [4].

In her policy statement [5]⁶ on the new energy concept on June 9, 2011, the Federal Chancellor Angela Merkel said:

„Fukushima has changed my attitude to nuclear energy. [...] In Fukushima we had to take note that even in a high-tech country like Japan, the risks of nuclear energy cannot be controlled safely”

The energy transition means at the same time withdrawing from nuclear energy and fossil fuels and switching the electricity supply to at least 80% from renewable energies by 2050. The sun and wind should make the biggest contribution. With this decision, Germany is considered a pioneer in this field.

⁴ [Anzahl der betriebsfähigen Reaktoren in Kernkraftwerken weltweit nach Ländern im Januar 2019]
<<https://de.statista.com/statistik/daten/studie/152153/umfrage/anzahl-der-sich-in-betrieb-befindenden-atomkraftwerke-weltweit/>> (09.06.2019)

⁵ [Verteilung der weltweiten Energieerzeugung nach Energieträger im Jahr 2016]
<<https://de.statista.com/statistik/daten/studie/167998/umfrage/weltweiter-energiemix-nach-energietraeger/>> (09.06.2019)

⁶ <https://archiv.bundesregierung.de/archiv-de/dokumente/wende-zum-zukunftsstrom-419100> (Letzter Zugriff: 09.06.2011)

"We can be the first industrialized country in the world that will create the turning point in the energy future." [5]

Energy transition is one of the most ambitious major projects for Germany in the 21 century [6]. Many hope that other countries will realise the advantage of German energy transition and will take an example from Germany.

2.2 Renewable energy in Germany

The electricity supply in Germany is getting „greener“ year by year. The share of renewable energy in electricity consumption is growing steadily: from around 6 percent in 2000 to around 36 percent in 2017. By 2025, 40 to 45 percent of the electricity consumed in Germany should come from renewable energy. Crucial for this is the Renewable Energy Sources Act (germ. EEG = Erneuerbare-Energie-Gesetz). According to EEG 2014 [7], the following energy sources belong to renewable energies:

- a) hydropower including wave, tidal, salt gradient and flow energy;
- b) wind energy;
- c) solar radiant energy;
- d) geothermal power;
- e) Energie aus Biomasse einschließlich Biogas, Biomethan, Deponiegas und Klärgas sowie aus dem biologisch abbaubareren Anteil von Abfällen aus Haushalten und Industrie (§ 5 EEG). energy from biomass including biogas, biomethane, landfill gas and sewage gas as well as from the biodegradable fraction of household and industrial waste.

3 GERMAN ELETRICITY MARKET

Already one third of the electricity in Germany (32.5%) is generated by the sun, wind and biomass. By the year 2025 40 to 45% of the required electricity will be generated from renewable energy sources. Conventional coal and nuclear power plants are losing their importance. A big problem for Germany's largest energy providers, who have been using nuclear power plants, classic gas and coal power plants for years. A big switch for RWE AG, EnBW AG, E. On SE and Vattenfall GmbH. Critics accuse the energy providers of having reacted too late to the changed market conditions.

RWE AG is one of the largest energy providers in Germany. Due to its dominant market position, RWE plays a central role in the energy transition. About the socio-political discourse on the energy transition, RWE's situation is extremely difficult. Compared to the rest of Germany, RWE's energy production still consists of 95% fossil and nuclear sources⁷. RWE, which currently has a majority negative connotation (one of Europe's biggest "CO2 polluters"⁸), is now required to define its role in the energy transition process. RWE must make a shift to significantly more renewable energy sources. So, additional to its power grid, RWE is trying to develop the green electricity business around RWE Innogy. The actual logo of the firm sounds "Powering. Reliable. Future" (germ. "Zukunft. Sicher. Machen")⁹

Not to forget are the energy prices. The energy transition is often criticized for its expensive cost implementation, which is to be paid by energy consumers. Due to the report on energy prices and costs in Europe [8] published in 2019 by the European Commission wholesale energy prices have fallen in recent years due to increasing competition on wholesale markets from big amounts of renewable energy, improved interconnections and a more integrated internal electricity market. Interestingly, that 2018 Germany topped the list if countries with the highest electricity prices worldwide in 2018¹⁰. Due to the report by the European Commission future electricity production costs are expected to increase for fossil fuel-generated electricity (due to import prices and the carbon price) and fall for renewables (linked to the decreasing costs of investment as technologies evolve), with the

⁷ [Anteil der Energieträger an der Stromerzeugung des Energiekonzerns RWE im Jahr 2014] <<http://de.statista.com/statistik/daten/studie/184795/umfrage/an-teil-der-energietraeger-an-der-stromerzeugung-von-rwe/>> (09.06.2019).

⁸ [„Weltklimagipfel will Lösungen“ 29.11.2015] <http://www.cash.ch/news/alle/weltklimagipfel_will_loesungen-3395045-448> (09.06.2019)

⁹ [Official Website of RWE] <<https://www.group.rwe/>>(09.06.2011)

¹⁰ [Global electricity prices in 2018] <https://www.statista.com/statistics/263492/electricity-prices-in-selected-countries/> (09.06.2019)

report suggesting that that electricity market prices could reduce the need for subsidising renewable energy technologies by 2030.

Despite the criticism the energy transition is progressing. It is one of the biggest contemporary energy projects worldwide. Due to its unfinished or progressing status it is not so easy to evaluate correctly all the advantages and disadvantages for the future.

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