

Nuclear power program in Poland

Executive summary

The Polish government has undertaken the nuclear power program, which aims at the construction of at least three nuclear power units before 2030.

However, large costs of nuclear power stations and the associated costs of the transmission system upgrade to accommodate the electricity produced by large nuclear units rise doubts if such a program can be implemented in accordance to the time table and whether the Polish energy users can with stand very high electricity prices.

The aggressive lobbying for nuclear power faces relatively weak reaction of antinuclear groups. They are not well organized and suffer from a lack of prominent experts. The funds dedicated by the Polish government to the promotion of nuclear power have gradual impact on the public leading to larger acceptance of the nuclear power industry.

A campaign of antinuclear associations supported by energy experts can increase the concerns of the public relating to the safety of nuclear power stations, storage of nuclear waste and highlights high costs of nuclear policy.

1. Żarnowiec – the first attempt

The first attempt to construct a nuclear power station in Poland was undertaken in 1982, when the communist government decided to build nuclear power facilities near Żarnowiec, in the Gdańsk region.

The power station planned was to have four nuclear units, each of 440MW rated power. Nuclear reactors were to build in Czechoslovakia, in the Skoda factory, which owned the Russian license. The reactors were cooled by pressurized water. The first generator should have started its operation in 1989, while the next one should be commissioned in 1990.

The collapse of the communist system led to the appointment of a new Solidarity government, which in December 1989 stopped the construction of the Żarnowiec nuclear power station. The referendum in the Gdańsk region carried out in May 1990 resulted in small support for the nuclear power station (only 13,9%), while over 86,9% voters were against the continuation of the construction. Having the referendum support and facing the decreasing demand for electricity caused by shutting down heavy industry, the Polish government in December 1990 cancelled the

investment. The nuclear reactors ordered in the Skoda factory were sold to Finland and Hungary, the concrete construction was left for the gradual degradation.

The decisive factor for the resignation from the continuation of the nuclear construction was the outage in Chernobyl and the public fears of about the safety of the nuclear power plants.



Fig.1. Remains of the nuclear power station in Żarnowiec. Source: Wikipedia.

2. Government nuclear power program

The idea to construct nuclear power stations in Poland has been reappeared for many years. Small but active lobbying groups advertised from time to time the advantages of nuclear power. The lobbyists include: researchers working in nuclear laboratories and old power engineers still being under the communist propaganda when pushing for nuclear power in Poland in the eighties of the XX century. The visible PR was also carried out by the European industries involved in the production of nuclear reactors.

The transition period from the socialist economy characterized by the heavy industry and significant demand for electric power to the modern economy resulted in the smaller demand for electricity in Poland. Also relatively small power producing companies were not able to withstand a

large burden of capital investment in nuclear power stations. The public still had reservations to nuclear technologies.

The picture rapidly changed when in the beginning of January 2009, the Polish government announced a new nuclear power program intended to construct three nuclear power units. The press release heralded the appointment of a special envoy for the nuclear power placing her at the position of the Deputy Minister of Economies. Her and her department duties include the drawing up the plan which will lead to the construction of three nuclear power units. The announcement also indicated that the Polish largest energy company, Polish Energy Group (PGE SA) will construct at least two nuclear units. The complex program with the detailed time table of the nuclear power construction, the draft localization of nuclear power stations and the storages for nuclear wastes should be ready by the end of 2010.

This rapid jump of the Polish government into the nuclear pool was so surprised that media started speculation that the Polish nuclear program is driven by the promises to procure three nuclear units as the result of a political deal to support the derogation for the Polish power industry in EU ETS in a form of free CO₂ allowances. This rapid move was also surprising for environmental organizations. They have problems to withstand the aggressive propaganda promoting the nuclear power industry. Every week, several papers are published by the nuclear lobbyists to encourage the public to the support nuclear power.

This industry is promoted as the most safe and reliable power producing technology, which is additionally the cheapest one and does not emit the carbon dioxide. The Polish government has dedicated several million zloty for the promotion of nuclear power. The action is managed by the Deputy Minister of Economies and the Nuclear Power Department responsible for the nuclear program. Ministry of Economy has also appointed a supporting team of researchers to provide the credence to the nuclear propaganda.

Despite the vigorous lobbying in 2009, some PR experts indicate that the Polish government will slow down the nuclear promotion in 2010 as it is afraid of the split in public opinions over the issue during the presidential election, in which the current Prime Minister seems to be a leading candidate.

3. Who for and who against?

The analysis of the perception of the nuclear power program indicates at least four distinctive positions. Environmental organizations strongly oppose the nuclear power. Lobbyists aggressively

push to convince the public to accept nuclear power stations in Poland. The leading experts are skeptical, while the public is split.

3.1 Environmental organizations

Environmental organizations are against the proliferation of nuclear power. Greenpeace¹ is advocating against the nuclear power stating that “*The safe nuclear energy is a myth*” and “*power stations are the most expensive energy sources taking into account the costs of the construction, operation and demolishing*”. They also indicate that “*Nuclear waste storage is the unsolved problem left for the generations to come*”.

The Antinuclear Initiative² was established as “*the reaction to the decision of the Polish government accepting the energy policy, which indicates the necessity to construct nuclear power stations*”. This Initiative states that “*in the country in which the public is against the nuclear power, such a government’s decision is not acceptable without public consultations*”. The opponents of the nuclear power established the internet petition³ “*A million against nuclear power*”. This petition calls on the European Union not to construct new nuclear power stations.

The weakest element of the environmental organization campaign is a lack of leading experts, who could support the campaign and the zealotry when promoting the climate warming theory as well as the unconditional support for the renewable energy sources. The environmental conference in Copenhagen, which seems to be more a place of haggling over the funds than the discussion how to protect environment, has changed the attitude of the Polish media which are becoming more critical about the climate changes and the commitment of CO₂ emitted by the industry to the warming effect. The information about the Mike’s tricks from Climate Research Unit over the temperature data fueled the public skepticism to the global warming theory. These are draw backs not only to nuclear power but also to renewables as both expensive technologies are fertilized by the ideology of climate changes.

3.2 Nuclear lobbyists

Nuclear lobbyists in Poland represent at least four groups. The first one includes lobbyist working for the industry producing equipment of nuclear power stations. The second squad consists of the employees of various nuclear laboratories and remainings of nuclear agencies established by the communist government when aimed at the construction of the Żarnowiec nuclear power station. They are the most active in promoting the nuclear power. The Seren organization in Poland is

¹ <http://www.greenpeace.org/poland/kampanie/energia-atomowa>

² <http://www.ian.org.pl/>

³ <http://www.ekologia.pl/>

headed by this group of activists. The third group embraces the power industry engineers, mostly old generations, who were imprinted by the communist propaganda that the nuclear power stations are symbols of modern industry and society. The last is a group representing new generations, which are relatively easy target for nuclear propaganda manipulation.

3.3 The public

The public is split over the nuclear power construction. Most people, especially the older generations still keep in their minds the Chernobyl disaster. Younger generations buy the nuclear propaganda myths and are ready to accept nuclear power. In the survey carried out in 2008 about 47% voters accepted the construction of a nuclear power station, while 42% were against with over 10% undecided. The funds dedicated by the Polish government to the nuclear power program will allow for more vigorous PR promoting nuclear power and gradually change of public attitudes to nuclear power stations. If the opponents are not able to find the adequate counter measures to the nuclear propaganda the public will be gradually convinced and will accept nuclear power.

3.4 Leading experts

Leading experts in Poland are skeptical to nuclear power. Prof. M. Nowicki, a former Minister of Environment, who resigned in December 2009, had stated⁴: *“I am skeptical to nuclear power stations in Poland, as it is very expensive investment and does not provide panacea [to the Polish problems]”*. Prof. K. Żmijewski of the Warsaw Technical University, a former CEO of the Polish power grid company, wrote⁵: *“The construction of a nuclear power station does not solve any problem of the Polish power industry”* and referring to nuclear power propaganda, which states that the nuclear power stations are the less expensive he wrote in his blog⁶: *“Persuading that something which is expensive is cheap is not only unmoral but also harmful”*. Prof. J. Popczyk of the Silesia Technical University, also a former CEO of the Polish power grid company says in an interview for Rzeczpospolita⁷: *“We will have to reconstruct the transmission network to allow for the flow of electricity from nuclear power stations to the users”* and states⁸: *“Nuclear technologies of power generation are against the nature of democracy”*.

4. Cost of nuclear energy

Despite the statements published by nuclear lobbyists that the electricity produced by the nuclear power stations is less expensive than by other electricity generating technologies, the professional

⁴ <http://wiadomosci.wp.pl/kat.1342,title,Czy-Polska-potrzebuje-elektrowni-jadrowej,wid,10623018,wiadomosc.html>

⁵ http://wyborcza.pl/biznes/1,82244,5490764,Atomowy_kwiatek_do_kozucha.html

⁶ http://www.wnp.pl/blog/2_195.html

⁷ <http://www.rp.pl/artykul/247954.html>

⁸ <http://www.cire.pl/item,39845,1.html>

investment cost calculations show that nuclear power is the most expensive technology to produce electricity.

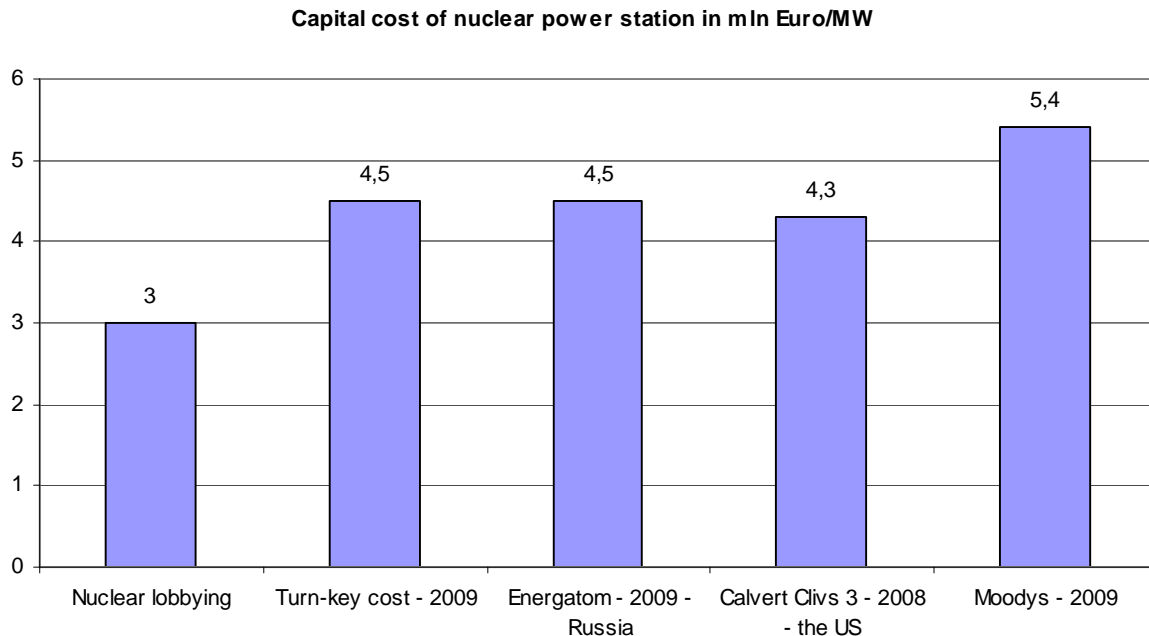


Fig. 2. Capital cost of nuclear power stations

Capital costs of all power stations are continuously rising. In particular the cost of nuclear power stations. Due to the information published by the leading consulting company, Cambridge Energy Research Associate⁹ (CERA), the power capital cost index (PCCI) increased from the base value in 2005, when assumed 100, to about 180 for the coal power stations and to about 230 for nuclear power stations in 2008. It is reflected by the capital cost per 1MW of installed power – Fig. 2.

The nuclear lobbying advertised 3 mln Euro/MW as the basic cost of nuclear power stations. However, this cost perhaps refers to the initial contractors' bids but it does not take into account other associated costs that have to be covered by investors. The turn-key cost is evaluated by the author to 4,5 mln Euro/MW. The data published by various sources confirms that the realistic cost of nuclear installations is higher about 50% than stated by the nuclear lobbyists. The Russian company, Energatom, announced the plan to construct two new nuclear units in the Kaliningrad area. The cost is estimated to about 4,5 Euro/MW. Similar figures are published in the US. The nuclear power station Calvert Clives 3 will cost about 4,3 mln Euro/MW¹⁰. The rating agency Moodys¹¹ assumes about 5,4 mln Euro/MW in its NukeCo model.

⁹ <http://www.cera.com/>

¹⁰ <http://www.world-nuclear.org/info/inf41.html>

¹¹ www.moodys.com

Very high capital costs lead to the expensive electricity produced by nuclear power stations. The calculation of electricity costs for 2015 in Poland shows that costs of electricity production from hard coal, lignite and gas fueled power stations including the cost of CO₂ allowance for 40Euro/ton, are about 400PLN/MWh, while the cost of electricity from nuclear power stations reaches over 550PLN/MWh for the typical commercial cost of investment financing – Fig. 3.

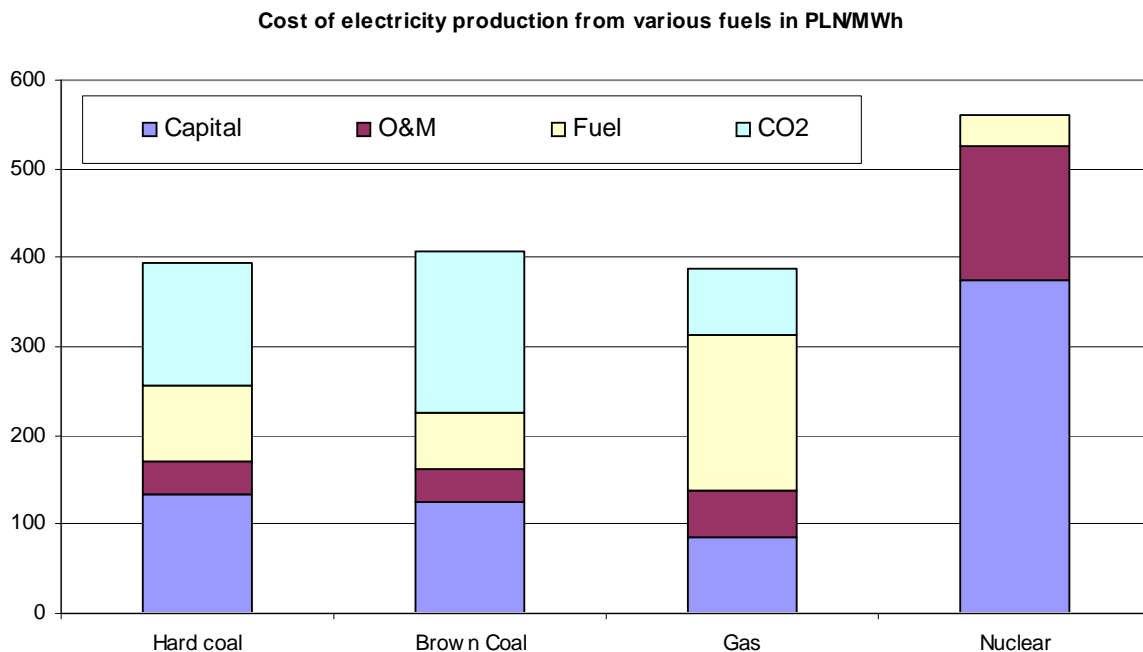


Fig. 3. Cost of electricity production using various fuels.

The calculation presented in Fig. 3 indicates that without the additional support nuclear power stations are not competitive. The subsequent calculations of the nuclear power station costs have been carried out with the use of the Net Present Value method as a function of the capital cost (Weighted Average Cost of Capital = WACC). The WACC is calculated as the average value taking into account the cost of external financing and the cost of the company equity. The typical WACC when borrowing the money at the competitive market is about 9,6% per year. When the investment can be guaranteed by the government, as in the US, the WACC can be lower. However, the state guaranties for the nuclear power stations are public aids which can be only obtained in some specific circumstances.

The calculation of NPV shows – Fig. 4 – that for typical market conditions the nuclear power station can be competitive provided the price of CO₂ allowance is higher than 80Euro/ton, what is rather unlikely, as most analysis indicate cost of CO₂ allowances about 40Euro/MWh.

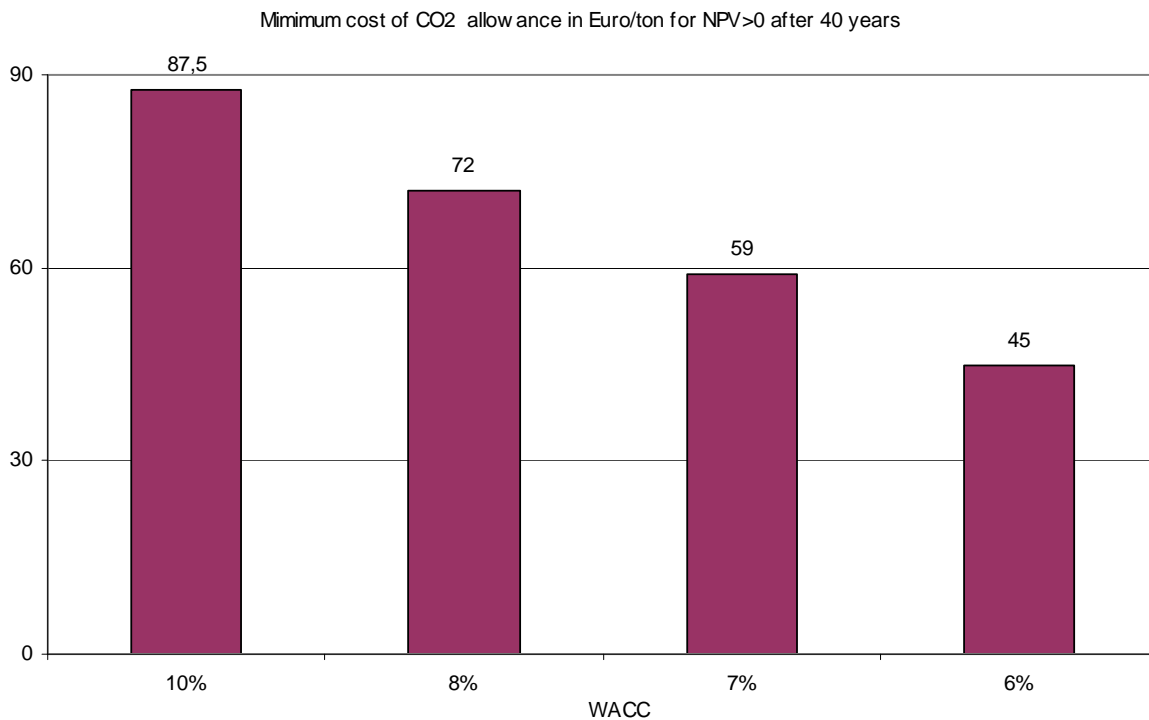


Fig. 4. Minimum cost of CO₂ allowance to make nuclear power stations competitive assuming return from investments after 40 years (NPV>0) as a function of the capital cost.

5. Safety concerns

Despite the advertising nuclear power stations as very safe installations, there are still safety concerns raised by various institutions. Recently, the Nuclear Installations Inspectorate¹² (NII) in Great Britain has written to EDF and Areva, the French companies which want to construct four nuclear reactors in the UK expressing the concerns about nuclear technology to be implemented. The letter highlights the concerns about *“the absence of safety display systems or manual control that would allow the reactor to be shut down, either in the station’s control room or at an emergency remote shutdown station.”*

The NII is a very professional institution employing over 450 experts, so its position indicating the possible compromise in safety of the newest French nuclear reactor called EPR, should be taken into account very seriously. The technology can be improved but it takes time and rises the cost of the nuclear reactors.

¹² The Times, July 1, 2009.

6. Nuclear waste

Nuclear lobbying groups play down the problem of nuclear wastes. Such wastes include high radiation stuff, which has to be stored for several hundred thousand years and low radiation waste which consists of the construction of the reactor and the auxiliary equipment. None country, currently using the nuclear technology, was able to solve the nuclear waste problems.

France will determine the long term storage for nuclear waste after year 2025. Germany is carrying out research on the best place of nuclear waste storage not indicating the possible dates of such a storage construction. A very difficult situation is in the US, where after the rejection of the Yucca mountain storage built by the federal government it is little idea what to do with nuclear waste. In mean time, over 70 000 ton of high radiation waste is waiting in temporary sites, mostly water polls in nuclear power stations, for any solution.

7. Impact on the power system

7.1 Balancing of supply and demand

The nuclear power stations are promoted in Poland as a way to reduce CO₂ emission and provide the significant production allowing for the balance of the growing demand. The ambitious nuclear program, approved by the government, assumes the construction of the first nuclear unit of 1600MW in 2020, the next unit should be commissioned before 2025, while the third one is to be operating before 2030.

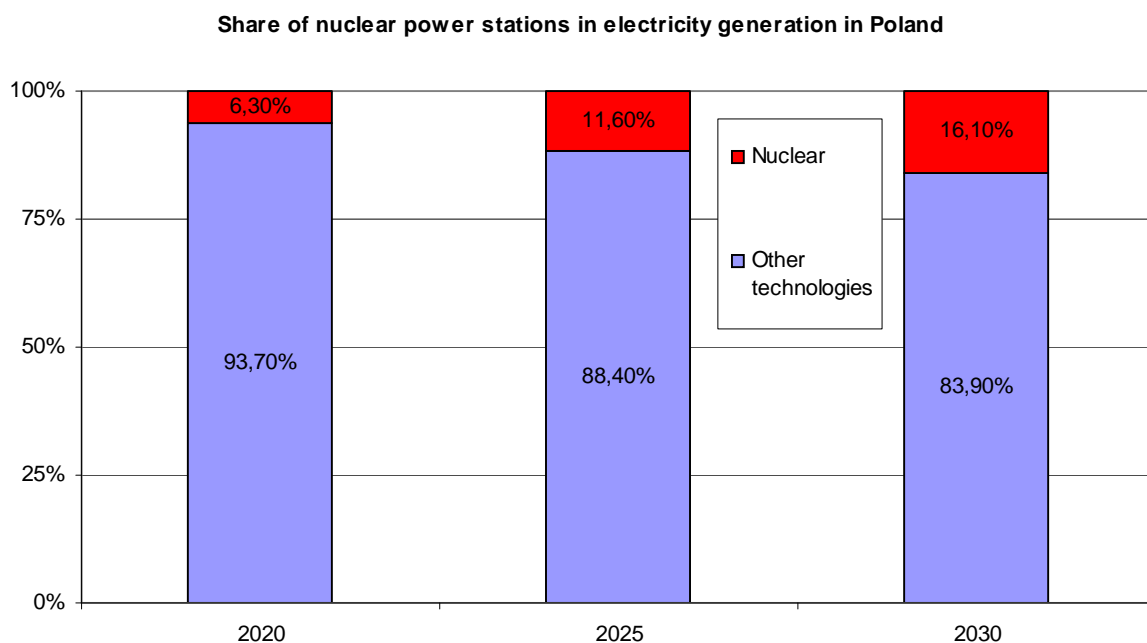


Fig. 5. The share of nuclear power stations in the balance of the electricity production and supply.

The simulation based on this very ambitious, but rather unrealistic, governmental program indicates that nuclear power stations will have insignificant impact on the balance of the electricity production and supply – Fig. 5. The possible renewables share can reach about 15% in the total production so Poland will have to produce at least 70% of electricity using fossil fuels. Very high costs of the nuclear power program will not be compensated by the reduction of CO2 allowance burden. Poland is not able to avoid the domination of fossil fuels and large CO2 taxes, in a form of CO2 allowance in EU ETS, will lead to diminishing of the economy growth.

7.2 Transmission system and power reserve

The discussion on the nuclear power stations is concentrated on the cost of the construction or problems with nuclear waste. The connections of nuclear installations to electric power networks and the network operation with large generators having rated power of 1600MW attract little attentions. The Polish transmission system is relatively weak. There are only several 400kV lines and the power transmission is based on old 220kV systems requiring the urgent upgrade. A large nuclear power station rated at 1600MW has to be connected to several 400kV lines, which should be specifically constructed to accommodate the electricity generated by nuclear units. The largest generator currently connected to the Polish power grid is a 500MW unit, ie. 3 times smaller than the nuclear unit planned.

Another problem to be solved by the transmission system operator is the fast reserve to compensate the power generated by a nuclear unit when its outage happens. Currently, the fast reserve in the Polish power system is about 700-800MW what is enough to compensate the failure of the largest 500MW unit. However, the construction of nuclear power stations with generators rated to 1600MW will require to provide large amount of fast reserve.

Some experts indicate that the investment of 1 mln Euro in generating assets requires the investment of 0,5-0,7 mln Euro in the transmission systems to accommodate the power generated and ensure security of supply. The transmission grid can be and should be upgraded but it takes time and requires significant investment in transmission lines. When adding the high cost of nuclear power stations and associated costs of the transmission system upgrade as well as the construction of fast reserve systems, the question appears if power companies, and by the end of the day power consumers can afford such expenses.

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