



How could Germany reorganize their electricity production in case of a shut down of nuclear power plants?

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Purposes of our seminar paper

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- Summarization and evaluation of the plan of shutting down all the nuclear PP's in Germany
- Overview of the current power plant structure in Germany
- How the future electricity structure has to be planned or restructured in order to reduce the emissions of CO₂/MWh

Current situation in Germany

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- Germany's production in 2011:
 - ▣ 629 TWh

- Total installed capacity in 2013:
 - ▣ 174 179 MW
 - Installed capacity of RES 74 603 MW
 - 42 % of total installed capacity
 - Nuclear PPs operating net capacity 12068 MW

Method – Short term

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- Time period 2013 - 2020
- We consider power plant structure as fixed
- Calculating with all existing conventional PPs until
2020

Method – Short term

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- Work plan:
 - ▣ elapsed time extension of fossil fired PPs
 - ▣ Retrofit old conventional PPs
 - ▣ Modification to fast adjustable PPs

Method – Long term

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- From 2020 to 20xx
- Shut down nuclear PPs
- Calculation of:
 - ▣ RES development
 - ▣ Scenario for electricity demand

Result – Short term

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- Highest CO₂- emissions:
 - ▣ brown and stone coal
- Start to make them more efficient and to reduce their amount of CO₂
- need of fast adjustable PPs will be increasing
 - ▣ have to be able to stabilize the volatile electricity production of RES

Result – Short term

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- Retrofit old coal fired power plants into fast operating gas fired combined cycled PPs.
- Combined heat and power technology
- Carbon Capture and storage
- Use Compressed air depositories , hydrogen depositories and batteries
- Development of RES has to be forced as fast as possible

Result – Long term

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- Can Germany cover their need of electricity by 2020 without nuclear power plants?

2013	Szenario decreasing electricityNeed	75012,6 MW
2013	Secured generation capacity	80880,6 MW
2013	Szenario connstant electricity Need	76700 MW
2013	Secured generation capacity	82700 MW
2020	Scenario DENA Increasing electricity demand	72865 MW
2020	Secured generation Capacity needed 2020	78565 MW
2020	Scenario DENA Constant demand for electricity	76700 MW
2020	Secured generation Capacity needed	82700 MW
2020	Scenario "Frauenhofer" out of BEE- Scenario	58000 MW

Source: Own Calculation

Result – Long term

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Source	Secured generation capacity in MWh 2013	Installed capacity 2013 [MW]	Prognosis Extension 2020 [MW]	Secured generation capacity in MWh 2020	CO2-Emissions 2013 of max. secured Production [t]	CO2-Emissions 2020 of max. secured Production [t]	Delta [t]
Sum non RES	87 220	74 604	110 893	75 997	54 082, 9	53 779, 8	- 303,2
Sum RES	9 206	174 179	198 146	17 879	234, 1	543, 5	+ 309,4
TOTAL	96 426	248 783	309 039	93 876	54 316, 9	54 323, 3	+ 6,4

Source: Own calculation

Discussion - CO₂ price

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- In 2010 -53 462 742 CO₂ allowances
- Difference between 2013 and 2020 6 433, 3 kg
- Import from France (410 TWh; 16 050 484 CO₂ allowances)
- Last period of EU ETS (2013 – 2020)
- 14th May, 2013: 3,23€/ton CO₂
 - ▣ → no effect on the merit order of PP

Discussion – CO₂ price

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Preis



Source: eex.com

Discussion – further research

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□ Economics

- ▣ reduction of GDP growth
- ▣ Electricity price according CO₂ emissions

□ Energetic

- ▣ level of CO₂ price to change energy mix significantly
- ▣ CO₂ prices according CO₂ emissions by using scenarios

Summary

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- Nuclear PPs capacity can be produced by RES in 2020
- We do not need green electricity
 - ▣ Only we have to decrease CO₂ emissions
- For further research more factors have to be considered

Sources

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- GRIN: Der Atomausstieg in Deutschland. [online]. [cit.2013-03-28]. Available from: <http://www.grin.com/de/e-book/176330/der-atomausstieg-in-deutschland>
- Federal Statistical Office (Destatis): Economic Sector. [online]. [cit.2013-04-14]. available from: <https://www.destatis.de/EN/FactsFigures/EconomicSectors/Energy/Production/Tables/GrossElectricityProduction.html>
- BMWi: Stromversorgung. [online]. [cit.2013-03-28]. available from: <http://www.bmwi.de/DE/Themen/Energie/stromversorgung.html>
- Bundesnetzagentur. [online]. [cit.2013-03-28]. available from: http://www.bundesnetzagentur.de/DE/Sachgebiete/ElektrizitaetGas/Sonderthemen/Kraftwerksliste/VeroeffKraftwerksliste_node.html
- BDEW: Energy mix. [online]. [cit.2013-03-28]. available from: <http://www.bdew.de/internet.nsf/id/0AB381E4EC443E9BC1257A7600404535>
- E-CONTROL: Stromkennzeichnungsbericht 2012. [online]. [cit.2013-04-21]. available from: <http://www.e-control.at/portal/page/portal/medienbibliothek/oeko-energie/dokumente/pdfs/Stromkennzeichnungsbericht%202012.pdf>

Sources

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- Statista: CO2 Emissionen. [online]. [cit.2013-03-29]. available from:
<http://de.statista.com/statistik/daten/studie/233868/umfrage/co2-emissionen-bei-der-stromerzeugung-nach-erzeugungsart/>

- BMU: Erneuerbare Energien 2011. [online]. [cit.2013-03-28]. available from:
http://www.bmu.de/fileadmin/bmu-import/files/pdfs/allgemein/application/pdf/ee_in_zahlen_2011_bf.pdf

- BMU: Kyoto protokoll. [online]. [cit.2013-04-12]. available from:
<http://www.bmu.de/themen/klima-energie/klimaschutz/internationale-klimapolitik/kyoto-protokoll/>

- BMU: Das Integrierte Energie- und Klimaschutzprogramm (IEKP). [online]. [cit.2013-04-12]. available from: <http://www.bmu.de/detailansicht/artikel/das-integrierte-energie-und-klimaschutzprogramm-iekp/>

- BP: Electricity - Review by energy type. [online]. [cit.2013-04-10]. available from:
<http://www.bp.com/sectiongenericarticle800.do?categoryId=9037156&contentId=7068663>
Nuclear power plants shut down in Germany

Sources

- Enerdata: Global Energy Statistical Yearbook 2012. [online]. [cit. 2013-04-12]. available from: <http://yearbook.enerdata.net/electricity-domestic-consumption-data-by-region.html>
- BDEW: Energy consumption. [online]. [cit.2013-04-09]. available from: <http://www.bdew.de/internet.nsf/id/DA2ADF9EE4270788C1257A76004055A6>
- DESTATIS: Economic sector - Production. [online]. [cit.2013-04-10]. available from: <https://www.destatis.de/EN/FactsFigures/EconomicSectors/Energy/Production/Tables/GrossElectricityProduction.html>
- European Energy Exchange: EU Emission Allowances Chart. [online]. [cit.2013-05-15]. Available from: www.eex.com/de/Marktdaten/Handelsdaten/Emissionsrechte/EU%20Emission%20Allowances%20%7C%20Spotmarkt/EU%20Emission%20Allowances%20Chart%20%7C%20Spotmarkt/spot-eua-chart/2013-05-14/1/1/1y/p3
- World Nuclear Association: Nuclear Power in France. [online]. [cit.2013-05-10]. available from: <http://www.world-nuclear.org/info/Country-Profiles/Countries-A-F/France/#.UYzFw8ovs2g>
- Entsoe: Country data packages. [online]. [cit.2013-05-10]. available from: <https://www.entsoe.eu/db-query/country-packages/production-consumption-exchange-package/>.

THE END

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- Do not hesitate and ask us
- Thank you for your attention!