

Germany



Summary

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- Energy Policies
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- Natural Gas & Oil
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- Nuclear
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- Germany's Energy in the Future

Overview

History (1900s - Present)

- 1914 - Expansion of military and foreign policy
- 1933 - Adolf Hitler comes to power
- 1939 - Invasion of Poland: Beginning of World War II
- 1949 - Separation of East & West Germany
- 1961 - Berlin Wall is built
- 1989 - Berlin Wall torn down - Unification of Germany

Overview

Geography & Demography

- Capital - Berlin
- Population 80.62 million (2014)
- Land Area - 134,572 square miles (2014)
- Major Cities - Berlin, Hamburg, Munich
- GDP: \$3.073 trillion USD



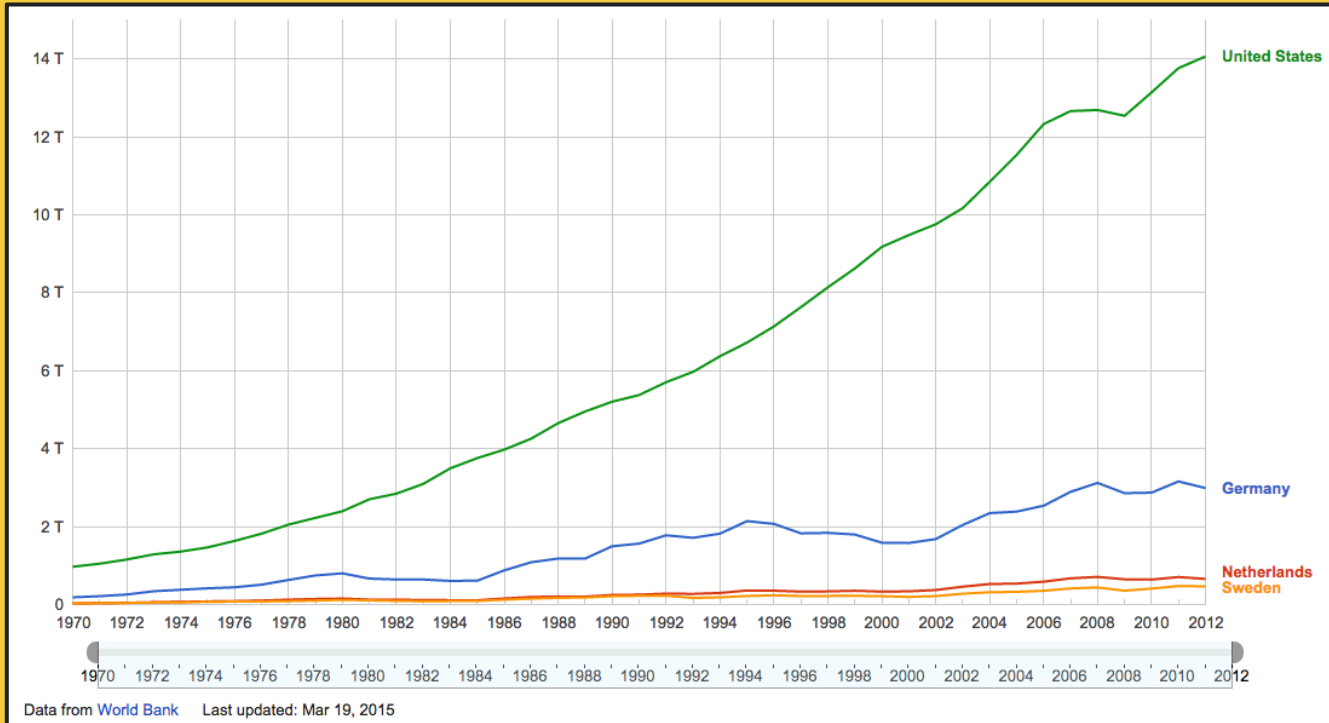
<http://i.infoplease.com/images/mgermany.gif>

German Economy

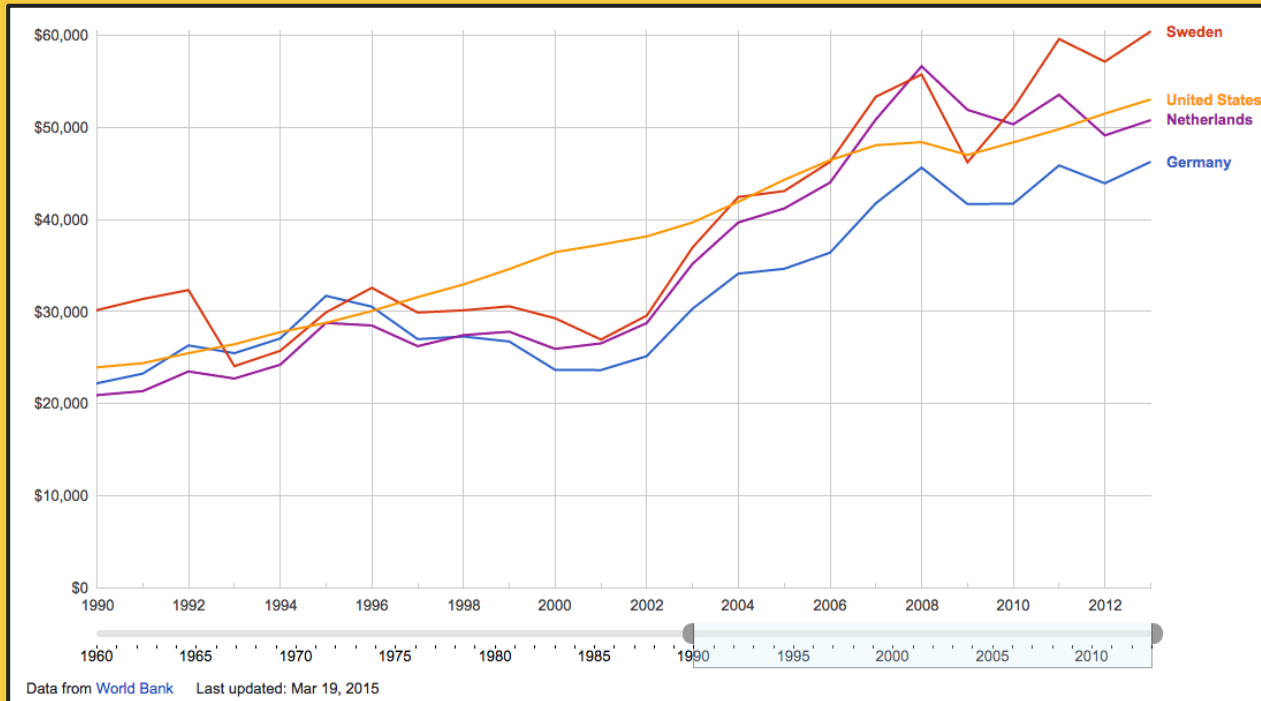
- Fourth largest economy in the world by GDP (natural gross production) in 2012 following the U.S., China, and Japan
- Exports (lead partners: France, U.S., UK)
 - Machinery
 - Vehicles
 - Chemicals
- Imports (lead partners: Netherlands, France, China)
 - Oil and gas
 - Metals
 - Electric equipment
- Among the world's leaders in producing iron, steel, cement, electronics, etc.



Adjusted Net National Income (US \$)



GDP per Capita



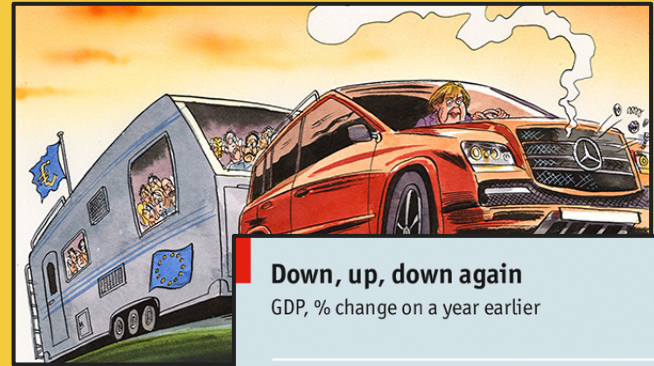
European Economy

[European Economy Guide \(Interactive Map\)](#)



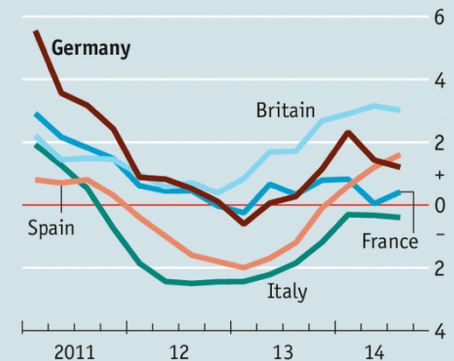
Possible Economic Collapse

- Minimum wage of \$11/hour introduced in 2015
- 5.3% unemployment rate (2013)
 - 52nd overall (U.S. is 79th with 7%)
- Possible economic struggles in the future
 - “Germany’s economy isn’t as strong as Europe believes” - MarketWatch
 - “German model is ruinous for Germany, and deadly for Europe” - The Telegraph
 - “Germany’s economy: The sputtering engine” - The Economist
- Tax policies and social structures have encouraged collapse of the fertility rate
- German workforce will shrink by 200,000/year
- A fifth of German children are raised in poverty



Down, up, down again

GDP, % change on a year earlier



Sources: Eurostat; Haver Analytics

2010 Energy Concept

- Topics
 - Renewable energies as a cornerstone of future energy supply
 - Energy efficiency as the key factor
 - An efficient grid infrastructure for electricity and integration of renewables
 - Energy upgrades for buildings and energy-efficient new buildings
 - Energy research towards innovation and new technologies

Passed by the Federal Ministry of Economics and Technology

2010 Energy Concept

“The Concept is about designing and implementing a long-term overall strategy for the period up to the year 2050. Our aim is to provide long-term orientation while at the same time preserving the flexibility required for new technical and economic developments. Renewable energy sources are to account for the biggest share in this future energy mix.”

This energy mix will be dynamic, as conventional energy sources are steadily replaced by renewables. Nuclear energy is a bridging technology on this road. We are aiming for a market-oriented energy policy that is free of ideology and open to all technologies, embracing all paths of use for power, heat and transport.”

2010 Energy Concept

Figure 2: Restructuring the energy system – overall approach

General principle

Energy policy is the foundation for growth and prosperity: The restructuring of the energy system will not just happen by itself – it needs the backing of consumers and businesses. At the same time, Germany is to remain a competitive location for industry. To deliver on this goal, we must place the restructuring on a solid economic footing.

Objectives

What do we want to achieve? We want a secure and affordable supply of energy in Germany. We have mapped out the development path through to 2050 in the Energy Concept. Greenhouse gas emissions must be reduced, the share of renewables increased and energy efficiency improved.

Action areas and measures

How will we manage to restructure the energy system? The Federal Government took the first important step toward the restructuring in summer 2011 with the introduction of the Energy Package (six laws and one ordinance). The Energy Concept contains over 120 individual measures that must now be implemented gradually.

Finance

How will we finance/support this project? Essential investments and associated new business fields are closely linked to costs charged to consumers and tax payers. Financed through systems such as the renewables surcharge and grid utilisation fees. Supported also by the Energy and Climate Fund (Energy Efficiency Fund, Building Modernisation Programme etc.)

Implementation/ Monitoring

How do we track implementation? Annual implementation monitoring (grids, power stations, renewable energy and energy efficiency). An independent commission of experts will oversee this process. We will also engage in dialog with key stakeholders (Grid Platform, Power Plant Forum)

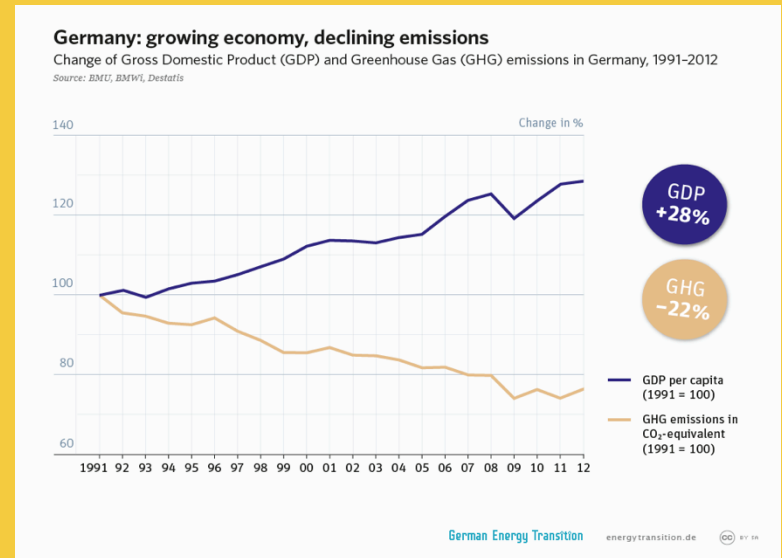
2010 Energy Concept



Energy Policies

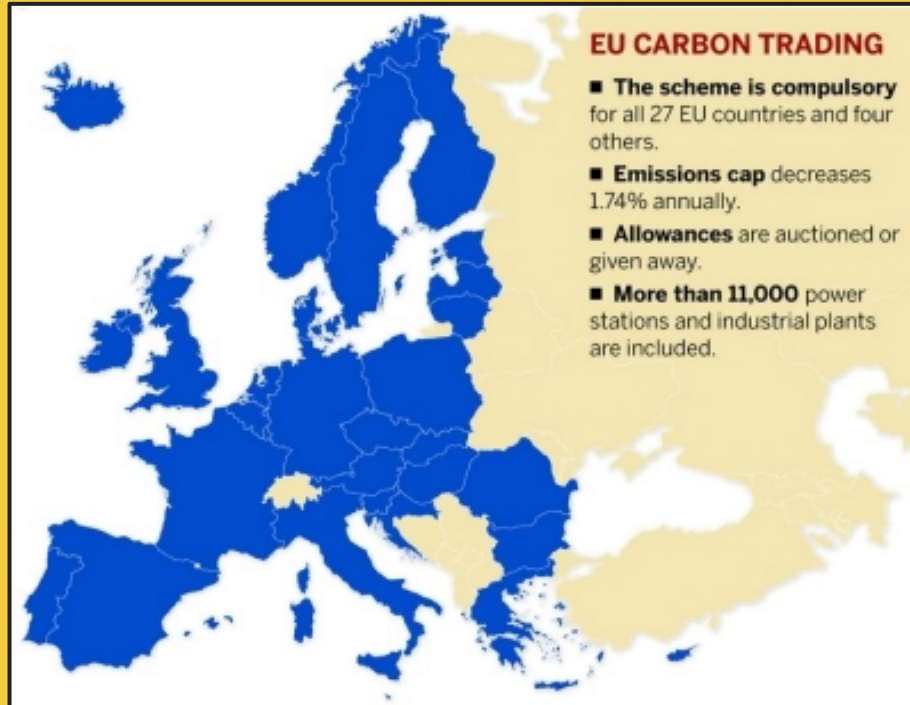
Energy Transition

- Fight climate change
- Reduce energy imports
 - 70 % of German energy is imported
- Stimulate technology innovation and the green economy
- Reduce and eliminate the risks of nuclear power
- Energy security
- Strengthen local economies
- Advococation of electric vehicles



<http://energytransition.de/>

Carbon Tax Stance



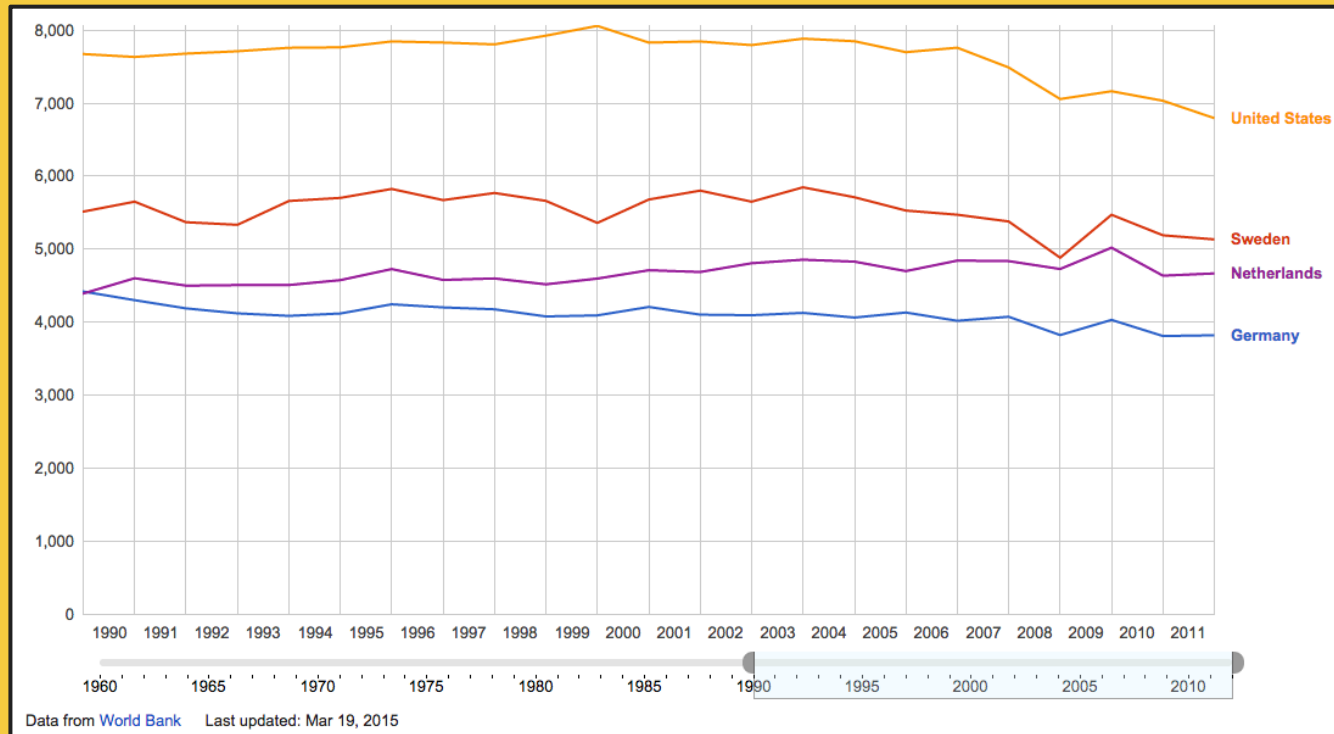
EU Emissions Trading System

- Works as a 'cap and trade' system. There is a cap set which the total emissions from all of the factories, power plants, and installations in the system must stay under.
- There is a limited amount of 'allowances' available
- These allowances are bought and traded between companies to determine the amount of emissions their factory/plant can expend

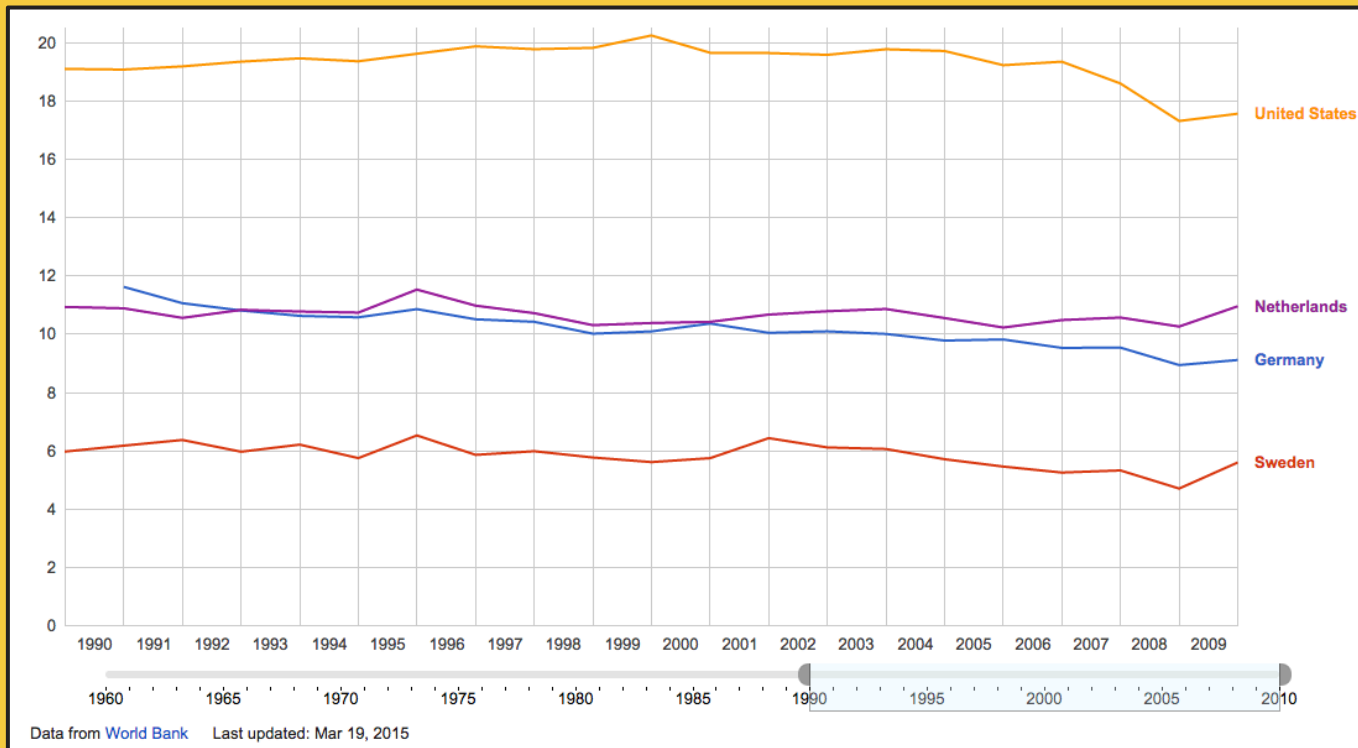
EU ETS Phase 3 (2013-2020)

- One consistent EU-wide cap on emissions instead of individual country caps
- Allowances will now be auctioned off. Previous they were allocated to the companies
- More sectors and gases included in system
- 300 million allowances set aside to help fund renewable energy research and carbon capture technologies.

Energy Use Per Capita



CO2 Emissions Per Capita



The 20-20-20 Targets

- A 20% reduction in EU greenhouse gas emissions from 1990 levels
- Raising the share of EU energy consumption produced from renewable resources to 20%
- A 20% improvement in the EU's energy efficiency

All to be completed by the year 2020

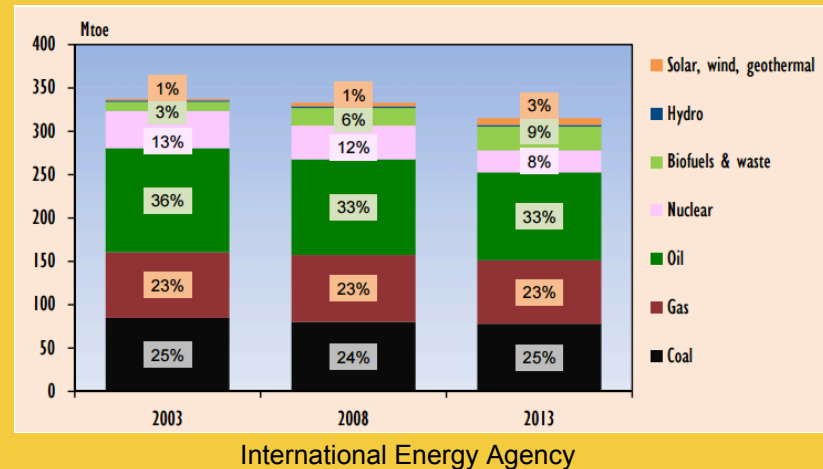
4 Measures for the 2020 Program

- Reform of the EU Emissions Trading System
- National targets for non-EU ETS emissions
 - Housing, agriculture, waste, transport
- National renewable energy targets
 - depend on nation's starting points
 - For example in Malta 10% but Sweden 49%
- Carbon capture and storage

Energy Profile

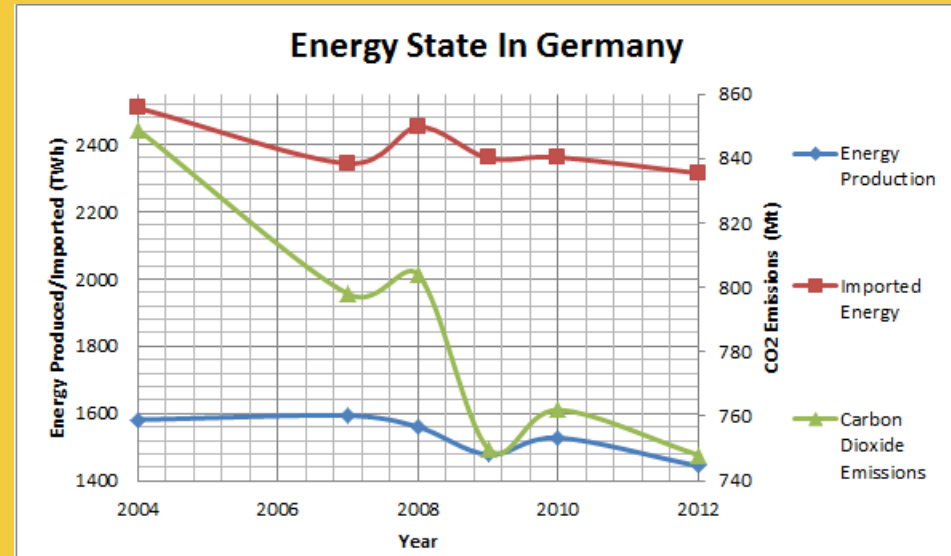
- Largest energy consumer in Europe (2012)
- Petroleum is the main source of energy at 37%
- No liquefied natural gas terminals - strictly imported
- Fifth largest nuclear generator in 2012
- Coal is Germany's most abundant energy resource
- Largest producer of non-hydro renewables

Energy State In Germany



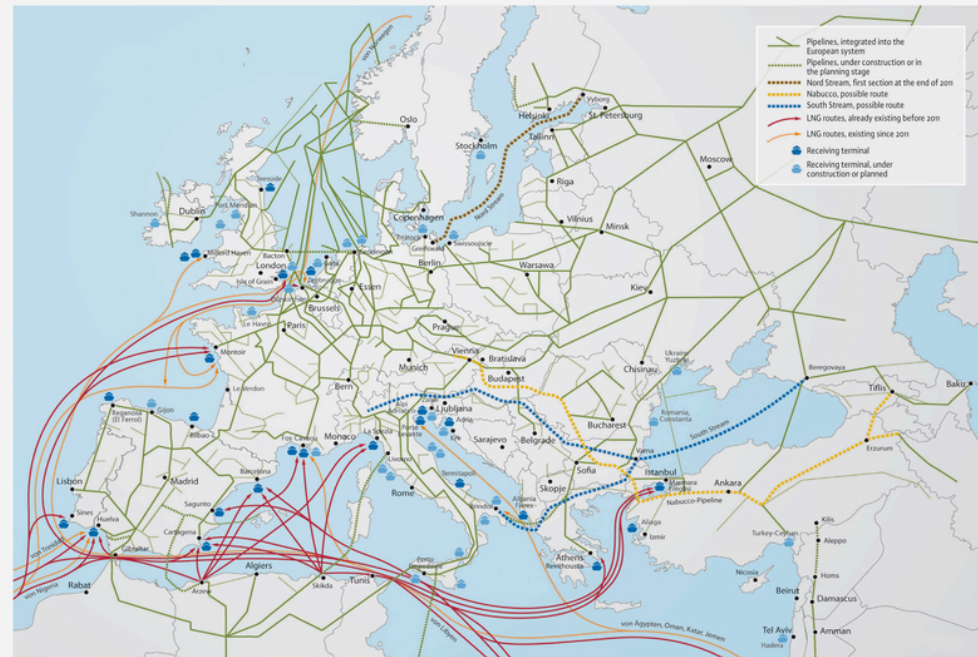
Energy Profile

- Total Production (2012) - 1,444 TWh
- Imports (2012) - 2,315 TWh
- Carbon Dioxide Emissions (2012) - 748 Mt



Natural Gas & Oil

Natural gas pipelines and LNG terminals in Europe



Sources: BDEW, Eurogas

Natural Gas & Oil

- Over 70% of Germany's total energy supply depends is imported from other countries
 - Russia by itself accounts for a over a quarter of Germany's gas (38%) and oil (35%)
- Despite the lack of petroleum production, they continue to be the main source of energy for Germany (37% of the country's total energy consumption)
- Germany can only supply 15 percent of it's own gas needs. However, they do have reserves that if utilized could change this situation.
- The Federal Institute for Geosciences and Natural Resources (BGR) found 6.8 trillion - 22.6 trillion cbm of shale gas in Germany. Out of these reserves, it is estimated (with 10% extraction rate) that between 0.7 and 2.3 cbm of gas could be produced.

Fracking in Germany

- Despite their great reserves, Germany has taken a strong stance against fracking.
- This past year, legislation was passed to ban fracking above 10,000 ft.
- This leaves open the possibility for tight gas extraction, but the estimates for these reserves are much lower (0.1 trillion cubic feet)



Natural Gas & Oil

German natural gas output by countries of origin in 2011¹⁾

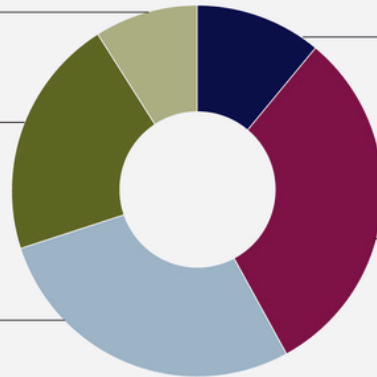
Denmark, Great Britain and others 9 %

Netherlands 21 %

Norway 28 %

Germany²⁾ 11 %

Russia 31 %







Source: BDEW

¹⁾ Preliminary figures







²⁾ Including feed-in of bio natural gas

Natural Gas & Oil

Natural Gas (Billion Cubic Feet)		Previous Year				Latest Year
	History	Germany	Europe	World	Rank	Germany
Production	 (1991-2013)	462.20	10,319	118,910	36	416.15
Consumption	 (1991-2013)	3,001.21	18,698	119,568	9	3,123.44
Net Export/Imports(-)	 (1991-2013)	-2,400.25	-8,199	--	4	-2,687.01
Proved Reserves (Trillion Cubic Feet)	 (1980-2015)	4.10	136	6,973	49	3.43

Source: EIA

Natural Gas & Oil

▼ Petroleum (Thousand Barrels per Day)		Previous Year					Latest Year
	History	Germany	Europe	OECD	World	Rank	Germany
Total Oil Production	 (1991-2013)	164.51	3,974	22,538	90,457	41	165.33
Crude Oil Production	 (1991-2013)	51.00	3,111	15,667	76,160	55	51.56
Consumption	 (1991-2013)	2,389.13	14,447	45,868	89,721	9	2,403.16
Estimated Petroleum Net Exports	 (1991-2013)	-2,224.62	-10,472	-23,330	--	212	-2,237.82
Refinery Capacity	 (1991-2012)	2,418	16,787	45,873	88,097	7	2,417
Proved Reserves (Billion Barrels)	 (1980-2015)	0.23	12	233	1,656	51	0.23

Source: EIA

Coal

- Decline in production and consumption since 1991
- Supplied 47% of Germany's electricity (2013)
- Domestic supply of coal includes:
 - Anthracite
 - Coking Coal
 - Bituminous Coal
 - Lignite - Approximately 25% of electricity generation is from lignite

Coal

- Fukushima disaster played a major role in coal use in Germany
- New coal plants to be built using funds from nuclear energy
- Mining industry dominated by RAG Aktiengesellschaft with hard coal and RWE Power with lignite
- Reserves (via EuroCoal):
 - 2.5 billion tons of recoverable hard coal
 - 40.4 billion tons of recoverable lignite

Nuclear

The Fukushima Disaster completely changed Germany's Nuclear Industry

Before Fukushima:

- Germany was the fifth-largest generator of nuclear energy in the world before
- Between their 17 reactors (9th most for a country), they obtained one quarter of their electricity
- Due to their energy policies, Germany had some of the lowest wholesale electricity prices and some of the highest retail prices



Fukushima Disaster (2011)

- Great East Earthquake occurred at 2:46PM on March 11th
- Magnitude 9.0
- Earthquake and tsunami triggered the nuclear accident.
- Worst nuclear accident since Chernobyl



Germany's Nuclear Stance

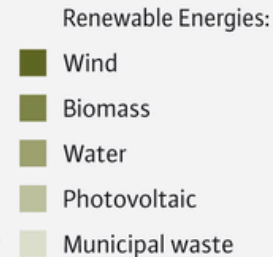
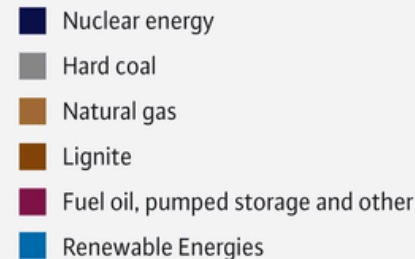
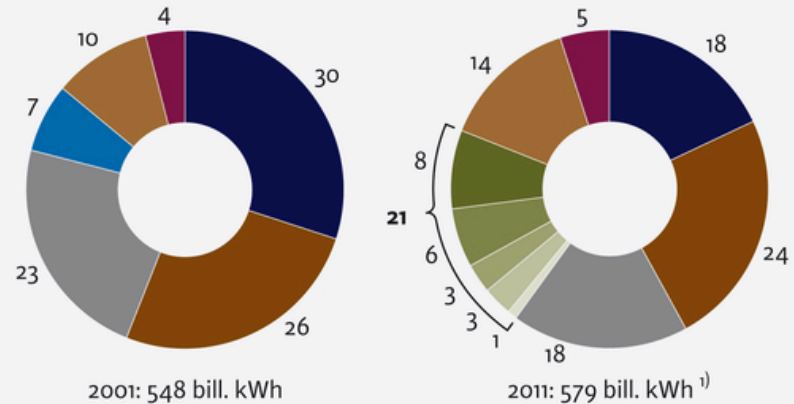


Out with Nuclear

Following Fukushima Disaster...

- Eight of the country's 17 nuclear reactors shut down immediately
- The remaining plants would be closed by 2022
 - to be replaced by renewables
- Before shutdown, Germany relied on nuclear for over 20% of electricity generating capacity and nearly 50% of its base-load electricity production

Shares of energy sources in net electricity generation in Germany (percent)



Source: BDEW

¹⁾ Preliminary figure

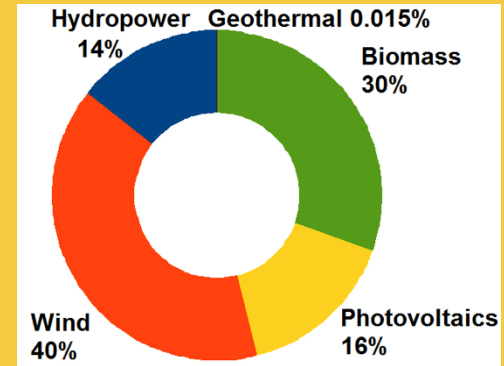
Fukushima Fallout



Renewables

- Energy Transition emphasizes renewables
- Steps in renewable electricity supply
 - 2020 - 35%
 - 2025 - 40-45%
 - 2035 - 55-60%
 - 2050 - 80%

Renewable Electric Power in 2011



	Municipal waste*	Industrial waste	Primary solid biofuels**	Biogases	Liquid biofuels	Geothermal	Solar thermal	Hydro	Solar PV	Tide, wave, ocean	Wind
<i>Unit</i>	<i>GWh</i>	<i>GWh</i>	<i>GWh</i>	<i>GWh</i>	<i>GWh</i>	<i>GWh</i>	<i>GWh</i>	<i>GWh</i>	<i>GWh</i>	<i>GWh</i>	<i>GWh</i>
Gross elec. generation	9900	1604	12091	27238	349	25	0	27849	26380	0	50670

Source: International Energy Agency

Renewables

- Largest domestic supply in the form of municipal waste & biogases
- Solar Power - 400 MW of solar power capacity per million people
- Breakdown of how different renewables are used:
 - Municipal waste - Industrial
 - Primary solid biofuels - Industrial/Residential/Commercial
 - Biogases - mostly commercial
 - Solar thermal - mostly residential

Energy in the Future

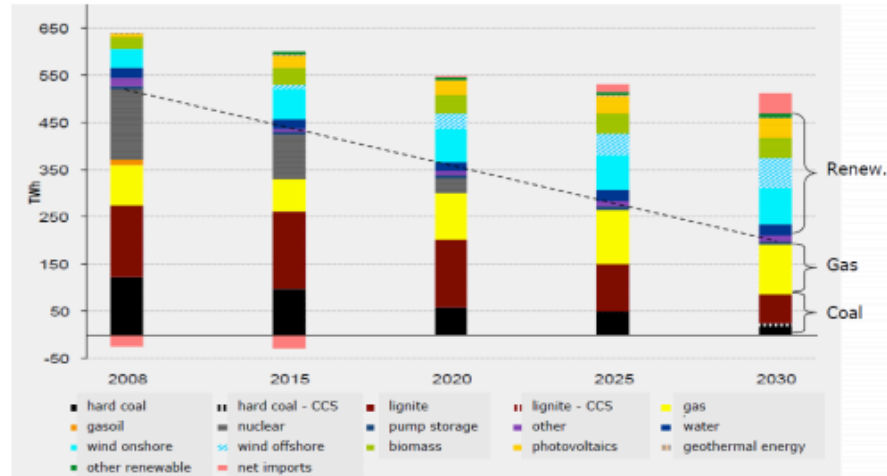
Table 1: The Energy Concept – pathways and goals

	today	2020	2030	2040	2050
<i>Reduction in greenhouse gas emissions (base year: 1990)</i>	- 27 %	- 40 %	- 55 %	- 70 %	- 80 %
<i>Share of renewable energies in total final energy consumption</i>	10 %	18 %	30 %	45 %	60 %
<i>Share of renewable energies in electricity consumption</i>	16 %	35 %	50 %	65 %	80 %
<i>Reduction of primary energy consumption (base year: 2008)</i>	- 5 %	- 20 %			- 50 %
<i>Reduction of electricity consumption (base year: 2008)</i>	- 1 %	- 10 %			- 25 %
<i>Reduction of final energy consumption in the transport sector (base year: 2008)</i>		- 10 %			- 40 %

Source: Ministry of Economics and Technology.

Energy in the Future

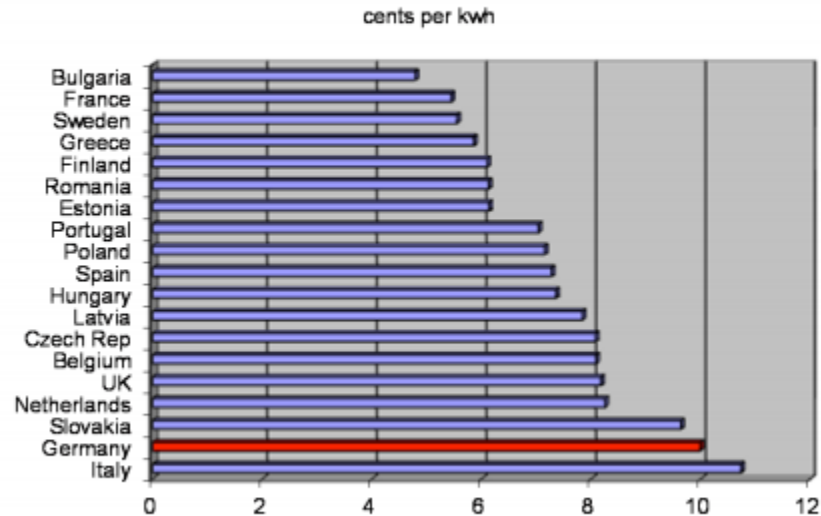
Figure 1: Germany's changing electricity mix after the nuclear phase-out decision



Source: Prognos; Energy Research Institute, University of Köln (EWI); Ministry of Economics and Technology.

Energy in the Future

Figure 8: Average electricity prices (with taxes except for VAT) for industrial consumers using 70,000–150,000 MWh a year, July–December 2011



Source: compiled by author based on Eurostat data.

Energy in the Future

Table 3: More coal than gas in the short term – capacity changes in independently operated power plants, 2012–14

MW capacity	2012		2013		2014	
	Add capacity	Take out of commission	Add capacity	Take out of commission	Add capacity	Take out of commission
Brown coal	2,740	-1,960	0	-60	0	0
Hard coal	0	-1,110	4,616*	-520	2,365	0
Gas	509	-160	875	-1,037	0	-383

Source: Adapted from *Bundesnetzagentur supply report 2012*. * Excludes Eon's 1,055 MW plant at Datteln whose construction is held up by litigation.

Energy in the Future

Table 1: Funding for Research and Development under the Federal Government's 6th Energy Research Programme
(in thousands of €)

	Actual	Planned	Projected data ^{1,2}		
	2010	2011	2012	2013	2014
Efficient energy conversion and use, energy efficiency					
Federal budget	210,256	218,135	209,433	211,137	208,599
Energy and Climate Fund	—	28,000	33,500	121,850	137,500
Total	210,256	246,135	242,933	332,987	346,099
Renewable energy					
Federal budget	205,142	225,668	255,873	271,493	266,373
Energy and Climate Fund	—	40,000	29,000	130,000	165,000
Total	205,142	265,668	284,873	401,493	431,373
Nuclear safety, final disposal					
Federal budget	71,543	73,021	73,916	74,930	75,558
Fusion					
Federal budget	131,031	148,148	152,655	154,611	153,599
Overall					
Federal budget	617,971	664,971	691,877	712,171	704,128
Energy and Climate Fund	—	68,000	62,500	251,850	302,500
Total	617,971	732,971	754,377	964,021	1,006,628

1 Figures relating to the federal budget are subject to parliamentary approval.

2 Funding for the Energy and Climate Fund is subject to change.

Source: Federal Ministry of Economics and Technology

Energy in the Future

- Following recent legislation, Germany will continue to move towards renewables, and will further their distance from nuclear energy and fracking
- In the meantime, they will have to adopt coal production and increase their imports to make up for their massive energy deficit.
- Germany's dependence on other countries for their energy leaves them in a very vulnerable situation
- While Germany is becoming a leader in adopting renewable energies as a main energy producer, their economy may soon be in jeopardy of a fallout. Social, political, and innovative pressures may leave Germany with a much smaller workforce and a depleted economy.

Questions?

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