Coal

Fuel for the 21st century

European Association
for Coal and Lignite AISBL

EURACOAL

Fuelling competitiveness, growth and jobs in the 21st century

Agios Dimitrios lignite power plant in Northern Greece

Exploiting natural resources creates jobs and adds to economic wealth. It always has and always will. In the EU, the most abundant energy resource is coal. In these times of austerity and high unemployment, the EU can look forward to a future fuelled by coal, not dirty old coal of the past, but with modern clean coal technologies fit for the 21st century and in use today in Europe.

Abundant, affordable and available: in the EU, 88% of our energy reserves lie in coal beds.

Competitive energy: without inter-fuel competition from coal, we would be faced with much higher energy prices for industrial and residential electricity.

Base-load power generation: given the intermittency of renewables, coal and other conventional fuels will be needed for many years to come.

Quality jobs and wealth creation: coal is a large and mature industry that employs over one quarter of a million people in well-paid jobs, and many more at the suppliers of equipment and materials.

Secure energy: in 2013, the EU spent €500 billion on energy imports – 4% of GDP compared with just 1.5% in 2002 – a burden that coal can reduce.

Clean energy: the latest coal plants cut CO_2 emissions by 30% or more; sulphur dioxide emissions have fallen 80% since 1990 and other pollutant emissions have been massively cut since the 1980s.

Flexible energy: coal- and gas-fired power plants are equally capable of balancing the intermittent output from wind turbines and solar PV panels.

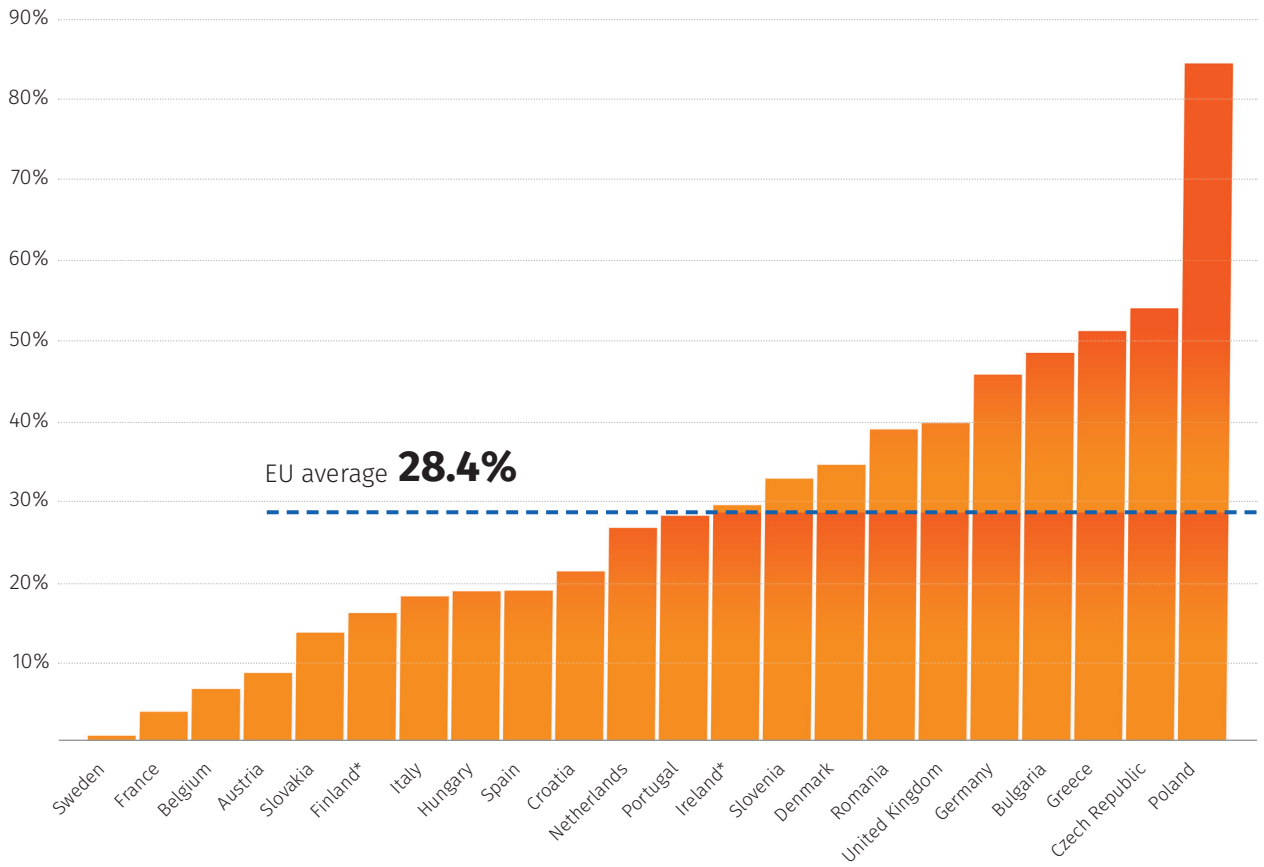
Sustainable energy: by embracing new technologies, coal and other energy sources have a bright future – all will be needed to meet the forecast growth in demand.

A 3-step strategy: EURACOAL calls for state-of-the-art technologies to be deployed today, research carried out in readiness for tomorrow so that CCS can be deployed the day after tomorrow.

Coal: abundant, affordable and available

Few in Europe think about where their electricity comes from and are often surprised to know that 28% comes from coal – much more in many EU member states. For electricity, coal is No. 1.
Coal is also used to make steel, cement and fertilisers – the raw ingredients for a comfortable urban life. Manufacturing processes rely on heat from coal, including sugar refining and paper making. In many countries, notably in Scandinavia, coal fuels CHP (combined heat and power) plants and district heating and cooling plants. Affordable energy from coal is supplied to whole towns and cities across Central and Eastern Europe.

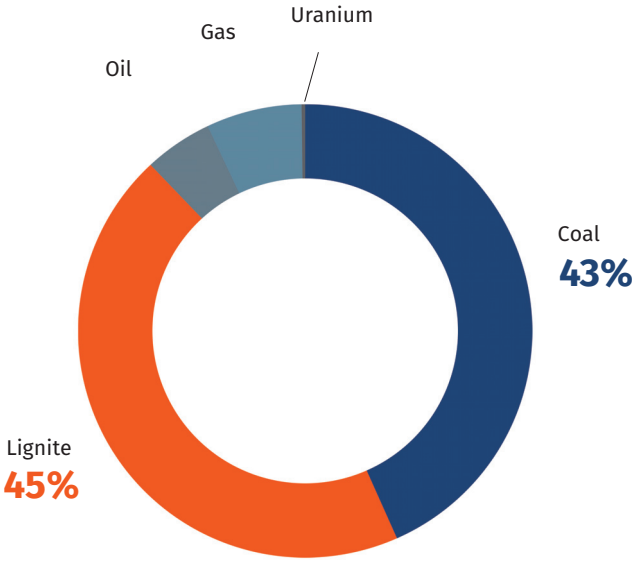
Almost 90% of the world's energy resources are in the form of coal and lignite or brown coal: since the turn of the century, coal has been the fastest-growing source of energy. In the EU, 88% of our energy reserves lie in coal beds that can be economically mined using modern underground techniques or by surface mining. Imaginative post-mining restoration projects have provided communities with a variety of leisure and employment opportunities in new landscapes.



Share of coal in electricity production for EU member states, 2012

* includes peat

Source: Eurostat database nrg_105a last update 29.04.2014



88% of the EU's energy reserves are in the form of coal and lignite (2012 data)

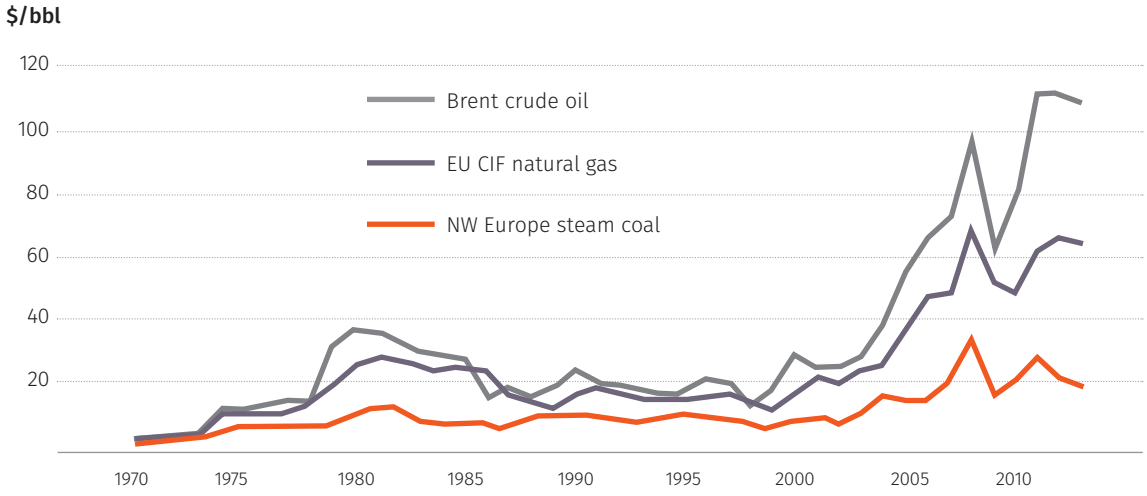
Source: *Energy Study 2013 – Reserves, Resources and Availability of Energy Resources*, The Federal Institute for Geosciences and Natural Resources (BGR), December, 2013

Ski resort built on a spoil tip at Bełchatów brown coal mine in Poland

Source: Starostwo Powiatowe w Bełchatowie

Coal: competitive energy

Coal is abundant, affordable and available – that's why it is the fuel of choice for electricity generation in many developed and developing countries. In Europe, coal ensures a truly competitive energy market. The major suppliers of natural gas – Russia, Norway and North Africa – still maintain price linkages between oil and gas. For this reason, gas prices are very high today and coal is more competitive than at any time over the past twenty years. Without inter-fuel competition from coal, we would be faced with much higher energy prices for industrial and residential electricity consumers across Europe.



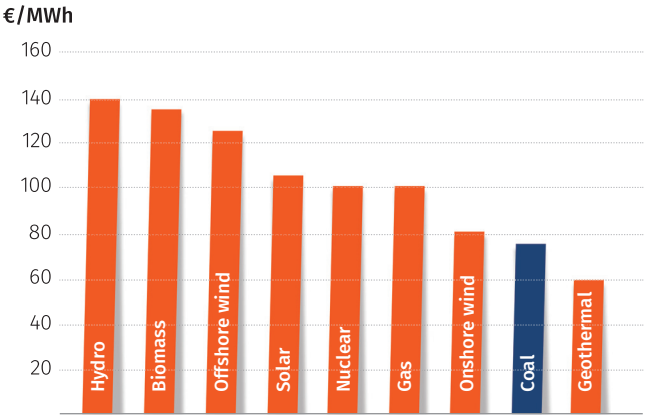
Oil, gas and coal prices since 1970 – compared on an energy basis

Sources: BP, World Bank and McCloskey Coal Information Service

Coal: base load power generation

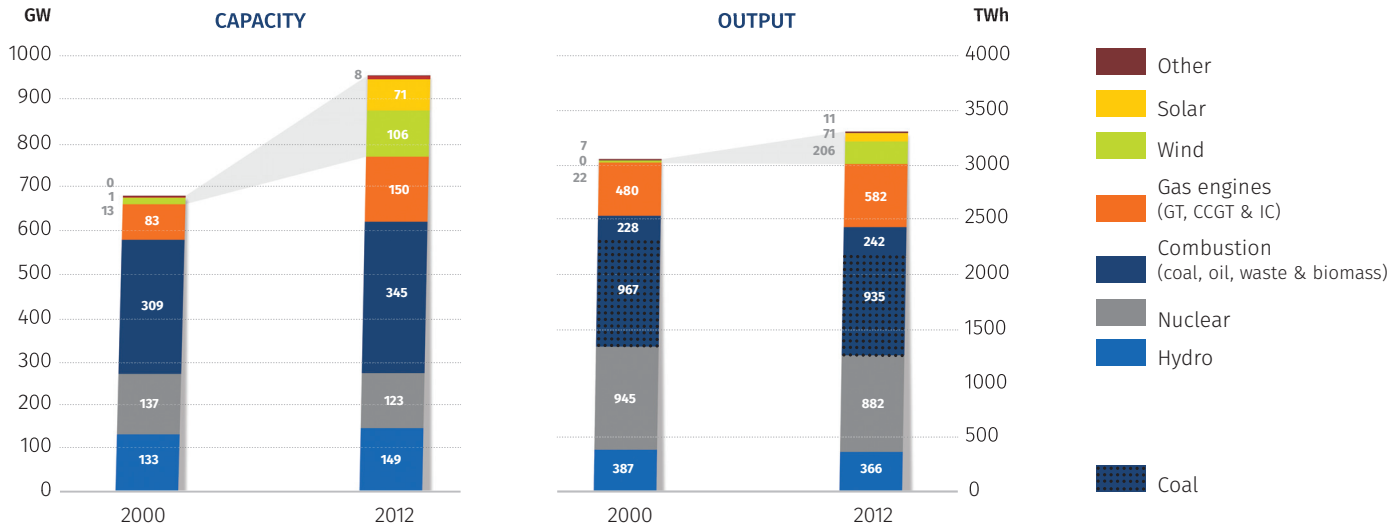
Between 2000 and 2012, EU electricity generation increased by 9%: output from nuclear and coal plants shrank, but grew from gas plants and renewable energy sources. Overall, fossil fuels still underpin about 50% of generation, with coal in particular being very competitive at base load.

Horse racing at Most hippodrome
The site of a restored coal mine
Source: Severní energetická a.s.



Levelised cost of electricity generation in the EU, 2012
Coal is one of the most competitive sources of power today
Source: Subsidies and costs of EU energy, Ecofys for EC, Oct 2014

In contrast to the modest increase in *output* – averaging 0.7% each year – generation *capacity* increased by 41% over the 2000-12 period. Well over 200 gas-fired power plants were built, totalling over 100 GW and renewables capacity grew by 190 GW, albeit at a high cost to consumers. In Germany, the green levy on consumers has risen from 0.2 €ct/kWh in 2000 to 6.24 €ct/kWh in 2014 to meet the €20 billion annual cost of subsidising renewables in that country. Given such high costs and the intermittency of wind and solar power, it seems that coal, gas and nuclear will be needed for many years to come. Instead of building a new renewable power system to replace our existing system, Europe is in fact building a second system that relies on conventional plants on still nights and at many other times. Whereas nuclear plants produce around 80% of their maximum possible output and fossil plants can run with similar reliability, wind turbines produce barely more than 20% and solar PV panels generate not much more than 10% of their rated full-load output.[1]

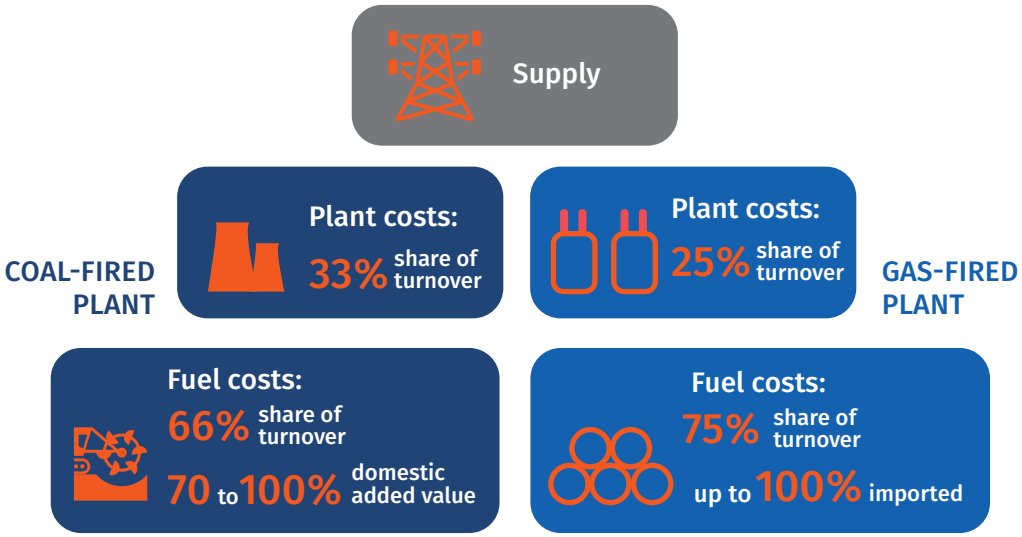


EU power plant capacity and output growth from 2000 to 2012 – building a second system
Despite the phenomenal growth in wind and solar PV capacity, the power supplied from these renewable sources remains rather small and not well-aligned with periods of high electricity demand

[1] All percentages are compared with full-load operation. For example, the average wind turbine in Europe produces an output equivalent to the same turbine running at full output for 1,936 hours. Given that there are 8,760 hours in a year, this is a 22% load factor. In practice, wind is highly variable, so the turbine rarely runs at full output and has periods when it is stationary, but the load factor gives a precise indication of how much power the machine produces each year.

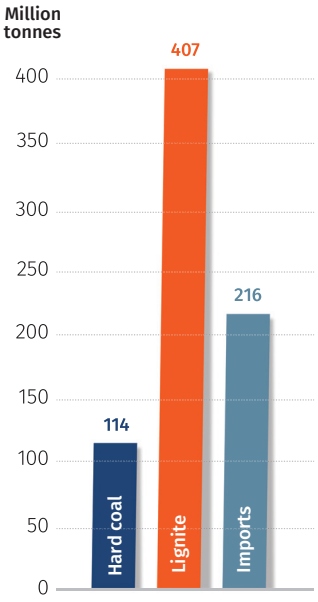
Coal: quality jobs and wealth creation

In the EU, coal mining is a large and mature industry that employs over one quarter of a million people in well-paid jobs, and many more at the suppliers of equipment and materials. Mining is often the No. 1 employer in regions which would otherwise be depressed and suffering from high unemployment. With youth unemployment across the EU now at 24%, new jobs are vital and the energy sector can provide them. A large coal-fired power plant turns over €7 billion during its typical 20-year life. Nearly all of this cash flow stays in the EU, providing quality jobs in a supply chain that stretches from mine to power plant.



Energy flow is cash flow

A 1 000 MW power plant operating at base load for 7 000 hours each year for 20 years has a €7 billion turnover (€50/MWh)



EU28 coal production, lignite production and imports in 2013

Source: EURACOAL

The face of a modern industry

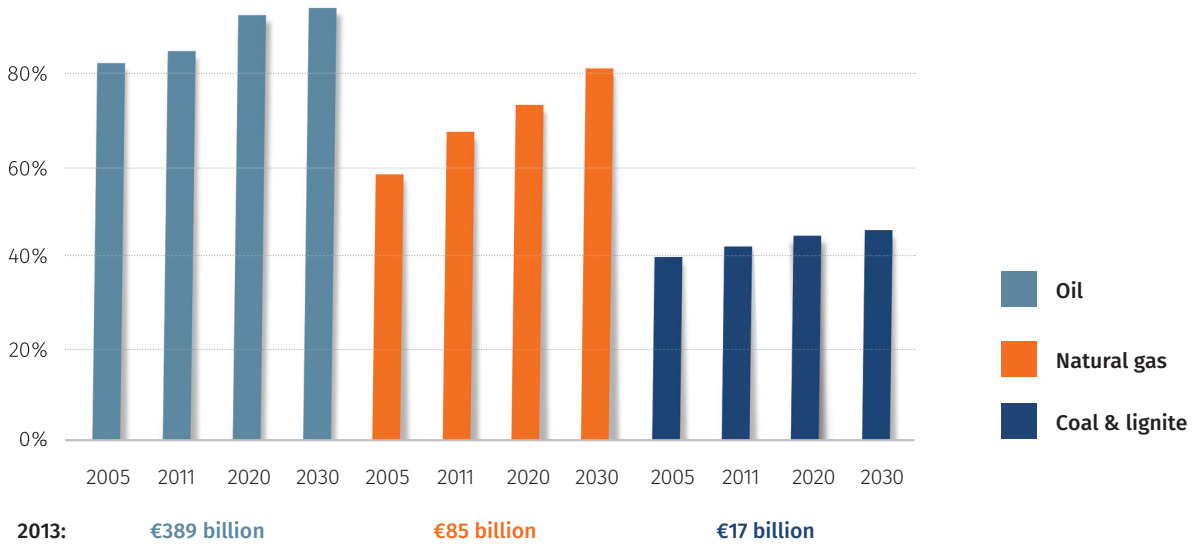
"Coal is black gold – we're lucky to have so much and we'd be fools not to win it from the ground beneath our own feet."

Matjaž Kamenik at Velenje lignite mine in Slovenia

Source: © Srdjan Zivulovic / Reuters / Corbis

Coal: secure energy

A secure energy supply is fundamental to our modern society. Without electricity, for example, nothing functions and a breakdown in law and order can quickly follow. Thankfully, it is many years since Europe suffered from serious disruptions to its energy supply following the Arab oil embargo of 1973. Once complete, the internal energy market should help to ensure future energy security. Even then, our dependence on imported fuels will grow. In 2013, the EU spent €499 billion on energy imports, including electricity – 3.8% of GDP compared with just 1.5% in 2002. This bill will rise since imports are forecast to rise. Exploitation of domestic energy can reduce this outflow of wealth and create well-paid jobs. Local coal and lignite production, plus imported coal from a number of countries on different continents, mean that coal makes a significant contribution to energy security and diversity. However, the EU must be careful not to throw away this benefit with policies that disadvantage coal.



EU fossil fuel import dependence

In 2013, the EU spent 3.8% of GDP to import €491 billion of oil, gas & coal

Sources: chart – European Commission (2013), "Energy challenges and policy", Commission contribution to the European Council of 22 May 2013, data – EURACOAL

Coal: clean energy

2013 was the "year of air" in the EU and the coal industry looked back with some pride that emissions from coal-fired power plants have been massively reduced since the 1980s. Sulphur dioxide emissions have fallen 80% since 1990 and there have been large falls in dust and NOx emissions such that road transport is now the most significant cause of poor air quality in urban areas. In the future, we can look forward to even cleaner electricity generation from coal as new technologies are introduced.

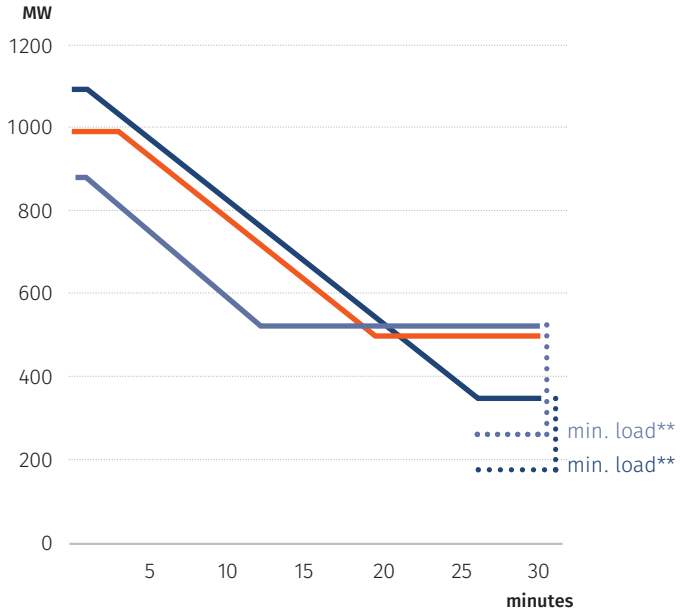
Refurbishment of the Prunerov coal-fired power plant in the Czech Republic will reduce emissions by 41% through increased efficiency – up from 32.8% to 40.0% – and a smaller, more flexible capacity.

Power plant modernisation and renewal

Source: ČEZ Group

Coal: flexible energy

Electricity systems are becoming more complex with many new small generation units, from 0.003 MW solar panel systems on the roofs of homes to 6 MW wind turbines in the North Sea on the supply side, and from electric vehicles to intelligent metering with load shedding on the demand side. Intermittent supplies and unpredictable loads mean that reliable and flexible power generation units must always be on hand. The mighty 1100 MW coal-fired units at Europe's newest power stations provide both, being every bit as flexible as gas-fired plants.



BoA 1 to 3

Max. load	~1000 MW
Min. load	~500 MW
Max. ramp rate	± 30 MW/min

Gas-fired CCGT at Lingen

Max. load	~2 x 400 MW
Min. load	~520*/260** MW
Max. ramp rate	± 32 MW/min

BoA*plus*

Max. load	~2 x 550 MW
Min. load	~350*/175** MW
Max. ramp rate	± 30 MW/min

* 2 boilers operating
** 1 boiler operating

Flexibility of conventional power plants

Coal-fired power plants are every bit as flexible as gas-fired power plants: the latest plants can ramp up or down at a rate of 30 MW every minute over a range of 500 MW or more

Source: RWE

Coal: sustainable energy

Cheap energy and technological progress have fuelled economic growth. The 19th century brought us ships and trains fuelled by coal. The 20th century was the era of electrification and of motor cars fuelled by oil. The 21st century will certainly see more and probably quicker changes, with many new technologies on the horizon. In the transport sector, natural gas might replace oil as a cleaner transport fuel. Electricity is likely to become an even more important way of delivering clean and convenient energy to consumers.
At the same time, the world faces the challenge of climate change.
In the USA, President Obama calls for *"an all-of-the-above strategy for the 21st century that develops every source of American-made energy"*. The EU similarly needs to embrace all available options to ensure the region's future development is sustainable, secure and competitive. Coal will be part of our future and we should plan to use it wisely.

Coal: a 3-step strategy for clean energy

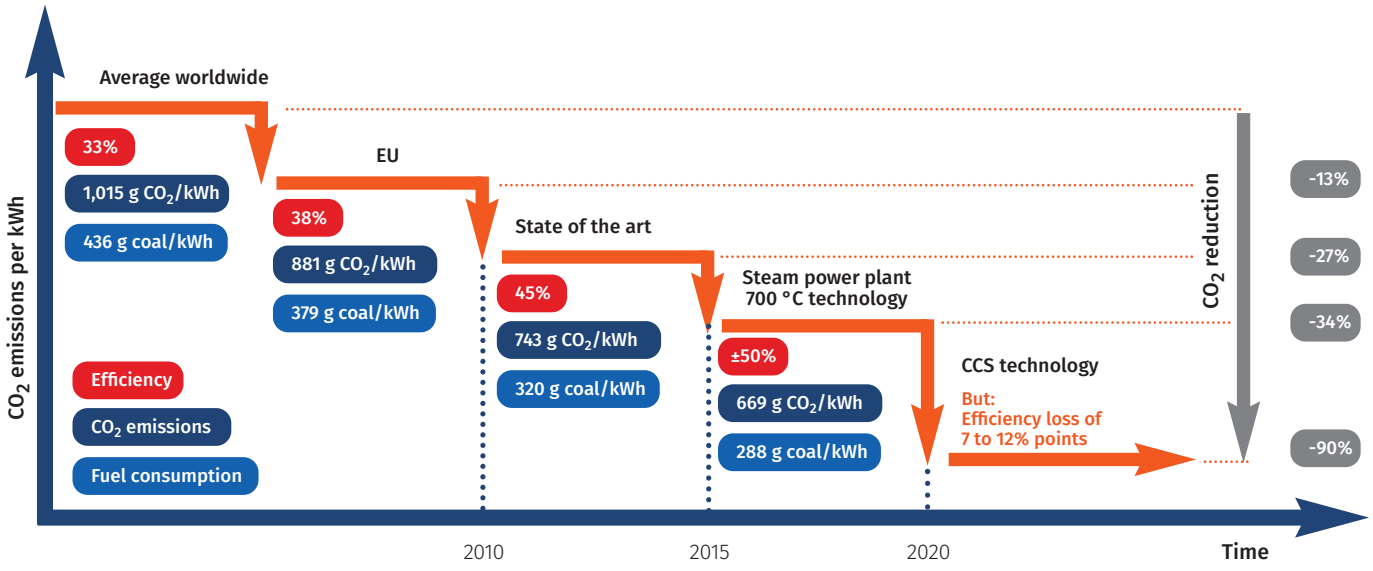
The replacement and modernisation of old coal-fired power stations is the first step to improve energy efficiency, reduce fuel consumption and reduce emissions, by one third or more in the case of CO_2.
In planning for tomorrow's world, we should invest in R&D for the next generation of high-efficiency, low-emissions coal-fired power stations that can complement renewable generation with their flexibility.
The final step is the demonstration and deployment of carbon capture and storage, a suite of technologies that will see coal become one of the most competitive low-carbon sources of electricity generation.
Coal can thus help meet the expected 41% increase in EU electricity demand between now and 2050.[2]

EURACOAL promotes a pragmatic 3-step strategy:

1
Introduce state-of-the-art technology across the EU coal-fired generation sector to boost efficiency and reduce emissions

2
Develop the next generation of high-efficiency flexible technologies for coal-fired electricity generation

3
Demonstrate and deploy CO_2 capture and storage at coal-fired power stations around the world



Emission reductions from efficiency and CCS

Source: *Electricity Generation 2013-2014 – facts and figures*, VGB Powertech, September 2013

[2]Impact Assessment Accompanying the Energy Roadmap 2050, Staff Working Paper SEC(2011) 1565/2, European Commission, Brussels.

Coal: fuel for the 21st century

EURACOAL's clean coal strategy offers the EU a no-regrets route to a cleaner future. Whilst the EU could contemplate replacing coal with more expensive natural gas, such a move would make the region uncompetitive and contribute little or nothing to solving the climate challenge: the EU's greenhouse gas emissions are just 10% of the global total.[3] Tackling only the direct emissions from power plants in the EU ignores the embodied emissions in the EU's growing volume of imports. On a consumption basis, EU CO_2 emissions rose by 47% between 1990 and 2006.[4] Likewise, when Europe imports fuel, no account is taken of the upstream emissions embodied in that supply or the knock-on effects, such as the growing use of coal in Russia – 15% per year – to free up gas for export to Europe. The Union's carbon footprint is *growing* and its citizens are *adding* to the climate challenge. For this reason, EU climate and energy policy should be revisited with the aim of making the EU a competitive place to manufacture goods more efficiently and more cleanly than elsewhere. Only with a return to strong economies across the whole of Europe can we look forward to a more prosperous and cleaner future which will undoubtedly continue to be fuelled by coal.

Coal-fired power generation in Germany

28% of EU electricity comes from coal-fired power plants such as Jänschwalde – the largest power plant in Germany
Source: © Klaus Engler, 2014

[3] UNEP (2012), *The Emissions Gap Report 2012*, United Nations Environment Programme (UNEP), Nairobi.
[4] Brinkley, A. and S. Less (2010), "Carbon Omissions – consumption based accounting for international carbon emissions", Research Note, Policy Exchange, London, October.

December 2014

For more information about coal and the EURACOAL clean coal strategy, please contact:

EURACOAL

Avenue de Tervueren 168 boîte 11
B-1150 Brussels
Belgium

tel. +32 2 771 31 70
e-mail euracoal@euracoal.org

www.euracoal.org

Front cover photo: © Jürgen Küppers, 2014