The Long-Term Perspectives for Coal in the EU Electricity Sector

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The energy and climate protection policy of the EU and its Member States bridges security of supply, environmental protection and competitiveness. It assumes that all sources of energy will be needed. Coal also is indispensable globally as well as in Europe.

The objectives of the EU energy and environment strategy cover the foreseeable times till 2020. The objectives for renewables and improved efficiency are ambitious; it must still be established if they are also realistic.

Summary of the Main Points

The initial energy policy situation in EU Member States varies widely. The burdens shared to reach the EU-wide objectives must not require excessive efforts of any Member; for CO_2 policy this also applies to countries that use large quantities of coal.

Indigenous hard coal and lignite make major contributions to the security of energy supply of the EU. Access to coal and lignite must be maintained; on the one hand, mines must not be closed hastily and without thorough examination; on the other hand, the legal system must continue to allow access to new deposits of raw materials in practice.

The demand for electricity in the EU will probably continue to increase. In addition to investments in the most modern technology by means of retro-fitting and new constructions with improved efficiency, the issue till 2020 is to establish the basis for future CO_2-free power generation on the basis of fossil fuels.

The Clean Coal Concept, combining state-of-the-art modernisation, research aiming at efficiencies above 50 % for new coal-fired power plants and CCS technology, makes it possible to use Clean Coal Technologies in all EU Member States according to their respective circumstances. The concept allows for a clear drop in specific CO_2 emissions at relatively low costs. It contributes to sustainable coal utilisation and can stimulate the transfer of EU technology to third countries.

EURACOAL supports the construction and operation of a series of CCS demonstration plants by 2015 and also the introduction of CCS technology on the market after 2020. It would be wise to develop a European CCS infrastructure as soon as possible. It is as urgent to speed up CO_2 storage as the capture and transport of carbon dioxide. Initiating the whole technology chain requires the support of the EU and of national governments and authorities.

Climate protection is a global issue. Europe only has limited influence and should be attentive to all measures that -like Emissions Trading- can threaten EU security of supply or competitiveness.

Emissions Trading leads to a very tight, if not inseparable, link between energy and environmental policies. As large quantities of coal are needed in some Member States, the political framework must allow its economic utilisation also as from 2013. The allocation system for emissions certificates must take into account the different capacities of various technologies and fuels. A fuel-specific benchmark for instance does this, simultaneously offering incentives to modernise installations.

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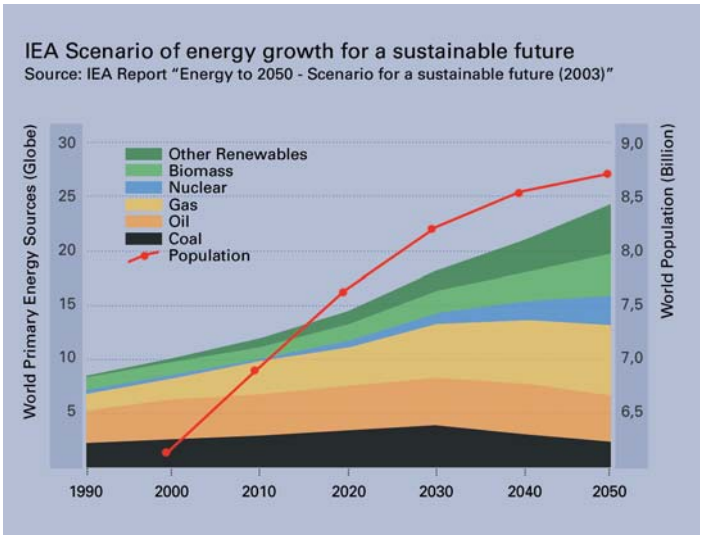
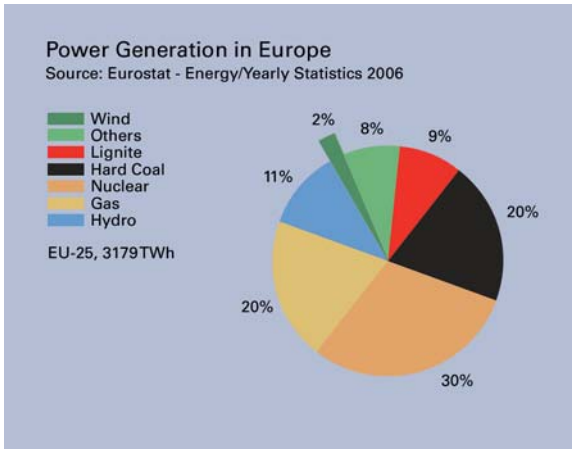
Preliminary Remark

The worldwide disparities between increasing population, prosperity, energy needs on the one hand and the uneven distribution of resources, supply risks and climate protection on the other hand also determine the energy strategy of the European Union and its Member States. The energy mix is a risk management strategy within the triangle of a secure, competitive and environmentally-friendly supply of energy.





Within the energy mix, oil stands for mobility, gas for heating, coal and nuclear for electricity. After the oil crises, the coal and nuclear based supply of electricity was developed in all the OECD countries in order to limit supply and price risks in this essential sector. At least 90 % of the EU electricity supply is based on coal (30 %), nuclear (30 %), gas (20 %), oil (4 %) and also on large hydro (11 %), the latter mainly in the Alps and the mountains of the Iberian Peninsula. Wind, biomass and solar energy make additional contributions.

According to the EU Council Conclusions of 8-9 March 2007, EU energy policy pursues three objectives:

1. Increasing security of supply.
2. Ensuring the competitiveness of Europe's economies and the availability of energy at affordable prices.
3. Promoting environmental sustainability and combating climate change.

The EU respects the decisions of the Member States concerning their energy mix and their sovereignty concerning primary energy sources.

An integrated climate and energy strategy should be developed.

A European Energy Strategy

The European Union is developing a global European climate and energy strategy on the basis of the Council conclusions of March 2007, aiming for an integrated concept, linking the objectives of available and competitive energy with demanding objectives for the reduction of CO_2 emissions.

The EU Energy Strategy up to 2020

The EU agreed on the objective to drastically reduce emissions of CO_2 by 2050. Climate protection and a sustainable supply of energy are however a long-term challenge, that depends a lot on how people live and

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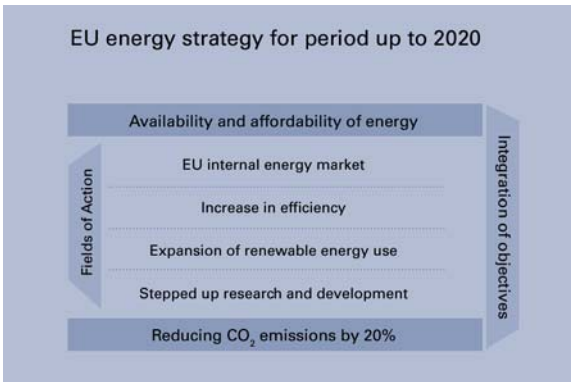

how the economy is run. It is therefore appropriate to consider energy strategy in terms of concrete objectives and scope for action within a manageable period. The year 2020 chosen by the EU can be understood as an intermediary objective in this sense.

The ongoing development of public opinion especially requires establishing if the planned objectives for 2020 are realistic and how they can be reached. The European Commission and the Member States now face the task of making the EU objectives in the context of burden sharing binding for the Member States. According to the Council decisions, specific features must be taken into account, such as the availability of resources, decisions concerning the structure of energy supply and the structures put in place on this basis, i.e. the capacity for production and adaptation. The further development of burden sharing is an important factor for CO2 abatement. When pursuing burden sharing, the year 1990 must be used as the base year, as stipulated in the Kyoto Protocol. The agreed sharing of burdens within the EU, prescribing binding targets for the individual Member States till 2012, will then have to be the basis for a burden sharing II agreement. These issues are of major importance for those Member States that use large quantities of coal.

The Role of Coal in the EU

Circumstances vary widely throughout the European Union. An average of 30 % coal share in the energy mix masks major discrepancies. The scope ranges from more than 90 % coal share in Poland to 1 % coal share in Sweden. The structures already in place can be explained by the coal deposits available. Important and regional economic structures have evolved from this. A comparison of different procedures to generate electricity shows that the generation of electricity on the basis of domestic deposits as a rule is not only economically attractive but also implies the creation of wealth locally. The extraction of coal and coal-fired power generation are often the starting point of a long chain of wealth creation and anchor these industries, metaphorically speaking, in the regions. In addition to its energy economy dimension, coal also is a major component of the regional economy.

Indigenous hard coal and lignite contribute significantly to stable prices and to security of energy supply of the EU. Maintaining access to these resources is therefore a vital task for policy-makers and for the coal industry. This means, first of all, that mines that still dispose of coal reserves worth mentioning should not be closed down hastily and on the basis of rather short-term considerations. Once deposits have been abandoned, they can often no longer be operated at all because of the long lead times necessary and because of the high investments required for re-starting operation, involving major extra costs. Relevant examples exist in England and also in Poland where deposits, abandoned because of mine closures, could today make competitive contributions to the supply of coal thanks to the infrastructure formerly available.

The protection of deposits remains a major energy policy objective because of the worldwide shortage of raw energy materials. The legal system at EU level and in the individual Member States must also be maintained and developed in such way as to enable, also in practice, access to coal resources in Europe, opencast or underground. In particular, the fact that coal mining is bound to a location must be taken into account. This must be appropriately reflected in all considerations concerning development plans and planning permission.

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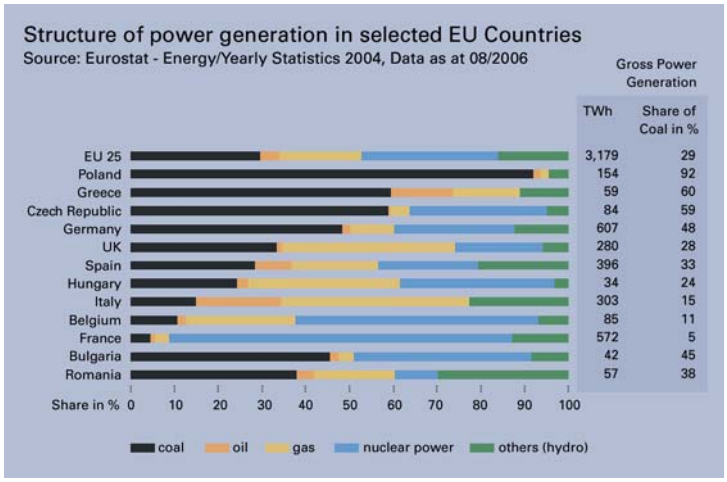


The Perspectives for Coal for the Production of Electricity

Experience has shown that an industrial society with an energy-saving economy is simultaneously electricity intensive. Electricity is the energy for modernisation. In very many cases energy savings are precisely linked to the use of electricity.

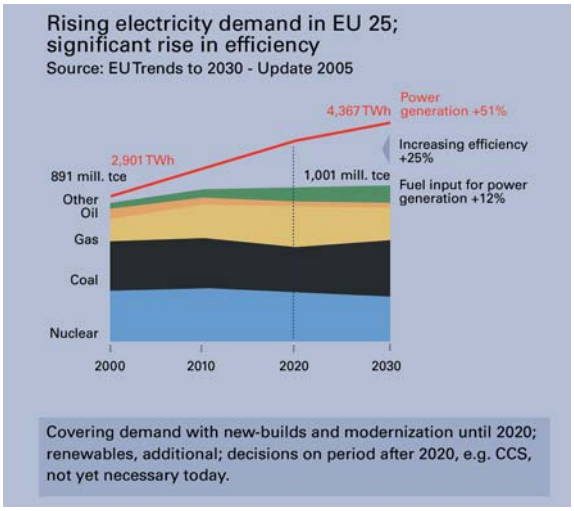
Reliable forecasts show that up to 2020 and beyond, electricity demand in the EU will increase significantly. This demand will be covered till 2020 essentially by the construction of new power plants and modernisation on the basis of existing technologies, with renewables making additional and increasing contributions.

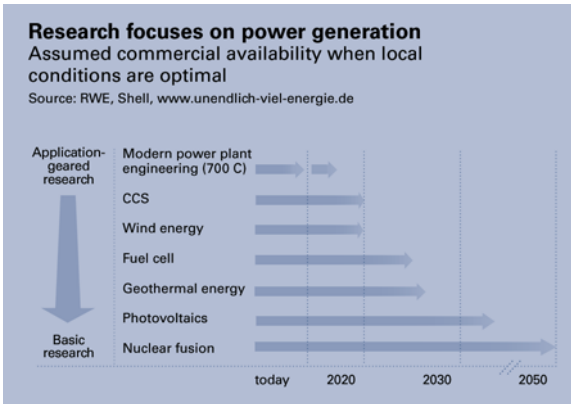
In addition to investments in the most modern technology, the challenge by 2020 is to establish the basis for zero CO_2 coal-fired and gas-fired production of electricity. Furthermore, an important task is to develop concepts on how to integrate the planned increased contribution of renewable energies reliably into the system. The fluctuating availability of electricity from renewables differs heavily from demand. What happens when the wind does not blow or the sun does not shine? The security of electricity supply can only be further secured by a sensible mix of various technologies. In this context, coal-fired and nuclear power plants play an important role today and tomorrow, providing baseload and guaranteeing the stability of the network. Gas is used essentially for medium and peak load and jumps in rapidly when supply fluctuates.

The Clean Coal Concept

The electricity and the coal industries must make sure that coal extraction and utilisation are not only useful in the long term but also continue to be accountable.

It remains undisputed that coal is cheap and securely available and that there are no risks involving transport, stocks or waste. Coal has





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developed into a multi-talent thanks to the production of electricity.

The impacts of coal extraction and utilisation on the environment have been significantly reduced during the last decades. On the timeline till 2020, the issues are further efficiency improvements and long term, the separation and storage of CO_2 arising from the production of electricity. Clean Coal stands for a gradual, step-by-step concept that can be used in all the EU countries but also, more importantly, according to specific circumstances. The concept simultaneously pursues three approaches:

Clean Coal 1: Modernisation of existing installations and the construction of new power plants according to best available technology, with the objective of increasing energy efficiency and reducing the classic emissions SO_2, NO_X and dust.

Clean Coal 2: Development and demonstration of new power plant concepts with the objective of increasing today's efficiency of above 40 % to above 50 %.

Clean Coal 3: Separation and storage of CO_2 arising from the production of electricity.

Clean Coal as an Integrated Strategy

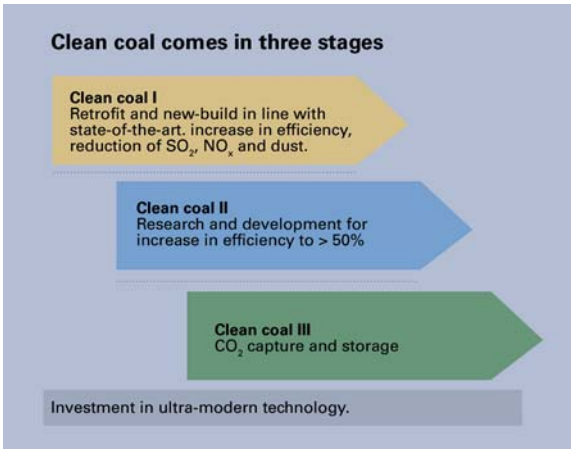
The integrated approach of modernisation, further development of power plant technology and CO_2 Capture and Storage is a path that is managed step-by-step. This enables current economic and long-term environmental policy objectives on the one hand to be linked with the technically feasible on the other hand. The objective of the coal and electricity industries is to accelerate procedures, aiming at making new options for action within the EU available on the market as soon as possible and making these technologies available globally.

A worldwide 40 % share of coal for the production of electricity and the tendency of coal utilisation to increase in important developing countries illustrate the challenge and the potential for demanding technology.

Increasing Efficiency

The efficiency of new hard coal-fired and lignite-fired power plants should be increased to more than 50 % in the medium term. This is a priority objective, because a clear reduction of specific CO_2 emissions can be reached by increasing efficiency with comparatively little effort. As a rule this is the cheapest way to reduce CO_2.

Research and Development efforts essentially strive to improve raw materials that make possible steam temperatures of 700°C with a pressure of 350 bar. E.on for example is planning to build a 400 MW coal-fired demonstration power plant by 2014 in the frame of



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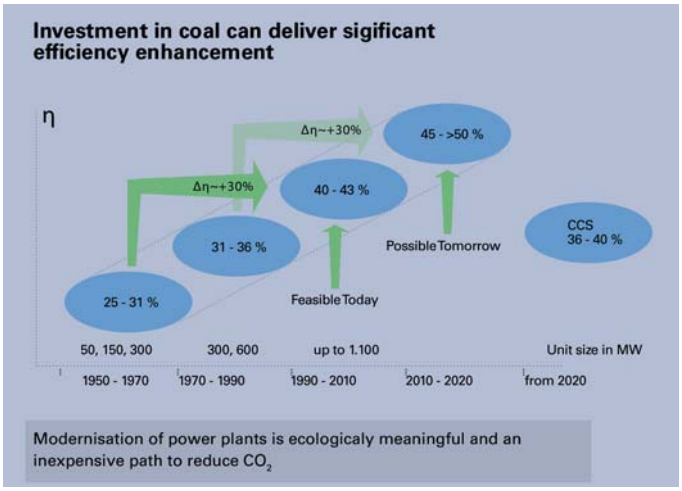


the COMTES 700 project that will exceed the "magical" efficiency limit of 50 %. RWE and Vattenfall are working at similar projects for lignite that would also include pre-drying coal. In the coal industry's opinion, research policy efforts must be accompanied by a political framework so that, in a favourable investment climate, the best available technology also becomes part of the production portfolio in the power sector.

Energy and Environmental Policy are Tied Together

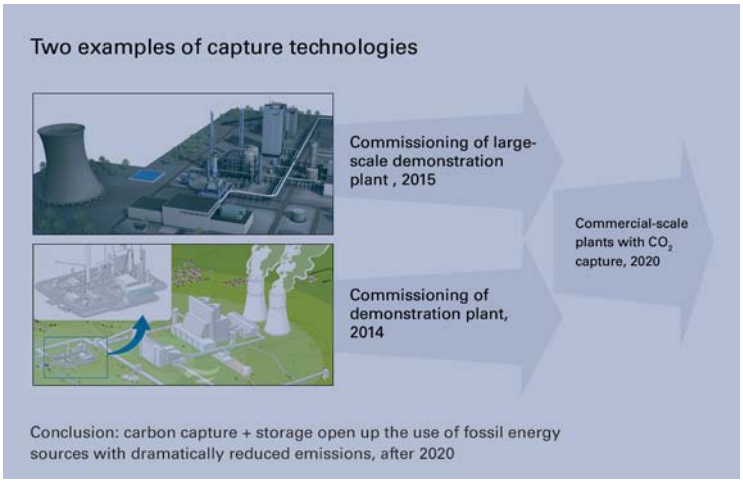
The integrated energy and environmental approach aimed at within the EU will only be successfully developed if Emissions Trading is designed appropriately.

The allocation of CO_2 emission rights is above all energy, structural and location policy. The Member States take over new responsibility for investments and employment by means of the Allocation Plans, but also for the development of their energy mix. The allocation system of CO_2 certificates should be designed so that more efficiency in a generally well balanced energy mix for power generation is reached. The system should offer incentives for a technology and economy-driven modernisation process; it should also offer affordable electricity on the basis of coal. The potential of the various technologies as well as the specific characteristics of the fuels and thereby the proportionality principle must be taken into consideration.

If coal – because of ultimate energy strategy reasons – is to be used widely throughout the world, in the EU and specifically in some Member States, the political decisions must leave scope for its economic use. It must be pointed out that functioning electricity markets are unconceivable if the large coal capacities available, that cover about 30 % of demand, would be limited in their use by a badly designed Emissions Trading Scheme.

Technology Platform Zero Emission Fossil Fuel Power Plants (ZEP)

With the participation of major electricity enterprises, the Technology Platform ZEP has carried out a comprehensive consultation and developed a strategy for research and implementation of CO_2 Capture and Storage in the field of electricity production.



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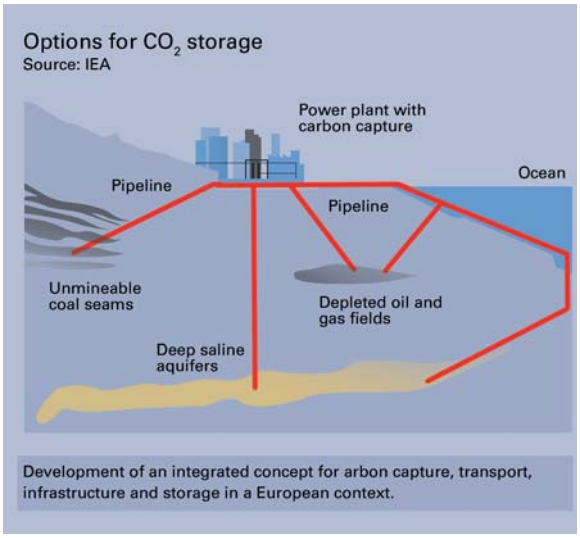

Development of an integrated concept for arbon capture, transport, infrastructure and storage in a European context.

The European Commission and the Member States have welcomed this initiative positively. Essential elements are mentioned in the Council conclusions of March 2007. In the European Council's action plan for "An Energy Policy for Europe", this is addressed in section V, Energy technologies. The Council greets the Commission's intention to promote the construction and the operation of up to twelve demonstration installations.

By 2015, this should create the basis for the sustainable use of fossil fuels for the commercial production of electricity. In Europe there are two developments for the capture of CO_2 being pursued by major electricity producers. Both trends aim at having large demonstration installations for the lignite-fired production of electricity with CO_2 Capture on stream by approx 2015. The oxy-fuel procedure and integrated coal gasification with CO_2 Capture are being tested. When developing the procedure, on the one hand one can depend on a series of proven components; on the other hand many engineering developments are required for the necessary robustness of the installations and their economic feasibility. Testing the new concepts is important because on the basis of operational experiences, the learning curve concerning availability and improved economic feasibility can be successfully pursued.

In the longer term, there is a route to near-zero CO_2 emission power stations

CO_2-capture	CO_2-storage
1. pre-combustion at gasification plants 2. post-combustion at conventional plants 3. oxy-fuel combustion	1. depleted oil and gas fields 2. deep saline aquifers 3. unmineable coal seams 4. mineralisation

Some technologies are well-proven, others need significant R&D.
All require demonstration with monitoring & verification of storage sites.

7th Framework Programme offers the opportunity to move ahead with demonstration projects and targeted R&D.

CO_2 Capture, Utilisation and Removal

Research and development has started on how the captured CO_2 can, if necessary, be utilised or if, and to what extent, it can be stored long-term in appropriate geological formations.

This deals with facts that have a technical and also a legal aspect. The existing legal framework is only partially applicable to CO_2 storage. Therefore the legal framework for a transparent approval procedure must be developed now to offer enterprises the necessary legal security to undertake such investments and contribute indirectly to a wider acceptance of CO_2 storage by public opinion. This concerns regulations at EU level and also eventual additional regulations at national level.

Considering the time span and the content, two aspects must be distinguished:

- For the planned demonstration installations, to be on stream by 2015 technically, regional / local solutions must be on stream. This requires European as well as national regulations.

- The perspective is that CO_2 separation, transport and storage will develop into a system that, like

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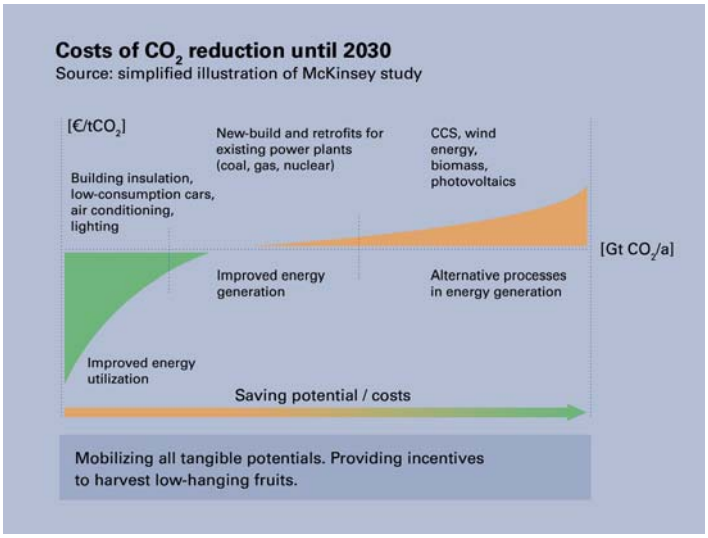

the supply of energy, can only be organised and implemented in a supranational context. What a CO_2 infrastructure will be like in the longer term, and what is necessary to connect the major sources, for example power plants, to performing sinks can not be comprehensively estimated today.

Looking especially at acceptance, the above circumstances prove the need to create the preconditions early enough to develop CCS technology on a solid legal basis. Regulations must on the one hand be flexible and on the other hand also offer scope for major changes.

and that narrowing the issue to coal is too limiting. Wide-ranging investigations show that reshaping energy systems is like a marathon. The time span for reshaping energy systems covers at least 50, perhaps even 100 years. Estimates till 2030, for example by the Consultants McKinsey, have indicated that most potential exists in the field of improved energy utilisation. Here, progress can even be reached with positive effects on costs. State-of-the-art modernisation of the power plant portfolio belongs to this category of measures. Further potential is connected to renewable energies and Carbon Capture and Storage.

However, today, they are not yet available at the necessary stage of development or, in some cases, are extremely expensive. Essentially, technical progress is to be stimulated by a planned market penetration at the same time avoiding that too many of the same appear on the market too early. This would lead to the targeted learning curve not being driven by the optimal use of means.

Climate Protection is a Global Issue

Climate protection without doubt comes under the heading “An issue that concerns us all can only be solved jointly by all of us”. This includes not only all regions throughout the world, but also all climate protection factors influenced by man. The slide provides a rough overview by sector, by region and by greenhouse gas. It is clear that Europe alone will not be successful,