Impact of Political Decisions on Production and Use of Coal Combustion Products in Europe

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ABSTRACT

In 2010, about 48 million tonnes of CCPs were produced in Europe (EU15). The production in all the European member states is estimated to be about 100 million tonnes. Due to the huge amount and constant qualities the utilisation of CCPs as replacement for natural occurring raw and construction materials was established. In some European countries, based on long term experience and technical as well as environmental benefits, the utilisation is higher than the production. The majority of the CCPs is produced to meet certain requirements of standards or other specifications with respect to utilisation in certain areas.

The utilisation of CCPs in Europe is being influenced by political decisions and environmental regulations. At present, the most important political decisions force increased clean coal technologies regarding most effective combustion and CO_2 reduction. This also results in the increased use of biomass for co-combustion in coal-fired power plants, increased use of biomass in FBC- and dry-bottom boilers, increased production by wind-, solar-, hydropower and others.

The environmental regulations have to be considered in the product/waste discussion following the revision of the Waste Directive. The discussion on classification regarding hazardous properties is driven by harmonisation of product and waste evaluation schemes. A consistent evaluation scheme is the most important legal base for the utilisation of CCPs which are registered as products according the REACH regulation. But also the Construction Products Directive requires additional information for health and hygiene (ER3) in the CE marking of construction products leading to the inclusion of requirements for environmental parameters in product standards.

This paper gives on overview on the management of CCPs in Europe and on the impact of political decisions and environmental regulations on quantity and quality of CCPs.

INTRODUCTION

CCPs are produced with the production of electricity in coal-fired power plants. “CCPs” are a synonym for the combustion residues such as boiler slag, bottom ash and especially fly ash from different types of boilers and the desulphurization products like spray dry absorption product and FGD gypsum.

In 2010, about 48 million tons of CCPs were produced in Europe (EU15). The production in all the European member states is estimated at approx. 100 million tones. Exact figures from most of the EU 12 member states are not available yet. CCPs are mainly utilised as a replacement for natural materials in the building material industry, in civil engineering, in road construction, for construction work in underground coal mining as well as for recultivation and restoration purposes in open cast mines. The majority of the CCPs are produced to meet certain requirements of standards or other specifications with respect to utilisation in certain areas.

In the last years the production of these CCPs has been increased in the member states due to legal requirements for flue gas cleaning. In some countries, in parallel to this development, the subsidizing systems for coal mining, mostly hard coal, were shortened and are subject to be stopped. The necessary amount of coal is then imported from different sources of the world. In some countries also national mining was completely stopped to reach national CO_2 reduction targets. Due to economic and social problems in the mining industry strategies for the use of national coal were re-implemented. In other member states CO_2 reduction is planned to be realized by constructing more effective coal-fired power plants, the increased use of biomass for co-combustion in coal-fired power plants, increased use of biomass in FBC- and dry-bottom boilers, increased production by wind-, solar-, hydropower and others. In some countries also the use of nuclear power was seen to become the solution to reach the reduction goals. After the Fukushima accident however, some countries, e.g. Germany, decided to withdraw nuclear power production, in other countries the plans for new nuclear power plants are on hold and some countries continue with production by nuclear power and construction of new nuclear power plants.

Also for producers of energy intensive construction materials, such as cement, lime, glass, steel, the CO_2 reduction goals have to be considered. For the cement industry the technology for clinker production was modified and over the last years the production of blended cement has increased as most of the CO_2 is emitted with the clinker production. For the production of blended cement fly ash is also used and a steadily increasing demand is observed.

As the utilisation of CCPs is well established in some European countries, based on long-term experience and on technical as well as on environmental benefits, they are part of regular production and therefore requested on a regular base. Availability is becoming a major problem in some member states as the production with imported coal, the use of biomass for co-combustion and the production by renewables result in a lower amount of CCPs. In addition, the increased use of wind power results in unstable operation conditions for some coal-fired power plants, which in addition to amount and availability, also has an impact on the quality of CCPs and the related efforts in the power plant.

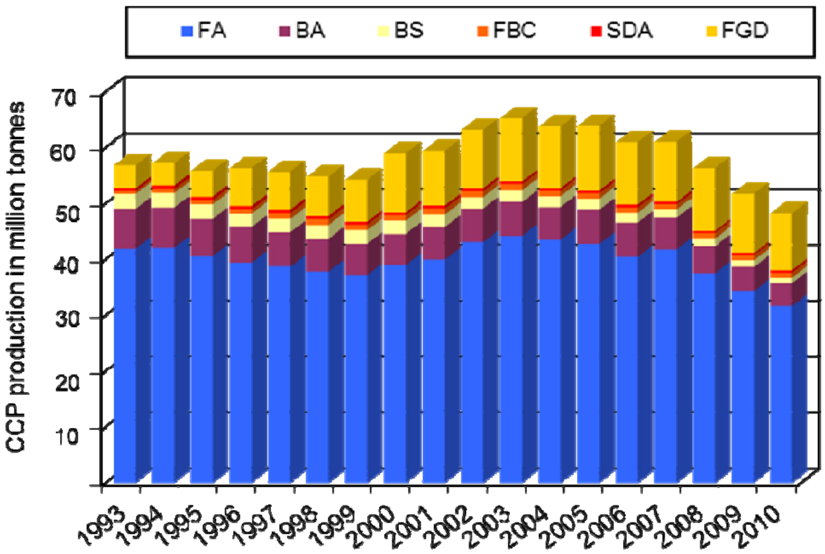
This paper gives an overview of the recent development of CCP production and utilisation based on political decisions regarding clean coal technologies, aims of EU energy plans and national solutions as well as resulting aspects regarding availability and quality of CCPs.

PRODUCTION OF CCPS

CCPs are produced by the production of electricity and steam in coal-fired power plants. The ECOBA statistics on production and utilisation of CCPs [1] reflect the typical combustion products such as fly ash (FA), bottom ash (BA), boiler slag (BS) and fluidized bed combustion (FBC) ashes as well as the products from dry or wet flue gas desulphurisation, especially spray dry absorption (SDA) product and flue gas desulphurisation (FGD) gypsum.

The development of CCP production in the EU-15 member states from 1993 to 2010 is shown in Figure 1. The total amount decreased from 57 million tonnes in 1993 to 55 million tonnes in 1999 and rose again to 64 million tonnes in 2005 due to higher coal-based generation of electricity and heat. From 2006 a continuous decrease is observed. In 2010, the amount of CCPs produced in European (EU-15) power plants totalled 48 million tonnes. This reduction was due to less coal-based power generation in some countries because of the lower economy crisis and the industrial/financial crisis in 2008 as well as the political decisions on CO_2 reduction resulting in e.g. increased production by renewables. It has to be noted that the ECOBA statistics refers to EU-15 countries. The total amount of CCPs in EU-27 did not decrease that much because the EU-12 countries generate more electricity in coal-fired power plants which is estimated to a total amount of CCPs of more than >100 million tonnes.

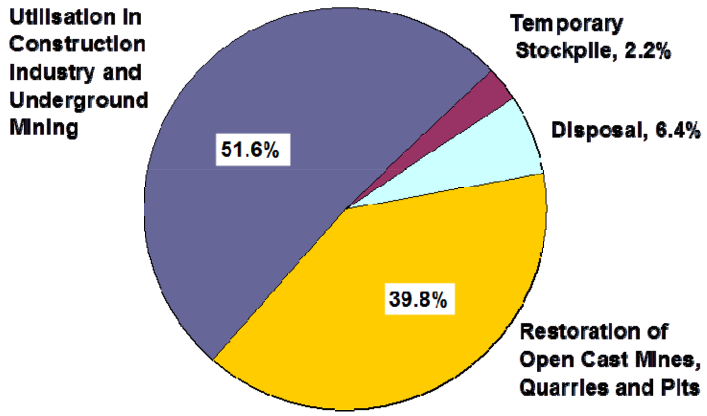
Figure 1 Development of the CCP production in Europe (EU 15) from 1993 to 2010 [1]
(FA – fly ash; BA – bottom ash; BS – boiler slag; FBC – fluidized bed combustion; SDA – spray dry absorption; FGD – flue gas desulphurisation)



UTILISATION OF CCPS

The CCPs are mainly utilized in the building material industry, in civil engineering, in road construction, for construction work in underground coal mining as well as for recultivation and restoration purposes in open cast mines. In 2010, about 52 % of the total CCPs are used in the construction industry, in civil engineering and as construction materials in underground mining and about 40 % for the restoration of open cast mines, quarries, and pits. About 2 % were temporarily stockpiled for future utilisation and about 6 % were disposed off (see figure 2).

Figure 2 Utilisation and disposal of CCPs in Europe (EU 15) in 2010 [1]

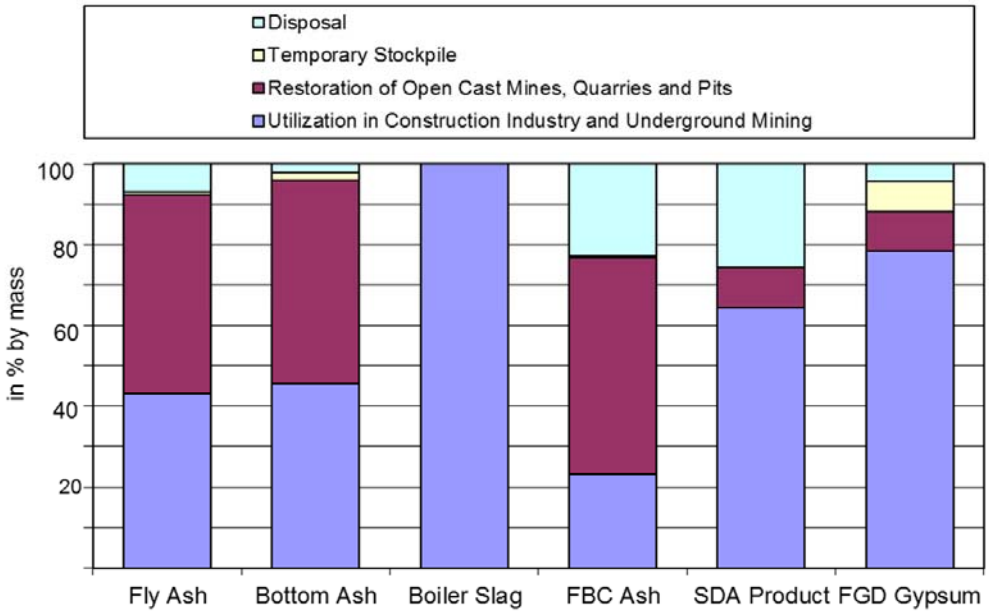


The rates of utilisation, temporary stockpile, and disposal for single CCPs are given in figure 3. The fields of utilisation of specific CCPs in 2010 in EU-15 are described below. The graphics regarding the utilisation of specific CCPs in 2010 in EU-15 countries is given in annex 1 a to f.

Fly ash is obtained by electrostatic or mechanical precipitation of dust like particles from the flue gas and represents the greatest proportion of the total CCP production. Depending on the type of coal and type of boiler, siliceous, silico-calcareous or calcareous fly ashes with pozzolanic and/or latent hydraulic properties are produced throughout Europe. The utilisation of fly ash across European countries is different and is mainly based on national experience and tradition.

In 2010, about 14 million tonnes of fly ash were utilised in the construction industry and for production purposes in underground mining. Most of the fly ash produced was used as concrete addition, in road construction and as raw material for cement clinker production. Fly ash was also utilised in blended cements, in concrete blocks, and for infill (that means filling of voids, mine shafts and sub-surface mine workings) (annex 1a).

Figure 3 Utilisation, temporary stockpile and disposal of CCPs in Europe (EU 15) in 2010 [1]



Bottom ash is a granular material removed from the bottom of dry bottom furnaces. Bottom ash is much coarser than fly ash. In 2010, about 1.9 million tonnes of bottom ash were used in the construction industry. Out of this about 42 % was used as fine aggregate in concrete blocks and in concrete, about 42 % in road construction and filling applications and about 10 % in cement production (annex 1b).

Boiler slag is a vitreous grained material derived from coal combustion in wet bottom boilers operated at temperatures of about 1,600 °C. Due to the high furnace temperature, the coal ash melts and flows down into a water bath at the bottom of the boiler where it is cooled down rapidly and forms a coarse granular material. It is removed from a water bath below the furnace bottom by a scrubber system. Boiler slag is a glassy, environmentally sound material. In 2010, about 1.0 million tonnes of boiler slag was produced in Europe (EU-15). About 62 % of the boiler slag produced was used as blasting grid, about 32 % in road construction, about 4 % for grouting and in drainage layers (annex 1c).

Fluidised bed combustion (FBC) ash is produced in fluidised bed combustion boilers. The technique combines coal combustion and flue gas desulphurisation in the boiler at temperatures of 800 to 900 °C. FBC ash is rich in lime and sulphur. In 2010, about 0.21 million tonnes were mainly used for engineering fill applications (53 %), for sub-grade stabilisation (19 %) and in cement (about 14 %). Some 19 % was used for sludge treatment and waste stabilisation (annex 1d). It has to be noted that the total amount of FBC ash in EU-15 countries is small compared to the amount produced at least in Poland and the Czech Republic.

Spray dry absorption (SDA) product is produced in dry flue gas desulphurisation processes in European power plants. In 2010, about 0.3 million tonnes of SDA product were produced. SDA product is a mixture of the minerals calcium sulphite hemihydrate, calcium sulphate dihydrate (gypsum), calcium carbonate, calcium hydroxide, calcium chloride, and calcium fluoride.

Depending on the location of the SDA installation in the flue gas stream (upstream or downstream the electrostatic precipitator), SDA product may contain fly ash up to 60 % by mass. Due to the high content of sulphur and chlorine, SDA product cannot be used in cement bound systems used for construction purposes because of the risk of unsoundness.

In 2010, the total SDA product in EU-15 countries was utilised in the construction industry for structural fill (53 %), for infill (29 %) and as sorbent in wet FGD or soil amendment (18 %, annex 1e). It has to be noted that also the total amount of SDA product in EU-15 countries is small compared to the amount produced at least in Poland and the Czech Republic.

Flue gas desulphurisation (FGD) gypsum is produced in the wet flue gas desulphurisation process of coal-fired power plants. The process consists of desulphurisation of the flue gas in the power plant and refining in the FGD plant including an oxidation process followed by gypsum separation, washing, and dewatering. Studies have shown that FGD gypsum has the same properties as natural gypsum regarding health aspects [2]. Based on these results and because of its constant quality, FGD gypsum is accepted in the gypsum and cement industry to directly replace gypsum from natural sources. FGD gypsum has to meet the quality specifications of the gypsum industry as published by EUROGYPSUM [3]. The amount of FGD gypsum produced in Europe (EU-15) was approximately 10 million tonnes in 2010. About 64 % was used for the production of plaster boards. Other applications include the production of gypsum blocks, projection plasters, and self-levelling floor screeds (about 28 %). In the cement industry FGD gypsum is used as set retarder (8 %; annex 1f).

IMPACT ON CCP PRODUCTION BY POLITICAL DECISIONS / LEGISLATIVE ASPECTS

The energy and steam production by coal and by this the CCP production is influenced by political decisions and respective legislation. Political decisions are either introduced by law, i.e. national law or European regulations, which have to be considered after publications in the official Journal of the EC, or by Directives, which have to be introduced into national law with a respective co-existence period. The decisions regarding energy and heat production by coal-fired power stations either have an impact on the power plant technology or on the combustion process. The decisions on the power plant technology can be covered with the heading “Clean Coal Technology”. The most important decisions and their impacts on coal-fired power stations and on CCPs are described in the following.

Clean Coal Technology – Impact of Directives

Industrial activities, including the use of coal in coal-fired power plants, have a significant impact on the environment, which must be kept as low as possible. Emissions from industrial installations have therefore been subject to a EU-wide legislation. Individual member states may set their own national legislation but all member states must comply with EC Directives, although derogations may be permitted. The most important Directives are:

- IPPC – Integrated Pollution Prevention and Control
- LCPD – Large Combustion Plant Directive
- IED – Industrial Emissions Directive

The IPPC Directive [4] sets out the main principles for the permitting and control of installations based on an integrated approach and the application of best available techniques (BAT) [5]. It covers all emissions and overall plant performances.

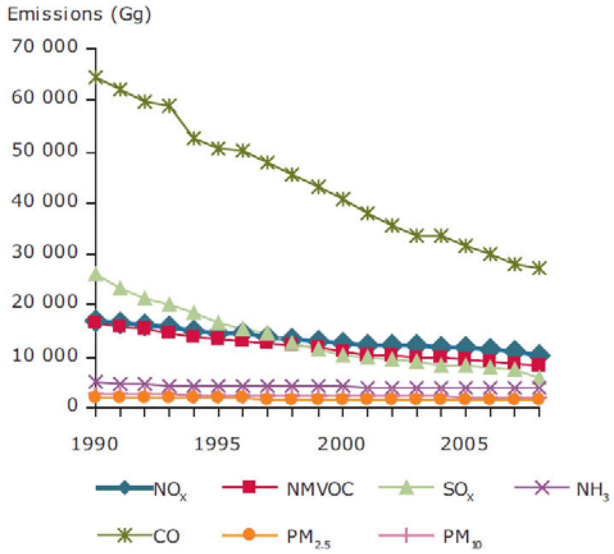
The LCP Directive [6] aims to reduce acidification, ground level ozone and particulates by controlling the emissions of sulphur dioxide, oxides of nitrogen and dust from large combustion plants (i.e. plants with a rated thermal input of equal to or greater than 50 MW_{th}). All combustion plants built after 1987 must comply with the emission limits in LCPD. Those power stations in operation before 1987 are defined as 'existing plants'. Existing plants can either comply with the LCPD by installing emission abatement (Flue Gas Desulphurization) equipment or 'opt-out' of the Directive. An existing plant that chooses to 'opt-out' is restricted in its operation after 2007 and must be closed by the end of 2015. Therefore, several old boilers in the member states are subject to close or are retrofitted.

The IE Directive [7] is the successor of the IPPC Directive and in essence, it is about minimizing pollution from various industrial sources throughout the European Union. The IED replaces the IPPC Directive and the sectoral Directives as of 7 January 2014, with the exemption of the LCP Directive, which will be repealed with effect from 1 January 2016.

As a result of these regulations the emissions from power plants are reported in the European Pollutant Release and Transfer Register (E-PRTR [8]), which replaces and improves the previous European Pollutant Emission Register (EPER).

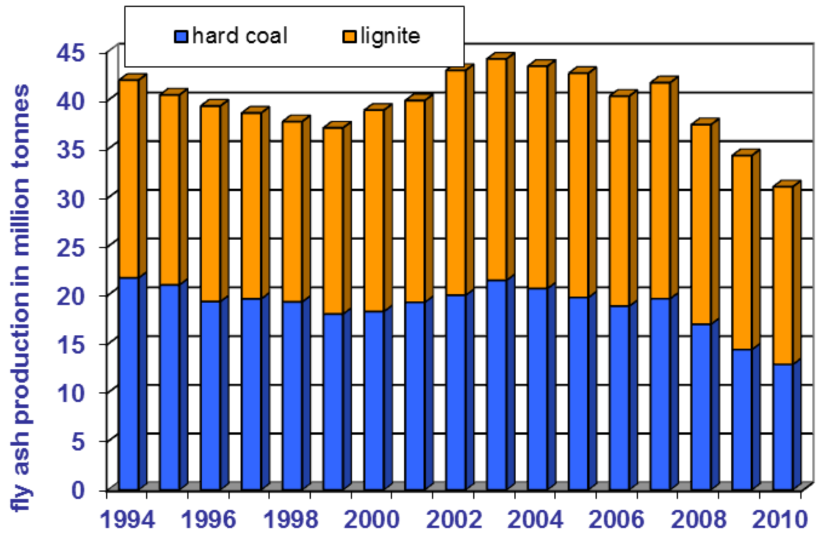
After several years of evaluation, the reduction of emissions can be shown best using the example of SO_x (see figure 4) as it demonstrates the largest percentage reduction of emissions since 1990 of the main pollutants across the European Union. Emissions in 2008 were 78 % less than in 1990, mostly by the reduction in the EU 15 countries. It is noteworthy that SO_x emissions decreased rather sharply, falling 20 % in 2008 compared to 2007, mainly due to reductions reported in Bulgaria, Poland and Spain. In each of these member states, the lower emissions were mainly reported from public power plants due to reductions. For example in Spain the emission reduction was higher due to the use of lower amounts of more polluting coal for electricity generation and the use of more natural gas and renewables such as wind, photovoltaic and biomass [9].

Figure 4 EU-27 emission trends for main air pollutants [9]



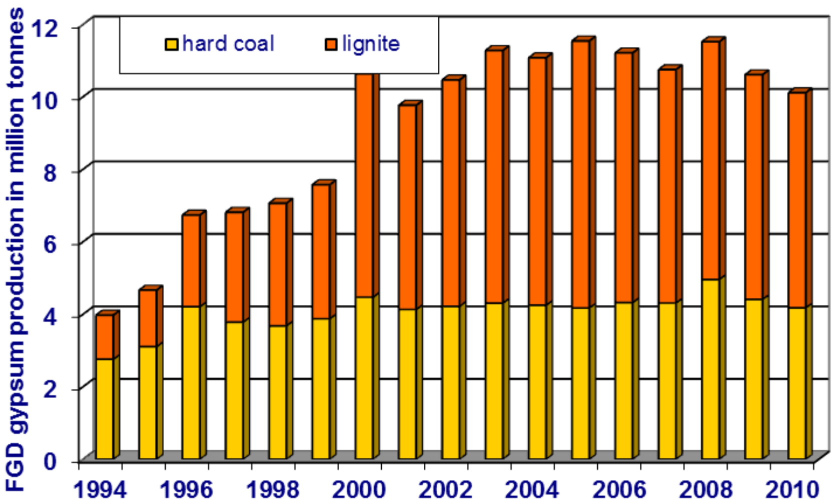
Together with the reduction of emissions the amount of residues from flue gas cleaning, i.e. fly ashes and FGD-gypsum, is increased. The development of the production of fly ash from hard coal and lignite combustion in dry-bottom boilers is shown in figure 5. Although in 2009 a smaller production of fly ash for the EU 15 members states is observed, it has to be noted that this figure follows the industry crisis and do not reflect the situation in the single EU member states. In some countries the production was at same level or even higher than the year before. In some countries coal mines were closed for different reasons, which caused the use of imported coal with mostly lower ash contents.

Figure 5 Development of the fly ash production from hard coal and lignite in in Europe (EU 15) from 1993 to 2010



In figure 6 the development of the production of FGD gypsum from hard coal and lignite is given. Compared to fly ash an increase of FGD gypsum production can be observed in 2008. It has to be noted that the figures will not show the effects of the above mentioned reduction of SO_x emissions as the data from East European countries are not covered by the EU 15 statistics of ECOBA [1]. Due to retrofitting of power plants in the East European countries, the amount of FGD gypsum is expected to increase. But this effect is reduced by the development in the West European countries regarding an increased production by renewables.

Figure 6 Development of FGD gypsum production from hard coal and lignite in EU 15 from 1993 to 2010



It is another important issue of Clean Coal Technology to avoid the disposal of the minerals produced in power plants and to use them as valuable sources. After more than 40 years of experience, CCPs are meanwhile mainly utilized in the building material industry, in civil engineering, in road construction, for construction work in underground coal mining as well as for recultivation and restoration purposes in open cast mines (see clause 4).

CLEAN COAL TECHNOLOGY – IMPACT OF ENERGY PLANS

On 11 December 1997, the representatives of 37 industrial countries agreed to reduce greenhouse emissions (GHC) to an average of 5 % against 1990 levels over the five-year period 2008-2012. This agreement is known as Kyoto Protocol [10] which entered into force in 2005. The protocol is linked to the United Nations Framework Convention on Climate Change [11]. When the Convention encourages industrialized countries to stabilize GHG emissions, the Protocol only commits them to do so.

One instrument given in the Kyoto Protocol to reach the reduction aim it the so-called clean development mechanism (CDM). The *CDM* allows emission-reduction projects in developing countries to earn certified emission reduction (CER) credits, each equivalent to 1 ton of CO_2. These CERs can be traded and sold, and used by industrialized countries to meet a part of their emission reduction targets under the Kyoto Protocol. The mechanism stimulates sustainable development and emission reductions, while giving industrialized countries some flexibility in how they meet their emission reduction limitation targets.

In December 2008, the European Parliament and the Council agreed upon the so-called "Climate and Energy Package", which entered into force in 2009. The legislative package put in place what is collectively known as the EU-20-20-20 targets to be met by 2020:

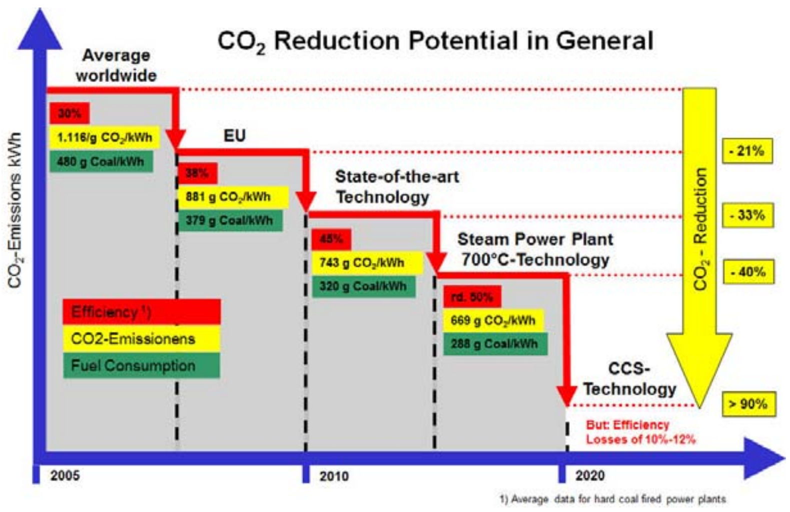
- Reduction of greenhouse gas emissions of at least 20 % below 1990 level,
- Increasing the share of renewable energy to 20% , and
- Improving the EU's energy efficiency by 20%.

With this package additional legislation was installed for promotion of the use of renewable energy (RES), geological storage of carbon dioxide and a revised Trading Scheme for greenhouse gases (GHG). From 2013, the system for allocating emission allowances will change significantly compared to the two previous trading periods (2005 to 2012). At first, the emission allowances will be distributed according to fully harmonized and EU-wide rules. At second, auctioning will become rule for the power industry, i.e. the allowances will not be allocated for free any longer.

In addition, the EU is of the opinion that there is a potential to further reduce emissions. In Article 28 of the revised EU, ETS for GHG an adaptation of the already ambitious mandatory target to reduce GHG by 20 % in 2020 to a 30 % reduction is foreseen if an international agreement is reached. The European Council has also given a long-term commitment to the decarburization path with a target for the EU and other industrialized countries of 80 to 95% cuts in emissions by 2050 [12]. To reach this ambitious aim again, the European Commission adopted the Communication "Energy Roadmap 2050" on 15 December 2011. In the Energy Roadmap 2050 the Commission explores the challenges posed by delivering the EU's decarbonisation objective while at the same time ensuring security of energy supply and competitiveness**.** The Energy Roadmap 2050 is the basis for developing a long-term European framework together with all stakeholders.

On one hand the instruments of the industry to reduce greenhouse gases (CHG) are the increase in energy efficiency. On the other hand a most effective use of coal will also lead to the reduction of CO_2-emission. In figure 8 the CO_2 reduction potential of European power plants is given together with the energy efficiency, fuel consumption and – based on this – the CO_2 emission. The state-of-the-art efficiency in the EU is 45%, which is going to be increased to 50 % with the construction of the new power plants. Further reduction with carbon capture storage will give higher CO_2 reduction rates but will counteract all efforts regarding efficiency by efficiency losses of 10 to 12 %.

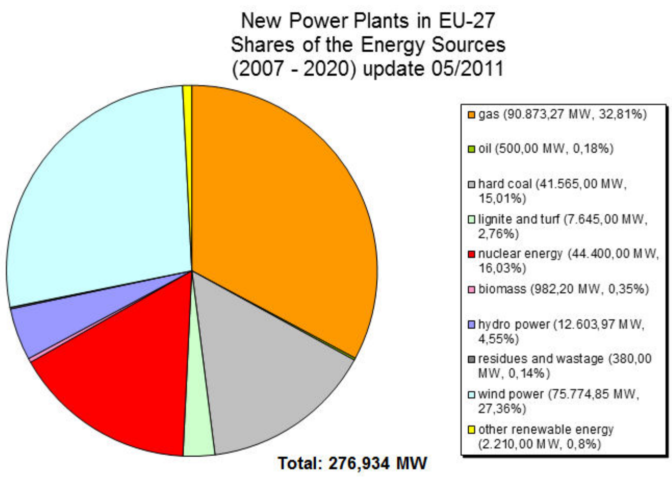
Figure 8 Power Plant efficiency and CO2 reduction potential of the European power industry [13]



With the construction of new power plants the EU member states prepare to meet the increasing demand for energy on one hand and meet the GHG emission reduction targets on the other hand. Due to the country specific situation (own coal reserves, availability of rivers for hydropower, accessibility for see trade, etc.) the energy plans of each country are different.

Due to the announcement of projects for the production plants by wind, hydropower, nuclear power, lignite and turf, hard coal, oil and gas the way to improve EU energy efficiency as well as to increase the share of renewable energy is shown (see figure 9). With the increased use of biomass in pure biomass combustion plants the load of coal-fired power plants is reduced. Together with the production by other renewables like wind, solar and hydropower a change from base load to partly peak load production was observed in some countries. This has an impact on the maintenance of the power plants and therefore to production costs. The quality of CCPs is affected too and more attention must be given to CCP production.

Figure 9 New power plants projects in European member states [14]



The projects for coal-fired plants - 42.565,00 MW in total – have been partly already started and/or near to start energy production. The power plants will partly replace old power stations. The construction of coal-fired power plants in Germany and the Netherlands are far advanced and the first production is expected soon. The power plants in the Netherlands and Germany for hard coal are developed and designed to burn import coal as well as for co-combustion of higher shares of co-combustion materials. The boilers and the process control advices are designed to produce fly ash for the use according EN 450 fly ash for concrete. Based on longterm experience with co-combustion of higher shares of co-combustion materials the revised EN 450-1 will cover fly ash with up to 40 % of co-combustion material (50 % in case of green wood). The revised table 1 of EN 450-1 with types of co-combustion is given in table 1.

Table 1. Types of co-combustion materials

(Table 1 of the revised EN 450-1)

1	Solid Bio Fuels conforming to EN 14588:2010 including animal husbandry residues as defined in 4.3 and excluding waste wood as defined in 4.40, 4.107 and 4.136
2	Animal meal (meat and bone meal)
3	Municipal sewage sludge
4	Paper sludge
5	Petroleum coke
6	Virtually ash free liquid and gaseous fuels

NOTE Other types of co-combustion materials not included in Table 3 (Table 1 of revised EN 450-1) may be subject to an ETA.

The boilers for lignite combustion are designed to burn the specific coal types mined nearby the plant. These boilers are also designed for co-combustion.

The new coal-fired power plants are designed to meet the requirements for carbon capture storage, a process for CO_2 separation from industrial processes and its safe and long-term disposal. Today, most of the plants are designed as CCS-ready, that means that they are designed to apply the technology when the research regarding capture is advanced and the storage technology and respective site is defined. CCS requires a 3-step approach: separation in power plants, transport and storage.

There are three main types of technologies existing to separate the CO_2 from the fuel or the flue gas:

- Post-combustion
- Pre-combustion
- Oxy-combustion

The basic technology exists for each of the solutions and was partly proven, at least in pilot plants or lower scale industrial applications. However, the costs for an up-scaling of existing plants and the costs for CO_2-certificates have to be considered. Doubts come with respect to the up-scaling and their costs. After separation the geologic storage is proven with high success in several different places, although yet with capacities 1 million ton/y. The assessment of local storage areas is of importance. In East Germany, the test to store CO_2 in deep mining have been stopped now. The transport technology is proven at an existing long network of CO_2 pipelines especially within North America. Adequate care is required with a composition of CO_2 impurities. The discussion e.g. in Germany showed great problems regarding public acceptance.

Post-combustion: Post-combustion CO_2 capture is a process where the CO_2 is removed from a gas mixture after the combustion of a fossil fuel. When a fossil fuel like coal, oil or natural gas is combusted in a traditional power plant, the flue gas will contain some CO_2, typically in the range from a few percent to 10 percent. The rest will be mainly nitrogen and water vapour.

There are several options for separating the CO_2 from this gas mixture by post-combustion CO_2 capture. The most common process is absorption based on a chemical reaction between CO_2 and a suitable absorbent in a scrubber system, where the flue gas from the power plant is mixed with an absorbent dissolved in water. Typical absorbents that are used today are amines and carbonates.
After the absorption process, the absorbent and the CO_2 are separated in a regeneration column. The result is then a stream of pure CO_2 and a second stream of absorbent that can be recycled to the scrubber column. The CO_2 is then compressed and sent to use or disposal. The post combustion process is the most recommended for retrofitting of existing power plants with CCS technology.

Pre-combustion: CO_2 can be separated from fossil fuel before combustion, which is the so-called pre-combustion CO_2 capture *method. The principle* of this process is to first convert the fossil fuel into CO_2 and Hydrogen gas (H_2). H_2 and CO_2 is then separated in the same way as in the post-combustion process, although a smaller installation can be used. This results in a hydrogen-rich gas which can be used in power plants or as fuel in vehicles. The combustion of hydrogen does not lead to any production of CO_2. With pre-combustion CO_2 capture about 90 % of CO_2 from a power plant can be removed. As the technology requires significant modifications of the power plant, it is only viable for new power plants, not for existing plants. It is *not* an option at? the pulverized coal (PC) power plants that comprise most of the existing capacity. However, it *is* an option for integrated coal gasification combined cycle (IGCC) plants.

Oxy-combustion: Oxyfuel combustion with CO_2 capture is very similar to post-combustion CO_2 capture. The main difference is that the combustion is carried out with pure oxygen instead of air which may lead to higher burning temperatures. As a result the flue gas contains mainly CO_2 and water vapor, which can be easily separated. Up to 100 % CO_2 can be captured through this process.

However, it is expensive to produce pure oxygen. The currently available technologies for pure oxygen-production are primarily based on the cryogenic separation of air. Here the air is cooled down below the boiling point before liquefied oxygen, nitrogen and argon are separated. However, the high amount of energy involved in this process make it a very expensive process and much research is subsequently carried out in order to develop membranes that separate oxygen from air more efficiently.

To inform about the progress of the process development and to increase the knowledge about the successful use of CCS technique i.e. the zero emission platform was created [15].

The pre- and post-combustion processes will not have any impact on the resulting CCPs as there is no change in the coal combustion and the desulphurization process. Due to higher burning temperature in the oxy-fuel process however an impact on CCP quality is expected.

A major technology to save or avoid CO_2 emissions is the production by nuclear power. Several countries are producing their energy mostly by nuclear power (e.g. France, Finland, etc.). In other countries nuclear power is part of the energy mix and a tool to work towards CO_2 reduction. The discussions for new power plants were mainly based on the disposal of the nuclear waste.

After the Fukushima accident on March 11, 2011 different reactions were observed in the member states. In Germany, the politicians decided to stop nuclear power although they have decided to extend the lifetime of existing plants some months before. In other countries the plans for new power plants are on hold or the future plans are still valid.

OTHER IMPACTS

- Coal mining

Other impacts on generation by power-fired power plants are based on the changes to imported coal due to a stop of national coal mining.
In Belgium, the national coal production reached a peak production of 30 million tons between 1952 and 1953. In the late 1950ies the Walloon mines were closed and the Limburg mines were closed 20 years later. In Belgium the last mine was closed in 1992.

In the Netherlands, hard coal was mined from 1900 to the mid 1970ies in the South Limburg area. At the north-west fringe of the German lignite basin near Cologne also lignite was mined opencast from 1925 to 1968. Today, the port of Rotterdam is now the biggest port for coal imports into Europe.

In Germany, from more than 150 mines in the 1950ies only 8 are left which are subject to closure by 2018. Only the lignite mines in the three main mining areas in the western part near Cologne, in the midth German part near Leipzig and in the Lausitz area near the Polish border will remain.

The hard coal-fired power stations have to use imported coal to a higher extent than by now. This causes more efforts to guarantee an appropriate ash quality for the use in the different fields of application and also to different ash amounts due to the different ash content of the imported coal.

- Product standards

In November 2005, CEN established a new Technical Committee (CEN/TC 351) for "Construction products: Assessment of release of dangerous substances". The TC has developed horizontal standardised assessment methods for harmonised approaches relating to the release of regulated dangerous substances under the Construction Products Directive (CPD) taking into account the intended conditions of the use of the product. It addresses emission to indoor air, and release to soil, surface water and ground water.

The standards for indoor air and for release into soil and ground are near to start the official procedure in the CEN committees. A robustness test for both procedures is still in progress. In the CE marking of all product standards information on the regulated dangerous substances have to be added. The standards for aggregates are the first of standards which have to define the substances and to propose evaluation criteria. The industry is working on dossiers with all relevant data to allow a decision whether the aggregates need a regular testing for the dangerous substances (WT- Without testing-; WFT – Without further testing-; and FT- further testing-procedures).

CONCLUSIONS

Coal is a major fuel for energy and steam production in European coal-fired power plants. The annual production of CCPs in EU 27 is still estimated to amount to about 100 million tons (52 million tons in EU 15 in 2009). Political decisions regarding clean coal technology led to modifications in power plant technology and installations of de-NO_x and de-SO_x system, which resulted in CCP production in countries without a developed market.

Decisions regarding a reduction or stop of the subsidization of national coal mining led to an increased use of imported coal and partly to different ash amounts in the power plants. This leads to more efforts for the marketing of ashes as construction materials.

The decision to reduce CO_2 emissions led to an increased use of biomass and production by renewable systems (wind-, solar-, hydropower) and force coal-fired power plants to be operated also for peak load and reserve. New coal-fired power plants have to consider carbon capture storage (CCS) technologies which are still under development.

Based on all the political decisions and plans which effect the power production in the European member states – and therefore also the production of CCPs - the power industry will take all efforts to provide always good quality products to the construction market.

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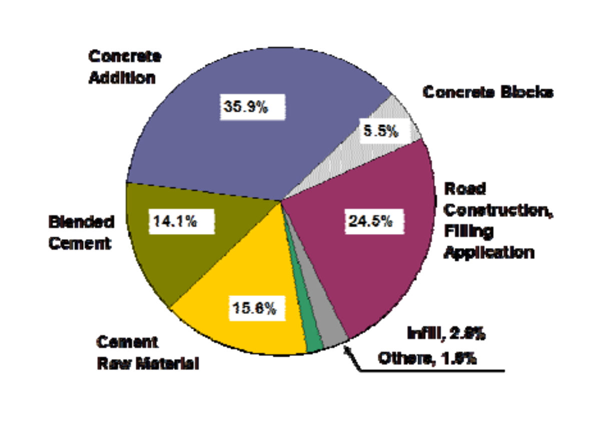
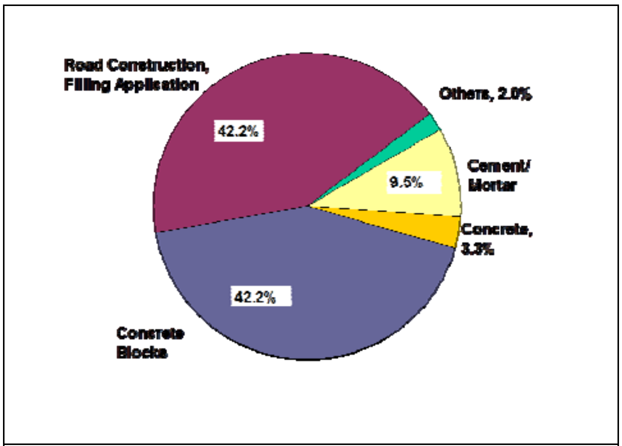
Annex 1

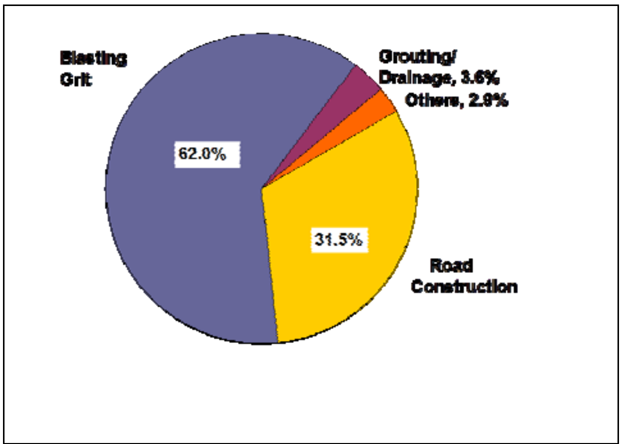
Annex 1 Utilisation of specific CCPs in Europe (EU 15) in 2010.



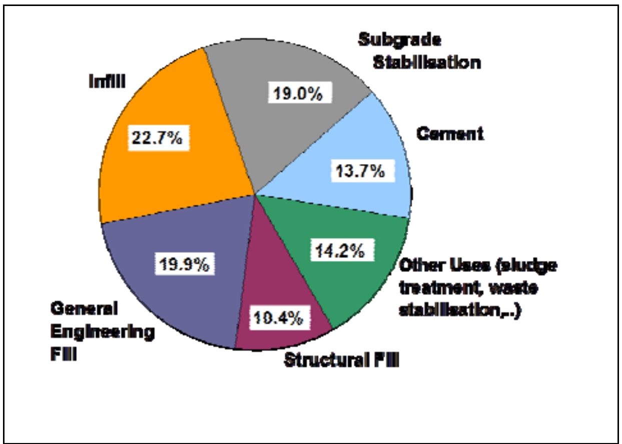
Annex 1a:
Utilisation of Fly Ash in the Construction Industry and Underground Mining in Europe (EU 15) in 2010.
Total utilisation 13.8 million tonnes.



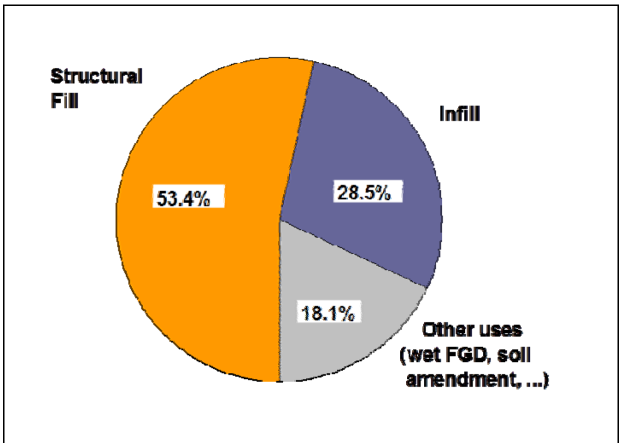
Annex 1b:
Utilisation of Bottom Ash in the Cons-truction Industry and Underground Mining in Europe
(EU 15) in 2010.
Total utilisation 1.9 million tonnes.



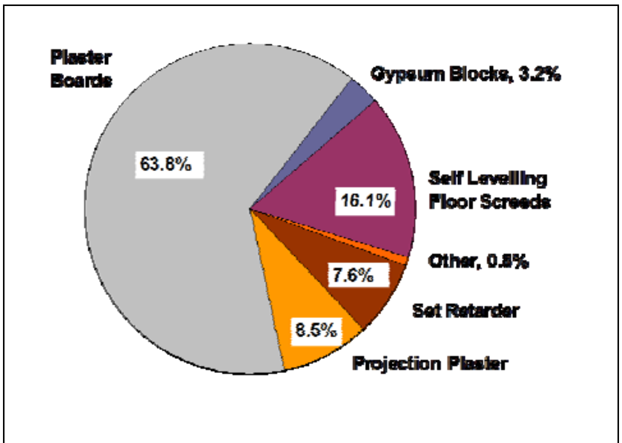
Annex 1c:
Utilisation of Boiler Slag in the Construction Industry and as Blasting Grid in Europe (EU 15) in 2010.
Total utilisation 1.0 million tonnes.



Annex 1d:
Utilisation of FBC Ash in the Construction Industry and Underground Mining in Europe
(EU 15) in 2010. Total utilisation 0.21 million tonnes.



Annex 1e:
Utilisation of SDA- Product in the Construction Industry and Underground Mining in Europe (EU 15) in 2010.
Total utilisation 0.31 million tonnes.



Annex 1f:
Utilisation of FGD gypsum in the Construction Industry in Europe (EU 15) in 2010.
Total utilisation 8.1 million tonnes.