# COAL 2012
## Preparing to phase out

German Coal Association

# Coal Annual Report
# 2012

German Coal Association

# Foreword

The year 2012 marks the final chapter in the history of coal mining in the Saar and western Ruhr areas. With a heavy heart we had to say farewell to more than 250 years of mining in the Saar, in line with the decision taken back in 2008. And at the end of 2012 the closure of West mine will spell the end of the tradition-steeped mining industry of the Lower Rhine region. This will leave just three active mines – at Bottrop, Marl and Ibbenbueren.

The closures are the inevitable result of the Saar earth tremor incident, combined with the economic conditions of the domestic mining industry and the political decisions taken in 2007. It has been agreed that subsidised coal mining in Germany will cease to exist by the end of 2018, which means that the last subsidised collieries in North Rhine-Westphalia will also have to shut in a couple of years.

However, the financial framework vouchsafed by the national and regional governments means that the phasing-out process can take place in an orderly and socially acceptable manner. It also facilitates the structural change that is required in the coalfield areas. And RAG has been given the time it needs to prepare itself for its new remit in the post-2018 era. This relates particularly to the management of inherited long-term liabilities. Marketing German mining know-how to the global markets, developing new ideas and projects that can harness industrial infrastructure for the generation of renewable energies at former mining sites – these are all real opportunities that we will pursue with full vigour.

'Preparing to phase out' is therefore not just the title of this year's GVSt Annual Report and the theme of the 2012 annual coal convention. It also serves as a guideline for all mining-related activities up to 2018. As well as looking back at the rich mining history of the Saar coalfield our Annual Report will also focus on the challenges that lie ahead. We should not forget the great efforts that RAG is making to ensure that the necessary manpower adjustments are made in a socially responsible way. Not a single mineworker will be cast adrift – that is not just an essential condition of the coal-policy agreement but remains a fundamental part of the company's personnel policy.

Of course GVSt's Annual Report once again presents the relevant developments on the international energy and commodities markets and in the area of environmental and climate policy making. Coal mining will continue to be RAG's main remit until the end of 2018 and we shall be supplying our customers with coal until that date is reached, in line with our contracts and agreements. We fully intend not only to satisfy our political remit but also to be a committed and reliable partner to our clients.

Herne, October 2012

Bernd Tönjes

Chairman of the Management Board
German Coal Association

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# Preparing to phase out

Saar mine in Ensdorf shut down on 30 June 2012. This mine closure was of special significance for the German mining industry as it marked a final farewell to mining in the Saar coalfield – a region steeped in coal mining history and the country's second-largest mining area. It was another milestone along the road that will eventually lead to the complete cessation of coal mining in Germany by the end of 2018. This year's Annual Report will therefore include a guest contribution tracing the 250-year history of the Saar coalfield (pages 19 to 24). And at the end of this year – on 31 December 2012 – West mine in the Ruhr coalfield will also cease production. West mine is now the last active mine in the Lower Rhine region and its closure will spell the end of coal mining in the Lower Rhine, which dates back more than 100 years.

Against this background, and with the perspective to phase out coal, RAG Aktiengesellschaft (RAG) – Germany's last coal producing company – has now set itself new targets. While the responsible management of the phase out process is clearly the main remit, the company also has to focus on preparations for the operational administration of the industry's long-term liabilities and the development of new business areas.

Downsizing the industry's remaining manpower in a socially responsible way remains the most important personnel-policy objective. To put it in plain language, this essentially continues to mean absolutely avoiding compulsory redundancies.

An essential prerequisite for this is that current production targets must be reliably met until the industry finally closes. Yet each and every employee who leaves RAG takes with him or her a degree of know-how and experience that has been built up over the years – which means that this expertise is then lost to the industry. The company's manpower management and selection process therefore plays a key role in that it must control the downsizing phase in such a way that the production sites remaining in operation continue to have access to sufficient numbers of suitably qualified employees as and when they are needed. This means asking a lot of our remaining workforce, who must be willing to accept change and display flexibility and mobility. The primary objective is to ensure that those members of staff not entitled to transition payments are found new positions between now and 2018. To this effect they are given targeted training in Personnel Development Centres before sent out to their new place of work.

The downsizing process in the coal industry has therefore entered its final, most important and most difficult phase. The positive experience acquired from the final closure of the Saar coalfield shows that this process can be achieved in a socially responsible manner. There the run-down process was accomplished without disruptions because the wage and personnel-policy instruments that were used were similar to those that have been agreed for operations in the Rhine and Ruhr region.

Even though the coal industry continues to be under huge pressure to downsize and adapt, it still manages to meet its regional and social responsibilities. As one of the largest training providers the industry again took on some 270 young apprentices in 2012. This meant that at the beginning of the training year RAG had a total of 1,009 apprentices enrolled in eleven future-oriented training courses at nine locations across the industry.

Coal consumption in Germany dipped noticeably again in 2011 as a result of cyclical economic trends. During the six-month winter period of 2011/2012 the German economy was relatively sluggish and in some areas even entered a recession. The optimistic economic forecasts for 2012 have therefore been put on hold. German economic output did pick up again in early 2012 and the various economic research institutes began to point to a recovery in the national economy. And yet growth predictions for 2012 remain modest at 0.9 %. The high energy prices, which have been caused by the cost of the energy switchover, and the potential shortages in industrial commodity supplies, can both be seen as economic risk factors.

Germany's energy and raw-material supplies continue to be very much reliant on imports. In 2012 the country will be nearly 70 % dependent on imported supplies of primary

energy, while in 2011 the coal market was 80 % import based, this being attributable to the decline in domestic coal production.

In 2011 the individual fuels contributed as follows to German electricity production: solid fuels accounted for about 45 % – with lignite providing 25 % and coal 19 %, of which one quarter was produced by German collieries. This placed coal ahead of gas, with oil taking third spot. All renewables combined accounted for some 20 % of the market.

For German consumers – households and companies alike – rising prices on the German energy market are becoming a growing problem. And for the energy-intensive industries (chemicals, steel, aluminium, metals, cement and paper) the high energy costs are proving to be a distinct locational handicap. According to calculations by the Federal Ministry of Economics and Technology (BMWi) primary-energy costs in 2011 totalled € 124 bn, a record figure that was 20 % higher than the previous year. Contrast this with the € 1 million in aids to disposal that the German coal industry received in 2011, a figure that is being reduced year on year.

According to provisional figures global coal production increased to nearly 7 bnt in 2011, which was 3.5 % up on the previous year. About 88 % of this (6.1 bnt) was steam coal and 12 % (0.9 bnt) coking coal. World coal production in 2011 was therefore nearly twice as much as that recorded in 1990, with China – the largest producer – accounting for 52 % of the total.

China was also the largest consumer of coal, taking up some 55 % of the total world output. Coal production in North America fell slightly by 0.6 %, with consumption declining more significantly at -3.6 %. This was caused by the increased production and consumption of unconventional gas in the USA, most notably shale gas. Coal production in Australia also fell by 2 %, this being due to the heavy rainfall and resulting flooding that affected Queensland at the beginning of the year. And output in EU-27 was also down on the previous year, while consumption rose by more than 7 %. EU coal production is expected to continue to decline in the long term, not least because of environmental policy measures.

The European Emissions Trading System (ETS), which will enter its third trading period on 1 January 2013, is just such a measure. After that date there will be no more free emission allowances for electricity production and power station operators will be obliged to buy-in the allowances they require. The new regulations for the allocation of emission allowances, and their sale by auction, is designed to bring much greater harmonisation to the emissions trading system on a Europe-wide basis. Over the previous years the lower price of $CO_2$ allowances has so far failed to make any significant progress in the implementation of the CCS strategy (carbon capture and storage).
The German energy market continues to be dominated by the reorganisation of the German energy supply system. This was initiated by the political decisions on an accelerated phasing-out of nuclear energy and the energy package of the summer of 2011. The Federal Network Agency believes that this will pose a serious risk to security of electricity supplies – over and above the impending 'grid squeezes'. In order to head off this problem a number of older, conventional power stations will have to remain in operation for longer than planned and some ongoing fossil-fuelled newbuild power station projects are now destined to become reality. Modern gas and coal-fired power stations will also be needed to absorb grid fluctuations and provide the capacity needed to meet base load demand. These stations will therefore perform a bridging function to provide back-up for fluctuating renewable energies and support their marketability.

The following scenario is therefore a foreseeable reality: the energy switchover will lead to further changes in the energy landscape. In the meantime there are few if any plans for new coal fired power stations in Germany. Eight such installations are currently under construction and one more has been approved, while a further three are still going through the approval process and one is at the project design stage. Legal and political obstacles, and the efforts of local opposition groups, are even slowing down the completion of ongoing newbuild projects.

# Status assessment: German coal

## Macroeconomic conditions

Energy and energy-policy determinants obviously have a huge effect on the economic situation of the German coal industry and the company responsible for it, namely RAG. And they also play a crucial role for the prospects of Germany's most important coal-fired power producers, such as STEAG GmbH. These macroeconomic conditions additionally impact on the various business segments involved. The consumption of steam coal and coking coal, and the development opportunities open to other coal-based activities, are also determined by the fluctuating economic climate and the direction of economic policy.

This was clearly demonstrated by the deep recession of 2009, which saw gross domestic product (GDP) shrink by about 5 %. It was then that coal consumption in Germany fell to its 'century low' of 51 mt ce. In the two years that followed the German economy then achieved relatively strong GDP growth rates of 3.7 % (2010) and 3.0 % (2011) as a result of economic stimulus programmes and the strong recovery of the global economy. Exports in particular experienced a real boom, with this sector now accounting for about half of German GDP. Domestic coal consumption in 2011 also recovered to a figure of 57.5 mt ce, though failed to reach the level of the pre-crisis period. A similar consumption rate is expected in 2012. In Germany too economic activity slowed down again in the winter of 2011/2012, and even went into recession in some areas, and so the initially optimistic forecasts for 2012 had to be withdrawn. Coal consumption also tailed off significantly. In the first months of 2012 German economic output then temporarily recovered again, with the economic research institutes once again referring to the German economy being 'on the rebound'. Yet overall their economic forecasts for 2012 remained fairly modest at 0.9 %. In the summer of 2012 there were again further signs of a return to recession.

With its spring forecasts for 2012 the Federal Government has deliberately retained a 'cautious approach' and has kept its growth estimates down to just 0.7 %. Any stronger growth dynamic following this 'dip in growth' is not expected until 2013. However, the risk of Germany going into recession was fairly limited by mid-2012, even though the business climate for German industry was again on the decline. Nevertheless, many experts continue to see development as being 'on shaky ground' (Macroeconomic Policy Institute) with significant downward risks, particularly the macroeconomic uncertainties and contagion risks associated with the continuing financial and economic crisis in the eurozone. The relatively high energy prices and possible squeeze on supplies of industrial commodities are also proving to be real economic risk factors.

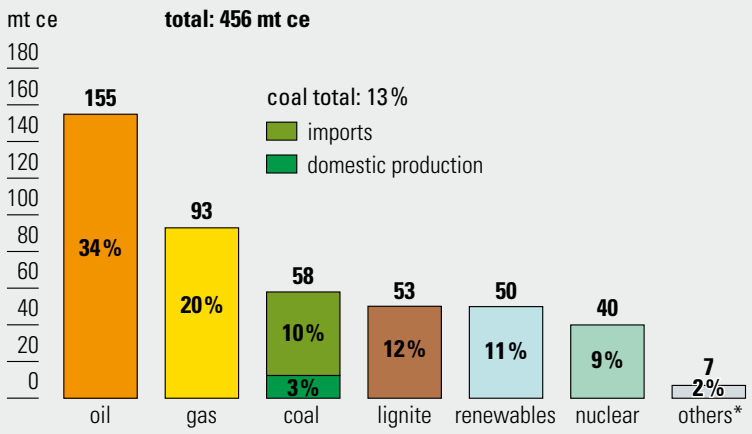
Stable macroeconomic development is not just crucial for the market perspectives of most companies, including the coal industry. It also determines the success of efforts aimed at consolidating the state finances without social upheaval or having to forgo future investment and, moreover, is key to the continuing positive development of the German job market. In 2011 the employment situation in Germany reached a new record high with a working population of over 41 million. Here it should also be noted that only about two thirds of those officially registered as employed benefit from fully-fledged social security provisions (28.4 million). Almost one quarter of all jobs in Germany now fall into the low-wage sector. In 2011 the number of registered unemployed in Germany fell to 3.0 million (unemployment rate of 7.1 %) – with the Federal Employment Agency reporting an 'underemployment rate' of 3.8 million. According to forecasts for 2012 and 2013 the official jobless figures could fall to as low as 6 % if economic developments prove favourable. However in regions affected by structural problems, which especially includes the Ruhr area following the run-down of the coal mining industry, unemployment still stands at over 10 %.

Germany therefore has still some way to go before reaching the ultimate goal of full employment. And in some of our EU partner countries, particularly those in the eurozone, unemployment is now much higher than in Germany, a development that is partly driven by conditions of recession tending towards depression. All the more important, then, that the Community develops and introduces a European anti-crisis strategy capable of providing growth, employment and prosperity for all its citizens.

## Energy consumption, energy mix and energy costs

The German economy is fundamentally reliant on the export sector more than in other major industrialised country. 2011 was the first year in which more than half of our GDP was generated by export sales. By contrast, our energy and raw-materials supplies continue to be very much dependent on imports. As in 2011, we are also expecting to be nearly 70 % reliant on imported supplies of primary energy supplies in 2012. Because of the run-down of the indigenous mining industry coal deliveries were even more heavily import based in 2011, with 79 % of supplies being sourced abroad. And the politically determined closure of the German coal industry in 2018 means that coal consumers will be completely dependent on solid-fuel imports from 2019 on. For oil and gas, the two fuels that have come to dominate the national energy mix, import reliance has always been much greater than in the case of coal. With the foreseeable exhaustion of conventional indigenous reserves sometime around 2020 these two fuel sectors could also become 100 % reliant on imports.

**Primary energy consumption in Germany 2011**




Source: AGEB, 3/2012

* incl. elec. exchange balance

The Federal Government heralded in the national energy switchover by introducing its Energy Plan 2010 and then accelerated this process with a raft of energy measures that were agreed in 2011 following the Fukushima incident. This change in energy policy not only comprises the phasing out of nuclear power (by 2022) but also includes, as a more long-term measure, the abandonment of fossil fuels and their replacement by mainly, but not exclusively, domestic supplies of renewables-based energy. For the time being there will therefore be little change in that our primary-energy supplies will continue to be mainly based on oil, gas and coal – and this primarily means imports. This situation is set to persist for some time to come and bring with it price and availability risks.

According to provisional calculations by the Working Group on Energy Balances (AGEB) German primary-energy consumption (PEC) in 2011 was 456.3 mt ce. This was some 5.3 % down on the previous year's figure and the lowest consumption rate since 1990. This was primarily attributable to the mild weather and the resulting fall in demand for heating fuel. But it was also partly caused by the economic effects of higher energy prices, which tended to curb consumption, along with the energy-statistical impact of the politically determined

partial closure of German nuclear energy capacity and the incentives being provided for the expansion of the renewables sector. Macroeconomic energy productivity (GDP/PEC) rose exceptionally strongly in 2011, recording an increase – after adjustment for one-off effects – of about 3 %. This was twice the long-term average. The decline in PEC has also seen a further reduction in Germany's energy-related $CO_2$ emissions, which have now fallen by 24 % since 1990. Germany has therefore exceeded its Kyoto commitment in this regard.

Mineral oil continues to have the largest share of PEC within the German energy mix. Gas is some way behind in second place, while coal occupied the third spot in 2011 with nearly 13 % of the market – although indigenous coal only made up about one fifth of this. German-mined lignite, which accounted for 12 % of the national energy mix, was in fourth place. In 2011 the fossil fuels were therefore still supplying almost 80 % of German PEC. The $CO_2$-free energy sources (renewables and nuclear), which now tend to dominate the energy policy debates in Germany, taken together still account for just 20 % of the market.

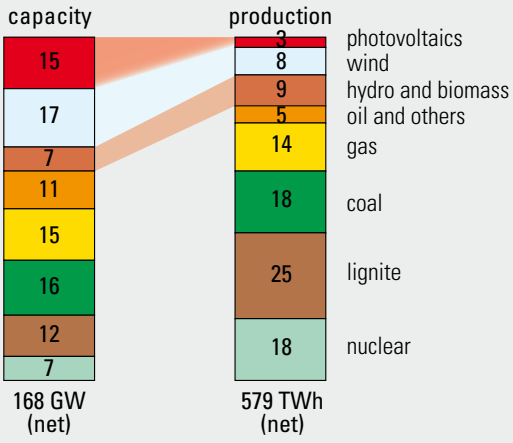
Fossil fuels also accounted for two thirds of the German power generation market (gross electricity production in 2011 was just below 615 bn kWh), well ahead of the contribution made by renewables (20 %) and nuclear power (18 %). In 2011 45 % of all electricity was generated at solid fuel-fired installations, making coal and lignite the main pillars of German power production. The largest single contributor was lignite (25 %), with coal – of which one quarter or more was supplied by German mines – occupying third spot with a 19 % share of the power generation market, clearly ahead of gas and far outstripping oil (which only has a 1 % share) and other sources (incineration plants, etc.). The electricity foreign trade balance was once again in surplus in 2011, although this was indeed lower than that of previous years. The exception was imported electricity from France, which increased by a third in 2011. Generally speaking, electricity imports are expected to go on rising in the years ahead.

Fossil fuels, including coal, also dominate the domestic primary-energy production sector. Of course the significant expansion of renewable-energy production in recent years has tended to limit further increases in the already-high reliance on imports for meeting PEC needs. But renewables' contribution to the indigenous energy production sector, amounting to 35 % in 2011, was only about half that of all the other home-produced fuels. This area was dominated by lignite (39 %), followed by indigenous oil and gas production (12 %) and German-mined coal (9 %), whose contribution in 2011 was still greater than that of wind power (4 %) and solar energy (2 %). Incidentally, bio-energies (biomass, biogas and biofuel) still account for about three quarters of total renewable energy production and therefore make a far larger contribution than wind and solar power.

The public is often left with an all too vague conception of these matters, and this applies not just to the consumption and production structures of German energy supply and the challenges this poses for security of supply. It has also become increasingly apparent in recent months that our energy supplies are becoming ever more expensive. The rising cost of fuel oil, motor fuels and electricity is already making 'energy poverty' a crucial issue for low-income consumers. And for the average household too energy costs have become a significant factor, representing more than 7 % of net income. High energy costs pose particular locational problems for energy-intensive industries (such as chemicals, steel, metal and paper manufacturers). According to calculations by the BMWi (Federal Ministry of Economics), just procur-

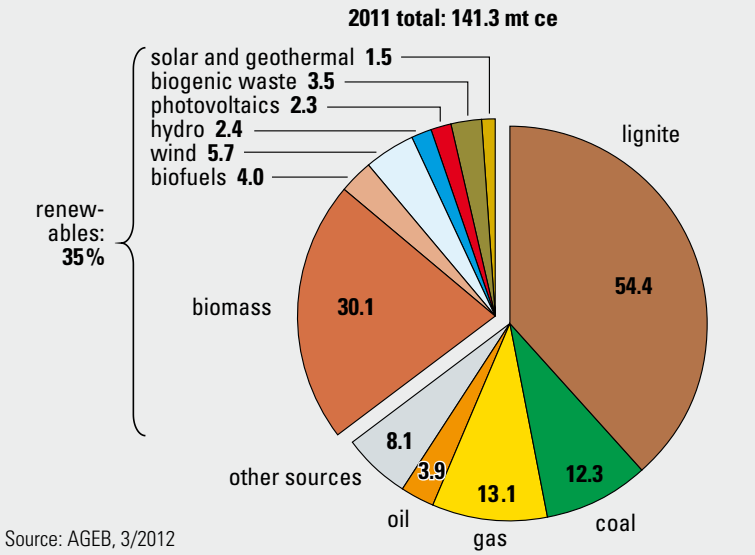
**Power station capacity and electricity production in Germany 2011**

shares in %




Source: BDEW, 2012

**Primary energy production in Germany 2011**



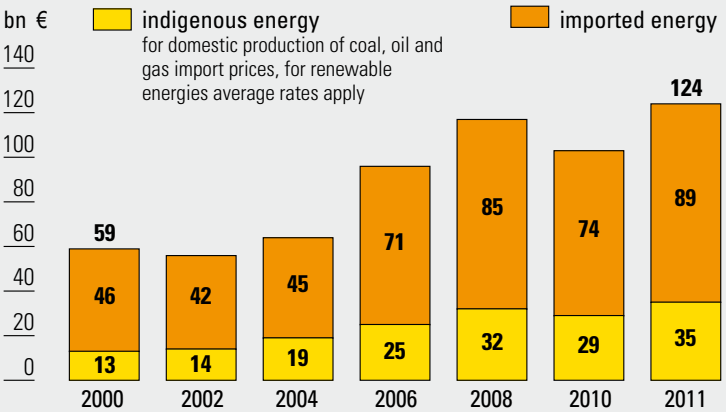

Source: AGEB, 3/2012

ing primary energy cost German industry a record € 124 bn in 2011. This was some 20 % more than the previous year's figure and even exceeded the previous peak set in 2008 when the world markets were hit by a series of price explosions. Much higher world market prices for fuels, and particularly oil, have also been driving costs in recent months. This has been compounded by the inflationary developments on the domestic energy markets, especially the price burdens imposed by the Government on energy and electricity consumers. State taxes now account for more than 50 % of the cost of petroleum products, while for electricity the figure has now reached 45 %.

Taxes and duties on electricity now bring in nearly € 24 bn – ten times more than just 15 years ago. Of this € 14 bn or more is used to promote renewables-based feed-in electricity. Compare this with the € 1 bn in aid to disposals that the coal industry received in 2011, a subsidy that is still being reduced year on year. The German mining supplier industry is increasingly active on the international markets. In contrast to the subsidy system that has been set up for renewables, German cost pressure has helped bring about a technically unparalleled and internationally competitive development of the entire mining technology process chain.

The German energy switchover must of course provide us with an energy supply that is not only environmentally sustainable but also affordable. Yet in the near term at least we are threatened by considerable additional cost burdens. According to the latest estimates the cost to the economy will have totalled € 170 bn by the end of 2020 alone. This is about twice as much as Germany would have to write off in the event that Greece leaves the European monetary union.

**Cost trends for the provision of primary energy in Germany**



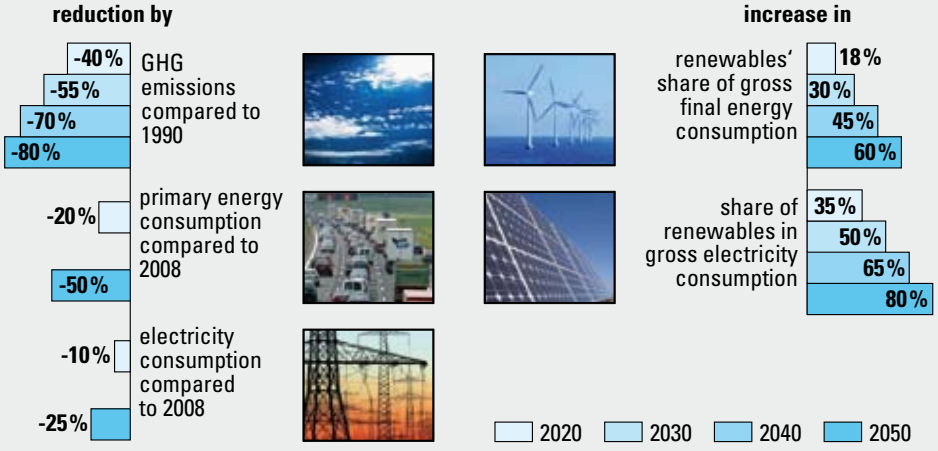

Source: BMWi, 'The energy switchover in Germany', 2012

## Energy switchover and outlook for the German coal market

When it adopted the 2010 Energy Plan the Federal Government set itself some very ambitious, long-term energy and climate-policy targets. The Plan aims to achieve a massive reduction in national greenhouse-gas emissions (a reduction of at least 80 % by 2050 and by 40 % by just 2020, compared with 1990 levels). At the same time energy consumption is to be cut significantly by way of improvements in energy efficiency (which is to be increased by 20 % by 2020 compared with 2008 efficiency levels). This is all designed to pave the way into the age of renewable energies. Their contribution to total energy consumption, which currently stands at 10 %, is to be increased six fold by 2050 (and tripled by 2020), while their share of the power generation market, currently 20 %, is to be quadrupled by the 2050 reference date. By that time fossil-based energies will not feature significantly in our energy supply make-up.

The 2010 Energy Plan initially assigned nuclear power the role of a bridging technology into the age of renewables. However, the recent decisions to speed-up the withdrawal from nuclear energy, and the Energy Package of the summer of 2011, have now given a new impetus to the German energy restructuring programme and provided it with a new set of priorities. Now modern gas and coal fired power stations are set to take over the bridging function for electricity generation and to some extent also provide cover for base-load requirements. These installations will also increasingly be used as backup and balancing capacity. The Energy Plan contains more than 120 individual measures that are to be introduced on a step-by-step basis.

**The German Energy Plan – long-term objectives**




The Government has also agreed on a monitoring process to run alongside the energy switchover that is designed to oversee the implementation of the various projects. The first status report is to be submitted at the end of 2012, and then every year thereafter. A progress report will also be issued every three years, beginning in 2014, that will also provide a strategic assessment of events. An expert committee will be set up to support the monitoring process and close dialogue will be maintained with the key players (network platform, power station forum, renewable energies platform, etc.). While this monitoring approach will at least supply a wealth of current data on energy-related activities, there is still some real political debate ongoing as to whether or not the monitoring system will be sufficient. Some federal states are calling for a 'master plan' to be developed jointly by the federal and state governments and it has now been arranged that regular discussions will be held at joint Government-Laender energy summits. The IG BCE (Mining, Chemical and Energy Industrial Union) has initiated its own 'support process', which also includes the new 'Innovation forum for the energy switchover'. The Federation of German Industries has recommended the establishment of a systematic 'project management' and has called for an energy switchover conference. Various experts have been commissioned to submit solid proposals in this direction that will also define key milestones in the implementation process. There are also proposals for an indicator system that will detail the achievement of the energy policy objectives. This will provide

a means for examining and ensuring consistency between each of the three central energy-policy objectives: environmental sustainability, economic viability and security of supply. There have to date been some serious problems to overcome, not least in meeting the last two of these policy targets. This has become all too clear with rising energy prices and costs and with the three 'near miss' blackouts of the winter of 2011/2012. Given the discrepancy between the tough demands that have been set and the complexity of the whole issue Federal Chancellor Merkel admitted in May 2012 that the energy switchover was proving to be a 'Herculean task' for German policy makers.

By the summer of 2012 it was clear that the implementation of the energy switchover had not yet succeeded in a number of areas. While the expansion of the renewables sector, which is being subsidised by electricity prices via the EEG (Renewable Energy Sources Act), has in a number of respects certainly progressed more quickly than expected, the required expansion of the grid system and conventional reserve capacity has so far failed to maintain the same pace. As recently as the beginning of this year the Federal Network Agency reported a massive backlog in the grid expansion programme. Of the some 1,800 km of high-voltage transmission lines planned since 2009 only 214 km have so far been completed and a mere 100 km actually put into service. According to estimates by dena, the German Energy Agency, the energy switchover requires a grid expansion on at least twice this scale.

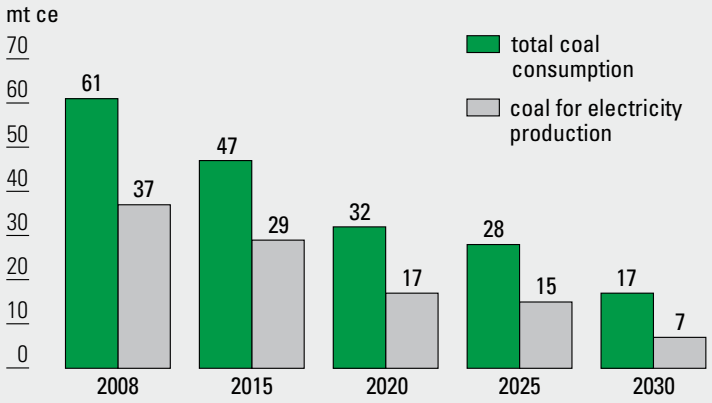
*West Mine in Kamp-Lintfort*

The deadlines for the grid expansion programme to 2020 are therefore unlikely to be met, despite an intensification of efforts to develop the grid infrastructure and the introduction of a first national network development plan.

And aside from the threat of 'grid squeezes' the Government is now applying pressure for all power stations to remain in operation in order to ensure security of electricity supply in the short term. Moreover, the current fossil fuel-fired newbuild projects in the 10 to 12 MW category, including a number of coal fired stations, will soon have to go on stream in order to provide supply security over the medium term. Even the Institute for Applied Ecology shares the Federal Network Agency's concerns about possible supply shortages. What is more, the national regulatory framework needed for investments still has to be clarified in a number of key areas, ranging from storage technologies through to the energy refurbishment of buildings. If we are to retain the compulsory feed-in of renewables-based energy we will also have to take various decisions relating to the design of the so-called 'capacity markets' in the power station sector. And further clarification would also appear necessary in other areas, including the coordination of energy policy measures between the Government and the Laender and the relationship between the national energy switchover and the EU institutions and European partner countries, particularly in respect of the future renewable energies policy.

A McKinsey study on the energy switchover published in 2012 considers it likely that Germany will continue to take the lead in climate protection at international level. However, the study points out that the actual 31 % cut in emissions falls way short of the national $CO_2$ reduction target of 40 %, even assuming the effective implementation and acceleration of the measures currently in place, such as all the offshore wind farm projects. One key factor

**German coal market projections to 2030 according to '2011 energy scenarios'**




Sources: Prognos / EWI / GWS

is that electricity demand will not fall by 10 % between now and 2020 but will in fact increase by around 24 % – and this against a background of increasing risk of power cuts and a real increase in electricity prices of about 10 %. The cost of the energy switchover (development of renewables and expansion of the electricity grid system) for companies and private households, according to McKinsey, will increase by 60 % by 2020 to a total of € 21.5 bn a year.

It is conceivable that the energy switchover will lead to further upheavals in the energy landscape and, as well as some winners, will also 'produce' quite a few economic losers. In Germany, a mining country of long tradition, one of the main losers will be the coal industry, unless new policy orientations come into play that can improve its prospects. As a particularly cost-effective base-load energy resource, lignite appears likely to profit in the short and medium term from the energy switchover, and more specifically from the nuclear phase-out. This is borne out by the recent increase in lignite consumption. For German coal, on the other hand, the downward trend is predictable. Coal consumption, which is primarily concentrated on medium-load installations, has recently been coming under noticeable pressure in its main operating sector, namely power generation. This can be attributed to the priority feed-in accorded to renewables – a situation that is likely to persist for the foreseeable future. The Renewable Energy Sources Act has fundamentally altered the price and load curves that apply in the German electricity market. For conventional power stations this has essentially placed a cap on the midday peaks and hence on essential profit margins. Germany is not at the moment planning to build a single new coal fired power station and the few newbuilds currently under way are being slowed down by legal, political and lobby-group resistance.

Coal consumption for steel production tends to fluctuate with the structural and cyclical trends affecting the German steel industry and for this reason its prospects are limited and trending downward. In the heat sector the coal industry has for many years only been able to supply a market niche. The German Government's 2010/2011 energy scenarios have already pointed to a severe contraction of the German coal market in the period to 2020 and 2030. The EU's long-term decarbonisation scenarios (Energy Roadmap 2050 etc.) point in a similar direction.

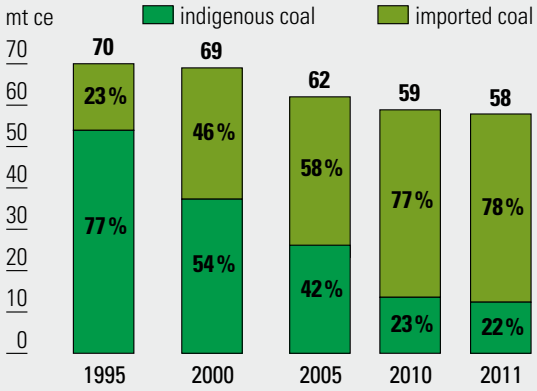
The framework conditions for coal-based power generation are essentially changing in respect of the feed-in priority granted to renewables, the emissions trading system, $CO_2$ utilisation and the safeguarding of coal-based generation capacity. However, the latter is unlikely to happen as long as the restructuring of the national energy supply system is weighted in favour of climate-policy targets and, from a sectoral viewpoint, remains focussed on the power generating sector and the power infeed of renewables. Restructuring should instead also be directed towards the replacement of oil and gas by renewables – in other words replacing those fuels that are in shortest supply both globally and here in Germany too. What is more, these resources are to a large degree concentrated in some of the world's most politically unstable regions. To this end the energy switchover should also be given a higher priority in the heating and transport sectors.

## Coal policy decisions

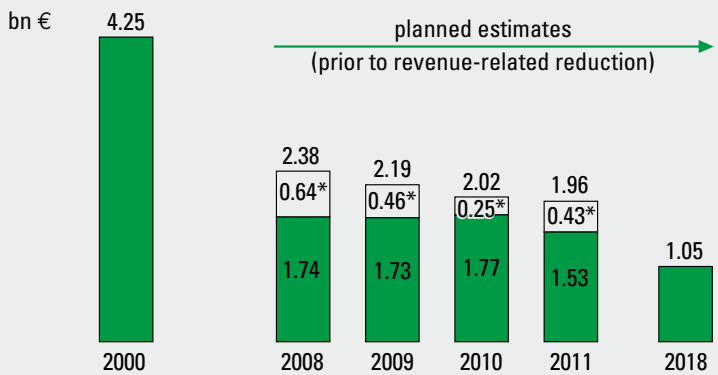
In any case, the energy scenarios for the period after 2020 no longer have a place for subsidised German coal. In line with Government policy, the coal industry is to be phased out until the end of 2018. The 2010 Energy Plan also includes the provision that 'the subsidised production of indigenous coal will end in accordance with European and national regulations'. The closure of the coal industry became irreversible with the entry into force, on 1 January 2011, of the Council Decision on State aid to facilitate the closure of uncompetitive coal mines (2010/787/EU) and the Bundestag's (German Parliament) decision in the summer of 2011 to delete the 'review clause' from the Coal Industry Financing Act. This cancelled the original provision that required the German Bundestag to re-examine the energy-policy aspects of the coal-industry closure decision in June 2012. To this effect, and following a detailed examination, the European Commission gave its approval at the end of 2011 for aid to be granted without restriction to cover the cost of the German closure plan up to 2018. In issuing its approval the Commission was giving official recognition to the German mine closure plan.

This has done much to pave the way for the reliable, orderly and socially responsible run-down of the mining industry. It means that the restructuring process that has been under way in the German coal industry for many years, and the resulting structural changes that have been taking place on the German coal market, can now be continued right through to the end. This year's Annual Report outlines the main social and bargaining instruments that are being used to support the downsizing process. Yet some problems may still lie ahead for the socially responsible restructuring and closure process. This includes the political efforts under way to amend the existing and well-proven Mining Law. While the demands being made are not primarily directed at the coal industry, they could however affect its planning basis and its limited financial framework by way of additional cost-impacting constraints, such as new mining royalties.

**German coal market: consumption of indigenous and imported coal**




**Reductions in state aid to the German coal industry**
(aid for disposals and closure): phasing-out production until 2018



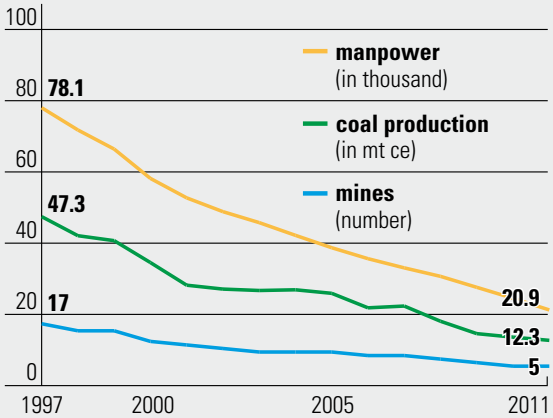

* revenue-related reduction

Until 2008 as in the 2003 coal-policy agreement (not considering deferred payments);
as from 2009 planning estimates according to the 2007 framework agreement;
from 2019 no state-aid.

## Corporate development

The mining division of RAG will continue to make its reliable contribution to the nation's energy supply until subsidised coal production ceases at the end of 2018. Local mining conditions, delivery commitments and the legal provisions of the Coal Industry Financing Act, approval notices and coal industry guidelines all create the framework for our corporate activities and the strict cost discipline that applies within the German coal mining industry. In recent years the industry has not even had to take up a part of its allocation of approved coal aid (in 2011 this part amounted to over € 400 million). In 2012, however, the relatively sharp drop in import prices has done much to restrict the industry's capacity for further actions of this kind.

**Adaptation in the German coal industry**




as at end of 2011

German coal production in 2011 totalled 12.3 mt ce, which was 0.8 mt short of the previous year's figure. This was mainly due to the loss of Ost mine in Hamm, which closed on 30 September 2010. The mining workforce also shrank to below 21,000. The targets set out in the current business plan provide for a further reduction in output to around 11 mt and a continued downsizing of the workforce to below the 18,000 mark.

While no collieries closed during the course of 2011, it was decided that Saar mine in Ensdorf would cease production on 30 June 2012 as a result of the earth tremors that struck the area in February 2008. This date does not just mean the termination of coal production at Ensdorf, for with the shutting of the workshops at Hirschbach and other RAG sites in the region it marks the closure of Germany's second-largest coalfield and the end of a mining industry rich in traditions and history. Our guest contribution (pages 19 to 24) marks this occasion by tracing the eventful history of the Saar coalfield over some 250 years and paying tribute to the contribution it has made to the welfare of the Saarlanders and to the development of techniques and machines for the coal mining industry.

The closure of West mine in the Ruhr coalfield on 31 December 2012 will also mark the end of our operations in the Lower Rhine area, which has a history of coal mining dating back more than 100 years. Our Annual Report 2013 will cover this event in some detail.

From 2013, therefore, the German coal industry will be concentrated exclusively on the North Rhine-Westphalia region and will comprise the two Ruhr mines – Prosper-Haniel in Bottrop and Auguste Victoria in Marl – and Ibbenbueren mine in the northern Muensterland.

It was in response to these political decisions that RAG introduced a change of strategy at the end of 2011. After 2018 the company will switch from producing coal to managing the industry's inherited and long-term liabilities. This will include dealing with mining subsidence problems and issues involving old mine workings, as well as the key area of mine dewatering and drainage. This involves dismantling a number of operating areas previously connected with coal mining operations and developing new business units – a process that will continue even after all mining activities have ceased.

One of these business areas is already covered by RAG Montan Immobilien GmbH, which has now had more than 30 years experience in the redevelopment and reutilisation of land and buildings left over from the mine closure programme. The company not only assumes sustainable responsibility for its own real estate and buildings but is also under an obligation to look after some 12,000 hectares of land in the

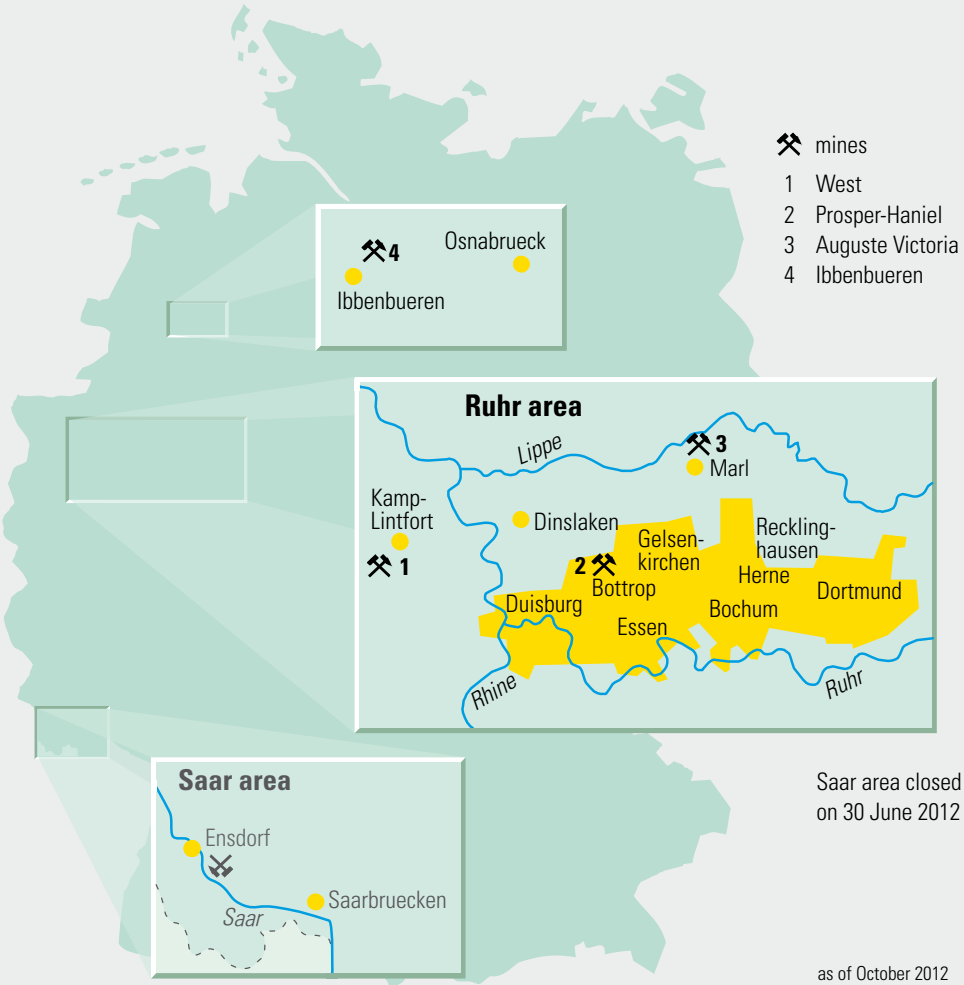
Rhine, Ruhr and Saar areas that are part of the property portfolio of the entire RAG group. As well as developing new residential districts and recreational facilities RAG Montan Immobilien is also creating the basis for attracting new businesses and is therefore supporting structural change in the coalfield regions. The company displayed some entrepreneurial endeavour of its own by relocating its head office in March 2012 to the Zollverein industrial complex in Essen, which is now a UNESCO World Heritage Site. RAG Montan Immobilien has teamed up with the site's co-owners, the Zollverein Foundation and NRW.URBAN, to ensure the ongoing development of this complex, which has a total potential of some 23 hectares.

RAG is also increasingly looking at the development of former mining sites with an even more forward-looking aim in mind. Biomass, solar energy, wind power, geothermal energy and the exploitation of former mining infrastructures above and below ground now form the basis for harnessing a whole range of renewable energy sources (see also 'Coal and the environment' in this Report).

Another business segment that has emerged from the mining sector is the international marketing of the extensive body of mining know-how and the large quantity of plant and machinery that is no longer required as indigenous coal production is gradually cut back. These marketing activities have been successfully managed by RAG Mining Solutions GmbH since 2009. The transfer of German mining expertise is now increasingly proving to be a viable business model, not least in areas connected with health, safety and the environment. In order to be able to respond to the growing interest from various market players RAG Mining Solutions has now set up subsidiaries in China and Poland. In this way the German coal industry is also making a responsible contribution to know-how transfer in the field of health and safety protection.

The RAG Group acquired a majority

**Coal mines in Germany in 2012**



*New company headquarter of RAG Montan Immobilien GmbH*

51% holding in RAG Verkauf GmbH on 1 August 2011. The complete transfer of the remaining 49 % of the company's shares, which are still held by Evonik Industries AG, will take place as agreed on 1 January 2013. The marketing of coal and coke has been the core business of RAG Verkauf and its predecessor companies since 1953 and the sale of steam coal and coking coal from RAG-operated collieries currently forms the company's main focus of activity. RAG Verkauf GmbH also supplies both German and imported coking coal to the Prosper coke works in Bottrop, which is now owned by the ArcelorMittal group. In addition, the company is responsible for marketing the coke and tar and gas by-products produced at the plant. RAG Verkauf also sells part of the mining refuse generated as a by-product of coal production and is also involved in fuel and recyclables processing via its affiliates and subsidiaries.

As well as RAG and its subsidiary companies the German Coal Association (GVSt) can still count among its members the Essen-based STEAG GmbH, which is Germany's fifth-largest electricity producer. STEAG has been involved in coal-based power generation for 75 years and has now undergone a successful relaunch after the public utility consortium Rhine-Ruhr acquired a 51 % majority holding in the company from previous owners Evonik Industries in 2011. STEAG's core business is currently based on power station electricity generation and CHP (combined heat and power) operations. The company is engaged in the planning, construction and operation of large power stations – including various international projects as an independent power producer in Turkey, the Philippines and Colombia – and also operates some 200 mine gas-fired thermal power plants here in Germany. STEAG continues to take a lead in the development of efficient, resource-friendly technologies for coal-based power generation. It is also one of Germany's leading importers and distributors of coal. In addition, the company is a major provider of district heating in North Rhine-Westphalia and its Saarland operation is one of the largest integrated district heating grids in the country. Indeed the company's enduring regional links with Saarland are borne out by the fact that the area is also home to the headquarters of STEAG subsidiaries STEAG Power Saar GmbH and STEAG New Energies GmbH.

# *Guest contribution – RAG Aktiengesellschaft:*
# ***The closure of the Saar coalfield***

**The Duhamel landmark –**
**design: Katja Pfeiffer and Oliver Sachse, architects, Berlin**
**visualisation: Studio/Aida, Wiesbaden**
**client: BergbauErbeSaar (Society for the preservation of the legacy of the mining industry and miners at the Saar)**

# The closure of the Saar coalfield

by Dipl.-Ing. Friedrich Breinig*

It was nothing less than the end of an era that was marked in Saarland by a ceremony held at the Duhamel shaft in Ensdorf on 30 June 2012: a farewell to the Saar mining industry after some 250 years of industrial coal production that has had such a lasting impact on the economic and cultural life of the area and people in this south-western corner of Germany. 'It will not be an easy day, but together we will work the final shift with a sense of pride!', said Saar mine chief, Friedrich Breinig, as he summed up the collective mood of the Saar mineworkers in front of some 400 invited political and community representatives. Thousands of visitors, local residents and employees attended a 'last shift' at the mine and in the evening the church bells sounded throughout the region to spell the end of the Saar mining industry. The significance of the occasion had been recognised two weeks before in a symbolic act performed by the Saarland Government when Saarland's Minister-President Annegret Kramp-Karrenbauer summoned her ministers to a cabinet meeting at mine horizon 24 some 1,712 metres below ground. She acknowledged the outstanding achievements of the local mining community and RAG, which in 1998 had taken over management of the Saar mining industry with the unification of all mining operations in the Rhine and Ruhr areas under Deutsche Steinkohle AG. Over the course of


*The RAG orchestra at Saar coalfield provided for a dignified farewell of the Saar coalfield closure*

* General Manager of Saar mine and RAG regional manager for Saarland, Ensdorf

the previous 250 years the Saar miners had produced 1.5 bn tonnes of coal – the raw material for industrialisation, for war, for national reconstruction after devastation and the economic motor for the Saar and beyond. In the 1920s more than 210,000 people earned their living directly from the Saar coal industry. Tens of thousands of jobs at steel works, coke works and power stations also depended on coal mining. The development of Saarland's infrastructure – roads, electricity systems, water supply, district heating grids and housebuilding – is inconceivable without the coal industry, which for many years was the biggest employer, purchaser and training provider in the entire region.

## Historical development

The closure of Saar mine – foreseeable since the political decisions contained in the Coal Industry Financing Act of 2007 and accelerated by the earth tremors of February 2008 – has marked the end of mining in the oldest recorded coalfield on German soil. As early as 700 B.C. the 'Heinitz Celtic Mine' was extracting coal as a natural resource from the Tauentzien seam that outcropped at Neunkirchen-Heinitz, as shown by cannel-coal burial objects found at Celtic burial sites. Coal remains found at Roman dwellings in Saarbruecken, Brebach and Beckingen confirm that the Romans too practised coal mining in this part of the province of Germania.

The shallow 'free diggings' in the Saar coal forest were eventually closed down by the local rulers who filed mining claims to the resources in the 14th and 15th century. Actual nationalisation then occurred in 1751, when Prince Wilhelm Heinrich of Nassau-Saarbruecken secured access to the coal mines and workings by 'confiscation' and followed this up in 1754 by applying a 'general reservation of title'. From then on penalties were imposed on private prospection or mining activities and coal mining then came under central state control for the next 250 years – something quite unique to Europe.

A centralised mines administration marked the start of 'artful', systematic and efficient coal mining in the Saar. In 1766 there were twelve pits in the Saar coalfield. Seven years later 141 miners were producing 21,000 tonnes of coal from 45 drift workings. In 1769, by royal command, the first social class was established in the form of the 'Bruderbuechse' brotherhood – the forerunner of the Saarbruecken Miners' Guild. By 1790 coal production had risen to 50,000 tonnes a year. When the Napoleonic revolutionary army marched into the area in 1793 the Saar coalfield came under French control for the first time. Two more phases of French administration were to follow: at the end of the First World War the Treaty of Versailles transferred ownership of the Saar mines in 1920 to the 'Mines Domaniales Françaises de la Sarre' for a period of 15 years, while Saarland was again to come under French control after World War Two when the area was economically integrated with France. In 1807 Napoleon established a Mining Academy at Geislautern near Voelklingen and in 1810 its engineers produced the 'Saar coal atlas', the first large-scale cartographic map of the region's coal deposits. Coal was still not of any great economic significance, but this was soon to change: in 1813 output from the Saar coalfield amounted to 83,000 tonnes, while three years later the 917 Saar miners were producing 100,000 tonnes of coal a year. Following the Second Treaty of Paris in 1815 most of the region's coal mines came under the ownership of the State of Prussia and for the next 100 years or so would be administered by the Prussian Bergfiskus (State Mining Authority). It was a period of rapid industrial development. The widespread introduction of the steam engine allowed coal to be extracted increasingly efficiently from deeper winding levels and then transported to markets via the railway system that developed after 1848 and the Saar coal canal, which was completed in 1866. This was all happening at a time of growing demand for coal, coke and steel. Industrial infrastructure and coal mining were part of an accelerating and self-perpetuating cycle. The first 'rail-company mines' were developed: Heinitz, Reden, Altenwald, Dudweiler and Von der Heydt. Huge coke works were built at the coking-coal mines. The

growing network of collieries, coke works, iron and steel factories and coal-fired power stations became a motor for economic development that was to ensure the livelihoods of tens of thousands and later hundreds of thousands of people. By 1860 the Saar's 12,700 miners were producing 2 million tonnes of coal, a figure that was to double by 1872. The workforce had increased to more than 30,000 by the year 1890, with coal output nearly 6.4 million tonnes, and by 1910 there were 54,500 mineworkers producing nearly 11 million tonnes a year. The Saar coalfield reached its historic employment peak in the mid-1920s when the coal-industry workforce rose to 75,000. The Saar achieved its all-time production record of 16.3 million tonnes in the year 1957.

## Technical achievements

The difficult geological conditions of the Saar coalfield posed significant challenges that the miners and engineers were able to meet by a process of continuous technical development. Though the coal plough was invented in the 1940s by a miner from the Saarland, and then developed to production-ready status in Ibbenbueren, it was cutting winning by coal shearer that was to dominate the Saar coal faces as this technology was better suited to the hardness of the Saar coal measures. The development of the drum shearer loader, and its ongoing refinement since the 1960s, boosted face performance significantly. At the same time the introduction of compact and flexible shield supports helped create a much safer environment for face-workers. In the early 1980s full mechanisation was achieved with the integration of winning machine and chain conveyor. The all-automatic coal plough did not come back into play until 2008 when the withdrawal from the Primsmulde workings meant that the Saar had to work thin-seam faces until production finally ceased. Other technical milestones in the history of the Saar coal industry include: the development of shield supports for pneumatic-stowing faces, the introduction of boom-type roadheading machines and tunnelling machines for roadway drivages, the completion of the 1,750 metre-deep North Shaft with its six-rope mine winder in 1987 and the ongoing development and refinement of mine safety technology, including enhanced explosion protection with the SaarEx 2000 mobile explosion triggered barrier. Since 1950 the latest technological achievements from the Saar coal industry have been put on show at the annual 'Saarmesse' trade fair, where high-tech mining products have been impressing international audiences year after year.

For many decades the Saar coal industry served as a technological and economic catalyst for other sectors and the power generating and coke making industries, for example, have benefited hugely from its innovative capacity. The stamping technique that was developed at Fuerstenhausen coke works, and later brought to industrial-scale maturity at the Saar central coke works in Dillingen, was subsequently marketed throughout the world. Contracts worth millions from the Saar mining industry have promoted growth and secured jobs throughout Saarland. This has also created a highly productive mining supplier sector whose know-how and high-tech products are now in great demand all over the world. About a dozen Saar-based mining supplier companies currently maintain business contacts with customers from eastern Europe to South Africa and from South America to Asia.

## Saarbergwerke AG and the integration with RAG AG and DSK AG

In the year 1957, when Saarland joined the Federal Republic of Germany, the French operators 'Régie des Mines de la Sarre', which administered the industry throughout the post-war period, were replaced by a new company – Saarbergwerke AG – which was 74 % owned by the Federal Government and 26 % by the new Federal State of Saarland. In 1958 the Saar coal company comprised 18 collieries and 99 mine shafts and had some 66,000 employees. Yet even then imported coal and cheap oil were creating a sales crisis that forced the company to introduce a programme of mine mergers and closures. When the newly estab-

lished RAG Deutsche Steinkohle AG took over the Saar mines in 1998 the area's 12,000 miners were producing 6.5 million tonnes of coal a year from the Saar's three stand-alone mines. But the process of rationalisation and concentration continued unabated: just two years later the decision was taken to close Goettelborn/ Reden mine and then in 2004 the new Saar mine was created with the merger of the two remaining collieries of Warndt/Luisenthal and Ensdorf. After a serious earth tremor in the Primsmulde south workings in February 2008 RAG then decided to initiate the 'Saar closure plan'. As well as withdrawing from the Primsmulde workings and relocating coal production to other districts this plan was also to bring the final closure of the coalfield forward to 30 June 2012. The social issues connected with the proposals played a key role right from the start and the Saar management was also determined that no mineworkers would be 'cast adrift'. For some 1,350 Saar miners the close-down meant moving to other jobs at collieries in the Ruhr or in Ibbenbueren. This process began in 2010 and will continue into 2013. There is still a huge amount of residual work to complete before then – including the environmentally-sound removal and salvage of valuable equipment and materials from some 57 km of mine workings and tunnels, the installation and long-term provision of a mine drainage and dewatering system and the closure, filling and sealing of five surface shafts,

*The mine fire brigade accompanied the farewell to Saar coalfield closure with lighted torches*

namely Duhamel, South, Prims, Ney and North.

Government and company representatives made it clear at an early stage that RAG will play a key role in helping Saarland tackle the problems of structural change as the area meets a series of challenges both now and after the closure of the mining industry. Even before the closure had taken place teams of land and property developers from RAG Montan Immobilien had begun to analyse the specific conditions prevailing at the various Saar mining sites and to draw up 'after-use plans' in conjunction with the Saarland Government's 'coalfield-sites steering committee'. RAG is currently developing a flagship project for the Duhamel site, in collaboration with the community of Ensdorf and the regional government, and a master plan is expected to be ready by the end of 2012.

Working closely with government departments, local communities and potential investors the aim is to re-develop in an appropriate manner the 800 buildings and some 2,350 hectares of land that were previously part of the Saar mining industry – this will range from the sale of property for commercial and residential purposes and the development, restoration and re-naturing of sites for leisure and recreational use to the establishment of sunrise industries.

A key strategic focus in the redevelopment plans being laid down by RAG und RAG Montan Immobilien involves the drafting of various concepts for the generation of renewable energies. Saarland enjoys a great number of sunny days and its spoil tips and other surface sites would provide ideal locations for photovoltaic systems.

*Waste heap and pit bank of Saar mine in Ensdorf*

In order to develop projects of this kind RAG Montan Immobilien has established the joint venture montanSOLAR GmbH, a joint venture whose first installations are to come on stream before the end of the year. The planned Luisenthal Energy Park will have solar systems operating alongside wind turbines, pumped storage installations and geothermal plants. While biomass is already being produced for the biomass-fuelled Warndt CHP plant, proposals to adapt pumped-storage power station technology for use in underground mine shafts, which will take the potential efficiency of this technology into a new dimension, are still at the drawing-board stage.

The Saar coal industry has made a significant contribution to German reconstruction and continues to provide an innovation impetus for future economic and technological developments. But it also leaves behind a rich cultural legacy. The mining industry has left its mark on architecture, art, music and the daily routines of life, social cohesion and interaction. The BergbauErbeSaar (Society for the Preservation of the Saar Mining Legacy) now plans to erect the Saar Polygon on top of the Duhamel spoil tip in Ensdorf as an unmistakable symbol of the industry's cultural impact. This steel landmark will stand as a tribute to the achievements of the Saar miners – and as a bridge to the post-mining era that has just begun.

# Socially responsible manpower downsizing

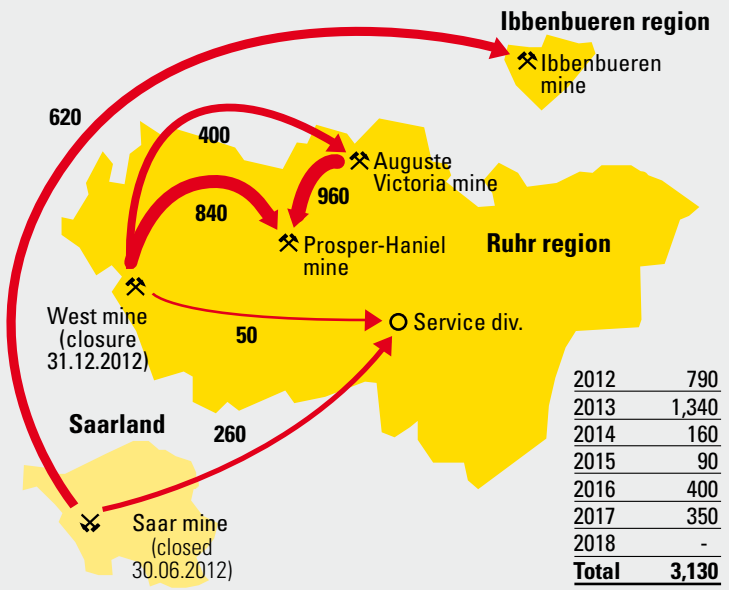
## … a special challenge

When the law amending the Coal Industry Financing Act came into force on 15 July 2011 it effectively deleted the 'review clause' and in so doing decided the fate of the German coal industry, which will now cease to exist at the end of 2018. Previous manpower planning and management activities, which were aimed at maintaining a core mining industry beyond 2018 in the event of a positive review outcome, were therefore rendered null and void and will henceforth focus exclusively on the eventual phasing-out of the coal industry.

The foremost priority from a manpower viewpoint is still to ensure that the downsizing process is conducted in a socially responsible manner – in other words without compulsory redundancies. A key prerequisite for the success of this policy is that current production targets are met in full. Every employee who leaves the industry takes away a body of technical expertise and know-how. The real challenge for the industry's human resources planning therefore lies in ensuring that the remaining collieries and operating sites continue to have access to sufficient numbers of qualified employees. This calls for highly precise manpower planning and training schedules.

The employees concerned will have to embrace change and display exceptional flexibility and mobility.

**RAG: staff transfers 2012 to 2018**




| | |
|---|---|
| 2012 | 790 |
| 2013 | 1,340 |
| 2014 | 160 |
| 2015 | 90 |
| 2016 | 400 |
| 2017 | 350 |
| 2018 | - |
| **Total** | **3,130** |

Source: RAG AG, as of 7/2012

Those who are transferred to other sites as a result of the mine closure programme will have to adjust to longer travel-to-work times, and in some cases will have accept new routines and get to know new working colleagues. The workers at the host mine, for their part, will also be called upon to show a high capacity for integration. This will particularly affect those who worked in the Saar coalfield, which closed down on 30 June 2012. During 2012 some 620 Saar mine workers will transfer to Ibbenbueren mine or to one of the Ruhr pits. A further 260 employees will follow in 2013. Some 130 Saar personnel took this route in 2011 and a total of 3,130 staff relocations are expected to be completed within the coal industry between 2012 and 2018.

Meeting the challenges posed by the personnel restructuring process will continue to require a targeted and coordinated set of statutory, collective-bargaining and contractual regulations and initiatives.

Early retirement has been and will be an important instrument for the socially responsible downsizing process. The legal framework for this will continue to be based on the transition payments system (APG) for coal industry employees that the state legislators introduced in 1972. These transition payments take the form of a monthly-paid financial bridging support that is made available for a maximum period of five years to workers after early termi-

nation of employment and until they first qualify for the pension insurance scheme. All employees who lose their jobs before 31 December 2022 are entitled to receive such benefits as soon as they reach the specified age threshold and period of service.

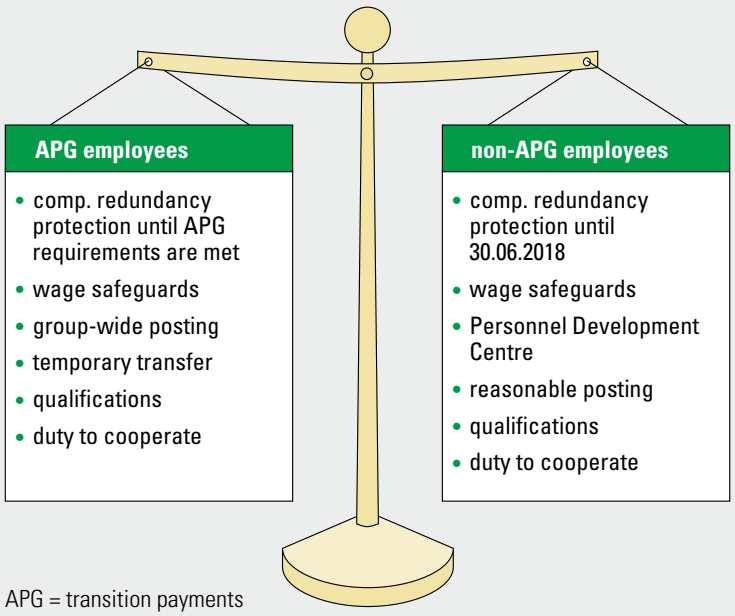
Even if the early retirement potential is exploited to full capacity, the degree of downsizing required between now and the final closure of the industry cannot be achieved without the use of additional instruments. Of the 18,000 employees still on the industry's books at the beginning of 2012, some 1,700 are not entitled to APG benefits. About 500 of this group can, of course, be kept in employment in order to enable the industry to meet its long-term operational commitments after 2018. However, about 1,200 staff will have to leave the industry by 2018 at the latest. The nature of this challenge is such that even the collective-bargaining and contractual instruments that have supported the restructuring process for so long will be unable to guarantee that coal production and manpower downsizing targets can be met in the run-up to 2018. As in the past, the bargaining parties have therefore faced up to their socio-political responsibilities and created a new unified concept that is geared towards achieving these objectives.

## … a unified concept

The basis for this unified concept was laid down in the 'Collective agreement for the planning of socially acceptable personnel measures to facilitate the closure of the German coal industry on 31 December 2018' (in short the 'Agreement on the closure of the German coal industry'). This agreement, which was negotiated between the GVSt (German Coal Association) and the IG BCE, came into force on 1 April 2012 and provided a framework that was fleshed out and supplemented by a balance of interests, a social compensation plan and various works agreements. The provisions that now apply to all permanent employees of the Rhine-Westphalia and Ibbenbueren coal mining industries form a self-contained, overall concept that is designed to balance the interests of all stakeholders in a fair and appropriate way. On one side of the equation these rules guarantee the highest possible level of protection in respect of working conditions and a high degree of social security for both APG and non-APG employees. On the other, employees are called upon to show a high level of flexibility. The rights and obligations of both employee groups are tailored to their specific situation. In their entirety, however, they are evenly distributed and are well balanced in labour law terms.

The collective bargaining regulations are discussed and presented below. The balance of interests, social compensation plan and works agreements are all a matter for the parties involved.

**Balanced labour-law provisions**




APG = transition payments

*Socially responsible farewell: Miner underground*

## … rules for employees with APG entitlement

Employees who are entitled to transition payments (APG) cannot be made redundant under normal operating circumstances until such time as they meet the requirements for the receipt of APG. In return, and in the event of their job ceasing to exist, they accept that they may have to take up another free post in another part of the country, either in the coal industry or at an RAG subsidiary company, and indeed may have to make such a move more than once. Any post that the employee is able to fill after a maximum three-month induction period, or at most a nine-month period of training, can be considered as eligible under this arrangement. Employees must also agree to being transferred for a period of time to another affiliated company or, if this is not possible, to an external employer. Those who transfer to jobs elsewhere are entitled to claim compensation payments in respect of their previous gross monthly income. Where further qualifications are required as a condition of taking up a new post, the employees concerned are obliged not only to attend the training courses but also to contribute actively towards them to the best of their ability.

## … rules for employees without APG entitlement

Special employment protection arrangements are also in place for those who are not entitled to transition payments. In order to ensure that they will be able to find a new job by the end of 2018 at the latest, employees in this category cannot under normal circumstances be made redundant until 30 June 2018 at the earliest.

The primary aim is to ensure that employees have been transferred to new jobs by 2018 and special Personnel Development Centres (PDC) are being set up for this purpose. PDCs are to be established in the Ruhr coalfield and at Ibbenbueren and the centres will remain in operation until the end of 2018. Non-APG employees may be moved to the PDC, where training will be provided with a view to them being found alternative employment both within the RAG group as well as in the wider job market. The PDC will at the same time ensure that manpower requirements at the collieries are kept in a proper balance during the run-down. Employees who find themselves transferred to the PDC can be assigned to other duties with the company or within the group or may be seconded to jobs within the group or even to outside employers. In order to improve the opportunities for finding employment in the labour market the industry has set up a targeted training scheme for the workforce. A personal profile is drawn up based on an assessment of the employee's professional skills and qualifications. This profile is then matched against the demands of the labour market and any necessary measures are then derived from this. The aim of this job brokering system is to provide the employee with the best possible offer of a new job.

Both parties are involved in establishing a permanent clearing house for the PDC, this being manned on an equal representation basis by two employer's representatives and by two members of the Works Council. The clearing house makes

binding decisions relating to the need for, and type and duration of, any training and qualification measures being requested by the employer or employee and to the reasonableness of any job being offered. The employees retain entitlement to compensation payments to the amount of their gross monthly salary, this applying if and when they are moved to the PDC. The same applies for the duration of any temporary secondment to a post at another company site or during any period of loan employment. If an employee is transferred to a job with an external employer, and receives a lower salary for this work, he or she will be entitled to income support for a certain period of time.

Like APG employees, non-APG staff are also obliged to participate fully in this scheme. Non-APG employees are required to cooperate when it comes to any reasonable job that is offered to them, for after all, this labour agreement protects employees in this category from the threat of compulsory redundancy. Staff also have the right to attend retraining courses in order to acquire qualifications for future-oriented jobs outside the mining industry. These training programmes are funded by the employers up to a certain limit. It is a precondition of participating in these courses that the employee has agreed to terminate his current employment at or before the end of the training. In order to encourage the take-up of study courses employees can be granted an employer-funded loan provided that they agree to terminate their current employment prior to starting the course. The rules pertaining to retraining measures aimed at promoting and furthering a study course apply similarly to employees who are entitled to APG.

## …making it reality

The new labour contract and its supplementary provisions now have to be made reality. One of the main challenges facing the industry – alongside that of achieving our production targets – is to complete the programme of job transfers for non-APG employees. And the opportunities are there, with attractive jobs now being available at the ArcelorMittal coke works in Bottrop and at various companies in the Evonik Industries group. A cooperation agreement has also been signed with Deutsche Bahn AG (German Rail) that opens up new career prospects for those currently employed in the mining industry. An employment bureau manned by DB personnel has in fact now been opened for counselling interviews and the implementation of the cooperation agreements. New job opportunities for highly skilled coal-industry employees are also becoming available in other branches of industry as well as in the skilled trades, services and administrative sectors.

The manpower downsizing process taking place in the coal industry has now entered it last, most important and most difficult phase. The positive outcome of the Saar coalfield closure shows that this operation can be completed in a socially responsible way. The cessation of coal mining in the Saar was achieved smoothly and without social upheaval using similar wage and personnel policy instruments to those that have now been agreed for mineworkers in the Ruhr and at Ibbenbueren.

## … collectively agreed support for restructuring over the years

The German coal industry has been going through an ongoing restructuring process since the end of the 1950s. Nevertheless, it was not until 1993 that the bargaining parties first signed an agreement guaranteeing a socially responsible approach to the manpower restructuring programme. At the beginning of 1993, as a result of developments in the steel industry, coal sales in general – and coking coal in particular – suffered a significant decline. Plans for capacity adjustments had to be brought forward and this in turn created a manpower surplus. The workforce agreed to forgo a wage increase and in order to avoid compulsory redundancies a work redistribution programme was introduced in the form of additional non-working days – referred to as ‘free shifts’. Ever since then the supervision and support of socially responsible measures for implementing the downsizing process have been a key focus of the coal industry’s collective bargaining policy.

If we try to categorise the varied and complex aspects of the bargaining process since 1993 we will see that these break down into three distinct phases.

The first phase, which lasted until 2007, was essentially concerned with the reduction in working hours. The volume of work to be undertaken was distributed across a wider workforce. This reduced the surplus, though without differentiating between individual groups of workers. Reducing the working hours by introducing the 'free-shift' system proved to be a flexible and effective way of redistributing work. Changes in the employment situation over the years could be offset by varying the number of free shifts. The granting of free shifts depended primarily on operational requirements. Variations in the sales and employment situation over the year, for example, were compensated for by the timing of the free-shift system. The free shifts were financed by the forgoing of wage increases and, during the period 1994/95, by pay cuts of up to 6 %. The volume of work covered by overtime could also be redistributed by way of time-off in lieu and so could be used in order to preserve existing employment conditions. To this effect an agreement was reached in 1997 whereby overtime was completely offset by time-off in lieu within a period of 12 months. In 2005 this stringent criterion was relaxed slightly. When it came to the flexible granting of free shifts and time-off entitlements for overtime a higher degree of flexibility was called for by the management in the way in which the working hours were distributed. A proposal aimed at making Saturday part of the regular working time, while retaining the annual average 5-day week, failed to gain acceptance. Nevertheless, in 1997 agreement was reached on Saturday opening for production-related work.

In 1998 the two sides agreed on what was at the time a very innovative employment contract on part-time working, which was aimed at making such an arrangement more attractive to the workforce. Part-time working reduces the work-load of individual employees and at the same time helps safeguard employment. According to the employment contract the shorter working hours could be achieved over an average spread of up to 12 months. This high degree of flexibility also gave underground workers the opportunity to adopt practical part-time working arrangements. The introduction of long-term accounts, which was agreed in 1998, proved – in the particular circumstances that applied to the coal industry – to be an interesting device for the redistribution of labour. And it had a real impact in that it helped to compensate for temporary labour shortfalls and then to offset labour surpluses in later years. The granting of saved time-off entitlements could be used to create a solid block of days leading up to the final retirement date.

As the downsizing process gathered pace it became increasingly necessary, over and above the general arrangements for the wholesale redistribution of work, to ensure that manpower requirements could be met – both in terms of numbers and individual skills – for the production process. An analysis of the workforce situation showed that manpower surpluses, and in some cases shortfalls too, were rather varied. They tended to depend on the function and qualifications of the staff in question and, moreover, fluctuated from mine to mine as well as over time.

The second phase of the contractual support for the restructuring process, which ran from 2007 to 2011, was characterised by a set of collectively negotiated rules aimed at ensuring access to a sufficient number of staff with the required skills and qualifications. The collective agreement on fixed-term employment is one of the building blocks used to support the socially acceptable restructuring process and to sustain collieries in their day-to-day operations. This contract includes a provision that allows the maximum period of fixed-term employment to be extended to seven years. In order to provide for socially acceptable personnel measures for the proposed closure of the Saar coal industry on 30 June 2012 the bargaining parties concluded a collective agreement in 2008 that contained key elements of the Agreement on the closure of the German coal industry.

Further provisions were put in place with the collective agreement for the socially acceptable flexibilisa-

tion of the Rhine-Westphalian and Ibbenbueren coalfields. These provided for greater flexibility in manpower deployment above and below ground on a company-wide basis and also introduced a needs-based skills training scheme for the workforce. The collective agreement that was annulled in 2012 applied exclusively to those employees entitled to APG payments. It essentially included the provisions laid down in the Agreement on the closure of the German coal industry as applied to APG staff.

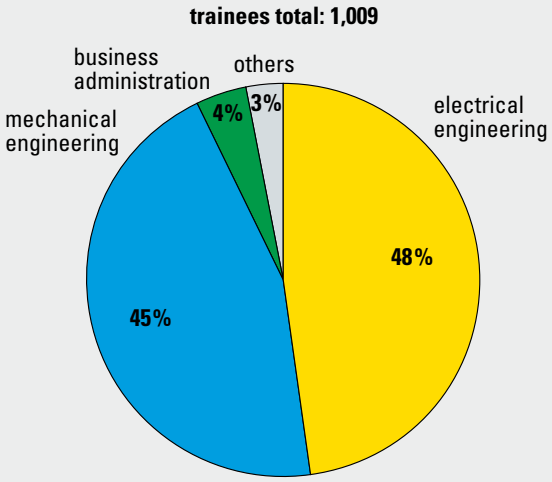
The Agreement on the closure of the coal industry, as concluded in 2012, contains – in a slightly modified form – most of the provisions of the two aforementioned employment contracts. What is new, however, is the ultimate objective of the Agreement, namely the irreversible termination of the German mining industry. In this respect this Agreement marks the third and final phase of the collective bargaining arrangements for the socially acceptable restructuring process. As well as adopting regulations to support restructuring, the two parties – in practising wage restraint – have properly taken into account the enormous financial pressure under which the coal industry has been operating. Since the beginning of the 1990s all wage settlements have been overshadowed to a quite exceptional degree by the coal policy situation and agreements in this area have fallen increasingly below the national average. However, consistent wage restraint was not sufficient by itself to counteract the financial pressure and it was inevitable that the workforce would have to accept additional financial cutbacks. As an example of this, since 2002 the industry has had to reduce the annual Christmas bonus by more than 500 €.

In conclusion: the negotiating parties have made a major contribution to the socially responsible restructuring process by adopting a series of flexible, innovative and, as we can now claim with the benefit of hindsight, successful regulations and provisions. They have throughout shown great pragmatism and a sense of responsibility towards the company and its employees and they have sought to avoid undue cost burdens for the company and maintain the functional integrity of the collieries.

## … responsibility for young people

In spite of the high pressures imposed by the restructuring process the coal industry has continued to meet its regional and social responsibilities. As one of the country's biggest training providers the mining industry took on some 270 new apprentices in 2012. That meant that at the beginning of the training year RAG had a total of 1009 apprentices enrolled in eleven future-oriented training courses at nine locations across the industry. The most popular courses tend to be industrial mechanics, industrial electronics, mechatronics, chemical techniques and business administration.

**Vocational training in the coal industry 2012**



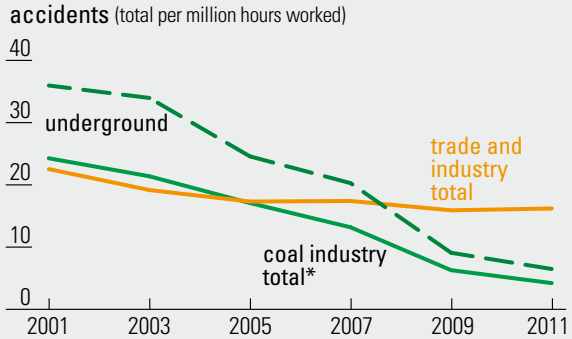

In view of the ultimate closure of the coal industry in 2018 it will not be possible to offer full-time employment to our apprentices after they have completed their training. The only exceptions to this will be in individual cases where trainees may be taken on for a certain period to help with various decommissioning and shutdown operations.

## … coal industry accidents continue to fall

Even as downsizing gathers pace the various companies that constitute the German coal industry have remained focused on the health and safety of their workers. And the successes achieved are confirmation of the efforts that have been made in this area. The total number

of accidents recorded per million hours worked (the accident rate) is now at a low level and the figure continues to fall. The accident rate at RAG has for several years been below the average for the German trade and industry sector as a whole – and this despite the special operating conditions that still prevail in the coal industry, particularly as far as work below ground is concerned. While in the business and commercial sector as a whole the accident rate for 2010 rose as the economy underwent recovery and the figure of 16.22 accidents per million hours worked nearly reached that of the previous year, the coal industry, by comparison, was able to keep its accident rate on a downward trend. The accident rate for all those parts of the company under mining authority supervision fell by 7 % to 4.22 and for underground workers alone the rate was 6.29 accidents per million hours worked (down 8.3 %). Since 2001 the accident figures for the business sector overall have fallen by 28.1 %, while the corresponding decrease for the coal industry as a whole was 82.6 %, with the underground sector recording a drop of 82 %.

**Statutory accident insurance: falling accident rate in the German coal industry**



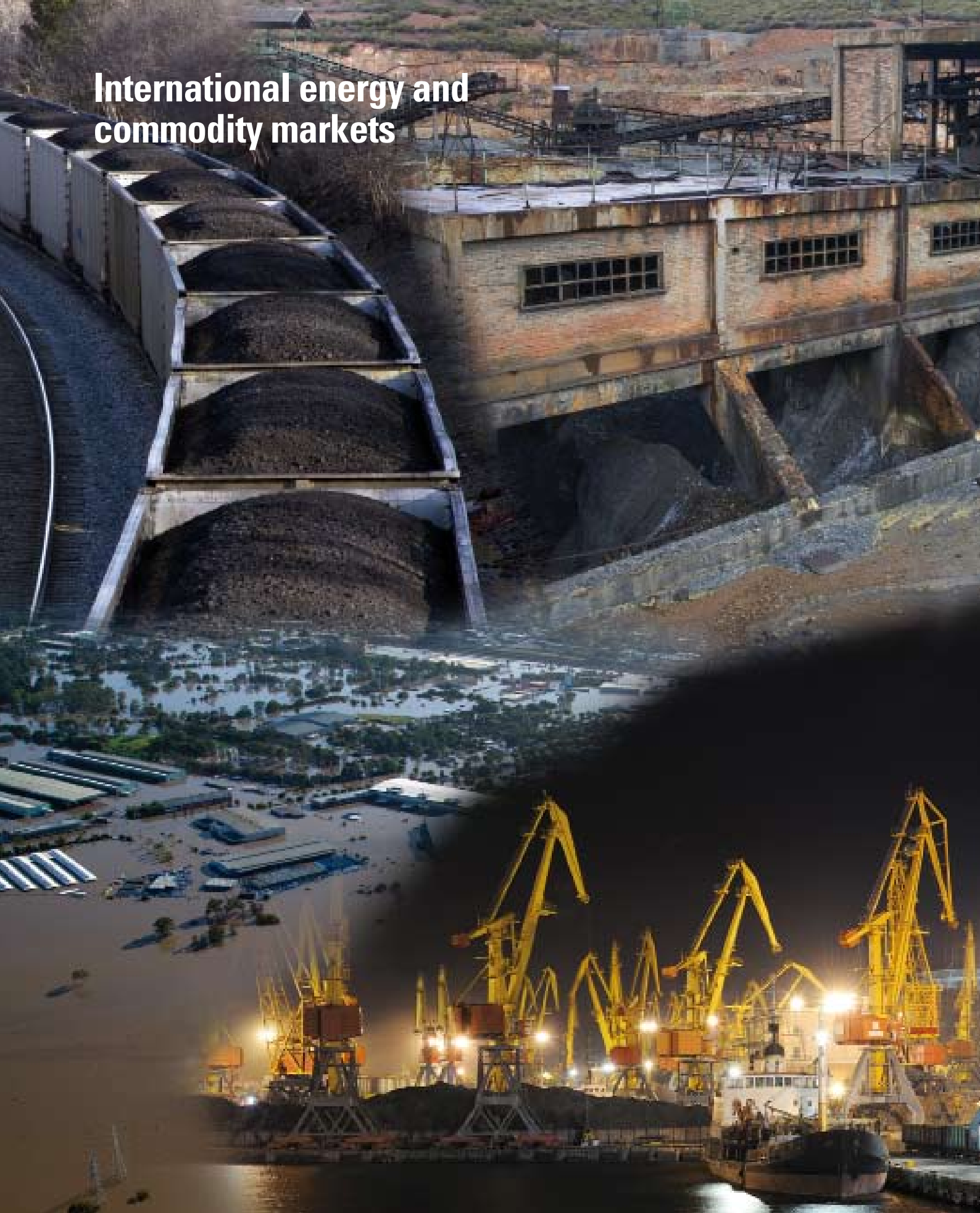

* only corporate units under mining-authority supervision

Sources: German statutory accident insurance / RAG AG

Because of the special working conditions that exist in the coal mining industry, occupational medical checks have been a statutory requirement for many years. To this effect RAG has established a number of well-equipped and professionally manned occupational health centres (OHCs). In 2011 some 26,000 people were given medical checks at the company's three OHCs. While most of the OHC's activities still clearly focus on health checks associated with underground work, the centres have now also been incorporated into a company healthcare management system, whose comprehensive approach provides a care and consultation service for all employees. The main focus of these centres has now shifted somewhat. While the heavy physical work associated with the mineworkers' daily routine used to be the main causal factor, the trend is now towards other types of problem such as increasing workload, changing workplaces and flexibilisation, along with the increase in the average age of the workforce.

Workplace health promotion and primary prevention are now an important aspect of the company healthcare management system. This includes various services and initiatives that either strengthen those elements responsible for maintaining workers' health or reduce the risk factors. The measures that have been put in place are designed to encourage employees to take responsibility for themselves in this regard. This relates particularly to the communication of knowledge about maintaining and improving personal health and also to improving working conditions in general. The existing statutory obligations contained in the relevant health and safety regulations have in fact been extended to cover this. The activities involved cover a broad spectrum and include prevention measures aimed at strengthening the musculoskeletal system, action on drug prevention, nutritional advice and help with post-traumatic stress disorders and stress management. The various healthcare actions have received much support and cooperation from the social security institutions, notably the Mineworkers' Health Insurance Fund and the Raw Materials and Chemical Industry Employers' Liability Insurance Association.

# International energy and commodity markets



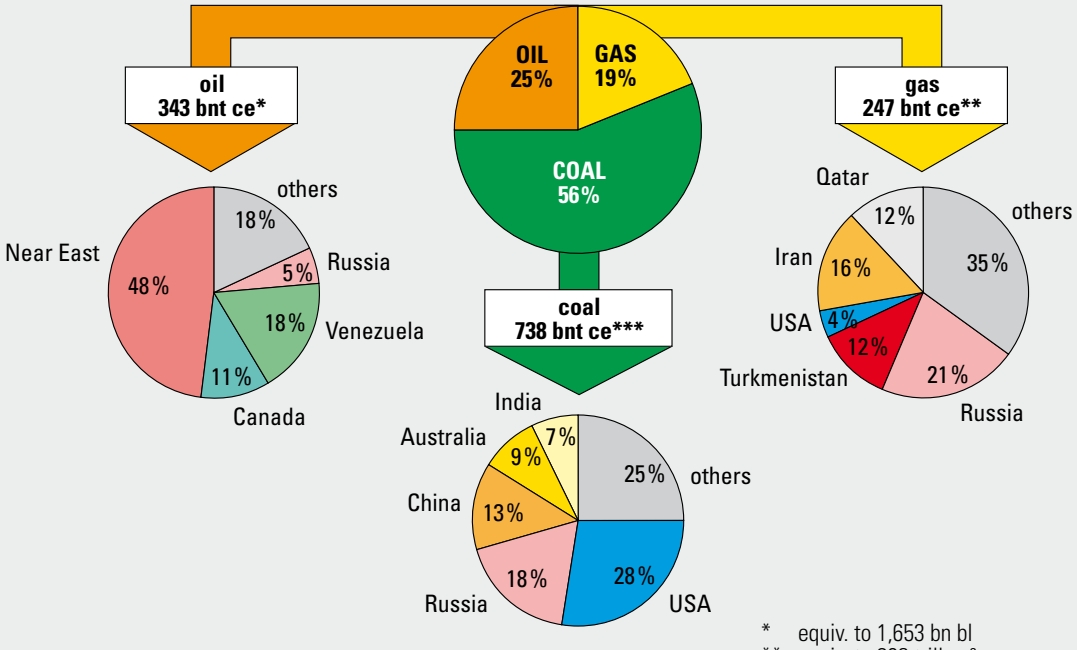
## Global developments

Questions of security of supply, especially for energy and raw materials, are now of growing concern to governments and economies all over the world. Yet the industrialised countries and emerging nations often tackle this problem in quite different ways. Many industrialised economies are fairly liberal in the way that they leave security of supply and cost effectiveness in the hands of the private sector and essentially create an environmental and energy policy framework within which to operate. Emerging countries such as China and India, on the other hand, take centrally controlled and far-reaching decisions on how their industries will operate and also plan well ahead. In these uncertain times, with the raw materials and energy markets subject to dramatic – albeit for the time being temporary – price fluctuations, China in particular is developing a huge advantage by a forward-looking policy aimed at securing energy raw materials from around the world on a long term basis. To this effect China is buying into mining projects all over the globe and is negotiating bilateral agreements with a number of different state authorities and operating companies.

Fossil energy reserves are distributed in diverse geographical areas around the world. Conventional oil deposits tend to be concentrated in the unstable Middle East region and even if so-called 'unconventional oil' is taken into account still constitute nearly 50 % of the planet's total oil reserves. Gas and coal, on the other hand, are to be found in many different regions of the world.

Moreover, the balance is shifting with the application of new (non-conventional) exploration, production and processing techniques. In the USA one particular production method has led to an unprecedented gas glut. This is the extraction of tight gas from sandstone beds

**World energy reserves – to end 2011 according to BP [bnt ce]**



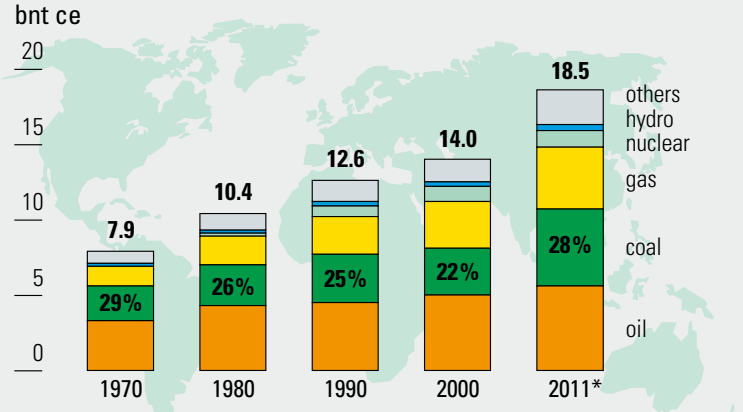

* equiv. to 1,653 bn bl
** equiv. to 208 trill. $m^3$
*** equiv. to 861 bnt

Source: BP Statistical Review of World Energy, 6/2012

or shale gas from oil shales by means of fracking – which involves generating cracks in dense rock by hydraulic means. In Canada they have been washing 'unconventional (heavy) oil' from oil sands for a number of years, and at great cost and effort. This industry has made Canada the third most important oil country in the world, after Venezuela and Saudi Arabia, in terms of the availability of reserves. While Venezuela has the most abundant oil reserves, it still lacks the financial and technical means to 'unearth this treasure'. The deposits in question mostly comprise tar-like, 'extra-heavy' oil.

**World energy consumption by energy source**

bnt ce




Source: World Energy Council Germany, 2012 * provisional

A great deal of work is being done at international level with a view to improving the way in which we use fossil fuels. In the power station industry ongoing improvements are being achieved in efficiency levels (for example by employing new types of materials that permit higher combustion temperatures) and this also helps reduce $CO_2$ emissions. A number of CCS (Carbon Capture and Storage) projects are already at the planning stage or are going through the approval process, and a few have already been implemented. However these carbon-capture measures do tend to reduce the efficiency rates of the power plant. Quite a few countries are also engaged in coal liquefaction and coal conversion projects (CTL – coal to liquids) in order to reduce their dependence on the world oil market. Examples here include the Monash Energy Project in the Latrobe Valley in Australia, the Moatize Project in Mozambique and China's 'Erdos' coal liquefaction project in Mongolia.

While the figures for existing and known reserves of conventional and unconventional raw materials may at first appear reassuring, it must not be forgotten that world primary-energy consumption (PEC) is continuing to rise. This trend was only briefly interrupted by the global financial and economic crisis of 2009, which resulted in PEC falling by 2 % to 17.4 bnt ce. The following year – thanks in part to the base effect – it increased strongly again by some 5 %. In 2011 growth levels for PEC returned to normal and according to provisional estimates from the German section of the World Energy Council energy consumption reached 18.5 bnt ce that year.

In its World Energy Outlook 2001 (WEO 2011) the International Energy Agency (IEA, Paris) presents three different scenarios. For the year 2035 the WEO estimates PEC to be between 21.3 (the environmental scenario – the so-called '450 ppm Scenario') and 26.2 bnt ce (the status quo scenario – or Current Policies Scenario). The reference scenario (or New Policies Scenario) lies somewhere in between the two, at 24.2 bnt ce, and is taken to be the baseline case. This scenario is based on the assumption that all previous agreements and plans for cutting greenhouse-gas emissions and for abolishing subsidies for fossil fuels are actually implemented around the world. It also assumes a decarbonisation of energy consumption in OECD countries (Organisation for Economic Co-operation and Development. The term is often used as a synonym for 'industrialised countries'). In this case the PEC would represent an average growth rate of 1.2 % a year as against the reference year 2009.

Solid fuel (with coal and lignite together amounting to 24 %) is expected to remain the second most important fuel after oil (27 %) and just ahead of gas (23%). This means that in 2035 about 75 % of PEC would be met by fossil fuels – as compared with the current figure of over 80 %. Renewables, excluding hydro power, biomass and energy from waste, would achieve the highest annual growth rate of 7.5 %. All renewable sources combined (wind and hydro, solar and photovoltaics, biomass and waste, plus others) would contribute about 18 % of the total requirement.

The IEA reference scenario also predicts that in 2035 fossil fuels will still play a dominant role with 56 % of the world (net) electricity production market. While solid fuel will see its contribution decline somewhat, coal and lignite will still be the most important fuel with a 33 % market share. Renewables (including hydro, biomass and waste) will by then be meeting more than 30 % of the world's energy needs.

The most important factors for the development of energy consumption and electricity production on a global level are the trends in world population and economic growth and the expansion of the electricity supply network. According to figures published by the UNFPA (the United Nations Population Fund) the world's population reached the seven billion mark for the first time at the end of October 2011. By the end of the forecast period in 2035 the IEA reference scenario expects the global population to be in the region of 8.6 billion. By 2050, according to UN calculations presented in its World Population Prospects, we are likely to see this figure increase further to 9.3 billion and the planet is expected to break through the ten billion barrier at the turn of the next century. In the industrialised countries population numbers will remain fairly steady at 1990 levels (1.3 billion) up to the year 2035, with growth taking place exclusively in the developing and emerging nations.

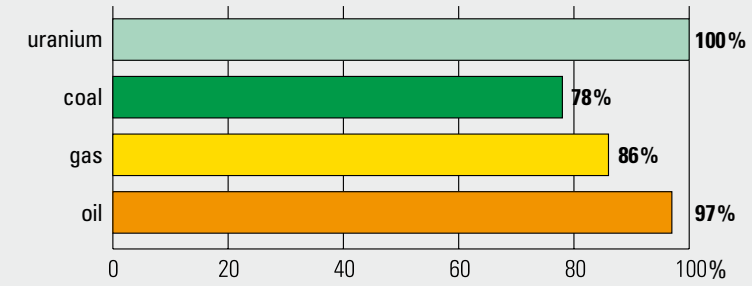
World economic growth paints a similar picture. While the economies of the industrialised nations are only expected to record moderate levels of growth, and will even contract slightly from time to time (as was the case in 2009), the newly emerging countries in particular are likely to continue the trend shown in recent years and, as the IEA reference scenario suggests, will record continuously high GDP growth rates during the period to 2035. In 2011 the industrialised nations registered an average economic growth of 1.5 %, while the key emerging countries – the so-called BRIC states of Brazil, Russia, India and China – achieved a mean average of 5.4 %. This year, however, the global economy generally appears to be cooling down significantly. Economic growth in the newly emerging nations is also being affected by this trend and is slowing down to a certain extent.

## Germany's reliance on imported energy resources

In 2011 Germany's reliance on imported coal increased slightly to 78 % as a result of the continued downsizing of the mining industry, while in the case of oil and gas the figure fell slightly to 86 % and 97 % respectively following moderate increases in indigenous production. In a few years time, after phasing-out the coal industry, Germany will be completely reliant on imports, while indigenous deposits of gas and oil that can be extracted economically by conventional methods will be completely exhausted around the year 2020.

A great deal of public interest is now focusing on the possibility of extracting gas from oil shale beds using the unconventional technique of 'fracking'. While this technique is already widely employed internationally, and particularly in the USA, the German Government for one continues to have serious reservations about its use. In an article entitled 'The gas drilling controversy – a ticking time-bomb', which was published in the Rheinische Merkur on 28 June 2012, the Bavarian Environment Minister Marcel Huber called for a complete ban on fracking in Germany. Notwithstanding this, in a special study that appeared in May 2012 under the title 'Assessment of the natural-gas potential of dense shale strata (shale gas) in Germany', the BGR

**German reliance on energy imports 2011**




Sources: Coal Industry Statistics / WEG / AGEB

(Federal Institute for Geosciences and Natural Resources) calculates that Germany has an exploitable shale-gas potential of some 2.3 trillion $m^3$. Contrast this with the fact that German natural-gas production in 2011 was 11.9 bn $m^3$ – while the country's total gas consumption that year was some 86 bn $m^3$.

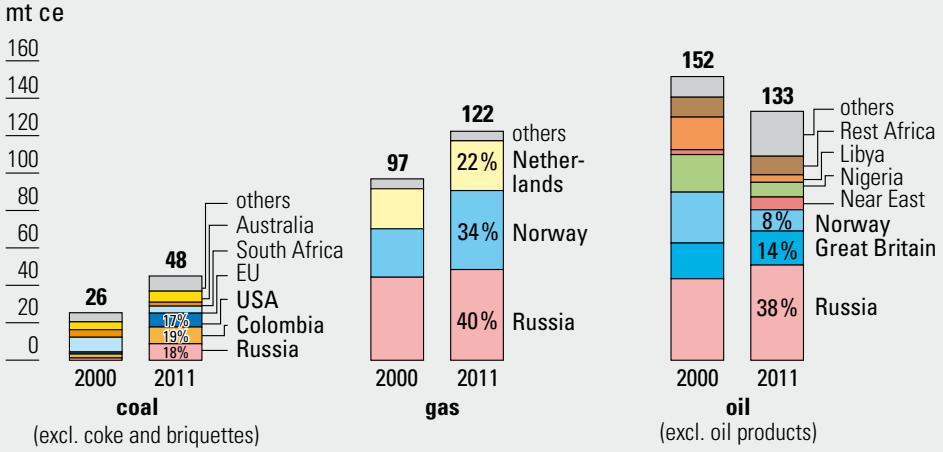
At EU level the Energy Commissioner Guenther Oettinger is unwilling to impose further regulations on the production of controversial shale gas, which is to be left up to individual member states. The reason for this lies in the different situations that apply around Europe. While in France it is not possible to obtain a licence for fracking, Poland already has a number of demonstration projects up and running. Some countries, including France and Germany, are concerned about environmental damage, while others – such as Poland – see shale gas as crucial for limiting their reliance on imported gas.

In 2011 German imports of energy resources (coal, gas and oil) came, in varying degrees, from just a few source countries. The three most important suppliers in each fuel category were responsible for 54 % of the demand, in the case of coal, and for 60 % and 96 % of the demand in the case of oil and gas respectively. Russia was the dominant supplier country in all three categories.

In the case of gas and oil, 40 % and 38 % respectively of total German imports were of Russian origin, while in coal's case Russia supplied nearly one fifth of the national requirement. As far as security of supply is concerned oil is still in the most critical situation, as domestic production is only able to meet 3 % of the country's needs and there is no effective substitute for oil in a number of important consumption sectors, such as transport. In the case of coal, some 22 % of total demand was still supplied by the domestic mining industry in 2011, while about 14 % of Germany's natural-gas supplies were provided by production from German gas fields. What is more, Germany has large underground gas storage facilities that can provide bridging capacity in the event of temporary shortages in the supply of imported gas.

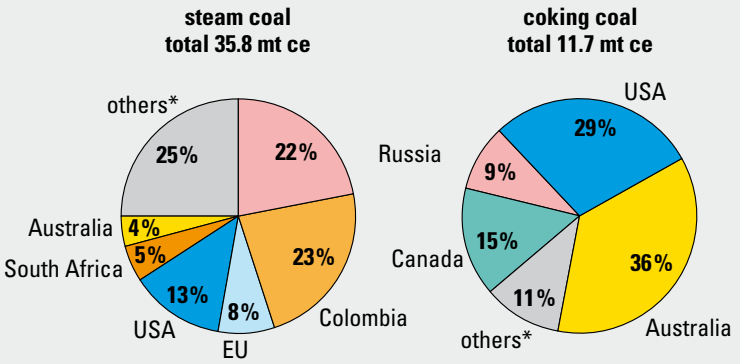
Russia's huge significance for German coal imports in 2011 applies exclusively to steam coal, with

**German fossil-fuel imports 2000/2011**
Shares of the three largest supplier countries in 2011




Sources: Coal Industry Statistics / BMWi, Energy data 2012 / WEG, 2012 / BDEW, 2012

**Sources of supply for German coal imports 2011**




* incl. non-assignable quantities from the named countries

Sources: Coal Industry Statistics / GVSt

Russia being the second most important supplier after Colombia and ahead of the USA. About 58 % of all German steam coal imports are sourced from these three countries. Imports of steam coal from EU countries were markedly down on the previous year (- 42 %), while supplies from South Africa and Russia also declined, albeit less significantly, by 19% and 13 % respectively. Imports from the USA (+ 40 %) and Colombia (+ 31 %) rose significantly in absolute terms. By contrast, German coking-coal imports were much more heavily concentrated – with about 80 % being supplied by the three main source countries, namely Australia (36 %), the USA (29 %) and Canada (15 %).

There is now in Germany a growing public debate about the conditions under which energy resources are extracted, and questions are particularly being raised about how these are consistent with human rights and the protection of the environment. In order to meet calls for an ethically acceptable coal supply seven European energy suppliers (DONG, EDF, Enel, E.ON, Fortum, GDF SUEZ, RWE and Vattenfall) agreed to set up the 'Better Coal' initiative at the end of February 2012. Their aim was to improve working conditions and environment protection policy in the coal mining industry. A similar, more cross-sector approach is being taken by the United Nations Global Compact initiative.

As a major exporting nation, Germany is keenly interested in maintaining a reliable and affordable supply of mineral and energy resources. 'Raw materials supply is an international issue. Here we are competing with countries that are operating a very strategic raw-materials planning policy', according to Chancellor Merkel addressing the Third Raw Materials Conference organised by the CDU/CSU Bundestag group in Berlin on 25 April 2012. Further action in this area is required.

According to calculations by the German Mineral Resources Agency (DERA) Germany produced some 17.7 bn € worth of raw materials in 2010 in the form of lignite (38 %), natural gas (17 %) and coal and oil (6 % each). This compares with a total of 109.3 bn € worth of raw-materials imports that same year – with energy resources alone making up 69.4 bn € of this (oil 57 %, gas 34 % and coal 7 %). Apart from a few recommendations, initiatives and expert working groups at Federal and EU level, the German Government adopts a liberal market and competition policy and generally leaves security of raw-materials supply in the hands of industry.

## Trends on the world coal market

According to provisional data world coal production increased by about 3.5 % in 2011 to a figure of nearly 7 bnt – its highest ever level. Of this, 88 % (6.1 bnt) was steam coal and 12 % (0.9 bnt) coking coal. Global coal production in 2011 was therefore nearly twice the figure recorded in 1990. Most of this increase has taken place in China. In 2011 China produced 52 % of all the world's coal, making it the

most important producer and, at the same time, the most significant consumer, with a 55 % share of the market. Coal production in North America fell slightly by 0.6 %, while consumption declined even more sharply by a factor of 6 (- 3.6%). In Australia production was 2 % down on the previous year. This can be attributed to the heavy rainfall and flooding that affected Queensland at the beginning of 2011. In the EU-27 coal production continued to decline, though consumption was up by more than 7 %. Generally speaking, the shift in the centres of production and consumption from the Atlantic to the Pacific regions has been a continuing trend. A similar pattern could be observed in the trade flows.

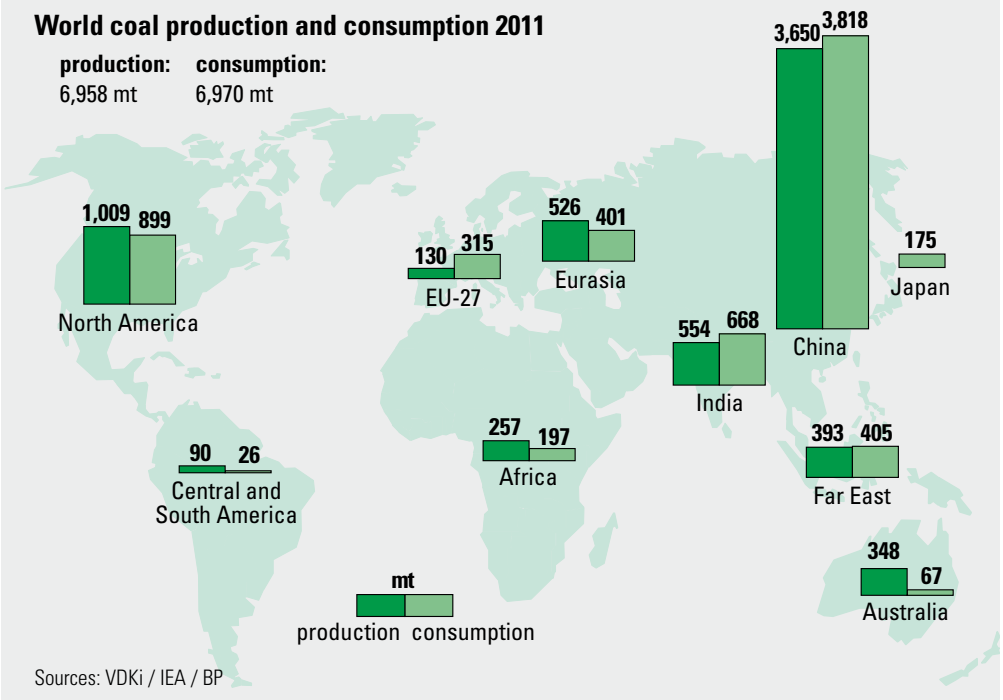
Compared with oil and gas, coal has a relatively low trading and export ratio. Between 2006 and 2011 only 15 to 16 % of world coal production went to the export market. The volume of coal traded in 2011 was over 1 bnt, with 94 % of this seaborne trade and the remainder going to inland markets. China, the world's largest coal producer and, since 2009, a net importer too, imported 183 mt of coal in 2011 and so moved to the number-one spot for the first time as the largest importing country. In doing so it ousted the previous frontrunner Japan (175 mt), which is 100 % reliant on imported coal. Japanese coal consumption fell by 5 % in 2011, mainly as a result of the Tsunami disaster. However, this figure is likely to increase sharply in the coming years as a result of Japan's partial withdrawal from nuclear energy probably implemented over this period.

In the coming years most of the increase in coal demand will tend to shift towards the Pacific market. This assertion is based on a medium-term prognosis for coal that was published by the IEA at the end of 2011 and which examined future developments using two possible scenarios (Coal – Medium-Term Market Report 2011, IEA, Paris 2011). According to the Low Chinese Production Scenario (LPS) China, India and other Asian states in particular will see by far the highest growth rates up until the end of the forecast period in 2016. In fact more than 90 % of the predicted increase in demand will be generated by China and India alone.

On the supply side too, steam-coal producers in the USA and Colombia, who in previous years almost exclusively served the Atlantic market, have been increasingly turning their attention to the Pacific zone, especially this year. In the USA domestic sales have suffered partly as a result of economic conditions but also because of the complete turnaround in environment policy, which representatives of the US coal industry have already labelled as a 'war on coal'. But even these factors are being outweighed by the extremely low gas prices (which have reached a 10-year low) created by the (shale) gas glut, which

**World coal production and consumption 2011**

**production:** 6,958 mt **consumption:** 6,970 mt




Sources: VDKi / IEA / BP

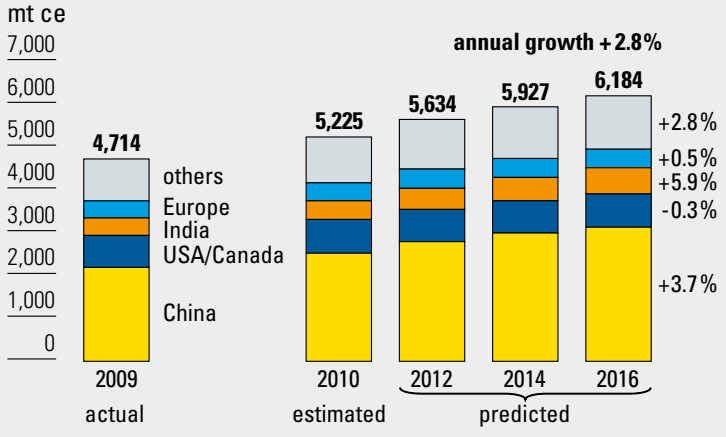
is increasingly displacing coal in the power generating market. Like Colombian suppliers, American producers of steam coal initially sought salvation in the European spot markets. However they were to come up against a slump in demand that had been ongoing for months as a result of economic, weather related and structural factors, along with high stock levels. Payment difficulties resulting partly from the rupee's unfavourable exchange rate against the US dollar also caused Indian purchasers to hang back or to switch their demand to cheaper grades of coal. The Chinese market too is showing signs of saturation and the pace of economic growth has been slowing down. By the middle of this year coal stocks at China's large power stations had swollen to nearly 90 mt. A number of Chinese buyers also refused contractually agreed purchases of coal that had been bought at too high a cost, after prices then fell by more than 10 US$/t. All this may have induced the US coal industry this year to shut down temporarily, or withdraw from the market, at least 7 % of total US production capacity, amounting to about 80 mt a year.

Developments in the international coking-coal market are determined to a large degree by the global situation in the steel industry. During the first half of 2011 global steel demand initially got off to a positive start, but then levelled off increasingly towards the end of the year as a result of the European financial crisis. Yet this was still enough to set a new world record for crude steel production of 1.5 bnt in 2011, which represented an increase of 6.1 % on the previous year. During the same period pig-iron production rose 6.5 % to 1.1 bnt.

However, during the first half of 2012 there was a further weakening in the global situation. Customers were ordering less because of the uncertain economic developments, due in part to the EU financial crisis, and were taking from stocks. Coking-coal demand collapsed accordingly. However, on the supply side the coking-coal market did benefit from the production losses that resulted from weather related problems and industrial action in Queensland, where mineworkers went on strike for nearly one and a half years against their employers, BHP Billiton Mitsubishi Alliance (BMA), which operates seven coking-coal mines in Queensland. Another trend has been the shortening of the reference price basis for annual coking-coal contracts. Against stiff resistance BHP Billiton has managed to introduce a quarterly price setting regime, though has so far failed to achieve a universal monthly pricing system.

The South African mining group Anglo American has ventured to make a medium to long-term market prediction for steam coal. Demand is expected to remain at a low level in the short to medium term, with prices falling steadily. This is attributed in particular to the ongoing recession in the eurozone and to the increasing price pressure exerted by competing energy sources such as gas and renewables. However, price levels for steam coal are set to rise again in the long term. The slowdown in economic growth in the emerging countries of China and India will pick up again and both players will then have a much stronger presence on the interna-

**New IEA medium-term forecast: developments in coal demand**




Source: IEA, Coal Medium-Term Market Report, 2011

tional commodities markets. India is massively expanding its coal-fired power station capacity and is planning to import 220 mt of coal a year between now and 2016 (in 2011 India imported 114 mt). Anglo American expects world seaborne trade in steam coal to reach 1.3 bnt by 2020, starting from a figure of 0.7 bnt in 2010. This suggests that by 2030 the world market for steam coal will increase nearly twofold to 2.2 bnt.

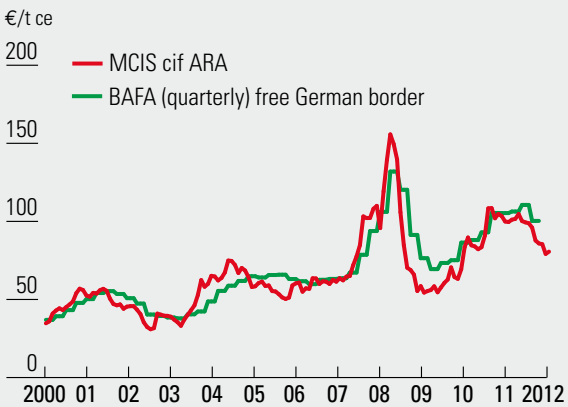
Another trend on the supply side of the international coal market is the emergence of significant new coal exporting countries such as Mongolia and Mozambique. According to IEA estimates Mongolia is planning to increase its 2010 export figure threefold to 35 mt by 2016 (coking coal and steam coal). The productive coalfield at Tavan-Tolgoi – 560 km south of the capital Ulan-Bator – contains high-grade deposits of coking coal; China has been the main customer up until now. The south-east African country of Mozambique began to export high-grade coking coal in 2011 and this trade is expected to reach some 25 mt a year by 2016. The Moatize coal basin in Mozambique, which is close to the city of Tete, has such a production potential that it is frequently compared to the Bowen Basin (Queensland) in Australia – the world's largest coking-coal exporter with 133 mt in 2011. Rio Tinto is already heavily engaged in Mozambique through shareholdings und extensive infrastructure projects. In early April 2011, and after some hard bargaining, the Australian miner acquired the majority stake in the Riversdale mining company – which is strongly focussed on Mozambique – for just under 4 bn US$. Mozambique could therefore become the world's second most important coking-coal exporting country, after Australia, within just one or two decades, thereby overtaking the USA (the country exported 60 mt of coking coal by sea alone in 2011).

## Price and rate developments

Somewhat calmer times appear to have returned to the international energy resources markets. The sector seems to have survived the turbulent rollercoaster ride of the 2008 boom, when raw-materials prices soared, and the subsequent economic crisis of 2009, when prices fell dramatically. World demand has slackened in recent months due to a deterioration in the global economy and the price of steam coal and coking coal in particular has fallen again after a temporary recovery. However, in the medium term, and possibly by the end of this year, analysts are predicting further shortages and excess demand, which will in turn translate into rising prices. In response to the way in which coal prices are developing, the Royal Bank of Scotland is already talking about the 'black gold of the future'.

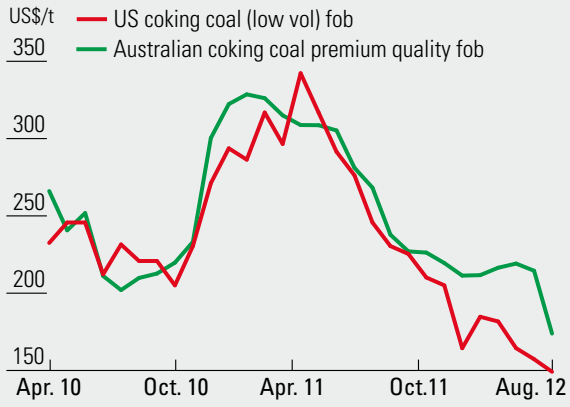
A buyers' market has prevailed in the north-west European steam coal sector since the second half of 2011. A high volume of supplies from the USA, Colombia and South Africa has come up against slack demand and high stock levels. In some cases suppliers have been offering major price discounts just to be able to dispose of their products. In the coal-fired electricity sector the effect of Germany's nuclear withdrawal policy has been less noticeable and in fact the impact of this was more than offset by the high input from renewable sources. By the first half of 2012 this had created high stock levels that will have to be reduced before the market can recover its momentum. Contract and spot market volumes therefore remained low and in mid-2012 prices fell to their lowest level for more than two years (below 90 US$/t cif ARA, i.e. including

**Price trends: steam coal cif north-west Europe and free German border**




Sources: IHS McCloskey Coal Report / BAFA

**Price trends: premium coking coal fob USA (east coast) and Australia (Queensland)**




Source: IHS McCloskey Coal Report

cost, insurance and freight charges to Antwerp, Rotterdam or Amsterdam).

Increasingly bleak economic expectations and fears of a weakening in global steel demand are putting increasing pressure on coking-coal prices worldwide. However, production losses caused by extreme weather conditions and industrial action in Queensland, which in turn led to supply shortages, enabled coking-coal prices to remain at a relatively high level. In the third quarter of 2012, for example, a benchmark price of 221 US$/t fob (port of shipment in Australia) was being traded for premium Australian coking coal and this is being applied as a reference point and price guideline for further coal supply contracts in the same delivery period. US providers of coking coal also had to contend with a collapsing domestic market and were offering their high-quality coking coal well below normal market prices.

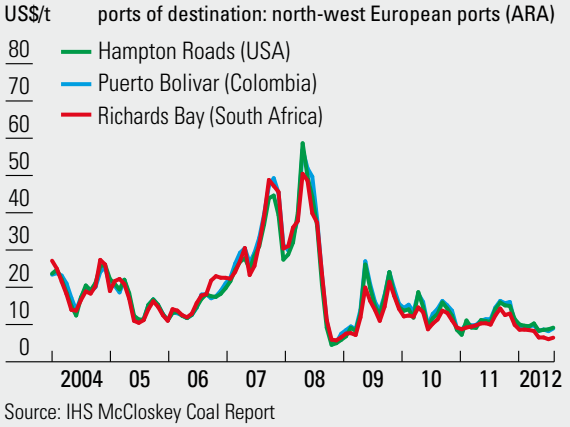
Unlike Panamax freighters, capesize bulk carriers still cannot pass through the Panama Canal because of their size (freight capacity in excess of 100,000 t). However, according to the latest plans this will become possible in early 2015 when the Canal extension and new locks are opened to shipping. Vessels with a draught of up to 15 m, and measuring up to 366 m in length and 49 m in width, will then be able to take this route.

Capesizers are mainly used for transporting coal and iron ore and so capesize cargo rates have recently been much affected by the low volumes of iron-ore exports from Brazil and reduced levels of Chinese coal imports. Up to mid-2012, for example, capesize tariff rates from South Africa (Richards Bay) to north-west European ports fell for a time to below 6 US$/t.

Because of the large number of new orders placed during the boom year of 2008 the world's freighter fleet has continued to grow. Many of these new commissionings are expected in 2012. The international freight market will therefore have to contend, in the short term at least, with a regular surplus of shipping capacity.

The sea freight business is ultimately becoming less and less profitable as it sees its margins shrink or even turn negative. The banks too have recognised this and are increasingly pulling out of the ship financing sector. This hit German shipowners particularly hard last June. Commerzbank, which had previously financed a large number of shipping schemes, announced that it would not be providing any new loans to shipping companies.

**Price trends: sea freight rates to Europe**




Source: IHS McCloskey Coal Report

# Coal and the environment

# Emissions trading

## The third trading period

The third trading period of the European Emissions Trading System (2013 to 2020) commences on 1 January 2013. Emissions trading will then become much more harmonised across Europe. This applies in particular to the rules for the allocation of emission allowances and for the auctioning process. The uniform EU allocation rules that the European Commission determined in April 2011 will be used as an allocation basis for all member states. After 2013 there will be no more free emission allowances for electricity production. Power station operators will then be obliged to buy-in, or purchase by auction, the emission allowances they need. The third emissions trading period will also see more high-emitting industries being brought into the trading system. In all, the annual $CO_2$ emissions permitted by the European Emissions Trading System are to be reduced by 21 %, from the current level of 2.1 bnt, by 2020. Approximately 1.4 billion emission allowances will be allocated in Germany free of charge between 2013 and 2020. These are intended for some 1,870 installations. For most plants the size of the allocation is calculated on the basis of product-related emissions. This 'product benchmark' applies throughout the EU and is derived from the 10 % most efficient installations in Europe. This means that in future inefficient installations will increasingly have to purchase emission allowances. In order to prevent industries being put at a competitive disadvantage at international level those installations operating in sectors where there is a high risk of outsourcing – the so-called 'carbon leakage risk' – will continue to receive the full allocation, while others will see their allocation gradually cut back to 30 % of the original amount between 2013 and 2020. After 2013 there will overall be significantly fewer free allowances allocated in the EU than was the case in the two previous trading periods. This is partly due to the targeted reduction in the number of available permits – the total quantity of emissions for all installations liable for emissions trading will be continuously reduced by 1.74 % a year from 2013 – and partly to the exclusion of free allocations for the entire electricity production sector.

It is doubtful whether the price of emission allowances, which was below 7 € in mid-2012, will increase at any time in the future. According to expectations the market will remain well supplied, due in part to the surplus available in the second trading period, whereby certain unused allowances can be transferred from one trading period to the next. However, another important factor in all this is that emission levels are down, mainly because of the economic crisis. In addition there are allowances from carbon offset projects in developing countries, i.e. the CDM (Clean Development Mechanism) projects. Some sectors have been able to cover as much as half their reduction obligations by using project certificates of this kind. All these factors tend to push allowance prices downward, with the result that in some cases it can be more favourable for operators to buy in allowances rather than cut their emissions. However, this does not alter the fact that the total allocation of emission trading rights is becoming increasingly restricted.

The disproportionately high increase in greenhouse-gas emissions from the aviation sector induced the EU to include airline companies in the emissions trading system from 2012. This is designed to ensure that all airlines providing flights from, to or within the EU, Norway and Iceland also make an appropriate contribution to climate protection. A number of non-European carriers responded by taking legal action, claiming that such a regulation infringed the principles of international law and was in breach of international conventions. The European Court of Justice ruled in December 2011 that the inclusion of the aviation sector in the European emissions trading system did not constitute an infringement and did not violate the sovereignty of non-European states over their airspace or the freedom to fly over the high seas.

The European Energy Exchange (EEX) in Leipzig has been included in the annex to the EU Auctioning Regulation as the first auction

platform for emission allowances in the third trading period and emission allowances for the aviation industry. The EEX has already been auctioning the German emission allowances since 2010. The member states can decide either to auction their allowances on a common European platform or to commission their own platform. Germany, Poland and the United Kingdom have opted for national platforms.

In Germany the rules for EU emissions trading under the revised Greenhouse-Gas Emissions Trading Law have been incorporated into German legislation. This has meant a reassignment of the implementing responsibilities of the Federal Government and Laender. As the national body, the German Emissions Trading Authority (DEHSt), which comes under the Federal Environment Agency, is responsible for implementing Europe-wide emissions trading for stationary installations and for the aviation industry. Its duties include the allocation and issue of emission allowances, the inspection of emission reports, the maintenance of an emission trading register and the management of the project-based JI (Joint Implementation) and CDM mechanisms. The DEHSt also publishes the NIMs list (NIMs = National Implementation Measures), which details the preliminary allocations of the third trading period in respect of stationary installations. Each EU member state submits a NIMs list to the European Commission, which checks and approves it, in some cases applying an EU-wide, cross-sectoral correction factor. This factor is used to adjust the volumes of allocations in accordance with the existing budget of emissions allowances. The DEHSt is then able to calculate the final allocation and prepare its allocation notices.

## The Energy and Climate Fund and $CO_2$ allowance prices

In the autumn of 2010 the German Government set up an Energy and Climate Fund to compensate for the lifetime extension of nuclear plants. The energy companies are required to pay their additional profits from nuclear power into the fund in order to finance the switch to renewable energies. The fund will also be supplied with proceeds from $CO_2$ emissions trading. With the decision taken six months later to shorten the operating life of nuclear plants, and the repeat amendment of the Atomic Energy Act, there will be no more payments forthcoming from the development fund agreement with the nuclear plant operators. Instead, the accelerated pace of the withdrawal from nuclear power over the next few years will require considerable investment if Germany's energy supplies are to be secured. In order to offset the revenue shortfall all Government proceeds from the auction of emission allowances are to be paid directly into the Fund from 2012 on. According to Government calculations this will provide the Fund with an annual income of some 780 million € from 2013. However, because of the sharp fall in the price of $CO_2$ allowances the revenue from $CO_2$ emissions trading will now be much lower than expected. For the period 2012 to 2015 the Government had been counting on around 17 €/t $CO_2$. However the actual price was about 8 € and in the summer of 2012 even fell as low as 6.50 €. As a result, the Climate Fund only took in 75 million € in 2011 and only paid out 46 million € in concrete projects, instead of the 300 million € that the Federal Government had originally agreed in expenditure for 2011. The Government is therefore planning for a much lower resource base for financing the energy switchover, namely around 10 bn € for the period 2013 to 2016. This means that the Fund will be paying out nearly 4 bn € less than planned for building renovation, the expansion of electromobility and research and development projects for renewables and new storage technologies.

The collapse in the price of $CO_2$ allowances is affecting not just Germany but the other EU member states too. Even though the total quantity of allowances will fall by 1.74 % each year, the European Commission takes the view that the current measures will not be sufficient to halt the slide. Plans currently being considered therefore include setting minimum price levels or artificially reducing the quantity of allowances made available. However, countries like Poland, which rely heavily on coal-based electricity production and are therefore very dependent on emission quotas, are quite opposed to such a move. German economic policymakers are also against

### The Energy and Climate Fund is supposed to finance measures in the following sectors:

- Research funding for renewable energies
- Energy storage and network technologies
- Energy efficiency, energy consulting
- $CO_2$ building refurbishment
- Electromobility
- Electricity-price levelling for electricity-intensive industries
- Promotion of national and international climate and environment protection

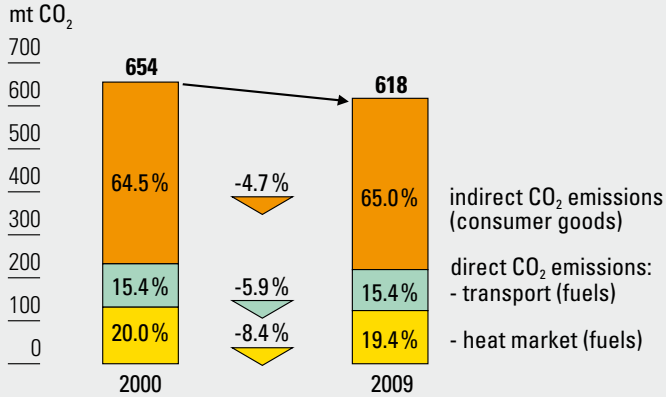
imposing any further artificial limits on allowances. There are fears that higher allowance prices will be passed on to the cost of electricity, which could place an enormous burden on German industry and consumers alike.

The price collapse is also causing tension at international level, for according to the Durban Climate Conference part of the proceeds from allowance trading are supposed to be paid into a 'Green Climate Fund'. This is designed to help poorer countries implement the climate-protection and adaptation measures. If these revenues are not forthcoming, and if they cannot be made up elsewhere, there could well be diplomatic problems, for the developing countries for their part only accepted the partially agreed climate alliances with the industrialised nations on condition that this financial support would be forthcoming. In Germany these international commitments are not negotiable, with the result that spending at national level then has to be scaled back accordingly.

## Advantages of an energy tax in place of emissions trading and the EEG?

When it was introduced, emissions trading was endorsed as a market-based instrument; however, its drawback is that limiting the volume of emissions makes for a system of quantitative intervention that cannot provide stable and reliable price signals in the long term. So while limiting emissions (cap) is certainly desirable from an environmental viewpoint, we must at the same time accept cyclical and growth-related price fluctuations. The EU's introduction of emissions trading in an internationally isolated way, and the resulting facility for 'carbon leakage', can severely impair the effectiveness of the quantitative measures. By relocating energy-intensive manufacturing to countries with lower environmental standards, and then importing the goods, we are not saving anything, and additional emissions may even be created by the production and transport process. This means that there is only an apparent reduction in $CO_2$ emissions at national or European level, while the carbon footprint is in fact growing in size. This can be seen in the following example: According to a survey carried out by the Federal Statistical Office direct and indirect $CO_2$ emissions from private households in Germany amounted in total to 618 mt in 2009.

**'Carbon footprint': direct and indirect $CO_2$ emissions from private households**




Source: Federal Statistical Office, 2010

Two thirds of this alone were indirect emissions generated nationally and internationally by the manufacturing sector in producing goods that households then consume. These indirect emissions have indeed declined somewhat since 2000, partly due to the fact that the consumption of services has increased at a greater rate than that of material goods and home production is based on a lower $CO_2$-producing electricity industry. However, the decline in indirect emissions has been less than the reduction in direct emissions from the use of heating and transport fuels, mainly because of the emissions generated by the importing of consumer goods. The key factor is the emission intensity of the manufacturing process – and in addition to this, the environmental aspirations of countries outside Europe will often be lower. In 2009 the importation of consumer goods was responsible for some 35 % of total indirect emissions.

The emissions trading system causes distortion not just internationally but at regional level too, for it impacts differently on companies depending on the federal state in which they are located. For example the energy and industry state of North Rhine-Westphalia, being the country's largest power generating region, produces disproportionately large $CO_2$ emissions. The division of labour that existed between the individual Laender that shipped coal-based electricity across their federal borders had been a most welcome agreement for many years. But now, because of this historic arrangement, the emissions trading scheme is placing businesses in North Rhine-Westphalia at a relative disadvantage as the auction revenues from the third trading period do not go to North Rhine-Westphalia but to the Federal Government, with the result that this – along with the allocation effects of the EEG (Renewable Energy Sources Act) – leads to a net outflow of funds.

In early 2012, by way of an alternative, the Scientific Advisory Board of the Federal Ministry for Economics and Technology proposed replacing the emissions trading scheme with an international emissions tax that would also be coupled with equal competition between indigenous production and imports. North Rhine-Westphalia would have no fears about such a model placing its industries at a disadvantage and would at least obtain tax revenue in the same way as with the indirect taxation system. At the same time a taxation-based solution that dispensed with the quantitative measures imposed by the emissions trading scheme would mean that the EEG would no longer be at odds with the pricing arrangements for $CO_2$ allowances, in other words the price signal based on taxes would remain unaffected by the EEG or by the growing market share of renewable energies.

However the EEG itself has come in for criticism. While the policy that was geared towards market rollout was successful as such, the financing approach has become increasingly problematical from an economic viewpoint (soaring differential costs, see also section 'Status assessment'). On top of that, the many subsequent market interventions have made the latter too bureaucratic and non-transparent. Neither has the EEG yet succeeded in fulfilling its key objective, namely to make renewables cost-effective by way of economy-of-scale and learning curve effects. Even offshore wind power and photovoltaics, which are the main renewable energy sources because of their high quantitative potential, have still not achieved this target. Moreover, it is a contradiction in itself to feed decentralised forms of energy into the grid instead of using or storing them at the place of production, simply because the EEG funding instrument provides for a grid-feed system. This is likely to cause network problems at every distributor level, whereas with decentralised use these would only arise at the low-voltage level. We would then possibly not have to live under the significant threat of power cuts currently associated with the rapid expansion of the renewables sector.

Only active marketing pressure can ultimately prevent market-unrelated inefficiencies. An 'incentive regulation' cannot in the long term replace the fundamental system change that is needed and will only create new profitable niches within the EEG. A sustainable integration of renewables into the market can only be achieved through a gradual reduction in the off-take obligations for all forms of eco-electricity that go beyond their market rollout in quantitative terms. The EEG should revert to what it was, namely a programme to launch a market. A much more cost-effective solution for the

politically desirable expansion of the renewables industry would be to introduce a tendering procedure or a quota scheme, which could possibly be coupled with the trading of allowances for ‚green electricity'.

The proposal for a $CO_2$ emissions tax, combined with an EEG that is only geared to market rollout, and in other respects with consumption being met by renewables in line with market and/or competition requirements, is not only important from an energy-usage and fiscal point of view but would solve another fundamental problem facing the energy industry. It would again be worth investing in power station capacity that could also be constructed under market conditions. The EEG provides no incentive for this whatsoever. If the guaranteed feed-in for renewables were to be dropped the market for power station capacity would be restored to equilibrium of its own accord. Those power stations being planned and designed in North Rhine-Westphalia, for example, could not only secure the region's industrial base in a free-market environment but would also contribute to the integration of the fluctuating inputs from renewable energies.

## Carbon Capture and Storage (CCS)

The low price of $CO_2$ allowances from the emissions trading scheme also impacts on the CCS strategy that had been under discussion in recent years. As the cost of CCS technologies is still relatively high, $CO_2$ prices should be controlled through emissions trading in order to help them achieve a breakthrough. Some industry representatives and European Parliament members are calling for market intervention, and possibly a reduction in the allowances, in order to raise the price artificially. EU Energy Commissioner Guenther Oettinger believes that there is no way of getting past $CO_2$ separation and storage if we are to achieve an almost $CO_2$-free energy sector by 2050. The Commissioner is of the view that it is in the energy industry where most carbon-dioxide savings can be made, since other sectors such as agriculture and manufacturing would not be capable of making a significant contribution. In an interview with the news agency Dow Jones in March 2012 he says: 'Perhaps we need an additional CCS regulation in future. We are currently examining whether we should develop a proposal setting a date when CCS will be made compulsory for new power stations and for older installations as well'. There was also a need to find solutions as to how CCS technologies could be employed in Germany too.

But Germany in particular is expressing real opposition to the introduction of CCS. It was not until the end of June that the Bundesrat and Bundestag agreed on a CCS compromise for transposing the European CCS Directive into national law, and this only allowed a very limited trial application. The total amount of storage was set at only 4 mt of $CO_2$ and the annual input was limited to 1.3 mt. Only time will tell whether these regulations are workable and adequate for future demonstration projects by the energy industry. Moreover, the operator's responsibility has been increased to 40 years following the closure of the storage facility – twice the minimum period laid down in the EU's CCS Directive.

The most contentious point was the so-called ‚exit clause' allowing individual Laender to prevent underground carbon storage within their territory. When determining that a trial or demonstration of permanent carbon storage is only permitted in certain areas, or not at all, the Laender now have to weigh up the local geological characteristics and other issues of public interest.

According to the EU Directive on Carbon Capture and Storage the member states can determine, according to the principle of subsidiarity, whether to prohibit carbon storage on their sovereign territory or to give priority to another usage for the underground site. In May 2012 Mecklenburg-Western Pomerania became the first German state to prohibit by law the underground storage of $CO_2$. As soon as the final parliamentary hurdle to the passage of the bill had been cleared, Lower Saxony and Schleswig-Holstein also announced that they were banning $CO_2$ storage in their territories. This decision means that the saline aquifers – the largest potential $CO_2$ storage areas in Germany – will no longer be available for this technology.

## $CO_2$ usage (CCU)

Increasing number of research scientists, and of late the Federal Chancellor herself, are now convinced that carbon dioxide is far too valuable to be banished below ground. There are new CCU technologies around ($CO_2$ usage) that could transform $CO_2$ into a valuable raw material for various industrial sectors. Potential applications range from synthetic film and foams to cement.

$CO_2$ is already being used in the production of urea for artificial fertilisers and in the preparation of aspirin. Since 2010 the US Department of Energy has invested some 106 million US$ in the research of carbon dioxide technology, while the German Ministry of Research has provided around 100 million €. In the coming years $CO_2$ could well become one of the chemical industry's most important raw materials. The substance itself is low in energy and inert and cannot essentially be processed without a considerable expenditure of energy. New chemical processes and special 'catalyst' substances will be used to give the inert carbon dioxide a helping hand. The catalysts activate the $CO_2$ in such a way that other substances are able to react with it. This in turn creates new substances, namely liquids and salts, that can serve as feedstock for all kinds of plastics and building materials.

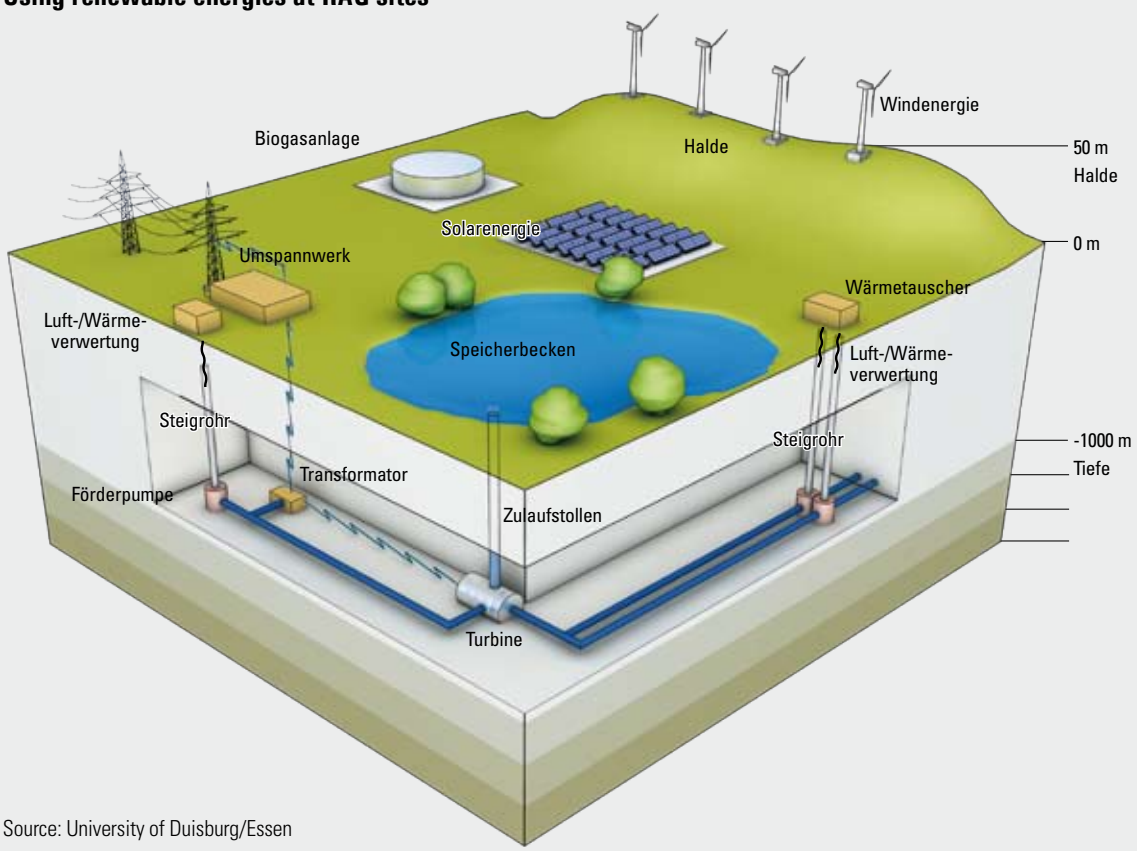
German chemical companies, including Evonik, BASF and Bayer, are already working on commercial applications, as are technology and energy concerns such as Siemens, RWE and EnBW. BASF is currently developing a new type of plastic for compostable packaging. Plastics are in effect excellent long-term storage systems for greenhouse gas – the $CO_2$ remains fixed in the material. Foams are another important everyday material and are used in the manufacture of sports shoes, safety helmets, mattresses and insulation board. These materials too can be produced from $CO_2$. Chemical company Bayer already produces several tonnes of 'polyols'. This liquid substance, nearly half of which comprises $CO_2$, is processed into a foam material – the same foam that used to be manufactured from mineral oil. Over the years the chemicals industry has been very heavily dependent on mineral oil. In order to reduce this reliance Bayer is now cooperating with the energy group RWE as a supplier of $CO_2$. The US technology company Skyonic uses $CO_2$ to manufacture mineral products such as lime and soda, which are in great demand in the building industry particularly, while Novomer is the first manufacturing company in the world to produce plastics in large quantities from carbon dioxide. The next step will be to tackle the rust problem; a metallic coating based on $CO_2$ plastics will create an invisible skin that can protect machinery, equipment parts and metal coils from corrosion.

Methanol production is another area of research. Like ethanol, methanol is an alcohol. However, whereas the manufacture of ethanol involves the release of small quantities of $CO_2$, the latter remains fixed during methanol production. The Japanese company Mitsui Chemicals has been manufacturing 100 t of methanol from $CO_2$ every year since 2009. This process is however more energy-intensive than the traditional oil-based method. The Icelandic company Carbon Recycling International is now exploiting the local abundance of geothermal energy for this purpose and from 2013 is planning to increase methanol production from 4 mt to 50 mt using $CO_2$ from a neighbouring power station.

## Renewable energies at RAG

RAG is now using its coal-industry heritage as potential for new activities in the renewables sector, with these running in parallel with the mine phasing-out programme.
A number of future-oriented projects have already been developed to operational maturity, while others are still at the research stage and should ultimately prove to be economically feasible, such as the schemes to generate pumped-storage electricity underground using mine shafts up to 1,000 m in depth. There are no other projects of this kind anywhere in the world and these schemes, which are being developed jointly with DMT and the universities of Essen/Duisburg and Bochum, will be ground-breaking

**Using renewable energies at RAG sites**




Source: University of Duisburg/Essen

ventures. The aim is to use the abandoned mine shafts as locations for power stations of up to 350 MW capacity. Providing such a storage capacity for renewable energy would indeed be a major contribution to the energy switchover.

Other new project ideas include exploiting the higher ambient temperatures that exist below ground as sources of heat for residential areas and industrial estates and using the heat generated within mine spoil tips as thermal stores. If mine tips have a heat absorption potential it would be possible to feed-in thermal energy via pipes set high up into the body of the tip and then to withdraw the stored process heat via exchanger tubes, as and when required, in order to provide a supply of heat to local properties.

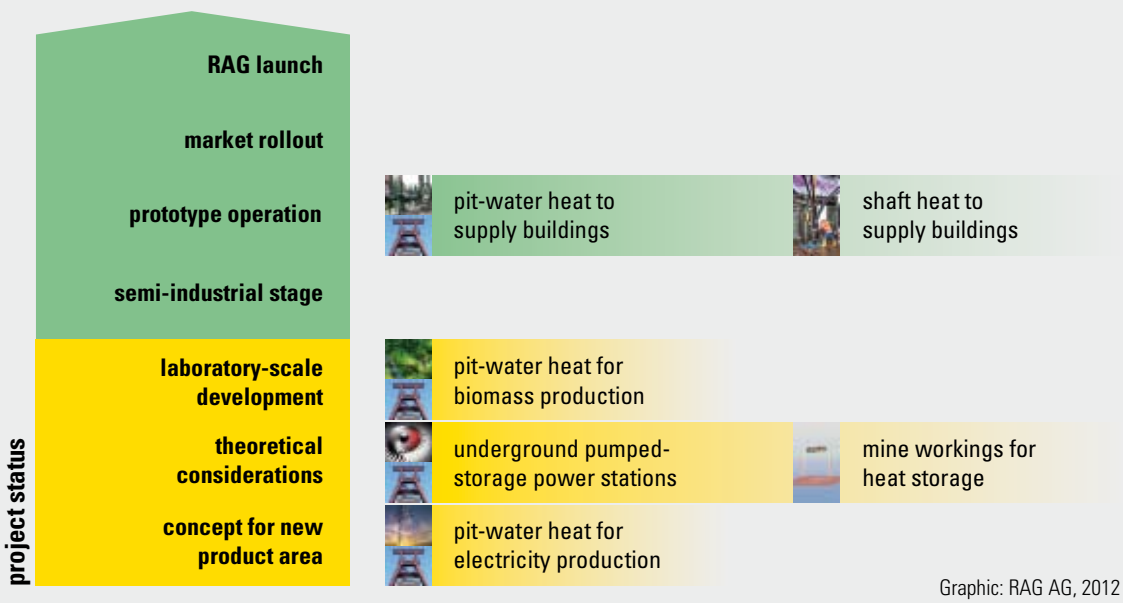
Because of their altitude, mine spoil tips – where the wind potential is on a par with coastal areas – are particularly good locations for installing wind turbines. RAG is therefore working with partners from the regions concerned to develop an overall concept for producing wind energy from these former mining sites. Initial findings from a feasibility study indicate that the wind turbines could even be combined with a pumped-storage power plant. The first concrete feasibility study has now commenced at the Sundern spoil tip in the eastern part of the Ruhr coalfield. The advantage of such a scheme is that it would produce electricity even on wind-free days. The tip would contain an upper reservoir and a lower reservoir. When the wind is blowing, water would be pumped from the

lower basin into the top reservoir and when the weather is calm the water would be allowed to flow down through a series of tubes and across a set of turbines, thereby producing electricity. If the results of the feasibility study are positive the Sundern project, which would initially be generating 20 MW of electricity, could well be the first pumped-storage power plant with the capacity to store both solar and wind energy.

Also after the closure of Saar mine RAG will continue to actively pursue structural change by developing schemes for the follow-up use of former mining sites. This will create new jobs in maintaining and developing the property and assets available in Saarland. Because of the Saar's relatively long hours of

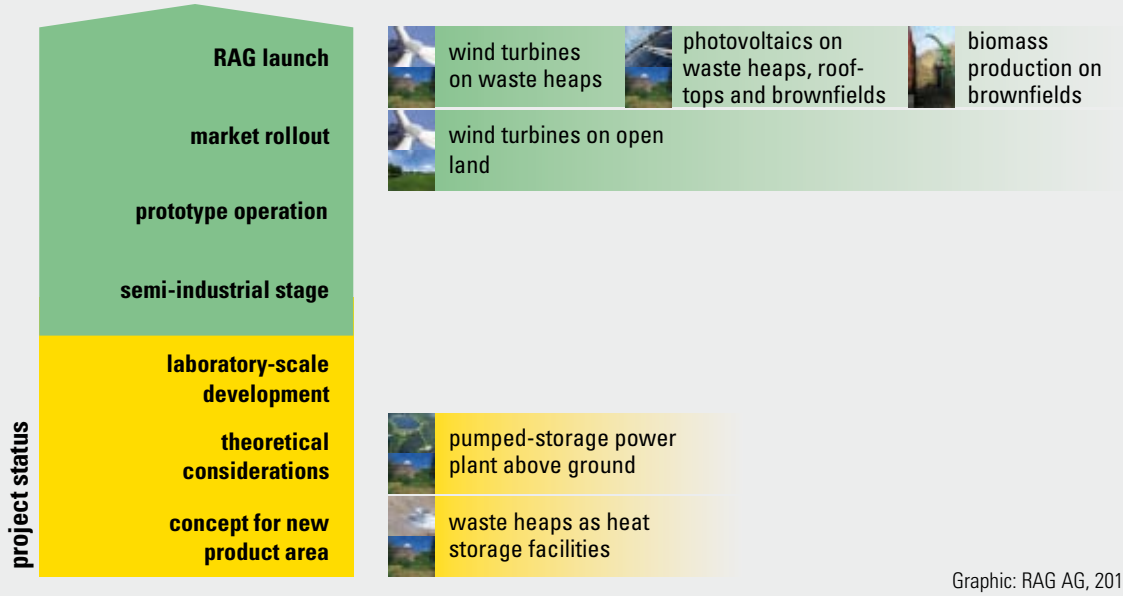
*Photovoltaics at the coal mixing plant of Auguste Victoria mine in Marl*

**Renewable energies – Exploiting underground resources**




Graphic: RAG AG, 2012

**Renewable energies – Exploiting surface resources**




Graphic: RAG AG, 2012

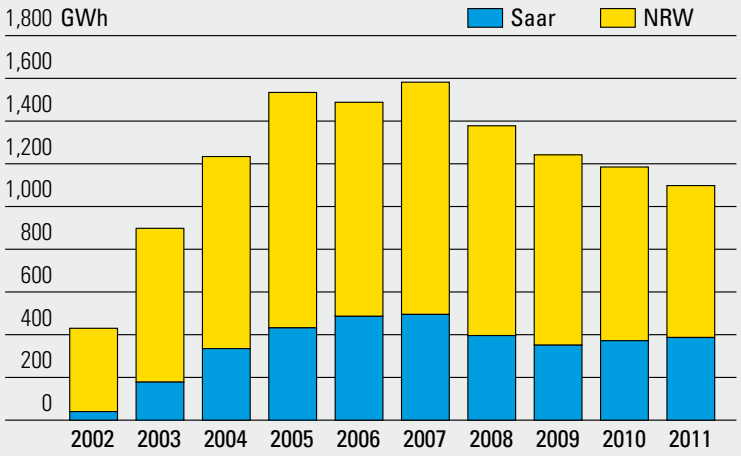
sunshine, photovoltaic systems with a potential of some 180 MW are to be installed during 2012 and 2013 on an area of land and roof-space covering approximately 319 hectares. The Goettelborn solar farm is already a success story – its 49,000 modules have been delivering 8.4 MW of solar power at this former shaft site since 2004.

## Methane utilisation

Mine gas from active collieries is extracted from the production faces and pumped to the surface through a series of pipes. It is then compressed and delivered to a block-central CHP station. Combustion takes place in a conventional gas engine that turns a generator to generate electricity. While North Rhine-Westphalia operates a large number of decentralised sites with thermal power generating modules of this kind, Saarland has its own 110 km interconnected mine-gas grid. This network connects the gas extraction stations with local mine gas-fired CHP installations (including the power stations at Fenne, Velsen and Wellesweiler). The quantity of gas required is adjusted from a control centre. The Saarland mine gas grid features the world's largest mine gas powered engine plant of its type. Installed at the Voelklingen-Fenne site, this unit delivers 42 MW of electric and thermal power. This system delivers a twofold benefit in that it also makes use of the engine heat and waste-gas heat. These specially adapted heat and power plants are capable of operating at an overall efficiency of as much as 85 %.

Even after a mine has been closed down and the shafts filled-in there will still be a release of gas via the cracks and fissures in the carboniferous strata. The system of pipes that run through the mine workings can continue to be used for the targeted extraction of these gases. All mine gas pumped from below ground is put to use in this way and so cannot escape in an uncontrolled manner into the environment. Using mine gas in a power station saves on primary energy and valuable resources can therefore be exploited

**Mine gas utilisation:**
**generating electricity from mine gas**

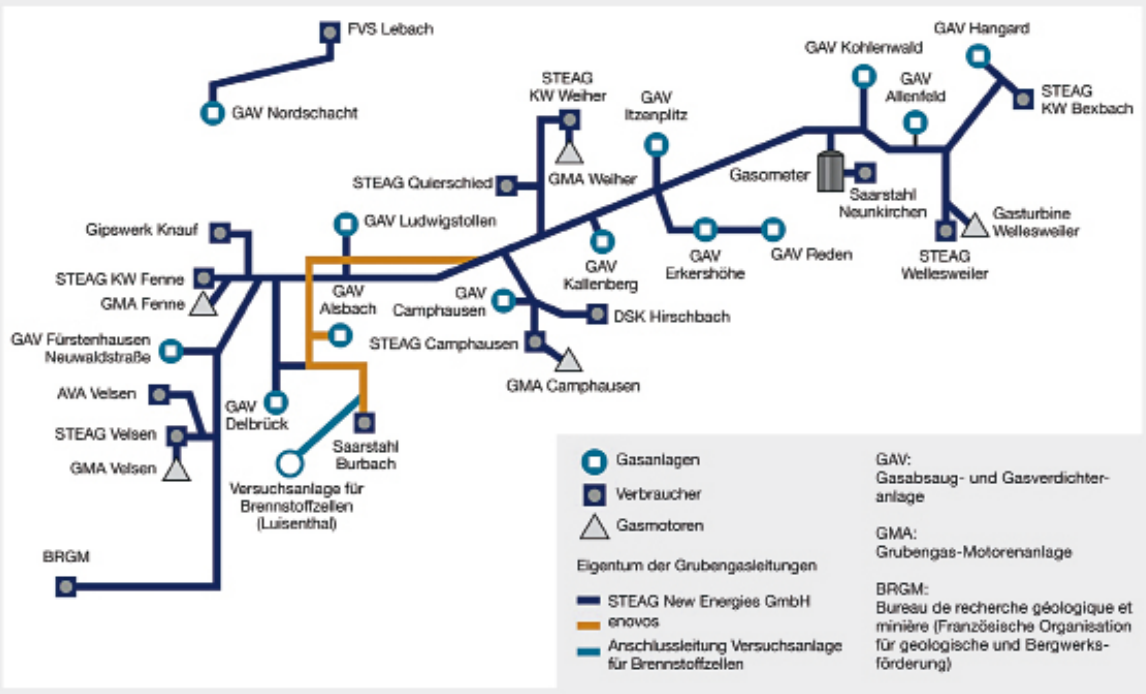



Source: GVSt

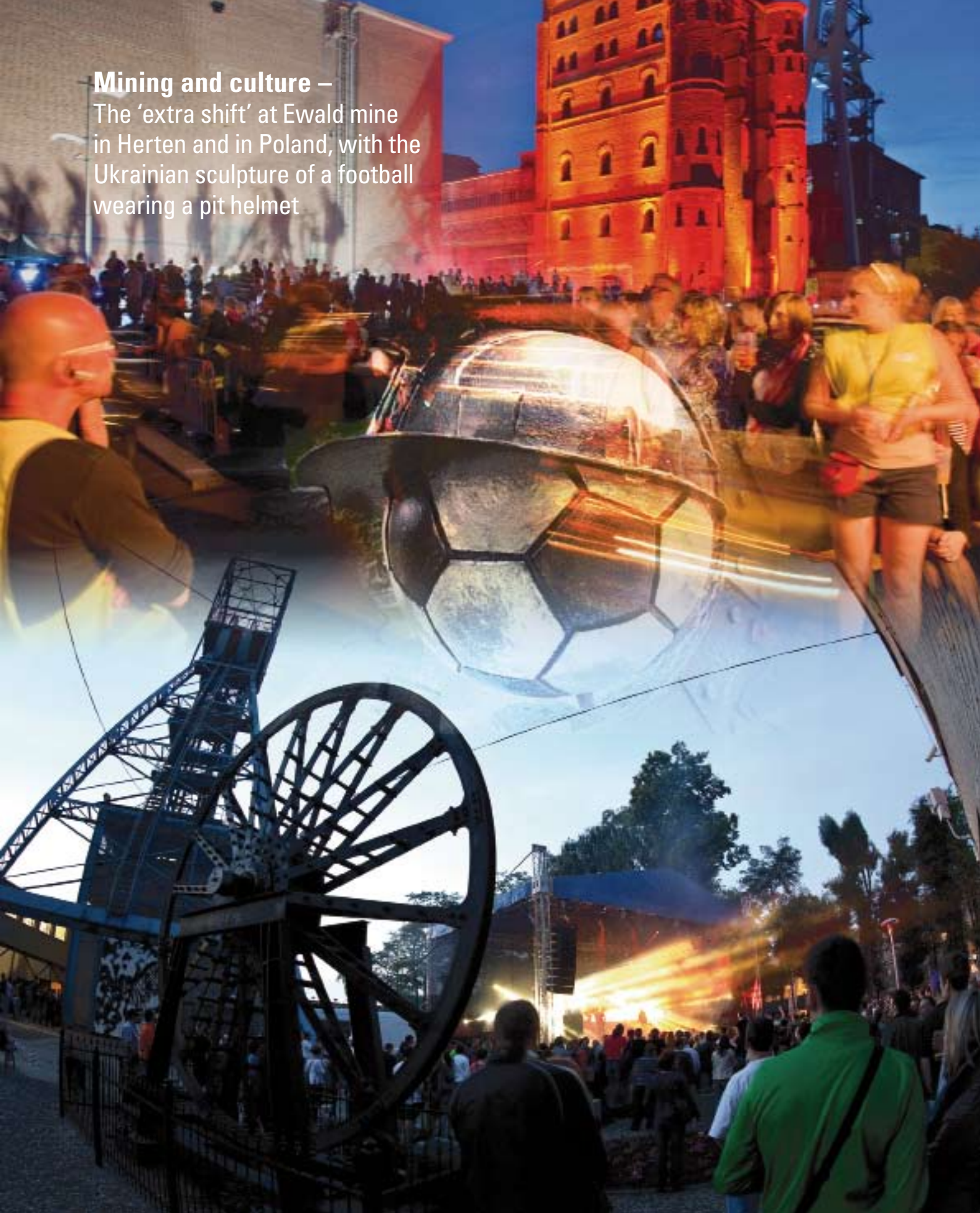
in a sustainable way. A thermal power plant in the 1.35 $MW_{el}$ class is capable of saving in the region of 50,000 t of $CO_2$ emissions each year.

In 2011 the mine gas utilisation companies of North Rhine-Westphalia and Saarland, which provide a total installed capacity of 240 MW, generated around 1,100 GWh of electricity and more than 440 GWh of thermal energy. This capacity was sufficient to prevent 4.8 mt of $CO_2$ equivalent greenhouse gas emissions – a major contribution indeed to climate protection and the conservation of resources.

**The Saarland interconnected mine gas grid**




Graphic: STEAG GmbH, 2011



**Mining and culture –**
The ‘extra shift’ at Ewald mine in Herten and in Poland, with the Ukrainian sculpture of a football wearing a pit helmet

## Global electricity generation

| year | coal and lignite | nuclear energy | mineral oil | natural gas | hydro and others | total |
|---|---|---|---|---|---|---|
| | TWh | | | | | |
| 1970 | 2,075 | 80 | 1,625 | – | 1,175 | 4,955 |
| 1980 | 3,163 | 714 | 1,661 | 976 | 1,802 | 8,316 |
| 1990 | 4,286 | 1,989 | 1,216 | 1,632 | 2,212 | 11,335 |
| 2000 | 5,759 | 2,407 | 1,402 | 2,664 | 2,968 | 15,200 |
| 2005 | 7,040 | 2,640 | 1,240 | 3,750 | 3,550 | 18,220 |
| 2010 | 8,330 | 2,725 | 828 | 4,560 | 4,290 | 20,733 |
| 2011 | 8,538 | 2,780 | 803 | 4,708 | 4,487 | 21,316 |
| 2020 | 10,860 | 3,576 | 713 | 6,020 | 6,712 | 27,881 |
| 2035 | 12,035 | 4,658 | 533 | 7,923 | 11,101 | 36,250 |

Sources: GVSt, 2011/BP, Statistical Review, 2012/WEC, 2012/
New Policies Scenario of the International Energy Agency (IEA), 2011

## World reserves of coal, lignite, mineral oil and natural gas

| regions | coal and lignite[1] | mineral oil | natural gas | total |
|---|---|---|---|---|
| | bnt ce | | | |
| EU-27 | 48 | 1 | 2 | 51 |
| Eurasia[1] | 213 | 28 | 91 | 332 |
| Africa | 27 | 28 | 17 | 73 |
| Middle East | 1 | 164 | 95 | 260 |
| North America[2] | 210 | 43 | 13 | 266 |
| Central and South America[3] | 11 | 70 | 9 | 89 |
| China | 98 | 3 | 4 | 105 |
| India | 52 | 1 | 2 | 55 |
| Indonesia | 5 | 1 | 4 | 10 |
| Far East | 7 | 3 | 7 | 17 |
| Australia[4] | 66 | 1 | 4 | 70 |
| World | 738 | 343 | 247 | 1,328 |
| | 56 % | 25 % | 19 % | 100 % |

[1] remaining Europe and GUS; [2] including Canadian oil sands; [3] including Mexico;
[4] including New Zealand

Sources: BP, 2012

## World reserves and production of coal

| regions | reserves[1] | production[2] |
|---|---|---|
| | bnt ce | |
| EU-27 | 14.212 | 0.111 |
| Eurasia[3] | 106.287 | 0.451 |
| Africa | 25.971 | 0.220 |
| Middle East | 1.031 | 0.000 |
| North America | 198.458 | 0.865 |
| Central and South America | 7.822 | 0.077 |
| China | 154.800 | 3.129 |
| India | 63.968 | 0.475 |
| Far East | 14.146 | 0.337 |
| Australia | 37.543 | 0.298 |
| World | 624.238 | 5.963 |

[1] data of 2010; [2] data of 2011; [3] remaining Europe and GUS

Sources: DERA/BGR, 2011/VDKI, 2012/BP, 2012

## World primary energy consumption

| year | nuclear energy | non-renewable energies: coal and lignite | mineral oil | natural gas | renewable energies: hydro | other fuels | total |
|---|---|---|---|---|---|---|---|
| | mt ce | | | | | | |
| 1970 | 28 | 2,277 | 3,262 | 1,326 | 146 | 827 | 7,866 |
| 1980 | 247 | 2,724 | 4,320 | 1,853 | 206 | 1,066 | 10,416 |
| 1990 | 738 | 3,205 | 4,477 | 2,525 | 271 | 1,420 | 12,636 |
| 2000 | 955 | 3,123 | 5,005 | 3,091 | 329 | 1,534 | 14,037 |
| 2005 | 1,031 | 4,191 | 5,488 | 3,522 | 379 | 1,960 | 16,571 |
| 2010 | 1,050 | 5,000 | 5,580 | 3,890 | 395 | 2,249 | 18,164 |
| 2011 | 1,070 | 5,090 | 5,600 | 4,087 | 405 | 2,291 | 18,543 |
| 2020 | 1,328 | 5,839 | 6,269 | 4,596 | 539 | 2,549 | 21,120 |
| 2035 | 1,733 | 5,864 | 6,642 | 5,617 | 679 | 3,719 | 24,254 |

nuclear energy and renewables evaluated by efficiency method; incl. traditional energies

Sources: GVSt, 2012/BP, 2012/WEC, 2012
Source for 2020/2035: IEA, New Policies Scenario, 2011

## Global $CO_2$ emissions

| regions/ countries | 1990 (base year) | 2000 | 2005 | 2010 | 2011 | changing rates[3] 2011 vs 2010 | 2011 vs 1990 |
|---|---|---|---|---|---|---|---|
| | mt | | | | | % | |
| Annex-I-Countries[1] | 14,981.3 | 14,430.2 | 14,910.1 | 14,143.5 | 14,095.3 | -0.3 | -5.9 |
| EU-27 | 4,426.3 | 4,124.7 | 4,263.2 | 3,901.2 | 3,813.1 | -2.3 | -13.9 |
| *thereof EU-15[1]* | *3,368.7* | *3,375.5* | *3,489.0* | *3,157.3* | *3,042.7* | *-3.6* | *-9.7* |
| *thereof Germany[1/2]* | *1,042.2* | *891.6* | *866.0* | *819.0* | *800.1* | *-2.3* | *-23.2* |
| Australia[1] | 278.2 | 349.7 | 382.4 | 401.8 | 436.2 | 8.6 | 56.8 |
| Canada[1] | 457.4 | 563.8 | 580.3 | 544.9 | 556.7 | 2.2 | 21.7 |
| USA[1] | 5,092.4 | 5,966.2 | 6,098.7 | 5,697.3 | 5,593.7 | -1.8 | 9.8 |
| Russia[1] | 2,498.6 | 1,471.4 | 1,524.8 | 1,593.2 | 1,638.8 | 2.9 | -34.4 |
| Ukraine[1] | 719.0 | 293.5 | 320.6 | 289.7 | 309.7 | 6.9 | -56.9 |
| Japan[1] | 1,141.2 | 1,251.6 | 1,282.3 | 1,191.9 | 1,194.6 | 0.2 | 4.7 |
| Korea | 229.3 | 431.3 | 468.0 | 558.1 | 574.5 | 2.9 | 150.5 |
| India | 589.3 | 976.4 | 1,159.5 | 1,683.3 | 1,798.4 | 6.8 | 205.2 |
| China | 2,244.0 | 3,077.6 | 5,108.3 | 7,391.5 | 8,081.2 | 9.3 | 260.1 |
| rest of Far East | 689.8 | 1,151.8 | 1,445.0 | 1,776.7 | 1,798.7 | 1.2 | 160.8 |
| Middle East | 588.2 | 975.1 | 1,245.0 | 1,597.1 | 1,658.1 | 3.8 | 181.9 |
| Africa | 546.2 | 688.3 | 823.4 | 966.8 | 971.4 | 0.5 | 77.8 |
| Brazil | 193.0 | 303.3 | 322.7 | 383.1 | 389.4 | 1.6 | 101.8 |
| Mexico | 292.9 | 356.8 | 385.5 | 406.4 | 413.4 | 1.7 | 41.1 |
| Latin America | 411.0 | 563.4 | 575.5 | 669.6 | 701.0 | 4.7 | 70.6 |
| Other States | 1,667.1 | 1,625.3 | 1,861.5 | 2,081.0 | 2,197.9 | 5.6 | 31.8 |
| World | 22,063.9 | 24,170.2 | 27,846.7 | 31,133.6 | 32,126.8 | 3.2 | 45.6 |

[1] Annex-I-Countries according to United Nations Framework Convention on Climate Change (see also http://unfcc.int)
[2] temperature- and inventory-adjusted
[3] calculated on the basis of decimal place

Source: H.-J. Ziesing, „...$CO_2$ emissions...", in ET 9/2012 and ET 4/2012

## Primary energy consumption in EU-27

| year | coal and lignite | mineral oil | natural gas | nuclear energy | hydro and others | total |
|---|---|---|---|---|---|---|
| | mt ce | | | | | |
| 2005 | 431 | 1,003 | 606 | 367 | 123 | 2,530 |
| 2006 | 458 | 1,032 | 627 | 371 | 132 | 2,620 |
| 2007 | 455 | 1,006 | 615 | 347 | 144 | 2,567 |
| 2008 | 431 | 1,005 | 631 | 350 | 138 | 2,555 |
| 2009 | 371 | 958 | 590 | 289 | 191 | 2,399 |
| 2010 | 394 | 947 | 639 | 297 | 216 | 2,493 |
| 2011[1] | 409 | 923 | 576 | 293 | 215 | 2,416 |
| 2020 | 326 | 749 | 694 | 330 | 381 | 2,480 |
| 2035 | 200 | 638 | 736 | 339 | 562 | 2,475 |

[1] preliminary

Sources: BP Statistical Review, 2012/IEA, New Policies Scenario, 2011

## Power generation in EU-27

| year | coal and lignite | mineral oil | natural gas | nuclear energy | hydro and others | total |
|---|---|---|---|---|---|---|
| | TWh | | | | | |
| 2005 | 990 | 160 | 660 | 930 | 440 | 3,180 |
| 2006 | 995 | 140 | 710 | 966 | 474 | 3,285 |
| 2007 | 1,040 | 110 | 710 | 935 | 515 | 3,310 |
| 2008 | 990 | 95 | 780 | 920 | 587 | 3,372 |
| 2009 | 818 | 97 | 752 | 894 | 648 | 3,209 |
| 2010 | 828 | 86 | 789 | 917 | 726 | 3,346 |
| 2020 | 667 | 42 | 848 | 885 | 1,124 | 3,566 |
| 2035 | 373 | 24 | 920 | 907 | 1,680 | 3,904 |

Sources: EU-Commission, 2012/BP Statistical Review, 2012/
IEA, New Policies Scenario, 2011

## Power generation in Germany

| year | coal | lignite | nuclear energy | mineral oil | natural gas | wind power | hydro and others | total |
|---|---|---|---|---|---|---|---|---|
| | TWh | | | | | | | |
| 1980 | 111.5 | 172.7 | 55.6 | 27.0 | 61.0 | 0.0 | 39.8 | 467.6 |
| 1990 | 140.8 | 170.9 | 152.5 | 10.8 | 35.9 | 0.1 | 38.9 | 549.9 |
| 1995 | 147.1 | 142.6 | 154.1 | 9.1 | 41.1 | 1.5 | 41.3 | 536.8 |
| 2000 | 143.1 | 148.3 | 169.6 | 5.9 | 49.2 | 9.5 | 50.9 | 576.5 |
| 2005 | 134.1 | 154.1 | 163.0 | 11.6 | 71.0 | 27.2 | 59.6 | 620.6 |
| 2006 | 137.9 | 151.1 | 167.4 | 10.5 | 73.4 | 30.7 | 65.9 | 636.9 |
| 2007 | 142.0 | 155.1 | 140.5 | 9.6 | 75.9 | 39.7 | 74.4 | 637.2 |
| 2008 | 124.6 | 150.6 | 148.8 | 9.2 | 86.7 | 40.6 | 76.6 | 637.1 |
| 2009 | 107.9 | 145.6 | 134.9 | 9.6 | 78.8 | 38.6 | 77.0 | 592.4 |
| 2010 | 117.0 | 145.9 | 140.5 | 8.4 | 86.8 | 37.8 | 91.7 | 628.1 |
| 2011[1] | 111.8 | 150.1 | 108.0 | 6.6 | 84.9 | 48.9 | 101.8 | 612.1 |

[1] preliminary

## Primary energy consumption in Germany

| year | coal | lignite | mineral oil | natural gas | nuclear energy | wind energy | hydro and others | total |
|---|---|---|---|---|---|---|---|---|
| | mt ce | | | | | | | |
| 1980 | 85.2 | 115.7 | 206.7 | 73.9 | 20.7 | 0.0 | 5.9 | 508.1 |
| 1990 | 78.7 | 109.2 | 178.0 | 78.2 | 56.9 | 0.0 | 7.6 | 508.6 |
| 1995 | 70.3 | 59.2 | 194.1 | 95.5 | 57.4 | 0.2 | 10.2 | 486.9 |
| 2000 | 69.0 | 52.9 | 187.6 | 101.9 | 63.2 | 1.2 | 15.6 | 491.4 |
| 2005 | 61.7 | 54.4 | 176.3 | 110.2 | 60.7 | 3.3 | 29.4 | 496.0 |
| 2006 | 67.0 | 53.8 | 174.7 | 111.3 | 62.3 | 3.8 | 31.6 | 504.5 |
| 2007 | 68.8 | 55.0 | 157.8 | 106.5 | 52.3 | 4.9 | 36.7 | 482.0 |
| 2008 | 61.4 | 53.0 | 167.3 | 104.4 | 55.4 | 5.0 | 38.6 | 485.1 |
| 2009 | 51.1 | 51.4 | 158.2 | 100.2 | 50.2 | 4.7 | 42.4 | 458.2 |
| 2010 | 57.9 | 51.6 | 160.0 | 107.1 | 52.3 | 4.6 | 48.3 | 481.8 |
| 2011[1] | 57.5 | 53.3 | 155.2 | 93.3 | 40.2 | 6.0 | 50.9 | 456.4 |

[1] preliminary
nuclear energy and renewables evaluated by efficiency method

Source: AGEB, 2/2011

## Coal and lignite production and imports in EU-27 in 2011

| country | production | | | imports |
|---|---|---|---|---|
| | coal | lignite | total | coal |
| | mt ce | | | |
| Poland | 65 | 19 | 84 | 13 |
| United Kingdom | 16 | – | 16 | 27 |
| Germany | 11 | 53 | 64 | 36 |
| Czech Republic | 10 | 14 | 24 | 2 |
| Spain | 6 | – | 6 | 13 |
| Bulgaria | 2 | 10 | 12 | 3 |
| Romania | 2 | 10 | 12 | 1 |
| Greece | – | 17 | 17 | 1 |
| Hungary | – | 3 | 3 | 1 |
| Slovenia | – | 1 | 1 | – |
| Slovakia | – | 1 | 1 | 3 |
| Italy | – | – | – | 21 |
| France | – | – | – | 13 |
| Netherlands | – | – | – | 10 |
| Finland | – | – | – | 6 |
| Danmark | – | – | – | 5 |
| Belgium | – | – | – | 3 |
| Sweden | – | – | – | 2 |
| Portugal | – | – | – | 3 |
| Austria | – | – | – | 3 |
| Ireland | – | – | – | 2 |
| EU-27 | 112 | 128 | 240 | 168 |

Sources: EURACOAL, 2012/GVSt, 2012

## German coal sales

| year | domestic | | | EU countries | | third-countries | total sales |
|---|---|---|---|---|---|---|---|
| | heat market | power stations | steel industry | steel industry | others | | |
| | mt ce | | | | | | |
| 1960 | 61.3 | 22.1 | 31.3 | 27.0 | | 5.3 | 147.0 |
| 1970 | 28.5 | 31.8 | 27.9 | 19.8 | 5.7 | 3.2 | 116.9 |
| 1980 | 9.4 | 34.1 | 24.9 | 13.0 | 4.8 | 2.1 | 88.3 |
| 1990 | 4.1 | 39.3 | 19.8 | 5.2 | 2.2 | 0.4 | 71.0 |
| 2000 | 0.7 | 27.6 | 10.0 | 0.0 | 0.3 | 0.0 | 38.6 |
| 2005 | 0.3 | 20.3 | 6.1 | 0.0 | 0.1 | 0.0 | 26.8 |
| 2006 | 0.3 | 18.3 | 3.7 | 0.0 | 0.1 | 0.0 | 22.4 |
| 2007 | 0.3 | 18.8 | 4.1 | 0.0 | 0.1 | 0.0 | 23.3 |
| 2008 | 0.3 | 15.0 | 4.1 | 0.0 | 0.1 | 0.0 | 19.5 |
| 2009 | 0.3 | 11.7 | 3.0 | 0.0 | 0.2 | 0.0 | 15.2 |
| 2010 | 0.3 | 10.6 | 3.7 | 0.0 | 0.2 | 0.0 | 14.8 |
| 2011 | 0.3 | 10.1 | 2.3 | 0.0 | 0.1 | 0.0 | 12.8 |

## German coal industry workforce[1]

| by end of year | workers | | white-collar employees | | staff (workers and white-collar employees) | |
|---|---|---|---|---|---|---|
| | underground | surface | underground | surface | total | thereof apprentices |
| | in 1,000 | | | | | |
| 1957 | 384.3 | 169.3 | 16.3 | 37.4 | 607.3 | 48.2 |
| 1960 | 297.0 | 140.2 | 16.8 | 36.2 | 490.2 | 22.7 |
| 1965 | 216.8 | 110.5 | 15.6 | 34.1 | 377.0 | 15.2 |
| 1970 | 138.3 | 75.6 | 13.0 | 25.8 | 252.7 | 11.5 |
| 1975 | 107.9 | 60.9 | 11.5 | 22.0 | 202.3 | 14.1 |
| 1980 | 99.7 | 55.8 | 10.6 | 20.7 | 186.8 | 16.4 |
| 1985 | 90.1 | 47.4 | 10.2 | 18.5 | 166.2 | 15.7 |
| 1990 | 69.6 | 35.9 | 8.9 | 15.9 | 130.3 | 8.3 |
| 1995 | 47.2 | 25.7 | 6.1 | 13.6 | 92.6 | 2.9 |
| 2000 | 25.6 | 18.2 | 3.8 | 10.5 | 58.1 | 2.3 |
| 2001 | 23.0 | 16.2 | 3.4 | 10.0 | 52.6 | 2.2 |
| 2002 | 21.6 | 14.4 | 3.1 | 9.6 | 48.7 | 2.4 |
| 2003 | 20.0 | 13.6 | 2.8 | 9.2 | 45.6 | 2.7 |
| 2004 | 19.6 | 11.6 | 2.8 | 8.0 | 42.0 | 2.9 |
| 2005 | 17.7 | 10.9 | 2.6 | 7.3 | 38.5 | 3.2 |
| 2006 | 16.2 | 9.9 | 2.4 | 6.9 | 35.4 | 3.0 |
| 2007 | 15.1 | 9.1 | 2.3 | 6.3 | 32.8 | 2.4 |
| 2008 | 13.6 | 8.5 | 2.0 | 6.3 | 30.4 | 1.8 |
| 2009 | 12.1 | 7.6 | 1.8 | 5.8 | 27.3 | 1.3 |
| 2010 | 10.7 | 6.7 | 1.5 | 5.3 | 24.2 | 1.1 |
| 2011 | 9.0 | 5.8 | 1.4 | 4.7 | 20.9 | 1.1 |

[1] workforce including short-time workers and trainees

## Rationalisation efforts in German coal industry

| year | output per manshift underground | output[1] per working face | mines[2] | working faces |
|---|---|---|---|---|
| | kg saleable[3] | t saleable[3] | number | |
| 1960 | 2,057 | 310 | 146 | 1,631 |
| 1970 | 3,755 | 868 | 69 | 476 |
| 1980 | 3,948 | 1,408 | 39 | 229 |
| 1990 | 5,008 | 1,803 | 27 | 147 |
| 2000 | 6,685 | 3,431 | 12 | 37 |
| 2005 | 6,735 | 3,888 | 9 | 24 |
| 2006 | 6,409 | 3,686 | 8 | 21 |
| 2007 | 7,071 | 3,680 | 8 | 22 |
| 2008 | 6,309 | 3,740 | 7 | 18 |
| 2009 | 5,597 | 3,375 | 6 | 15 |
| 2010 | 6,092 | 3,018 | 5 | 16 |
| 2011 | 6,623 | 3,156 | 5 | 14 |

[1] daily face output
[2] data status: end of year excl. small mines
[3] until 1996: Saar figures in t = t

## Coal production in Germany

| year | area | | | | Germany |
|---|---|---|---|---|---|
| | Ruhr | Saar | Aachen | Ibbenbueren | |
| | mt saleable | | | | |
| 1957 | 123.2 | 16.3 | 7.6 | 2.3 | 149.4 |
| 1960 | 115.5 | 16.2 | 8.2 | 2.4 | 142.3 |
| 1965 | 110.9 | 14.2 | 7.8 | 2.2 | 135.1 |
| 1970 | 91.1 | 10.5 | 6.9 | 2.8 | 111.3 |
| 1975 | 75.9 | 9.0 | 5.7 | 1.8 | 92.4 |
| 1980 | 69.2 | 10.1 | 5.1 | 2.2 | 86.6 |
| 1985 | 64.0 | 10.7 | 4.7 | 2.4 | 81.8 |
| 1990 | 54.6 | 9.7 | 3.4 | 2.1 | 69.8 |
| 1995 | 41.6 | 8.2 | 1.6 | 1.7 | 53.1 |
| 2000 | 25.9 | 5.7 | – | 1.7 | 33.3 |
| 2001 | 20.0 | 5.3 | – | 1.8 | 27.1 |
| 2002 | 18.9 | 5.4 | – | 1.8 | 26.1 |
| 2003 | 18.2 | 5.6 | – | 1.9 | 25.7 |
| 2004 | 17.8 | 6.0 | – | 1.9 | 25.7 |
| 2005 | 18.1 | 4.7 | – | 1.9 | 24.7 |
| 2006 | 15.2 | 3.6 | – | 1.9 | 20.7 |
| 2007 | 15.9 | 3.5 | – | 1.9 | 21.3 |
| 2008 | 14.2 | 1.0 | – | 1.9 | 17.1 |
| 2009 | 10.9 | 1.0 | – | 1.9 | 13.8 |
| 2010 | 9.6 | 1.3 | – | 2.0 | 12.9 |
| 2011 | 8.7 | 1.4 | – | 2.0 | 12.1 |

**Mining and culture –**
Art on show on the Haniel mine tip
in Bottrop

# Organisation of the German Coal Association (GVSt)

## Vorstand

**Vorsitzender (Präsident):**

*Bernd Tönjes, Herne,*
Vorsitzender des Vorstands der
RAG Aktiengesellschaft

**Stellvertretende Vorsitzende:**

*Dr. h. c. Wilhelm Beermann, Herne,*
(Ehrenpräsident)

*Jürgen Eikhoff, Herne,*
Mitglied des Vorstands der
RAG Aktiengesellschaft

*Dr. Jürgen-Johann Rupp, Herne,*
Mitglied des Vorstands der
RAG Aktiengesellschaft

**Mitglieder des Vorstands:**

*Rainer Platzek, Rheinberg*

*Joachim Rumstadt, Essen,*
Vorsitzender der Geschäftsführung
STEAG GmbH

*K.-Rainer Trösken, Essen*

*Prof. Dr. Franz-Josef Wodopia, Herne,*
Geschäftsführendes
Vorstandsmitglied

*Michael G. Ziesler, Saarbrücken*

## Geschäftsführung

*Prof. Dr. Franz-Josef Wodopia, Herne,*
Hauptgeschäftsführer

*Elmar Milles, Herne*

## Geschäftsbereiche

Wirtschaft/Energie/Umwelt
*Prof. Dr. Franz-Josef Wodopia, Herne*

Recht/Soziales/Tarife
*Elmar Milles, Herne*

## Mitglieder

RAG Aktiengesellschaft, Herne

RAG Deutsche Steinkohle AG,
Herne

RAG Anthrazit Ibbenbüren GmbH,
Ibbenbüren

RAG Beteiligungs-GmbH, Herne

RAG Mining Solutions GmbH,
Herne

RAG Montan Immobilien GmbH,
Essen

RAG Verkauf GmbH, Herne

STEAG GmbH, Essen

As at: mid-October 2012

# List of figures and tables



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# Coal industry data for 2011

| | |
|---|---|
| **Mines** (number) | **5** |
| coking plant (number) | 1 (until 31.05.2011) |
| **Workforce**[1] total | **20,925 employees** |
| - Ruhr coalfield | 16,073 employees |
| - Saar coalfield | 2,427 employees |
| - Ibbenbueren | 2,425 employees |
| **Coal production** total | **12.1 mt saleable**[2] |
| | = 12.3 mt ce[3] |
| - Ruhr coalfield | 8.7 mt saleable |
| - Saar coalfield | 1.4 mt saleable |
| - Ibbenbueren | 2.0 mt saleable |
| coke production | 0.8 mt |
| **Technical statistics** | |
| output per production unit | 3,156 t saleable/day |
| average seam thickness | 191 cm |
| average face length | 336 m |
| average winning depth | 1,152 m |
| deepest shaft | 1,465 m |
| **Sales** total | **12.8 mt ce** |
| - electricity industry | 10.1 mt ce |
| - steel industry | 2.3 mt ce |
| - heat market | 0.4 mt ce |
| **German coal's contribution** | |
| - to primary energy consumption in Germany | 3 % |
| - to electricity generation in Germany | 5 % |
| - to coal consumption | 22 % |
| - to coal-fired electricity production | 26 % |

[1] at year end; including staff on short time working and trainees

[2] saleable includes water and ash content

[3] t ce = tonnes of coal equivalent. 1 kg t ce = 7,000 kcal or 29,308 kJ