

# Reserves, Resources and Availability of Energy Resources

2010





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- ▶ Editor: Federal Institute for Geosciences and Natural Resources (BGR)  
German Mineral Resources Agency (DERA)  
Stilleweg 2  
30655 Hannover, Germany  
  
Contact Office German Mineral Resources Agency:  
Phone: +49 (0)511 643 3200  
Fax: +49 (0)511 643 53 3200  
E-Mail: [energierohstoffe@bgr.de](mailto:energierohstoffe@bgr.de)

Responsible  
Department: Sub-Department B1.4 "Economic Geology of Energy Resources"

Coordination by: Bernhard Cramer, Harald Andrleit

Contributions by: Hans Georg Babies, Andreas Bahr, Uwe Benitz, Jennifer Bremer,  
Dieter Franke, Jürgen Meßner, Sönke Rehder, Hilmar Rempel,  
Michael Schauer, Sandro Schmidt, Ulrich Schwarz-Schampera

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# **preface**

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The development of the world economy after the Second World War benefited from the fact that growing energy demand could be met by cheap crude oil. The development of the world economy at the beginning of the 21<sup>st</sup> century is subject to changed framework conditions. On the one hand, global CO<sub>2</sub> reductions are envisaged to limit the anthropogenic impact on the climate. This especially means a reduction of emissions from the energetic use of fossil fuels. On the other hand, there is a growing understanding that crude oil can become the first raw material in the world for which production can no longer be increased due to limitations of its geological availability. Both trends point to an increased use of renewable energy sources in the 21<sup>st</sup> century. At the same time, fast economic growth, especially of emerging economies like China and India, is based on the intensive use of non-renewable energy sources. In this situation, a number of questions arise which require knowledge regarding the global inventories of energy resources and their availability.

In this study, reserves, resources, production and consumption of crude oil, natural gas, coal, uranium and thorium worldwide will be analysed, evaluated and put into a regional context using data as of end 2009. The BGR publishes this study on an annual basis as part of its advisory role on raw materials for the German Federal Ministry of Economics and Technology. It follows BGR's comprehensive energy study (BGR 2009). The data is based on ongoing analysis and evaluation of information contained in technical journals, scientific publications, reports from industry, trade organisations and public authorities, internet sources and own surveys. The study reverts to the energy resources database of the BGR. This database is part of the raw material information system currently being set up by the German Mineral Resources Agency (Deutsche Rohstoffagentur, DERA) founded by the BGR in 2010.

## **Energy Trends in 2009**

2009 was an eventful year for those studying the situation of global energy resources. In recent years, economic growth and subsequently rising energy demand have led to increased global exploration and exploitation activities in the field of energy resources. These activities resulted in rising resource and reserve figures. This becomes already visible in the figures of this report and will affect the reporting of coming years. Furthermore, the global economic crisis and the volatility of energy raw material prices have affected the availability of energy resources. In particular, the following developments are to be mentioned:

- ▶ Due to rising market prices for uranium, the most important producing countries have re-classified their reserves and resources using higher cost categories. A decreasing number of countries use the cost category of < 40 USD/kg U, which the BGR so far used to define reserves. Deviating from previous studies, the BGR therefore had to set new cost margins for the reserves, extending the cost category of < 40 USD/kg U to the cost category of < 80 USD/kg U. For this reason, the uranium reserves in the BGR database have risen in 2009, bearing no relation to new, additional uranium discoveries.
- ▶ While the demand for coal and thus the import volumes decreased significantly in almost all major industrial countries due to the global economic crisis, China in particular took advantage of the relatively low world market prices in 2009 and expanded its coal imports at a massive scale. This way, China's hard coal imports grew threefold to 127 Mt and the country halved its hard coal exports to 22 Mt. Accordingly, China became a net importer and, on a global scale, the second biggest importer of coal after Japan. At the same time, China compensated the fall in demand for coal in other countries and thus stabilized the global seaward hard coal market.
- ▶ In a comparison of fossil fuels, natural gas experienced the biggest decline in global consumption due to the economic crisis. This led to a clear fall in production, especially in Russia (minus 12 %). In the USA, production increased slightly and the country became the world's biggest natural gas producer. The strong increase in the production of non-conventional natural gas, especially in the USA, led to an oversupply in the gas markets. For this reason, the cross-border prices for natural gas in Germany also dropped significantly. In Germany, the first exploration activities for non-conventional natural gas have started as well. In order to examine whether domestic shale gas resources can add to the security of supply like in the USA, the German Federal Ministry of Economics and Technology has requested the BGR to evaluate the potential for non-conventional crude oil and natural gas from shales in Germany.
- ▶ Since 2005, the global production of crude oil has not undergone significant increases. Production volumes vary slightly below 4 Gt/a. In its updated projection, the BGR shows a possible pathway by which the crude oil production could be increased until 2035 at the most using the entire geological oil potential. There are many factors and developments possible which could shift maximum oil production to an earlier date. The oil spill in the Gulf of Mexico in 2010 is a good example of the unpredictability of the factors affecting global oil production. Such incidents give rise to new questions regarding the growing challenges of crude oil exploration and production. Impacts on the global availability of crude oil cannot be determined yet.

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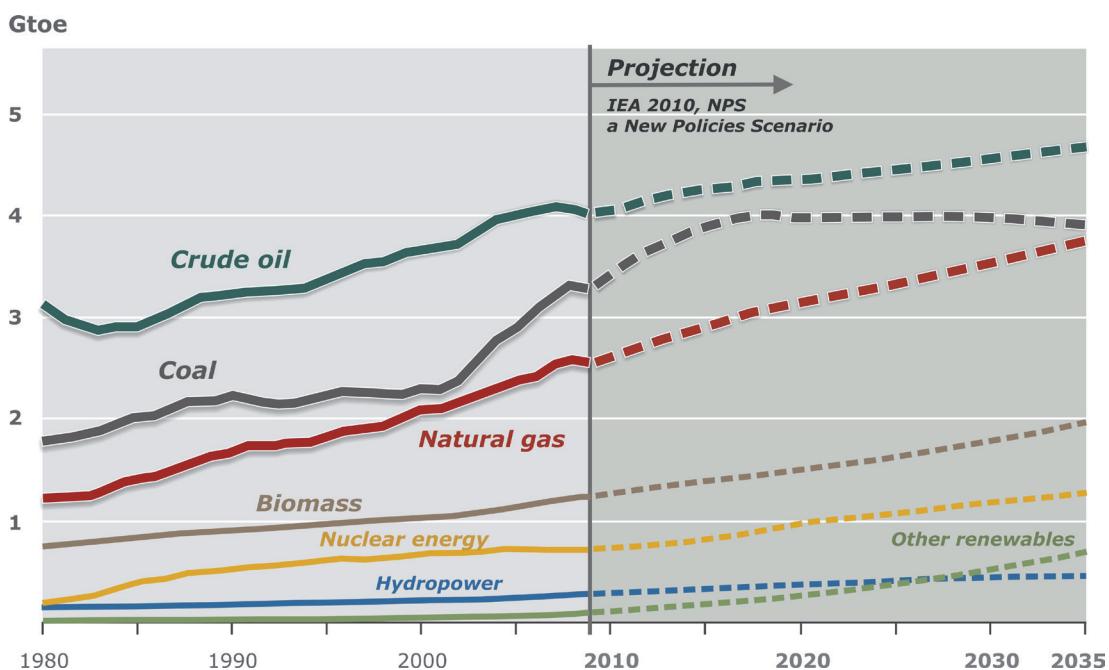


# 1 Energy Resources at a Glance

## Energy Resources in the Context of Global Energy Supply

The beginning of the 21<sup>st</sup> century has been characterised by a rapid increase of global primary energy consumption (Fig.1). The rising energy demand was foremost based on the fast growth of the emerging economies, in particular China and India. While nuclear energy remained stable in this period, the significance of crude oil, coal and natural gas as energy sources further increased. This development had the biggest impact on coal. Whereas energy production from coal had been stagnating until 2002, production between 2002 and 2008 grew faster than ever before (Fig.1). The current global economic crisis seems to have temporarily delayed this development. In 2009, primary energy demand and according energy production from crude oil and natural gas decreased worldwide. Contrary to the general trend, energy consumption in China and India grew further.

Both the development of the global primary energy consumption and the future shares of individual energy sources are not predictable. While the dynamics of the world economy will continue to have a crucial impact on energy demand in the coming years, the significance of non-renewable energy sources is an area of conflict between contradictory demands. On the one hand, the rapid development of emerging economies crucially depends on the quick and flexible availability of favourably priced energy. This demands an increase in the use of crude oil, natural gas, coal and nuclear energy. On the other hand, efforts to protect the climate demand a reduction of carbon dioxide emissions and thus a reduction in the combustion of fossil fuels. Against this background, scenarios regarding the development of the world energy consumption highlight different political pathways, attaching different values to these conflicting demands.



**Fig. 1:** Development of global primary energy consumption by energy source and one possible scenario for future developments (New Policies Scenario, IEA 2010 a)

The New Policies Scenario of the IEA (IEA 2010a), portrayed in figure 1, is based on the assumption that political measures planned and announced in the field of energy and climate policies worldwide will be implemented. Accordingly, non-renewable energy sources would remain the main energy source in the coming 25 years. By 2035, they would still have a share of 85 % in the global energy mix. Efforts to reduce CO<sub>2</sub> emissions are represented in this scenario by increased production of renewable and nuclear energy. Coal is expected to reach a plateau level in consumption around 4 Gtoe by 2015. For crude oil and natural gas, a continuous growth is projected in the IEA scenario. The growth scenario for crude oil foresees a demand of about 4.7 Gt by 2035. It is, however, questionable whether these volumes of crude oil will actually be available.

The prices for energy resources reflect the development of raw material consumption for energy production in the past 10 years, even though the dynamics differ. While nominal prices for energy resources varied without notable up- and downswings in the 1990s (Fig. 2), a significant rise in prices for crude oil and natural gas began shortly before the turn of the millennium. For coal, a similar trend is discernible from 2003 onwards. To a lesser degree the same applies to natural uranium for the period from 2004 onwards. These price increases only came to a halt by mid-2008 due to the global economic crisis. Despite the strong fall in prices from September 2008 onwards, on an annual average the highest oil price ever was recorded in 2008 (Fig. 2). After a few months of decreasing oil prices, by the end of 2008/beginning of 2009 the lowest price for crude oil was then reached. In relation to the daily quotations, the price dropped to a quarter of the maximum quotation in July 2008. Afterwards, the oil price recovered and the annual average price of 2009 again reached the level of 2006. In general the prices for coal, natural gas and uranium followed the price development of crude oil.

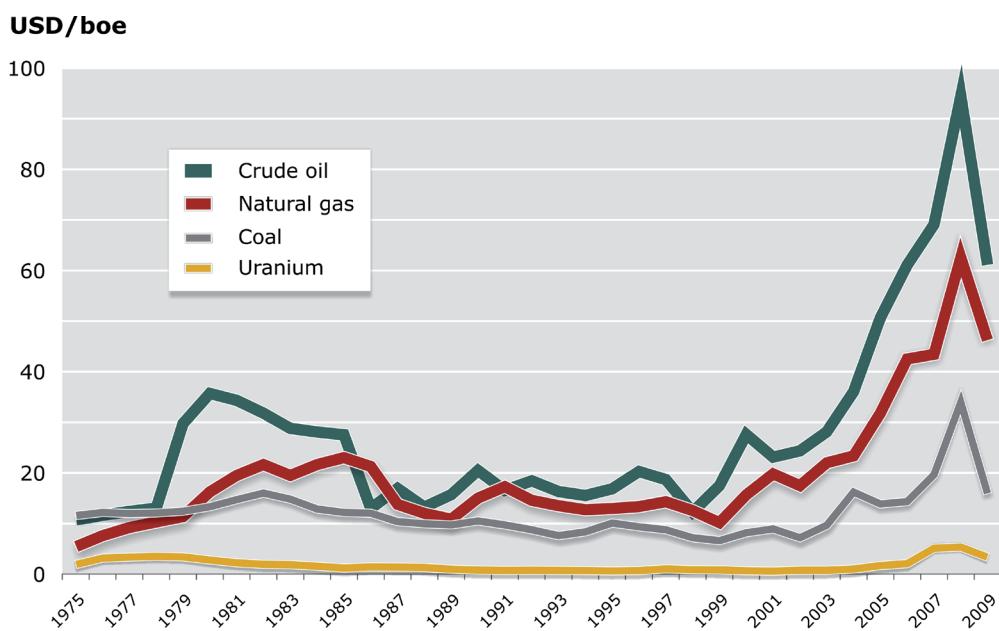
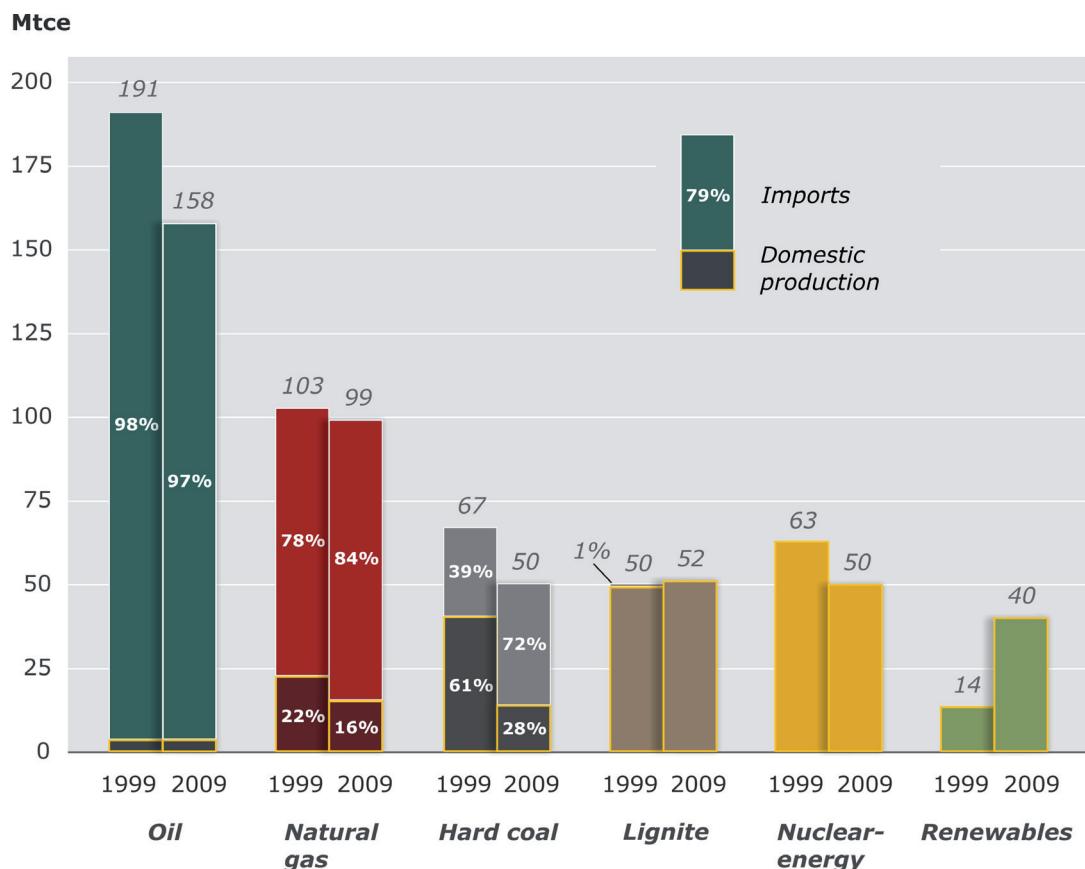


Fig. 2: Historical development of nominal annual average prices for non-renewable energy from 1975 to 2009

## Germany and the Need for Energy Resources

As an industrialized nation Germany depends on a secure energy supply at favourable costs. Primary energy consumption in Germany decreased by 8 % compared to 10 years ago. The use of natural gas was reduced by 4 %, crude oil by 13 %, nuclear energy by 21 % and hard coal by 25 % (Fig. 3). Among the non-renewable energy sources only the use of lignite increased by approximately 4 %.

At the same time, Germany is highly dependant on imports of energy resources. While the import dependency regarding crude oil amounts to 97 %, currently 16 % of the natural gas used in Germany still stems from domestic production (Fig. 3). Since 2008, exploration activities have started regarding non-conventional gas resources like shale gas and coalbed methane. If these efforts were to be successful, the extra natural gas production could make up for the decreasing production from conventional gas fields and thus lower the import share of natural gas for Germany. Due to the end of subsidised hard coal production planned 2018, the import dependency for hard coal in particular is expected to rise. Regarding lignite, Germany is self-sufficient. Uranium is not produced in Germany.



**Fig. 3:** Comparison of primary energy source use and the relationship between self-supply and import shares in Germany in 1999 and 2009

## Global Availability

The rapid increase in global energy demand in the past and the accompanying rise in prices has once again put the focus on questions regarding the availability of recoverable energy resources. In the following, global reserves and resources (definitions in the glossary) of energy resources will be portrayed, based on data as of end-2009 (Table 1). Accordingly, the energy content of all the reserves equalled 39 794 EJ. Coal is still the dominating energy source with a share of 53 % as measured by its recoverable energy content. Crude oil (both conventional and non-conventional) accounts for 24 % of the total reserves, natural gas for just below 19 % and nuclear fuels for 4 %.

**Table 1:** Reserves and resources of non-renewable energy resources as of end-2009 both in individually relevant units for the single energy resources (left column) and in EJ (right column)

Fuel	Units	Reserves (cf. left column)	EJ	Resources (cf. left column)	EJ
Crude Oil	Gt	161	6 731	99	4 152
Natural Gas	Tcm	192	7 291	241	9 142
Conventional Hydrocarbons	Gtoe	335	14 022	318	13 294
Oil Sand	Gt	45	1 888	110	4 609
Extra Heavy Oil	Gt	21	896	82	3 418
Oil Shale	Gt	< 0.5	1	119	4 966
Non-Conventional Oil	Gtoe	67	2 785	311	12 993
Shale Gas	Tcm	1.7 <sup>5)</sup>	65 <sup>5)</sup>	456 <sup>6)</sup>	17 329 <sup>6)</sup>
Tight Gas	Tcm	1 <sup>5)</sup>	46 <sup>5)</sup>	210 <sup>6)</sup>	7 970 <sup>6)</sup>
Coalbed Methane	Tcm	2	80	254	9 652
Aquifer Gas	Tcm	–	–	800	30 400
Gas Hydrates	Tcm	–	–	1 000	38 000
Non-Conventional Gas	Tcm	5	191	2 720	103 351
Non-Conventional Hydrocarbons	Gtoe	71	2 977	2 781	116 344
Hydrocarbons Total	Gtoe	406	16 999	3 099	129 639
Hard Coal	Gtce	611	17 906	14 531	425 886
Lignite	Gtce	110	3 216	1 701	49 861
Coal Total	Gtce	721	21 122	16 233	475 747
Fossil Fuels Total			38 121		605 386
Uranium <sup>1)</sup>	Mt	3 <sup>2)</sup>	1 258 <sup>2)</sup>	11 <sup>3)</sup>	5 286 <sup>3)</sup>
Thorium <sup>4)</sup>	Mt	1	415	5	2 508
Nuclear Fuels Total			1 673		7 794
Non-Renewable Fuels Total			39 794		613 180

– no production or reserves

<sup>1)</sup> 1 t U = 14 000 - 23 000 tce, lower value used or 1 t U = 0.5 x 10<sup>15</sup> J

<sup>2)</sup> RAR recoverable up to 80 USD/kg U

<sup>3)</sup> Sum of RAR producible 80-260 USD/kg U sowie IR and undiscovered < 260 USD/kg U

<sup>4)</sup> 1 t Th used the same tce-value as for 1 t U

<sup>5)</sup> only United States

<sup>6)</sup> in-place resources

By the end of 2009, the energy content of all non-renewable energy resources amounted to 613 200 EJ. Coal constituted the largest portion of all energy resources (about 78 %) and also of the reserves with about 53 % (Fig.4). Conventional and non-conventional natural gas made up about 18 % of the aggregated resources. At present, the number for non-conventional natural gas can only be roughly estimated at about 2720 tcm. This is more than ten-times the figure of the conventional resources (241 tcm). Crude oil has a share of about 3 % and nuclear fuels account for 1 % of the resources.

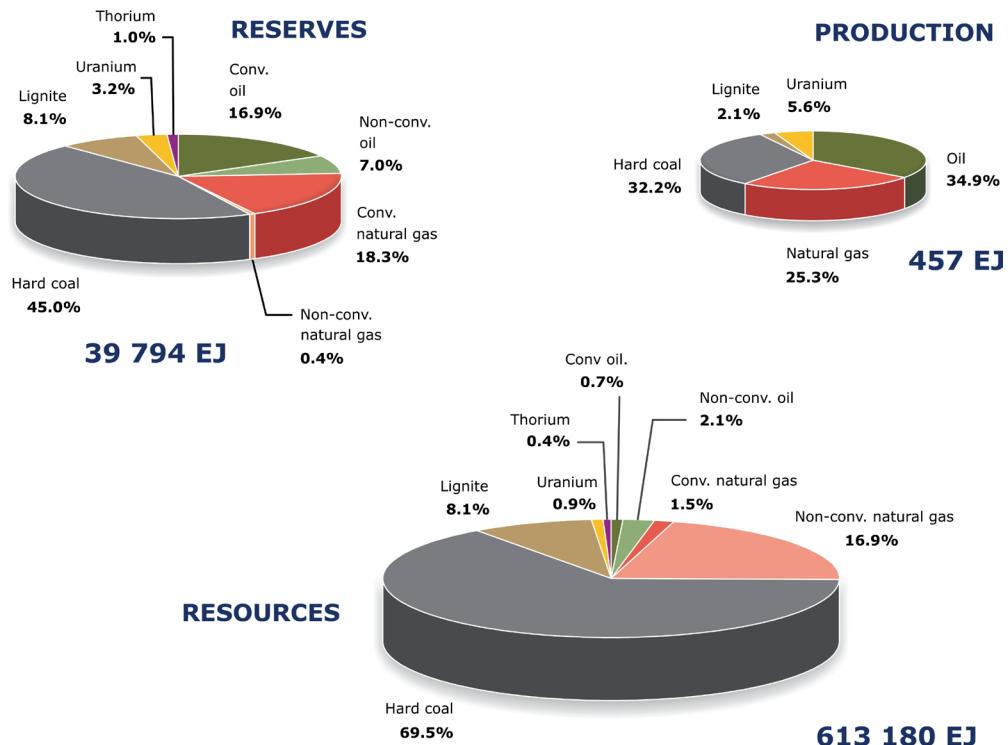
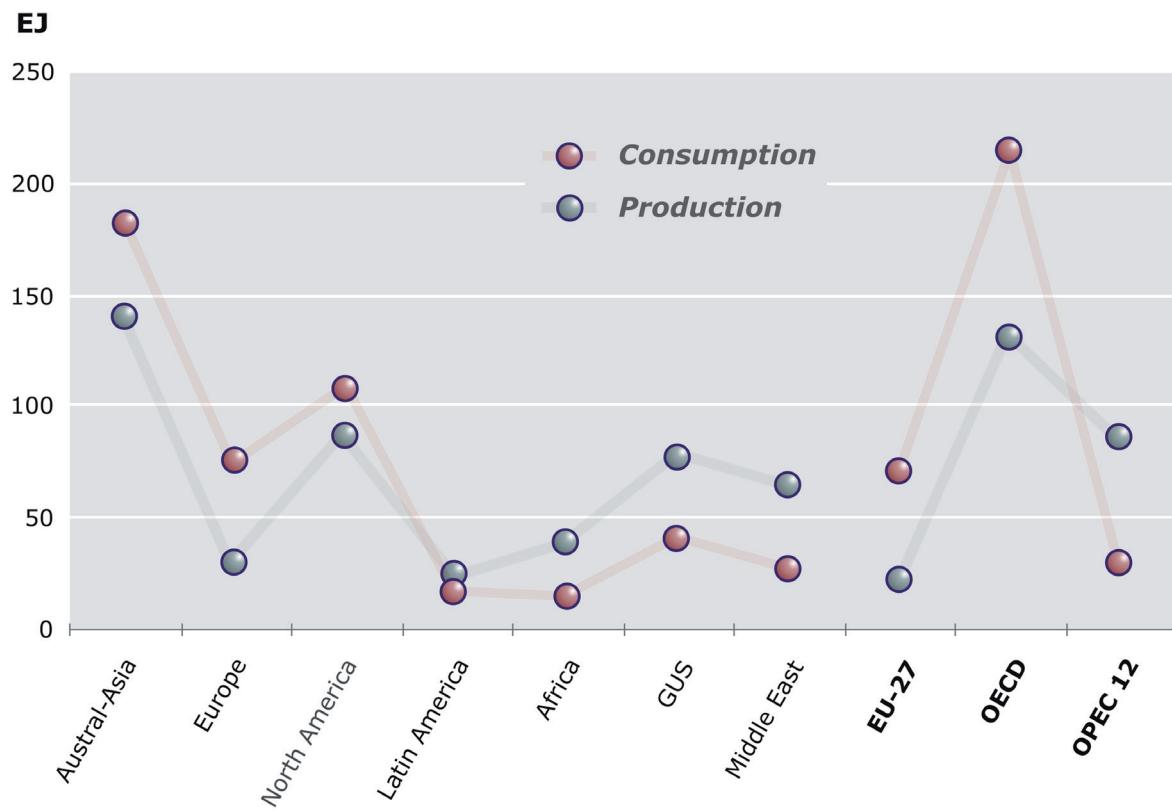


Fig. 4: Global shares of non-renewable energy sources in production, reserves and resources at the end of 2009

In 2009, non-renewable energy sources in the order of 457 EJ were produced. Comparing the global annual production of all energy resources with the amount of reserves (39 794 EJ) and resources (613 180 EJ), the relation is 1 to 87 to 1342 (Fig. 4). Hence, from a geological perspective the global availability of all energy resources appears to be sufficient to cover our future energy demand for many decades to come. However, it remains to be seen whether the relevant resources will always be available in sufficient amounts and at the time when they are needed.

Energy resources are not distributed evenly across the world. Regions and countries with rich occurrences or high production of energy resources do not necessarily coincide with regions and countries with high energy demand. This way, more energy resources are used than produced in Europe, Austral-Asia and North America (Fig. 5; definition of the regions in the annex). On the opposite, Africa, the CIS and the Middle East are regions where the production of energy resources more than doubles their own consumption. Tables 2 to 5 (in the annex) give a detailed overview of the distribution of resources, reserves, production and consumption according to regions.



**Fig. 5:** Production and consumption of energy resources (EJ) according to regions and country groups

North America and Austral-Asia possess the largest resources each with a share of a third (Fig. 6). This is primarily due to their coal resources but also related to significant resources of crude oil and natural gas. The CIS is also an important region holding around one sixth of the global resources, mainly consisting of crude oil and natural gas.

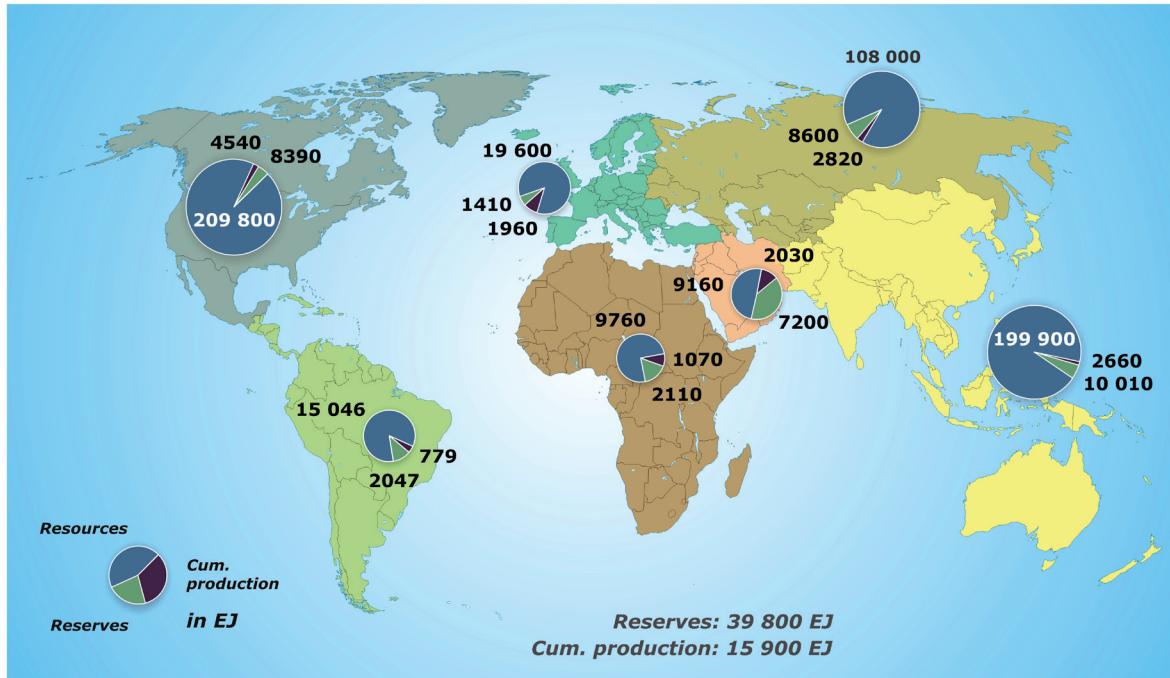


Fig. 6: Total potential of energy resources 2009: Regional distribution (cumulated production of coal since 1950)

The region with the biggest share (25 %) in global energy reserves is Austral-Asia, where 42 % of the hard coal reserves are located. The CIS, North America and the Middle East each hold about 20 % of the reserves (Fig. 6). Natural gas and coal dominate in the CIS, while North America holds huge reserves in non-conventional crude oil and coal. The Middle East dominates crude oil and natural gas reserves.

## 2 Energy Resources in Detail

### Crude Oil

In terms of global consumption, crude oil is still the most important primary fuel accounting for about 35 % of the world's primary energy consumption (excluding biomass). Future developments are fraught with uncertainties regarding resources, reserves and production on the supply side as well as regarding the developments on the demand side. It seems that the global economic crisis has only temporarily dampened crude oil demand and thus "spared" the reserves. As a response, global oil production 2009 decreased by about 100 Mt (minus 2.5 %). Throughout 2009, Russia became the biggest producer with its oil production amounting to 494 Mt, overtaking Saudi-Arabia. Since the beginning of commercial oil production, about 159 Gt have been produced and consumed worldwide. This is almost the same amount as today's remaining conventional oil reserves of 161 Gt.

The BGR estimates that the remaining potential of conventional crude oil (reserves and resources) at the end of 2009 is in the order of 260 Gt. Discoveries and reassessments of oil fields led to an increase in the remaining potential by 10 Gt (plus 4 %) compared to 2008 (BGR 2009). The biggest amount in reserves and resources is concentrated in the Middle East (123 Gt) followed by the CIS (42 Gt), Africa (32 Gt) and North America (22 Gt). The amount for Europe is rather moderate with about 6 Gt. The estimated ultimate recovery (EUR) of conventional crude oil at the end of 2009 was about 419 Gt (Fig. 7).

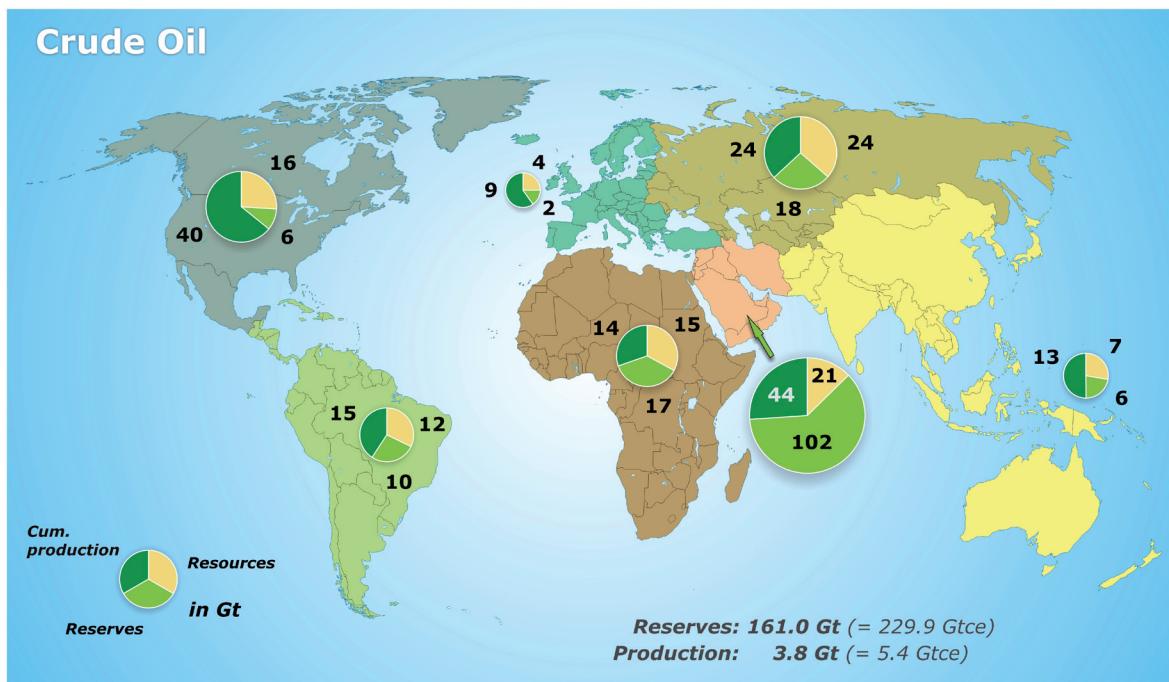


Fig. 7: Distribution of the estimated ultimate recovery of conventional crude oil (419 Gt) in 2009



The amount of crude oil reserves worldwide is estimated at 161 Gt. This is only 1 Gt higher than in the previous year. The increase in reserves mainly occurred in Qatar, Vietnam, Ecuador, Nigeria, Russia and Iran. About 64 % of the global reserves are located in the Middle East, followed by the CIS and Africa with 11 % each. The OPEC possesses about 76 % of the global reserves of which 63 % are located in the Gulf region. About 5 % of the global crude oil reserves belong to the OECD countries. These numbers show the important role of the OPEC and particularly the Gulf region for the oil supply in the future. Compared to 2008, the amount of oil resources increased by 10 % (8.6 Gt) due to reassessments in Latin America (Brazil, Falklands) and Africa (Angola, Congo, Egypt, Gabon, Uganda). The Middle East, the CIS and North America comprise the regions with the highest production in 2009.

During the last decades the relevance of offshore oil discoveries increased constantly. At the same time, the focus has increasingly shifted from shallow water (up to 500 m) to deep water (more than 500 m) and ultra deep water (more than 1500 m). Since 2006 about 50 % of the discovered reserves came from deep water areas. The accident on the Deep Water Horizon platform in the Gulf of Mexico with the following oil disaster illustrated the risks of offshore exploration and production dramatically. This has led to a fierce debate on future oil and gas production in deep water. Deep water oil production requires high standards in technology and safety. First successes were made during the 1980s in the Persian Gulf, the Caspian Sea and the Arabian Sea. Today's activities have been extended to the continental shelf of the South Atlantic Ocean of Brazil and West Africa (Nigeria, Angola), the Gulf of Mexico, Australia, Southeast Asia (Indonesia, Malaysia, China, Thailand) and the North Atlantic Ocean. To date approximately 1500 oil fields in 86 countries have been discovered in deep water areas. According to IHS CERA (2010), the global oil production capacity from deep water fields in 2000 was 75 Mtoe. In 2009 it tripled to 250 Mtoe. Hence, more than 6 % of the global oil production stem from deep water regions. IHS CERA (2010) predicts an increase to more than 500 Mtoe (13 % of total production) until 2015. Due to the enormous challenges of deep water exploration it can take more than ten years from discovery of an oil field to first production.

In addition to conventional oil accumulations, non-conventional oil occurrences have a sizeable potential. Reserves of non-conventional oil amount to about 40 % of the conventional oil reserves. At the same time, non-conventional oil resources exceed those of conventional oil occurrences by three times. About 40 % of non-conventional oil resources are located in oil sands and oil shales. However, in the foreseeable future an economic utilisation at a larger scale is questionable due to the relatively high costs involved and environmental problems. Therefore, only a few pilot projects are expected to be carried out.

In contrast, oil sands and extra heavy oil projects are not subject to these limitations and numerous projects have been started in Canada and Venezuela during the last years. Their contribution to global oil production amounts to about 3 % in 2009. In accordance with the successful developments in shale gas exploration and production in the USA, the production of shale oil seems to be promising. However, scheduled projects are still in their early stages.

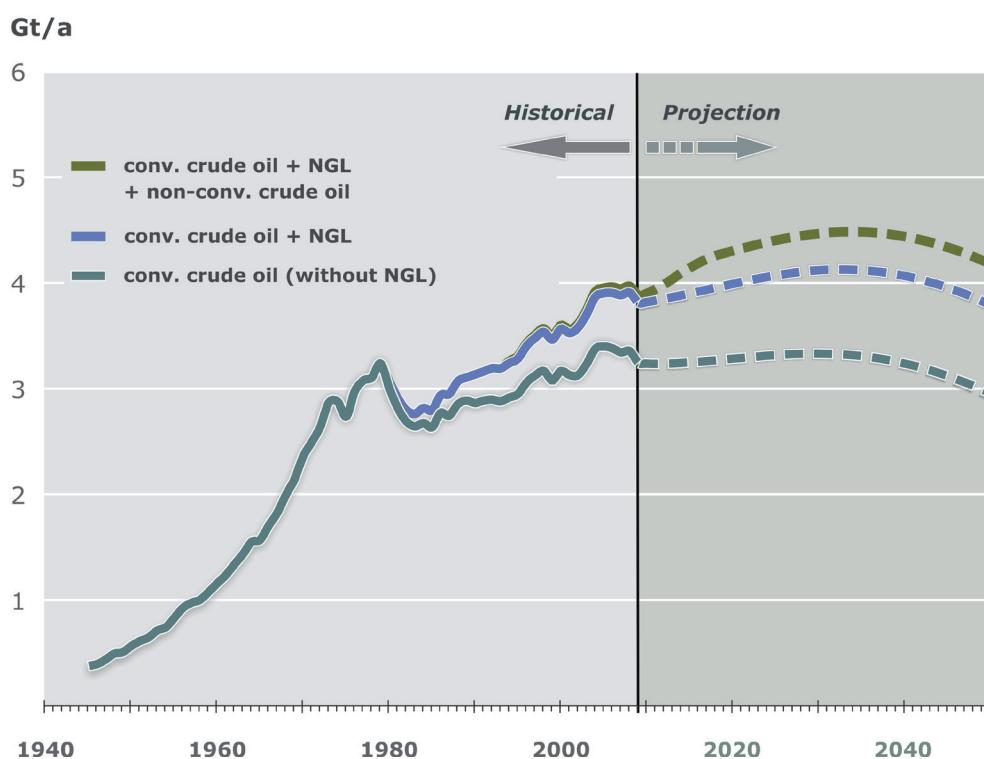
In 2009 the consumption of oil products decreased by about 25 Mt compared to 2008 and reached 3884 Mt. The consumption in Europe, North-America and the countries of the CIS fell due to the global economical crisis, although in Africa, the Middle East, Austral-Asia and Latin-America consumption increased considerably.

About two thirds of the crude oil produced in 2009 was transported across country boundaries, partly over large distances by either tanker or pipeline. Globally 2046 Mt of crude oil were exported in 2009, 90 Mt less than in the previous year, while imports increased by 70 Mt. Germany imported only 98.1 Mt (minus 7 Mt or 4.4 %). The main supply countries for Germany have been Russia, Norway and the UK.

Crude oil is classified in different benchmarks of oil grades (e.g. Brent). Apart from small price surcharges and reductions, each oil grade is traded globally at a uniform price. After the record oil prices in 2008 of more than 145 USD/b, the price fell to just below 40 USD/b by the end of 2008. In the course of 2009 oil prices recovered continually and exceeded in January 2010 the 80-Dollar benchmark again. A midterm forecast of the development of the oil price is impossible. However, it can be expected that oil production from increasingly complex fields and fields which are difficult to access (e.g. frontier areas) will become more challenging and thus more expensive.

A compilation of country-specific data concerning production, consumption, imports, exports, reserves and resources of crude oil is given in Tables 6 to 12 (in the annex).

Based on the latest available reserve data for crude oil, the possible development of the oil production until 2050 was calculated and visualised in the BGR-projection (Fig. 8). The crude oil production includes field growth, condensate (NGL) according to its expected share in the increasing future gas production, production from deep water and ultra deep water, oil sands and extra heavy oil. The dynamic of the projection is based on the course of oil production over the last 25 years, a period which was characterised by global free trade at more or less uniform prices. During this time a certain amount of resources has been transferred continuously to reserves. Accordingly the reserves amount to about 40-times the specific annual production. This trend is carried forward in the BGR-projection. This way, the projection illustrates an optimistic approach (BGR 2009). Therefore, the projection cannot simply be applied to determine the availability of oil or the consumption of oil in individual countries or country groups. The future developments in oil production are highly dependent on the question whether the uniform global market for crude oil will remain and on the behaviour of individual countries (e.g. whether China secures oil quota via bilateral contracts). Dependent on political, technical and economic developments it may be expected that the real production figures can deviate from the projected ones.



**Fig. 8:** Historic development of oil production and projected course of production for conventional oil including condensate (NGL) and additionally taking into account the oil sand production and increases in reserves (field growth).



According to the projection the climax („peak oil“) will be around 2035 (Fig. 8). After this date, a significant decrease in conventional oil production must be expected. Production of condensate (NGL) and non-conventional oil could gain a 10 % share in 2035. Only taking into account conventional oil (without condensate) the projection would feature a relatively flat trend (Fig. 8). A separate assessment of the curve progression of individual components, especially their production peaks, is not possible due to their interdependencies. In addition, it is not regarded to be crucial for global market dynamics. Hence, peak oil based on conventional oil only is not discussed here.

The amount of non-conventional oil production in the projection will not shift the global maximum significantly forward. According to the projection, the annual oil production could reach approximately 4.5 Gt/a. Hence the demand calculated by IEA in the New Policies Scenario for 2035 would not be satisfied.

### Crude Oil: Trends und Outlook

- ▶ From a geological viewpoint and considering a moderate increase in oil consumption, crude oil will be available in sufficient quantities for the next few years.
- ▶ According to the (optimistic) BGR-projection, global crude oil production could be increased until about 2035 and reach a maximum of 4.5 Gt/a.
- ▶ Global crude oil production in 2009 decreased due to a reduced demand for oil in the aftermath of the global economic crisis.
- ▶ The amount of oil produced in the OPEC countries (especially in the Gulf region) will increase within the next decades and according to IEA's World Energy Outlook 2010 (IEA 2010 a), the OPEC-share could reach more than 50 % in 2035.
- ▶ The contribution of non-conventional oil (especially oil sands from Canada and extra heavy oil from Venezuela) to total oil production is expected to grow in the coming years and, according to BGR's projection, could reach a share of almost 10 % by 2035.
- ▶ For different reasons, it is virtually impossible to predict future oil price changes. Important factors influencing oil prices are the policy of OPEC countries, the availability of additional production and refining capacities as well as the development of the global economy. Higher safety constraints for deep water oil production and the growing share of non-conventional oil will most likely result in higher production costs for crude oil.
- ▶ It can be expected that in the foreseeable future crude oil will not be available in the same unlimited quantities as it has been in the past. Taking into account the long lead times in the energy sector, it is necessary to develop alternative energy sources in time.

## Natural Gas

Almost a quarter of the world's primary energy consumption consists of natural gas. It is the third most important source of energy after crude oil and hard coal. After global gas production had increased steadily for many years, in 2009 falling demand caused annual production to drop to about 3 tcm. Compared to the remaining fossil fuels, natural gas experienced the biggest drop in consumption on a global scale which in turn led to a drastic cut in production (minus 12 %) in Russia. At the same time, the USA slightly increased their production and became the largest gas producer in the world. At the end of 2009 cumulative natural gas production reached around 93 tcm. This is about 33 % of the combined cumulative production and remaining reserves (285 tcm) at the end of 2009.

The global consumption of natural gas in 2009 was about 3 % lower compared to the previous year. The United States again were the biggest consumer followed by Russia, Iran, Canada and Germany. The latter depends on imports to a large extent, mainly from Russia and Norway (Fig. 3).

The remaining potential comprises both reserves and resources. For conventional natural gas global remaining potential was estimated at 432 tcm, which is about 6 tcm more than was reported in the previous year (BGR 2009). On a global scale, Europe has a rather small and relatively insignificant share of about 3 % in the remaining natural gas potential. The Commonwealth of Independent States (CIS), particularly Russia, possesses by far the largest remaining natural gas potential (Fig. 9). Important resources also occur in the Middle East and in North America, although the natural gas reserves in the Middle East are more than eight times higher than those in North America (Fig. 9).

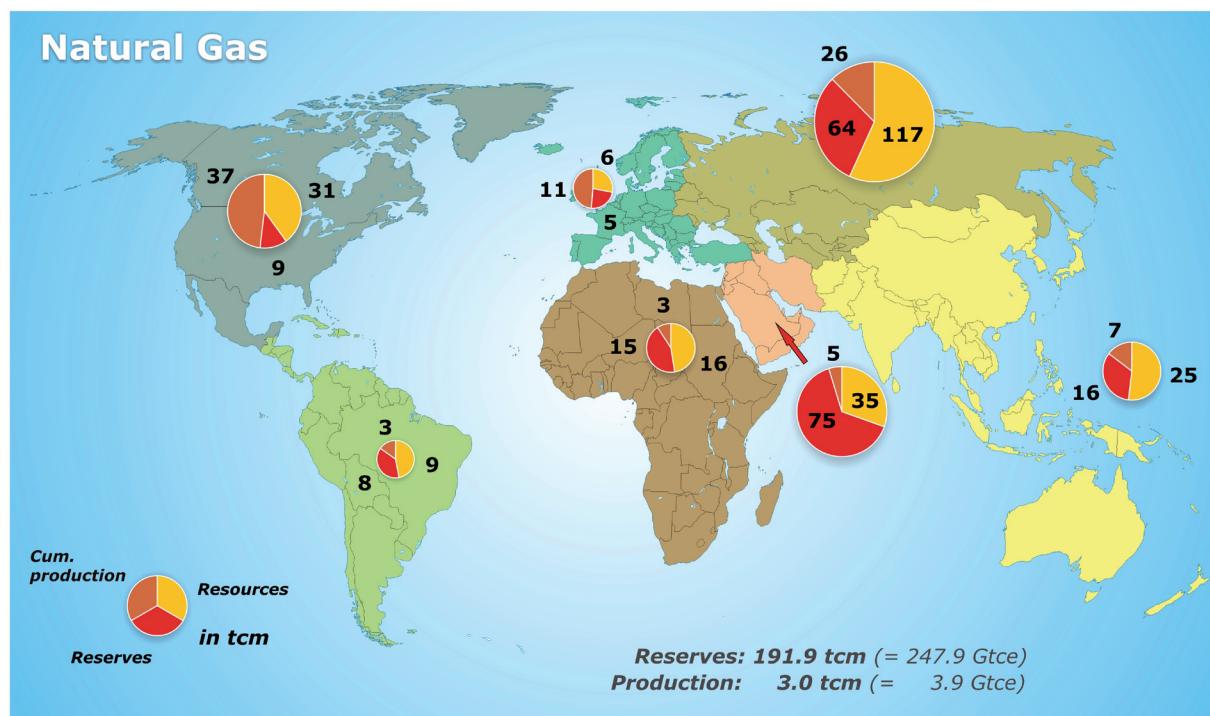


Fig. 9: Regional distribution of total potential of conventional natural gas 2009 (525 tcm)

Global reserves of conventional natural gas have grown further and were in the order of 192 tcm at the end of 2009 which is about 2 % above the amount in the previous year. More than 70 % of these reserves belong to state-run companies. The five largest international oil companies only have access to about 3 % of the natural gas reserves and their share in overall production amounts to around 11 %. Significant growth in reserves for instance occurred in Iran und again in Turkmenistan mainly as a result of a comprehensive reassessment of the reserves. More than half of the remaining natural gas reserves are located in three countries, i.e. Russia, Iran und Qatar.

At the end of 2009, the resources of conventional natural gas were estimated at 241 tcm (previous year: 239 tcm). Significant increases occurred in the Eastern Mediterranean Region, particularly in Egypt and Israel, but also in Southeast Asia and Westafrica (UsGS 2010 a-d).

Cross-border trading in 2009, excluding transit across third countries, amounted to about 880 tcm. This is about 29 % of the worldwide natural gas production in 2009 (Tab. 18 and 19 in the annex). More than a quarter (243 tcm) of this amount was traded as liquefied natural gas (LNG). There are four main regional natural gas markets in the world which are characterised by long-term contracts between producers and distributors:

- ▶ the European market with the main suppliers being Russia, North Africa, Norway and the Netherlands,
- ▶ the North American market (NAFTA),
- ▶ the Asian market, characterised by large distances between the main consumers (particulary Japan, Korea (Republic) and Taiwan) and the producing countries (mainly Indonesia, Malaysia, Brunei and the Gulf countries) and dominated by LNG trade,
- ▶ the Latin American market which has only developed in the last decade.

Europe's integrated and growing supply network provides access to more than half of the world's natural gas reserves either via pipelines or indirectly via LNG shipments. Therefore the European gas market is in a fairly comfortable position compared to other regional gas markets, notably North America. The persisting global economic recession caused a noticeable drop in demand for natural gas. In connection with the increased shale gas production in the USA, this led to an excess supply followed by a drop in gas prices. During the course of 2009, the cross-border prices for natural gas in Germany fell sharply. In December 2009 they were almost 40 % lower compared to January of the same year. Generally the price for natural gas is influenced by the specific transport costs which are significantly higher than those for crude oil and coal.

In the USA, production of non-conventional natural gas, particularly shale gas, has increased quite substantially and in connection with the global economic crisis this led to an oversupply of natural gas. Outside the USA, activities with respect to non-conventional natural gas are in an early stage of exploration at best. There is reason to hope that Europe can improve its supply situation by developing shale gas and coalbed methane. On a global scale, there are substantial quantities of non-conventional natural gas (ROGNER 1997; KAWATA AND FUJITA 2001). Despite considerable uncertainties in estimating the actual quantities, it is assumed that the potential of non-conventional natural gas exceeds the one for conventional gas several times (Tables 1 to 3).



The extraction of non-conventional natural gas from different occurrences requires specific methods and the development and the application of new technologies. Altogether exploration and development of non-conventional natural gas are at an early stage. Reliable reserves estimates are therefore only available for the USA (e.g. shale gas: about 1,7 tcm). However, in view of the huge potential this number appears to be rather conservative. Whereas coalbed methane (CBM), tight gas and shale gas are already contributing to natural gas production, commercial production from Aquifer Gas is unlikely to occur within the next decades. In the case of gas hydrates, it is presently unclear if and when the enormous potential can ever be used. The occurrence of non-conventional natural gas in countries with no or low conventional resources may have a considerable impact on the gas market as a whole (Fig. 9).

A compilation of country-specific data concerning production, consumption, imports, exports, reserves and resources of natural gas is given in Tables 13 to 19 (in the annex).

### Natural Gas: Trends and Outlook

- ▶ From a geological viewpoint, natural gas is available in sufficient quantities to meet growing demand as predicted for the next decades.
- ▶ The global economic recession caused a noticeable drop in demand for natural gas. In connection with the increased shale gas production in the USA, this led to an excess supply and a drop in gas prices.
- ▶ Declining production in Europe will increase the dependency on gas from the CIS, Africa and the Middle East. Hence, the potential development of non-conventional natural gas could improve Europe's security of supply.
- ▶ Transport of natural gas will continue to occur mainly by pipeline but the proportion of LNG will further increase, for which a spot market is expected to develop. Particularly Qatar could play a dominant role in supplying LNG.
- ▶ Growing gas to liquid activities (GTL) may have a noticeable impact on the overall availability of natural gas.
- ▶ Considerable long-term investment will be needed in the future in order to increase production capacities and to expand transportation facilities.



## Coal

Coal has the largest global reserves and resources compared to other fossil fuels. Coal accounted for about 29 % of the global primary energy consumption in 2009 (hard coal 27.6 %, lignite 1.8 %), surpassed only by crude oil (BP 2010). Coal is the fuel most widely used in power plants for electricity generation (global share of 40 %, IEA 2010 b). Since the beginning of the new millennium the global coal demand increased by an average of about 4 % per year and by that considerably faster than the demand for natural gas and crude oil. The yearly averaged growth rates for natural gas and crude oil amounted to 2.2 % respectively 1 % (BP 2010).

The development of the global coal demand in the coming decades is not predictable. The use of coal is located in a field of conflict. On the one hand, there exists the need for an affordable, readily available source of energy and, on the other hand, the will to reduce CO<sub>2</sub> emissions in energy production.

In this study, coals are divided into lignite and hard coal. This is in contrast to the frequently used classification of coal into lignite (soft brown coal), sub-bituminous coal (hard brown coal), bituminous coal (hard coal) and anthracite. Hard coal has a calorific value of > 16 500 kJ/kg and it contains sub-bituminous coal, bituminous coal and anthracite. Hard coal is an internationally traded commodity and usually not affected significantly by transport costs. Lignite has a calorific value of < 16 500 kJ/kg and is mainly used locally by power plants near the coal deposits due to its low calorific value and high water content.

At the end of the year 2009, global coal reserves amounted to 1001 Gt (723 Gt hard coal and about 278 Gt lignite). Estimates of coal resources have changed remarkably compared to the last study (BGR 2009). In particular by involving so far unaccounted resources in non-producing coal basins in Australia (GEOSCIENCE AUSTRALIA AND ABARE 2010), hard coal resources increased by about 1513 Gt (plus 10 %) to 17 167 Gt compared to the previous year.

The world's coal production in 2009 amounted to 6994 Mt. Compared to the previous year the global coal production increased by nearly 3 %. Of this amount, the vast majority was hard coal with 6006 Mt (plus 4 %), while the remaining 988 Mt (minus 4 %) was lignite. In contrast to crude oil and conventional natural gas, coal deposits are less concentrated on certain regions and countries respectively. Several companies and countries are engaged in coal mining.

A compilation of country-specific data concerning production, consumption, imports, exports, reserves and resources of hard coal and lignite is given in Tables 20 to 31 (in the annex).

### Hard Coal

The regional distribution of hard coal reserves, resources and the estimated cumulative production since 1950 is shown in Figure 10. Austral-Asia has the largest remaining hard coal potential (7171 Gt), followed by North America (6884 Gt) and the CIS (3006 Gt). Regarding hard coal reserves, the USA possess the largest volumes in the world (227 Gt; global share of 31.4 %), followed by China (25 %), India (10 %), Russia (9.5 %), Australia (6.1 %), and the Ukraine (4.4 %). Until 2018 the German government is subsidizing the production of national hard coal reserves in the order of about 0.07 Gt. More than one third of the world's hard coal resources are located in the USA (6465 Gt; 37.7 %), followed by China (29.2 %) and Russia (15.5 %).

The three largest hard coal producer in 2009 were China (48.8 %; 2930 Mt), the USA (15.1 %) and India (8.9 %). Whereas China and India increased their production by about 11 % respectively 8 %, the US coal production decreased by about 9 %.

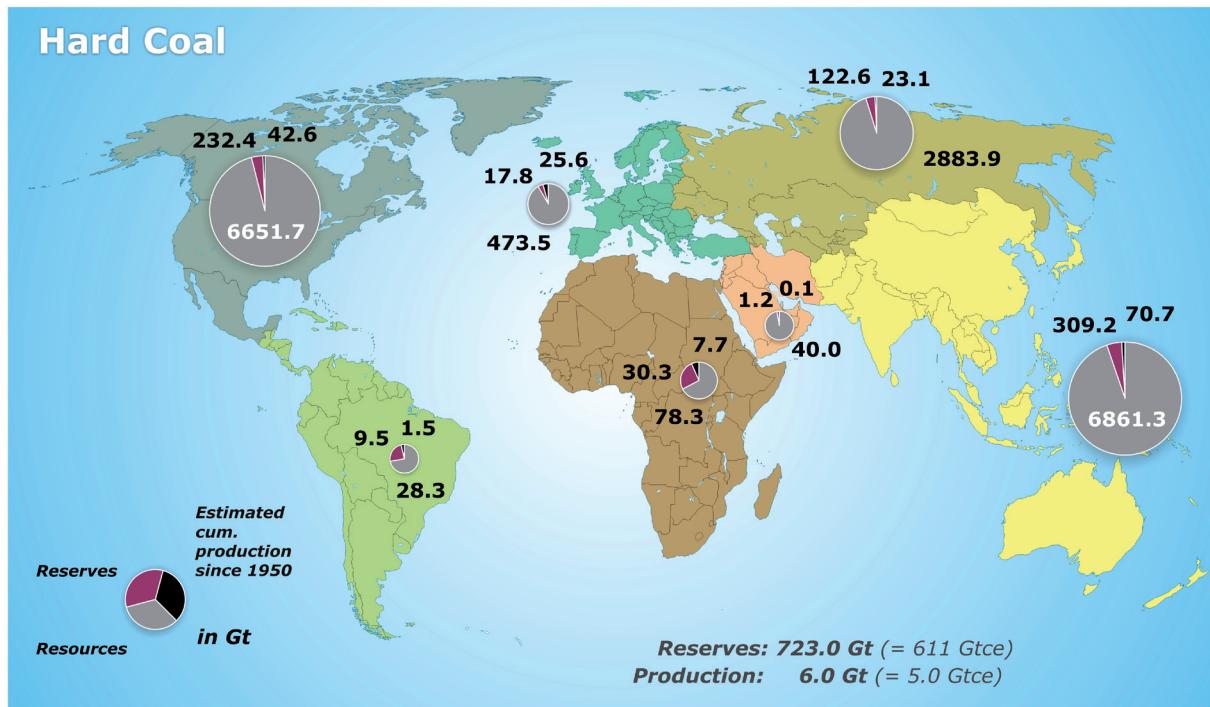


Fig. 10: Distribution of estimated ultimate recovery of hard coal (17 890 Gt) in 2009

About 15 % (922 Mt) of the global hard coal production was traded on the world hard coal market in 2009, with 859 Mt being transported by ship. Despite the global economic crisis the global market volume for hard coal decreased only slightly by 0.6 % compared to the previous year. It was again dominated by Australia which exported hard coal in the order of 274.2 Mt (29.7 %), followed by Indonesia (25 %) and Russia (10.6 %). The three most important hard coal importers are all situated in Asia. Japan, China and Korea (Republic) imported a total volume of 391.4 Mt (43.4 %) in 2009. China's hard coal imports tripled to 126.9 Mt within only one year. Thereby China and India together compensated the regional reduction of hard coal demand especially in Europe and North America due to the economic crisis. Important hard coal importers in 2009 were also India (7.5 %), Taiwan (6.6 %), the UK (4.2 %), and Germany (4 %). The German hard coal imports (36.5 Mt, excluding coke) mainly originated from Russia (25.9 %), South Africa (14.4 %), Colombia (14.2 %), USA (14 %) and Australia (10.3 %). Polish hard coal imports decreased again remarkably by about one third to 2.5 Mt, while coke imports from Poland (1.7 Mt) increased by about 9 % (VDKI 2010 a). With about 190.2 Mt (minus 35 Mt compared to the previous year) about one fifth of the worldwide hard coal imports were delivered to the European Union (EU-27).

The North West European spot market prices for steam coal (ports of Amsterdam, Rotterdam and Antwerp, ARA) fell on annual average by 53% from 174.74 USD/t tce in 2008 to 81.75 USD/tce in 2009. In spring 2009, the spot market prices even dropped below 70 USD/tce. In the following months prices recovered, reaching 90.10 USD/tce in December 2009 again. In comparison to 2009 when North West European spot market prices reached an all-time high of about 256 USD/t, 2009 was characterised by a strong reduction in European imports as well as lower prices and price volatility. Until November 2010, the North West European spot market prices for steam coal rose again to about 123 USD/tce (VDKI 2010 b). These spot market prices were less the result of European than Chinese and Indian demand for coal imports. At the same time, prices for coking coal fell significantly to a price level between 120 and 130 USD/t, compared to 300 USD/t in 2008. In 2010, prices for coking coal on the world market increased again to a level between 200 and 220 USD/t due to rising global steel production.

## Lignite

North America has the largest remaining lignite potential with about 1519 Gt, followed by the CIS (1380 Gt, incl. sub-bituminous coal) and Austral-Asia (1151 Gt) (Fig. 11). The global lignite reserves at the end of 2009 sum up to 277.5 Gt. About one third of those are located in Russia (32.9 %; 91.4 Gt, incl. sub-bituminous coal), followed by Germany (14.6 %), Australia (13.4 %), USA (11.1 %) and China (4 %). The USA hold the largest lignite resources amounting to 1368 Gt (global share 32.7 %), followed by Russia (30.6 %, incl. sub-bituminous coal) and China (7.3 %).

In 2009, 37 countries produced 988.2 Mt of lignite. However, only eleven countries provided about 81 % of the global lignite output. Germany was the most important lignite producer with a share of 17.2 % (169.9 Mt), followed by China (12.1 %) and Turkey (7.1 %).

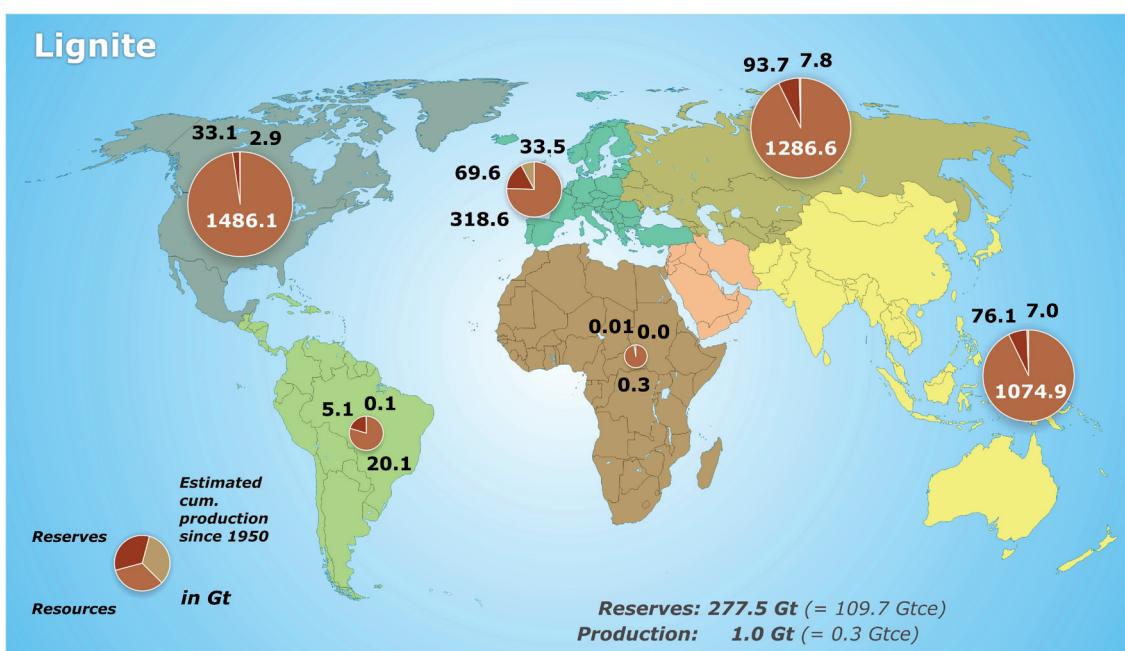


Fig. 11: Distribution of estimated ultimate recovery of lignite (4464 Gt) in 2009

## Coal: Trends and Outlook

- ▶ Coal has the largest potential of all non-renewable fuels and provides 53 % (721 Gtce) of the reserves and 78 % (16 233 Gtce) of the resources worldwide. The remaining potential of hard coal and lignite is sufficient to cover the expected demand for many decades to come.
- ▶ Coal accounted for nearly 29 % of the global primary energy consumption in 2009. Coal will continue to be a major source of the world energy mix.
- ▶ Both the annual average northwest European steam coal spot prices and coking coal prices decreased in 2009 compared to the previous year by more than half to 82 USD/tce and 125 USD/t respectively. In 2010, the prices for steam and coking coal increased again but they did not reach the high price level of 2008. Since 2009 the European coal prices are more and more influenced by the increasing Chinese and Indian demand for coal imports.

## Nuclear Fuels

### Uranium

Worldwide, a growing interest in expanding nuclear energy can be observed as a response to rising energy demand and the need to reduce CO<sub>2</sub> emissions. At the end of 2009, 55 nuclear power plants were under construction in 14 countries including China, Russia, Korea (Republic), India, Japan and Finland. With a gross rated power of 391.5 GW<sub>e</sub> (DATF 2010), approximately 68 646 t uranium in 2009 were used in the 437 nuclear power plants, of which 50 773 t came from mine production. Today's uranium reserves of 2.5 Mt (cost category < 80 USD/kg U) are sufficient to supply existing nuclear power plants for several decades to come even with a predicted increase in demand.

In contrast to other energy resources, reserves and resources of uranium are categorised according to production costs. Deviating from previous studies of the BGR, the cost limit for reserves has now been reclassified. Instead of the previous cost category < 40 USD/kg U, the cost category is now extended to the category < 80 USD/kg U. This is due to the fact that, following a sustained increase in market prices, major countries such Australia, Namibia, Niger and Russia have made a reclassification of their reserves and resources into higher cost categories and do not display any information regarding the lowest cost category < 40 USD/kg U anymore. In addition, the current uranium price (156 USD/kg U, end of November 2009) and the expected price development require a new definition using the higher cost category. This step results in increasing reserve figures, rising from 1766 kt (< 40 USD/kg U) in 2008 to 2516 kt (< 80 USD/kg U) in 2009. However, the cost category < 80 USD/kg U shows only minor changes compared to the previous year (2598 kt in 2008 compared to 2516 kt in 2009).

Resources of Uranium are distributed almost over the entire world. However, the recently specified uranium reserves of 2.5 Mt are located in only a few countries. 96 % of the reserves are located in 11 countries, including Australia, Canada, Kazakhstan, Brazil and South Africa. According to current data, those five countries possess almost 81 % of the global uranium reserves (Fig. 12).

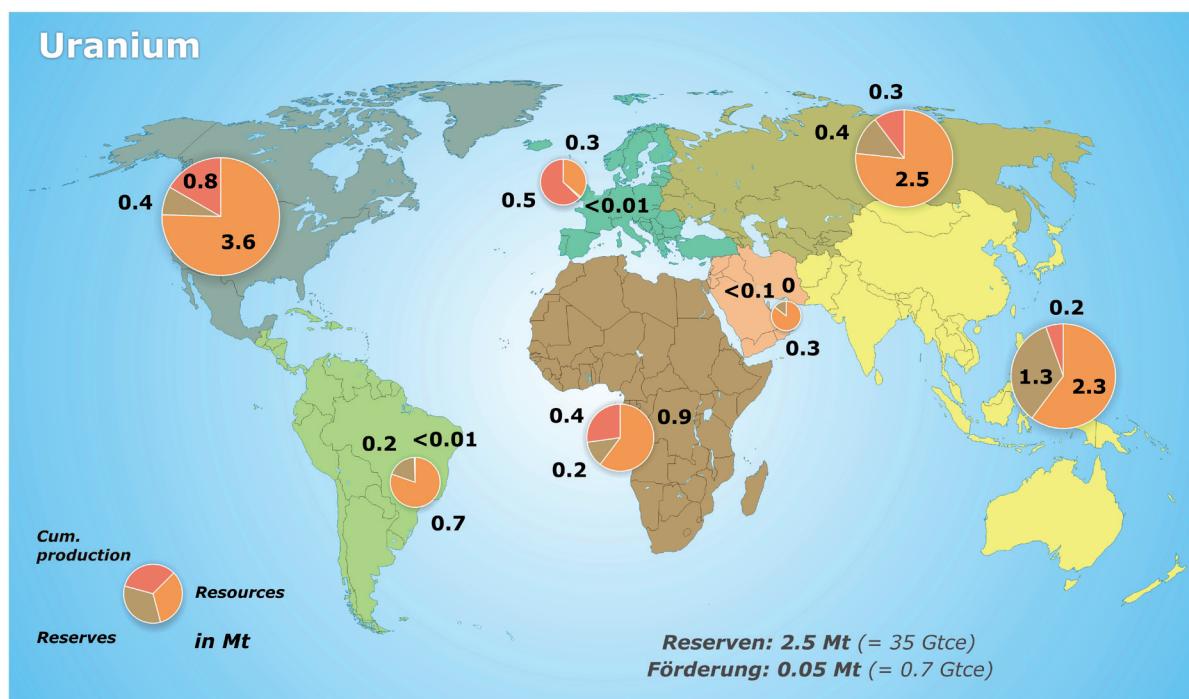


Abb. 12: Distribution of estimated ultimate recovery of uranium (15.3 Mt U) in 2009

A significant reduction in global uranium resources could be noted in 2009 compared to the previous year. This is principally the result of the fact that major countries like Brazil, Kazakhstan, Russia, South Africa and USA do not publish figures for speculative resources anymore. In this regard, no data has been disclosed by Australia for years. Due to the non-publication of data and the according decrease in speculative resources, the resource estimation of this study has to be regarded as conservative.

Annual global production in the last five years has been between 42 065 t and 50 773 t U with an annual consumption of above 60 000 t U. The demand-supply gap was covered by uranium from civil and military stockpiles, especially in Russia and USA. These stockpiles were set up by the overproduction of uranium in the period between 1945 and 1990 in anticipation of rising civil consumption and in view of military considerations. The military stockpiles in particular are currently being reduced successively. These reductions are primarily based on the agreements concluded between the USA and Russia in 1992 to convert highly enriched weapon-grade uranium (HEU) into low-enriched uranium (LEU). In addition to mine production, uranium from stockpiles and decommissioning of nuclear weapons as well as uranium from reprocessing of fuel rods will be available for the future consumption. At the same time, increasing the efficiency of reprocessed material has come into the focus of researchers worldwide.

On the supply side, a small number of countries accounts for the majority of uranium mine production. In 2009, Kazakhstan produced the largest share of uranium from mines for the first time, followed by Canada and Australia. Kazakhstan accounted for about 27 % (14 020 t U) of global production. Canada, Australia, Namibia and Russia delivered a further 52 % of the global production. Altogether, global uranium production has increased by 15.5 % from 43 895 t U in 2008 to 50 773 t U in 2009. Main consumers like the USA, France, Japan, Russia, Korea (Republic), Germany, China and Great Britain (79 % of world total) have only limited domestic mine production (USA, Russia, China) or depend entirely on imports. The uranium demand of German nuclear reactors (3398 t in 2009) was covered almost exclusively by long-term contracts with producers from France and Great Britain as well as from Canada and the USA.

Growing interest in nuclear energy worldwide resulted in increasing exploration activities over the last years. The global expenditures for uranium exploration in the period between 2003 and 2009 were 5.7 billion USD according to a study by the World Nuclear Association (WNA 2010 a). This trend continues and will result in a further diversification in production, extending production to previously non-producing countries and increasing reserve figures. At the same time, a market concentration regarding uranium producing companies can be noted. In 2009, about 86 % of mined uranium was produced by only eleven companies. Largest producer were Areva (France), Cameco (Canada), Kazatomprom (Kazakhstan) and Rio Tinto (Australia).

As a consequence of increasing demand, the uranium market has experienced an increase in prices over the last years. In summer 2007, the uranium spot price has reached the all-time high of 353.69 USD/kg U. During the period between 2007 and end of December 2009, spot prices have decreased to a level of 114 USD/kg U. However, global trade of uranium is primarily based on long-term contracts. Uranium deliveries on the basis of long-term contracts accounted for 95 % of the EU uranium trade in 2009. Here as well, an increase of prices can be noted, with the average price of long-term uranium deliveries reaching 77.72 USD/kg U. This is an increase of 18 % compared to 2008. Nevertheless, the price of uranium has only a small impact on electricity generation costs. The World Nuclear Association (WNA 2010 b) calculates that doubling the uranium price from 65 USD/kg U to 130 USD/kg U results in an increase of fuel cost from 0.50 US-Cent/kWh to 0.62 US-Cent/kWh.

A compilation of country-specific data concerning production, consumption, reserves and resources of uranium is given in Tables 32 to 36 (in the annex).



## Thorium

Thorium, the alternative to uranium, is currently not being used for power generation as there is no operating commercial thorium reactor. However, resources of thorium are being explored in line with the expanding exploration of other elements (uranium, raw earth elements, phosphate). Reserves of 0.8 Mt and resources of 5 Mt can be considered as a possible base for future supply.

## Nuclear Fuels: Trends and Outlook

- ▶ From a geological perspective, there is no shortage in the natural uranium supply to be expected in the near future.
- ▶ Uranium production mainly takes place in politically stable countries.
- ▶ Due to increasing demand and high prices for uranium, global exploration activities will increase even in countries without a uranium mining history. An increasing diversification of future producers can therefore be expected.
- ▶ The gap between the annual production and consumption will continue to exist. Additional supply will be provided by civil and military stockpiles.
- ▶ Worldwide, a number of countries have announced the construction of nuclear power plants in the next decade or are constructing new nuclear power plants, including China (23), Russia (11), Korea (Republic) (5) and India (4).

### 3 Summary

When comparing the estimated reserves and resources of crude oil, natural gas, coal and uranium with the respective cumulative consumption as predicted by the IEA (IEA 2010 a), coal clearly emerges as the energy resource with the highest potential (Fig. 13). In view of the successful development of non-conventional natural gas occurrences particularly in the USA, the substantial amount of non-conventional natural gas resources appears in a different light (Fig. 13). However, it has to be taken into account that these resources also comprise aquifer gas and gas hydrates whose economic exploitation has not been proven yet. According to the above IEA scenario, the majority of the presently estimated crude oil reserves would have been consumed by 2035.

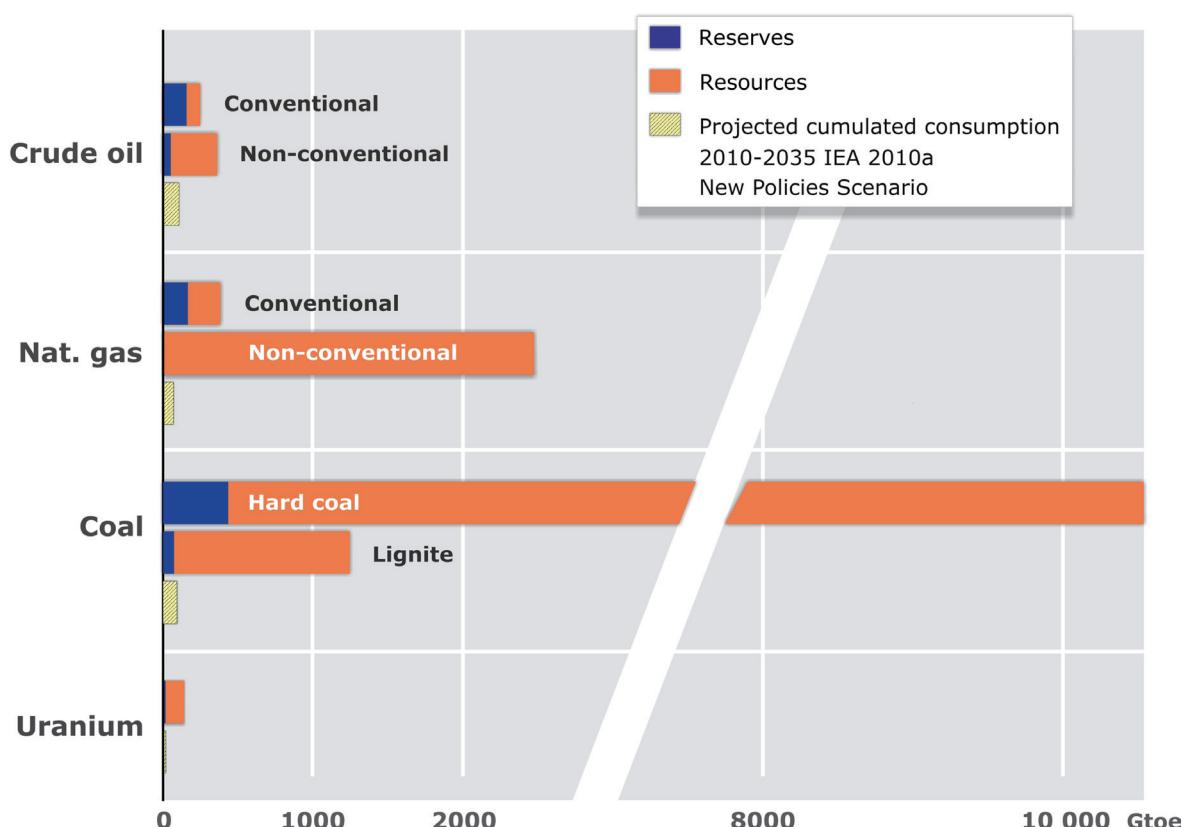


Abb. 13: Energy resources and their potential availability

In summary the following conclusions can be drawn with respect to the availability of the individual non-renewable energy resources at the end of 2009:

## Crude Oil

From a geological viewpoint and considering a moderate increase in oil consumption, the availability of crude oil is guaranteed in the next years. According to the BGR-projection, global crude oil production could be increased until 2035. The growing share of non-conventional oil production in the projection will not shift the global maximum significantly forward in time but will increase the maximum amount of oil produced to approximately 4.5 Gt per year. Hence, crude oil could become in coming decades the first energy resource not able to cover growing demand in the coming decades anymore.

Global crude oil production in 2009 decreased slightly due to reduced demand for oil following the global economic crisis. The decrease was not caused by limited oil reserves. The dependency on OPEC oil and oil produced in the so called 'strategic ellipse', comprising the Middle East as well as the Caspian Region up to North Russia, will increase in coming years. At the same time, the increasing share of oil fields in more challenging environments will raise production costs.

## Natural Gas

In contrast to crude oil and based on present reserves estimates, natural gas will be able to cover rising demand for several decades to come. In 2009, there was an oversupply of natural gas caused by falling demand in connection with the global economic recession, increased non-conventional natural gas production and growing LNG capacities. The European natural gas market is in a comfortable position as it has access to prolific producing areas in the CIS, North Africa and the Middle East. Growing transport of LNG and the envisaged increase in production of non-conventional natural gas in Europe will help to further diversify the gas supply.

## Coal

Among all non-renewable fuels coal has by far the largest geological availability. The remaining potential of hard coal and lignite is sufficient to cover as well an increasing demand for many decades to come. Despite the fact that coal produces the highest specific CO<sub>2</sub> emissions from all fossil fuels, it will continue to play a major role in the world energy supply. In 2009, China became an important hard coal net importer. Since that time, the European coal prices are increasingly influenced by rising coal demand in China and India.

## Nuclear Fuels

Worldwide, a growing interest in expanding nuclear energy can be observed as a response to rising energy demand and the need to reduce CO<sub>2</sub> emissions. From a geological perspective, today's uranium reserves (cost category < 80 USD/kg U) are sufficient to supply existing nuclear power plants for several decades to come even with a predicted increase in demand. World's uranium production has increased by 15.5 % in 2009. Kazakhstan produced for the first time the largest share of uranium from mines.

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# annex

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Natural Gas Markets
- ▶ Measures,  
Conversion Factors

► Tables

**Table 2: Regional Distribution of Reserves of Non-Renewable Fuels in 2009 [EJ]**

Region	Crude Oil		Natural Gas		Coal		Uranium	Thorium	Total	
	conven-tional	non-con-ventional	conven-tional	non-con-ventional	Hard Coal	Lignite			EJ	Share [%]
Europe	95	3	199	5	472	633	4	—	1 411	3.5
CIS	733	748	2 415	—	3 083	1 363	214	38	8 594	21.6
Africa	722	9	561	—	711	< 0.5	97	9	2 109	5.3
Middle East	4 279	—	2 864	—	30	—	22	—	7 195	18.1
Austral-Asia	234	8	612	16	7 523	784	651	183	10 011	25.2
North America	256	1 128	354	170	5 841	392	188	88	8 417	21.2
Latin America	412	889	288	—	246	43	82	86	2 047	5.1
World	6 731	2 785	7 291	191	17 906	3 216	1 258	415	39 794	100.0
OECD	370	1 131	645	187	7 474	1 334	773	111	12 026	30.2
EU-27	54	3	118	5	432	504	4	—	1 121	2.8
OPEC-12	5 098	898	3 427	—	62	< 0.5	—	—	9 485	23.9

**Table 3: Regional Distribution of Resources of Non-Renewable Fuels in 2009 [EJ]**

Region	Crude Oil		Natural Gas		Coal		Uranium	Thorium	Total	
	conven-tional	non-con-ventional	conven-tional	non-con-ventional	Hard Coal	Lignite			EJ	Share [%]
Europe	157	64	239	3 207	12 657	2 968	131	198	19 622	3.4
CIS	1 002	2 406	4 448	9 453	70 573	18 823	1 255	38	107 999	18.8
Africa	646	49	614	5 821	1 842	3	469	314	9 758	1.7
Middle East	885	184	1 344	5 613	1 008	—	129	—	9 163	1.6
Austral-Asia	291	156	952	18 244	168 186	10 349	1 141	589	199 906	34.8
North America	681	6 736	1 186	14 151	167 059	17 545	1 813	627	209 799	36.5
Latin America <sup>2)</sup>	489	3 398	359	8 862	736	173	347	681	15 046	2.6
World	4 152	12 993	9 142	65 351	425 886	49 861	5 286	2 508	575 180	100.0
OECD	870	6 936	1 481	22 449	221 451	21 878	2 194	1 254	278 514	48.4
EU-27	72	52	128	2 710	12 615	2 660	128	—	18 365	3.2
OPEC-12	1 269	3 446	1 472	10 664	1 274	2	20	300	18 447	3.2

<sup>1)</sup> not including gas hydrates (38 000 EJ), because they cannot be assigned to one of the regions; Shale Gas and Tight Gas in-place resources

<sup>2)</sup> including Antarctica (Hard coal 3825 EJ)

**Table 4: Regional Distribution of Production of Non-Renewable Fuels in 2009 [EJ]**

Region	Crude Oil	Natural Gas	Hard Coal	Lignite	Uranium	Total	Share [%]
Europe	9.0	11.0	3.7	4.7	0.2	28.6	6.3
CIS	26.8	28.8	10.1	1.1	10.4	77.2	16.9
Africa	19.2	7.7	6.0	—	4.3	37.2	8.1
Middle East	48.7	15.5	< 0.05	—	—	64.2	14.1
Austral-Asia	15.9	16.7	100.7	2.8	4.5	140.7	30.8
North America	25.5	30.5	24.2	0.9	5.8	87.0	19.1
Latin America	14.1	5.4	2.1	0.1	0.2	21.8	4.8
World	159.2	115.6	146.8	9.5	25.4	456.6	100.0
OECD	35.4	43.3	37.2	5.2	9.9	131.1	28.7
EU-27	4.0	7.0	3.6	3.6	0.2	18.4	4.0
OPEC-12	65.8	19.1	0.1	—	—	85.0	18.6

**Table 5: Regional Distribution of Consumption of Non-Renewable Fuels in 2009 [EJ]**

Region	Crude Oil	Natural Gas	Hard Coal	Lignite	Uranium	Total	Share [%]
Europe	29.8	19.7	8.3	4.7	11.8	74.3	16.0
CIS	7.5	21.3	7.7	1.1	3.1	40.7	8.8
Africa	6.2	3.7	4.6	—	0.2	14.7	3.2
Middle East	13.8	12.9	0.4	—	0.1	27.1	5.8
Austral-Asia	50.7	18.9	100.7	2.7	8.3	181.2	39.1
North America	42.9	30.8	22.4	0.9	10.7	107.8	23.3
Latin America	11.2	5.1	0.7	0.1	0.2	17.3	3.7
World	162.4	112.4	144.8	9.4	34.3	463.3	100.0
OECD	85.7	55.2	39.3	5.2	28.1	213.5	46.1
EU-27	27.2	18.0	7.7	3.6	11.5	68.0	14.7
OPEC-12	14.9	14.3	0.1	—	0.1	29.3	6.3

— no reserves, resources, production and consumption

► Tables

**Table 6: Crude Oil in 2009 [Mt]**

Country/Region	Production	Cum. Production	Reserves	Resources	EUR	Remaining Potential
Albania	0.5	52	27	20	99	47
Austria	1.0	119	7	10	136	17
Bulgaria	0.1	9	2	5	16	7
Croatia	0.7	100	10	20	130	30
Cyprus	–	–	–	45	45	45
Czech Republic	0.2	10	4	10	24	14
Denmark	13.5	295	165	50	510	215
France	0.9	122	14	70	206	84
Germany	2.8	289	41	20	350	61
Greece	0.1	16	1	20	38	21
Hungary	0.7	97	4	20	120	24
Ireland	–	–	–	10	10	10
Italy	4.6	164	128	120	413	248
Lithuania	0.1	4	2	20	25	22
Malta	–	–	–	5	5	5
Netherlands	1.7	140	44	60	244	104
Norway	115.5	3 164	882	1 900	5 947	2 782
Poland	0.7	60	13	40	113	53
Romania	4.5	751	82	160	992	242
Serbia	0.8	41	11	20	72	31
Slovakia	0.1	2	1	5	8	6
Spain	0.1	37	20	20	78	40
Turkey	2.3	133	36	70	238	106
United Kingdom	65.3	3 380	770	1 039	5 189	1 809
Azerbaijan	50.4	1 622	1 280	1 200	4 102	2 480
Belarus	1.7	131	27	30	188	57
Georgia	0.1	23	5	50	78	55
Kazakhstan	76.4	1 295	5 419	4 000	10 714	9 419
Kyrgyzstan	–	11	5	10	27	15
Moldova, Republic	–	–	–	10	10	10
Russian Federation	493.7	20 164	10 436	16 400	46 999	26 836
Tajikistan	< 0.05	8	2	30	39	32
Turkmenistan	10.2	489	235	1 700	2 424	1 935
Ukraine	4.0	351	54	150	554	204
Uzbekistan	4.5	183	81	400	663	481
Algeria	77.6	2 640	1 660	1 200	5 500	2 860
Angola	87.4	1 124	1 837	3 500	6 461	5 337
Benin	–	4	1	60	65	61
Cameroon	3.7	171	27	180	378	207
Chad	7.0	47	122	100	270	222
Congo, Democratic Republic	1.3	40	24	150	215	174
Congo, Republic	14.1	295	264	1 100	1 659	1 364

Country/Region	Production	Cum. Production	Reserves	Resources	EUR	Remaining Potential
Côte d'Ivoire	1.5	24	40	300	364	340
Egypt	35.3	1 451	599	1 450	3 499	2 049
Equatorial Guinea	15.2	153	232	500	885	732
Eritrea	—	—	—	50	50	50
Ethiopia	—	—	—	10	10	10
Gabon	11.4	487	272	1 600	2 359	1 872
Ghana	0.3	5	10	180	187	182
Guinea	—	—	—	40	40	40
Guinea-Bissau	—	—	—	40	40	40
Libyan Arab Jamahiriya	77.1	3 567	6 023	1 200	10 791	7 223
Madagascar	—	—	—	20	20	20
Morocco	< 0.05	2	< 0.5	30	32	30
Mauritania	0.5	4	14	100	117	114
Mozambique	—	—	2	20	22	22
Namibia	—	—	—	20	20	20
Nigeria	99.1	3 879	5 061	2 500	11 440	7 561
Sao Tome and Principe	—	—	—	150	150	150
Senegal	—	—	—	130	130	130
Seychelles	—	—	—	5	5	5
Somalia	—	—	—	20	20	20
South Africa	0.7	14	2	20	36	22
Sudan	24.1	164	912	210	1 286	1 122
Togo	—	—	—	50	50	50
Tunisia	4.1	190	79	300	569	379
Uganda	—	—	95	200	295	295
Western Sahara	—	—	—	20	20	20
Zimbabwe	—	—	—	10	10	10
Bahrain	9.1	203	17	200	420	217
Iran, Islamic Republic	202.4	8 791	18 641	3 900	31 332	22 541
Iraq	121.8	4 421	15 646	3 800	23 867	19 446
Israel	0.2	2	< 0.5	275	278	275
Jordan	—	—	< 0.5	5	5	5
Kuwait	121.3	5 478	14 150	700	20 328	14 850
Lebanon	—	—	—	240	240	240
Oman	38.5	1 221	748	700	2 670	1 448
Qatar	57.9	1 284	3 453	700	5 438	4 153
Saudi Arabia	459.5	17 177	35 701	8 700	61 578	44 401
Syrian, Arab Republic	18.7	695	340	450	1 485	790
United Arab Emirates	120.6	3 907	13 306	1 000	18 213	14 306
Yemen	14.0	353	363	500	1 217	863

► Tables

Country/Region	Production	Cum. Production	Reserves	Resources	EUR	Remaining Potential
Afghanistan	n. s.	< 0.05	n. s.	140	140	140
Australia	23.6	936	575	1 000	2 511	1 575
Bangladesh	0.3	2	4	30	36	34
Brunei Darussalam	8.2	483	147	300	930	447
Cambodia	—	—	—	20	20	20
China	189.0	5 260	2 018	2 300	9 578	4 318
India	35.4	1 107	792	400	2 299	1 192
Indonesia	49.0	3 171	543	400	4 114	943
Japan	0.8	49	6	10	65	16
Malaysia	33.2	940	751	700	2 391	1 451
Mongolia	0.2	1	2	50	53	52
Myanmar	1.0	52	7	150	209	157
New Zealand	2.8	50	8	50	108	58
Pakistan	3.2	86	43	150	278	193
Papua New Guinea	1.9	61	12	50	123	62
Philippines	1.5	13	19	200	232	219
Taiwan	< 0.05	5	< 0.5	5	10	5
Thailand	13.6	134	62	300	496	362
Viet Nam	16.8	254	612	700	1 566	1 312
Canada	155.7	4 765	667	2 400	7 831	3 067
Greenland	—	—	—	1 000	1 000	1 000
Mexico	130.1	5 721	1 591	2 900	10 212	4 491
United States	325.3	29 752	3 863	10 000	43 616	13 863
Argentina	33.8	1 416	343	500	2 259	843
Barbados	< 0.05	2	< 0.5	100	102	100
Belize	0.2	< 0.5	1	3	4	4
Bolivia	2.0	70	63	200	333	263
Brazil	100.4	1 598	2 450	5 000	9 048	7 450
Chile	0.1	61	20	75	156	95
Colombia	34.1	1 006	185	700	1 891	885
Cuba	2.5	50	17	500	567	517
Ecuador	25.2	636	887	150	1 673	1 037
Falkland Islands (Islas Malvinas)	—	—	—	500	500	500
Guatemala	0.7	18	11	10	40	21
Guyana	—	—	—	100	100	100
Paraguay	—	—	—	100	100	100
Peru	5.4	349	153	500	1 002	653
Suriname	0.8	11	11	50	72	61
Trinidad and Tobago	6.8	494	113	200	807	313
Uruguay	—	—	—	20	20	20
Venezuela, Bolivarian Republic	124.8	9 148	5 600	3 000	17 748	8 600

Country/Region	Production	Cum. Production	Reserves	Resources	EUR	Remaining Potential
World	3 809.5	158 756	161 023	99 337	419 108	260 352
Europe	215.9	8 984	2 264	3 759	15 007	6 023
CIS	640.9	24 276	17 543	23 980	65 798	41 523
Africa	460.5	14 261	17 276	15 465	46 994	32 733
Middle East	1 164.0	43 534	102 366	21 170	167 070	123 536
Austral-Asia	380.4	12 603	5 600	6 955	25 158	12 555
North Amerika	611.1	40 238	6 121	16 300	62 659	22 421
Latin America	336.8	14 859	9 854	11 708	36 421	21 562
OPEC-12	1 574.7	62 053	121 965	30 350	214 368	152 315
OPEC-Gulf	1 083.4	41 058	100 897	18 800	160 755	119 697
OECD	847.7	49 300	8 841	20 824	78 965	29 665
EU-27	96.2	5 494	1 298	1 729	8 521	3 027

n. s. not specified

— no reserves, resources or production

► Tables

**Table 7: Conventional Oil Resources in 2009:**  
Main Countries (Top 20) and Distribution by Regions and Economic Groups

Rank	Country/Region	Mt	Share [%]	
			Country	Cumulative
1	Russian Federation	16 400	16.5	16.5
2	United States	10 000	10.1	26.6
3	Saudi Arabia	8 700	8.8	35.3
4	Brazil	5 000	5.0	40.4
5	Kazakhstan	4 000	4.0	44.4
6	Iran, Islamic Republic	3 900	3.9	48.3
7	Iraq	3 800	3.8	52.1
8	Angola	3 500	3.5	55.7
9	Venezuela, Bolivarian Republic	3 000	3.0	58.7
10	Mexico	2 900	2.9	61.6
11	Nigeria	2 500	2.5	64.1
12	Canada	2 400	2.4	66.5
13	China	2 300	2.3	68.9
14	Norway	1 900	1.9	70.8
15	Turkmenistan	1 700	1.7	72.5
16	Gabon	1 600	1.6	74.1
17	Egypt	1 450	1.5	75.6
18	Libyan Arab Jamahiriya	1 200	1.2	76.8
	Algeria	1 200	1.2	78.0
	Azerbaidschan	1 200	1.2	79.2
...				
92	Germany	20	< 0.05	
...				
		99 337	100.0	
		3 759	3.8	
		23 980	24.1	
		15 465	15.6	
		21 170	21.3	
		6 955	7.0	
		16 300	16.4	
		11 708	11.8	
		30 350	30.6	
		18 800	18.9	
		20 824	21.0	
		1 729	1.7	

**Table 8: Conventional Oil Reserves in 2009:**  
Main Countries (Top 20) and Distribution by Regions and Economic Groups

Rank	Country/Region	Mt	Share [%]	
			Country	Cumulative
1	Saudi Arabia	35 701	22.2	22.2
2	Iran, Islamic Republic	18 641	11.6	33.7
3	Iraq	15 646	9.7	43.5
4	Kuwait	14 150	8.8	52.3
5	United Arab Emirates	13 306	8.3	60.5
6	Russian Federation	10 436	6.5	67.0
7	Libyan Arab Jamahiriya	6 023	3.7	70.7
8	Venezuela, Bolivarian Republic	5 600	3.5	74.2
9	Kazakhstan	5 419	3.4	77.6
10	Nigeria	5 061	3.1	80.7
11	United States	3 863	2.4	83.1
12	Qatar	3 453	2.1	85.3
13	Brazil	2 450	1.5	86.8
14	China	2 018	1.3	88.0
15	Angola	1 837	1.1	89.2
16	Algeria	1 660	1.0	90.2
17	Mexico	1 591	1.0	91.2
18	Azerbaijan	1 280	0.8	92.0
19	Sudan	912	0.6	92.6
20	Ecuador	887	0.6	93.1
...				
54	Germany	41	< 0.05	
...				
World		161 015	100.0	
Europe				
CIS				
Africa				
Middle East				
Austral-Asia				
North America				
Latin America				
OPEC-12				
OPEC-Gulf				
OECD				
EU-27				

► Tables

**Table 9: Crude Oil and NGL Production in 2009:**  
Main Countries (Top 20) and Distribution by Regions and Economic Groups

Rank	Country/Region	Mt	Share [%]	
			Country	Cumulative
1	Russian Federation	493.7	13.0	13.0
2	Saudi Arabia	459.5	12.1	25.0
3	United States	325.3	8.5	33.6
4	Iran, Islamic Republic	202.4	5.3	38.9
5	China	189.0	5.0	43.8
6	Canada	155.7	4.1	47.9
7	Mexico	130.1	3.4	51.3
8	Venezuela, Bolivarian Republic	124.8	3.3	54.6
9	Iraq	121.8	3.2	57.8
10	Kuwait	121.3	3.2	61.0
11	United Arab Emirates	120.6	3.2	64.2
12	Norway	115.5	3.0	67.2
13	Brazil	100.4	2.6	69.8
14	Nigeria	99.1	2.6	72.4
15	Angola	87.4	2.3	74.7
16	Algeria	77.6	2.0	76.8
17	Libyan Arab Jamahiriya	77.1	2.0	78.8
18	Kazakhstan	76.4	2.0	80.8
19	United Kingdom	65.3	1.7	82.5
20	Qatar	57.9	1.5	84.0
...				
53	Germany	2.8	0.1	
...				
World		3 809.5	100.0	
Europe		215.9	5.7	
CIS		640.9	16.8	
Africa		460.5	12.1	
Middle East		1 164.0	30.6	
Austral-Asia		380.4	10.0	
North America		611.1	16.0	
Latin America		336.8	8.8	
OPEC-12		1 574.7	41.3	
OPEC-Gulf		1 083.4	28.4	
OECD		847.7	22.3	
EU-27		96.2	2.5	

**Table 10: Oil Demand in 2009:**  
Main Countries (Top 20) and Distribution by Regions and Economic Groups

Rank	Country/Region	Mt	Share [%]	
			Country	Cumulative
1	United States	840.1	21.6	21.6
2	China	389.7	10.0	31.7
3	Japan	199.6	5.1	36.8
4	India	148.5	3.8	40.6
5	Russian Federation	124.9	3.2	43.8
6	Saudi Arabia	110.2	2.8	46.7
7	Brazil	104.3	2.7	49.4
8	Germany	104.1	2.7	52.0
9	Korea, Republic	98.4	2.5	54.6
10	Canada	95.1	2.4	57.0
11	Mexico	92.1	2.4	59.4
12	France	87.1	2.2	61.6
13	Iran, Islamic Republic	83.6	2.2	63.8
14	United Kingdom	76.4	2.0	65.8
15	Italy	73.6	1.9	67.6
16	Spain	72.2	1.9	69.5
17	Indonesia	62.0	1.6	71.1
18	Singapore	52.1	1.3	72.4
19	Taiwan	46.6	1.2	73.6
20	Netherlands	46.5	1.2	74.8
World		3 884.1	100.0	
Europe		713.2	18.4	
CIS		179.3	4.6	
Africa		149.2	3.8	
Middle East		329.5	8.5	
Austral-Asia		1 212.0	31.2	
North America		1 027.3	26.4	
Latin America		269.1	6.9	
OPEC-12		356.2	9.2	
OPEC-Gulf		270.1	7.0	
OECD		2 049.2	52.8	
EU-27		651.1	16.8	

► Tables

**Table 11: Crude Oil and NGL Exports in 2009:**  
Main Countries (Top 20) and Distribution by Regions and Economic Groups

Rank	Country/Region	Mt	Share [%]	
			Country	Cumulative
1	Saudi Arabia	313.4	15.3	15.3
2	Russian Federation	247.4	12.1	27.4
3	Iran, Islamic Republic	111.6	5.5	32.9
4	Nigeria	108.0	5.3	38.1
5	United Arab Emirates	97.7	4.8	42.9
6	Canada	97.1	4.7	47.7
7	Iraq	95.3	4.7	52.3
8	Norway	94.4	4.6	56.9
9	Angola	88.5	4.3	61.3
10	Venezuela, Bolivarian Republic	80.4	3.9	65.2
11	Kuwait	67.4	3.3	68.5
12	Kazakhstan	67.3	3.3	71.8
13	Mexico	65.0	3.2	74.9
14	Libyan Arab Jamahiriya	58.5	2.9	77.8
15	United Kingdom	45.0	2.2	80.0
16	Azerbaijan	40.5	2.0	82.0
17	Algeria	37.4	1.8	83.8
18	Qatar	32.3	1.6	85.4
19	Oman	28.7	1.4	86.8
20	Sudan	21.0	1.0	87.8
	Brazil	21.0	1.0	88.8
...				
57	Germany	0.1	< 0.05	
...				
	World	2 046.0	100.0	
	Europe	162.1	7.9	
	CIS	357.6	17.5	
	Africa	354.0	17.3	
	Middle East	768.9	37.6	
	Austral-Asia	82.0	4.0	
	North America	170.3	8.3	
	Latin America	151.1	7.4	
	OPEC-12	1 107.0	54.1	
	OPEC-Gulf	717.7	35.1	
	OECD	343.5	16.8	
	EU-27	62.1	3.0	

**Table 12: Crude Oil and NGL Imports in 2009:**  
Main Countries (Top 20) and Distribution by Regions and Economic Groups

Rank	Country/Region	Mt	Share [%]	
			Country	Cumulative
1	United States	452.0	20.4	20.4
2	China	203.8	9.2	29.5
3	Japan	181.4	8.2	37.7
4	India	129.9	5.8	43.5
5	Korea, Republic	115.8	5.2	48.8
6	Germany	98.1	4.4	53.2
7	Italy	82.7	3.7	56.9
8	France	72.3	3.3	60.2
9	Netherlands	60.9	2.7	62.9
10	Spain	56.0	2.5	65.4
11	United Kingdom	54.5	2.5	67.9
12	Taiwan	47.3	2.1	70.0
13	Thailand	40.5	1.8	71.8
14	Canada	39.9	1.8	73.6
15	Belgium	34.3	1.5	75.2
16	Singapore	30.0	1.4	76.5
17	Poland	21.5	1.0	77.5
18	Belarus	21.4	1.0	78.4
19	Greece	20.4	0.9	79.4
20	Australia	19.5	0.9	80.2
World		2 220.7	100.0	
Europe		638.4	28.7	
CIS		40.2	1.8	
Africa		49.2	2.2	
Middle East		34.3	1.5	
Austral-Asia		898.4	40.5	
North America		492.4	22.2	
Latin America		67.7	3.0	
OPEC-12		—	—	
OPEC-Gulf		—	—	
OECD		1 410.0	63.5	
EU-27		599.8	27.0	
— no imports				

► Tables

**Table 13: Natural Gas in 2009 [Mrd. m<sup>3</sup>]**

Country/Region	Production	Cum. Production	Reserves	Resources	EUR	Remaining Potential
Albania	–	8	1	10	19	11
Austria	1.6	91	26	50	167	76
Bulgaria	0.2	6	6	15	27	21
Croatia	1.7	61	31	80	172	111
Cyprus	–	–	–	300	300	300
Czech Republic	0.2	14	4	20	38	24
Denmark	8.0	151	105	90	346	195
France	0.9	226	7	300	533	307
Germany	15.5	961	162	150	1 273	312
Greece	< 0.05	1	1	10	12	11
Hungary	3.1	217	8	80	305	88
Ireland	0.4	55	10	50	114	60
Italy	8.0	712	70	500	1 282	570
Malta	–	–	–	30	30	30
Netherlands	73.7	3 133	1 390	200	4 723	1 590
Norway	102.7	1 436	2 046	2 600	6 082	4 646
Poland	4.3	240	109	150	499	259
Romania	11.0	1 243	629	200	2 072	829
Serbia	0.3	31	48	40	119	88
Slovakia	0.1	25	14	30	69	44
Slovenia	–	–	–	15	15	15
Spain	< 0.05	11	3	500	514	503
Turkey	0.7	11	6	200	217	206
United Kingdom	57.0	2 282	564	680	3 526	1 244
Azerbaijan	16.7	477	1 900	1 900	4 277	3 800
Belarus	0.2	12	3	20	35	23
Georgia	–	3	8	100	111	108
Kazakhstan	35.6	379	3 280	2 500	6 159	5 780
Kyrgyzstan	< 0.05	7	6	20	33	26
Moldova, Republic	–	–	–	20	20	20
Russian Federation	584.0	18 605	47 578	105 000	171 183	152 578
Tajikistan	–	8	6	100	114	106
Turkmenistan	36.4	2 265	8 104	5 000	15 369	13 104
Ukraine	21.2	1 908	984	900	3 792	1 884
Uzbekistan	64.4	1 955	1 683	1 500	5 138	3 183
Algeria	81.4	1 905	4 504	1 400	7 809	5 904
Angola	0.7	19	310	1 200	1 529	1 510
Benin	–	–	1	100	101	101
Cameroon	–	–	235	250	485	485
Chad	–	–	–	50	50	50
Congo, Democratic Republic	–	–	1	10	11	11

Country/Region	Production	Cum. Production	Reserves	Resources	EUR	Remaining Potential
Congo, Republic	0.4	—	130	400	530	530
Côte d'Ivoire	1.3	19	28	500	548	528
Egypt	62.7	536	2 190	6 000	8 726	8 190
Equatorial Guinea	5.9	16	37	200	253	237
Eritrea	—	—	—	150	150	150
Ethiopia	—	—	25	20	45	45
Gabon	0.1	4	28	600	632	628
Gambia	—	—	—	25	25	25
Ghana	—	—	23	300	323	323
Guinea	—	—	—	50	50	50
Guinea-Bissau	—	—	—	50	50	50
Libyan Arab Jamahiriya	15.3	250	1 540	600	2 390	2 140
Madagascar	—	—	—	5	5	5
Mauritania	—	—	28	100	128	128
Morocco	< 0.05	2	2	5	9	7
Mozambique	3.4	15	127	200	342	327
Namibia	—	—	62	300	362	362
Nigeria	24.9	307	5 249	2 000	7 556	7 249
Rwanda	—	—	57	20	77	77
Senegal	—	—	3	180	183	183
Seychelles	—	—	—	20	20	20
Somalia	—	—	6	400	406	406
Sudan	—	—	85	440	525	525
South Africa	3.6	33	10	50	93	60
Tanzania, United Republic	—	—	7	100	107	107
Togo	—	—	—	100	100	100
Tunisia	3.0	37	65	300	402	365
Western Sahara	—	—	—	20	20	20
Zimbabwe	—	—	—	10	10	10
Bahrain	12.8	212	85	200	497	285
Iran, Islamic Republic	131.2	1 599	29 610	11 000	42 209	40 610
Iraq	1.1	100	3 170	4 000	7 270	7 170
Israel	2.7	7	30	1 500	1 538	1 530
Jordan	0.2	4	6	50	60	56
Kuwait	12.5	266	1 798	500	2 564	2 298
Lebanon	—	—	—	1 380	1 380	1 380
Oman	24.8	260	980	900	2 140	1 880
Palästina	—	—	30	40	70	70
Qatar	89.3	689	25 365	2 500	28 554	27 865
Saudi Arabia	77.5	1 309	7 462	11 000	19 771	18 462
Syrian, Arab Republic	5.8	103	241	300	643	541
United Arab Emirates	48.8	936	6 091	1 500	8 527	7 591
Yemen	0.5	3	490	500	993	990

► Tables

Country/Region	Production	Cum. Production	Reserves	Resources	EUR	Remaining Potential
Afghanistan	n. s.	56	50	500	550	550
Australia	52.6	840	3 077	2 000	5 917	5 077
Bangladesh	19.7	240	355	900	1 495	1 255
Brunei Darussalam	11.4	348	350	350	1 048	700
Cambodia	—	—	—	50	50	50
China	82.0	956	2 455	10 000	13 411	12 455
India	38.7	553	1 115	900	2 568	2 015
Indonesia	71.9	1 686	3 185	4 400	9 271	7 585
Japan	3.7	120	21	5	146	26
Korea, Republic	—	—	20	50	70	70
Lao, People's Democratic Republic	—	—	—	30	30	30
Malaysia	62.7	943	2 381	1 400	4 724	3 781
Myanmar	11.5	122	570	700	1 392	1 270
New Zealand	4.0	137	34	100	271	134
Pakistan	37.9	639	906	800	2 345	1 706
Papua New Guinea	0.3	3	442	350	795	792
Philippines	3.1	22	99	400	521	499
Taiwan	0.4	50	6	5	61	11
Thailand	30.9	375	360	600	1 335	960
Viet Nam	8.0	54	682	1 500	2 236	2 182
Canada	161.4	5 202	1 754	7 000	13 956	8 754
Greenland	—	—	—	2 800	2 800	2 800
Mexico	48.3	1 369	476	1 400	3 245	1 876
United States	593.4	30 925	7 080	20 000	58 005	27 080
Argentina	41.4	949	399	1 100	2 448	1.499
Barbados	—	—	< 0.5	200	200	200
Bolivia	12.3	171	710	700	1.581	1 410
Brazil	11.9	196	365	2 000	2 561	2 365
Chile	1.7	102	98	180	380	278
Colombia	10.5	197	124	400	721	524
Cuba	1.2	9	71	20	100	91
Ecuador	0.3	4	8	50	62	58
Grenada	—	—	—	23	23	23
Guatemala	—	—	—	5	5	5
Guyana	—	—	—	150	150	150
Paraguay	—	—	—	100	100	100
Peru	3.5	59	317	500	876	817
Suriname	—	—	—	100	100	100
Trinidad and Tobago	40.6	417	435	900	1 752	1 335
Uruguay	—	—	—	30	30	30
Venezuela, Bolivarian Republic	18.4	958	5 065	3 000	9 023	8 065

Country/Region	Production	Cum. Production	Reserves	Resources	EUR	Remaining Potential
World	3 041.5	92 870	191 911	240 583	525 308	432 494
Europe	289.3	10 916	5 239	6 300	22 455	11 539
CIS	758.6	25 620	63 551	117 060	206 231	180 611
Africa	202.7	3 144	14 753	16 155	34 051	30 908
Middle East	407.2	5 487	75 359	35 370	116 216	110 729
Austral-Asia	438.8	7 144	16 107	25 040	48 235	41 147
North America	803.1	37 496	9 310	31 200	78 006	40 510
Latin America	141.8	3 064	7 592	9 458	20 114	17 050
OPEC-12	501.4	8 342	90 173	38 750	137 264	128 923
OPEC-Gulf	360.4	4 898	73 497	30 500	108 895	103 997
OECD	1 139.6	48 159	16 986	38 965	104 111	55 951
EU-27	183.9	9 369	3 107	3 370	15 846	6 477
European Market	1 049.0	34 484	59 712	76 545	170 742	136 257
Asian Market	463.7	7 310	20 407	71 040	98 701	91 447
Transition Zone	543.7	10 103	88 437	44 490	143 030	132 927
North American Market	803.1	37 496	9 310	31 200	78 006	40 510
Latin American Market	70.8	1 478	1 889	4 610	7 977	6 499

n. s. not specified

– no production or reserves

► Tables

**Table 14: Conventional Natural Gas Resources in 2009:**  
Main Countries (Top 20) and Distribution by Regions and Economic Groups

Rank	Country/Region	Mrd. m³	Share [%]	
			Country	Cumulative
1	Russian Federation	105 000	43.6	43.6
2	United States	20 000	8.3	52.0
3	Saudi Arabia	11 000	4.6	56.5
	Iran, Islamic Republic	11 000	4.6	61.1
5	China	10 000	4.2	65.3
6	Canada	7 000	2.9	68.2
7	Egypt	6 000	2.5	70.7
8	Turkmenistan	5 000	2.1	72.7
9	Indonesia	4 400	1.8	74.6
10	Iraq	4 000	1.7	76.2
11	Venezuela, Bolivarian Republic	3 000	1.2	77.5
12	Greenland	2 800	1.2	78.6
13	Norway	2 600	1.1	79.7
14	Qatar	2 500	1.0	80.8
	Kazakhstan	2 500	1.0	81.8
16	Brazil	2 000	0.8	82.6
	Australia	2 000	0.8	83.5
	Nigeria	2 000	0.8	84.3
19	Azerbaijan	1 900	0.8	85.1
20	United Arab Emirates	1 500	0.6	85.7
	Uzbekistan	1 500	0.6	86.3
	Viet Nam	1 500	0.6	87.0
	Israel	1 500	0.6	87.6
...				
72	Germany	150	0.1	
...				
	World	240 583	100.0	
	Europe	6 300	2.6	
	CIS	117 060	48.7	
	Africa	16 155	6.7	
	Middle East	35 370	14.7	
	Austral-Asia	25 040	10.4	
	North America	31 200	13.0	
	Latin America	9 458	3.9	
	OPEC-12	38 750	16.1	
	OPEC-Gulf	30 500	12.7	
	OECD	38 965	16.2	
	EU-27	3 370	1.4	
	European Market	76 545	31.8	
	Asian Market	71 040	29.5	
	Transition Zone	44 490	18.5	
	North American Market	31 200	13.0	
	Latin American Market	4 610	1.9	

**Table 15: Conventional Natural Gas Reserves 2009:**  
Main Countries (Top 20) and Distribution by Regions and Economic Groups

Rank	Country/Region	Mrd. m³	Share [%]	
			Country	Cumulative
1	Russian Federation	47 578	24.8	24.8
2	Iran, Islamic Republic	29 610	15.4	40.2
3	Qatar	25 365	13.2	53.4
4	Turkmenistan	8 104	4.2	57.7
5	Saudi Arabia	7 462	3.9	61.5
6	United States	7 080	3.7	65.2
7	United Arab Emirates	6 091	3.2	68.4
8	Nigeria	5 249	2.7	71.1
9	Venezuela, Bolivarian Republic	5 065	2.6	73.8
10	Algeria	4 504	2.3	76.1
11	Kazakhstan	3 280	1.7	77.8
12	Indonesia	3 185	1.7	79.5
13	Iraq	3 170	1.7	81.2
14	Australia	3 077	1.6	82.8
15	China	2 455	1.3	84.0
16	Malaysia	2 381	1.2	85.3
17	Egypt	2 190	1.1	86.4
18	Norway	2 046	1.1	87.5
19	Azerbaijan	1 900	1.0	88.5
20	Kuwait	1 798	0.9	89.4
...				
47	Germany	162	0.1	
...				
World		191 911	100.0	
Europe		5 239	2.7	
CIS		63 551	33.1	
Africa		14 753	7.7	
Middle East		75 359	39.3	
Austral-Asia		16 107	8.4	
North America		9 310	4.9	
Latin America		7 592	4.0	
OPEC-12		90 173	47.0	
OPEC-Gulf		73 497	38.3	
OECD		16 986	8.9	
EU-27		3 107	1.6	
European Market		59 712	31.1	
Asian Market		20 407	10.6	
Transition Zone		88 437	46.1	
North American Market		9 310	4.9	
Latin American Market		1 889	1.0	

► Tables

**Table 16: Natural Gas Production in 2009:**  
Main Countries (Top 20) and Distribution by Regions and Economic Groups

Rank	Country/Region	Mrd. m³	Share [%]	
			Country	Cumulative
1	United States	593.4	19.5	19.5
2	Russian Federation	584.0	19.2	38.7
3	Canada	161.4	5.3	44.0
4	Iran, Islamic Republic	131.2	4.3	48.3
5	Norway	102.7	3.4	51.7
6	Qatar	89.3	2.9	54.6
7	China	82.0	2.7	57.3
8	Algeria	81.4	2.7	60.0
9	Saudi Arabia	77.5	2.5	62.6
10	Netherlands	73.7	2.4	65.0
11	Indonesia	71.9	2.4	67.4
12	Uzbekistan	64.4	2.1	69.5
13	Malaysia	62.7	2.1	71.5
13	Egypt	62.7	2.1	73.6
15	United Kingdom	57.0	1.9	75.5
16	Australia	52.6	1.7	77.2
17	United Arab Emirates	48.8	1.6	78.8
18	Mexico	48.3	1.6	80.4
19	Argentina	41.4	1.4	81.8
20	Trinidad and Tobago	40.6	1.3	83.1
...				
32	Germany	15.5	0.5	
...				
World		3 041.5	100.0	
Europe		289.3	9.5	
CIS		758.6	24.9	
Africa		202.7	6.7	
Middle East		407.2	13.4	
Austral-Asia		438.8	14.4	
North America		803.1	26.4	
Latin America		141.8	4.7	
OPEC-12		501.4	16.5	
OPEC-Gulf		360.4	11.8	
OECD		1 139.6	37.5	
EU-27		183.9	6.0	
European Market		1 049.0	34.5	
Asian Market		463.7	15.2	
Transition Zone		543.7	17.9	
North American Market		803.1	26.4	
Latin American Market		70.8	2.3	

**Table 17: Natural Gas Consumption in 2009:**  
Main Countries (Top 20) and Distribution by Regions and Economic Groups

Rank	Country/Region	Mrd. m³	Share [%]	
			Country	Cumulative
1	United States	646.6	21.9	21.9
2	Russian Federation	389.7	13.2	35.0
3	Iran, Islamic Republic	131.7	4.5	39.5
4	Canada	94.7	3.2	42.7
5	Germany	92.0	3.1	45.8
6	China	88.7	3.0	48.8
7	Japan	87.4	3.0	51.8
8	United Kingdom	86.5	2.9	54.7
9	Saudi Arabia	77.5	2.6	57.3
10	Italy	71.6	2.4	59.7
11	Mexico	69.6	2.4	62.1
12	United Arab Emirates	59.1	2.0	64.1
13	India	51.9	1.8	65.8
14	Ukraine	51.9	1.8	67.6
15	Uzbekistan	48.7	1.6	69.2
16	Argentina	43.1	1.5	70.7
17	France	42.6	1.4	72.1
18	Egypt	42.5	1.4	73.6
19	Thailand	39.2	1.3	74.9
20	Netherlands	38.9	1.3	76.2
World		2 957.0	100.0	
Europe		519.1	17.6	
CIS		559.9	18.9	
Africa		98.5	3.3	
Middle East		338.9	11.5	
Austral-Asia		496.6	16.8	
North America		810.9	27.4	
Latin America		133.1	4.5	
OPEC-12		375.9	12.7	
OPEC-Gulf		303.9	10.3	
OECD		1 453.1	49.1	
EU-27		474.0	16.0	
European Market		1 066.0	36.1	
Asian Market		496.6	16.8	
Transition Zone		428.2	14.5	
North American Market		810.9	27.4	
Latin American Market		72.5	2.5	

► Tables

**Table 18: Natural Gas Exports in 2009:**  
Main Countries (Top 20) and Distribution by Regions and Economic Groups

Rank	Country/Region	Mrd. m³	Share [%]	
			Country	Cumulative
1	Russian Federation	173.7	19.8	19.8
2	Norway	98.9	11.2	31.0
3	Canada	92.2	10.5	41.5
4	Qatar	68.2	7.8	49.3
5	Algeria	52.7	6.0	55.2
6	Netherlands	49.7	5.6	60.9
7	Indonesia	35.7	4.1	64.9
8	Malaysia	30.7	3.5	68.4
9	United States	30.3	3.4	71.9
10	Australia	24.2	2.8	74.7
11	Trinidad and Tobago	19.7	2.2	76.9
12	Egypt	18.3	2.1	79.0
13	Kazakhstan	17.7	2.0	81.0
14	Turkmenistan	16.7	1.9	82.9
15	Nigeria	16.0	1.8	84.7
16	Uzbekistan	15.7	1.8	86.5
17	United Kingdom	12.2	1.4	87.9
18	Oman	11.5	1.3	89.2
19	Germany	11.5	1.3	90.5
20	Libyan Arab Jamahiriya	9.9	1.1	91.6
World		879.2	100.0	
Europe		187.0	21.3	
CIS		231.0	26.3	
Africa		105.1	12.0	
Middle East		92.8	10.6	
Austral-Asia		107.8	12.3	
North America		123.4	14.0	
Latin America		32.2	3.7	
OPEC-12		159.4	18.1	
OPEC-Gulf		80.9	9.2	
OECD		334.6	38.1	
EU-27		87.4	9.9	
European Market		442.2	50.3	
Asian Market		114.4	13.0	
Transition Zone		142.9	16.3	
North American Market		123.4	14.0	
Latin American Market		10.7	1.2	

**Table 19: Natural Gas Imports in 2009:**  
Main Countries (Top 20) and Distribution by Regions and Economic Groups

Rank	Country/Region	Mrd. m³	Share [%]	
			Country	Cumulative
1	United States	105.8	11.7	11.7
2	Germany	93.8	10.4	22.1
3	Japan	85.9	9.5	31.7
4	Italy	69.3	7.7	39.3
5	France	49.1	5.4	44.8
6	United Kingdom	41.1	4.6	49.3
7	Ukraine	38.0	4.2	53.5
8	Spain	36.0	4.0	57.5
9	Korea, Republic	34.3	3.8	61.3
10	Turkey	33.2	3.7	65.0
11	Russian Federation	32.3	3.6	68.6
12	Belgium	21.5	2.4	71.0
13	Canada	20.8	2.3	73.3
14	Belarus	17.7	2.0	75.3
15	United Arab Emirates	17.3	1.9	77.2
16	Netherlands	17.2	1.9	79.1
17	Mexico	13.2	1.5	80.5
18	India	12.6	1.4	81.9
19	Taiwan	11.8	1.3	83.2
20	Singapore	9.6	1.1	84.3
World		902.1	100.0	
Europe		437.1	48.5	
CIS		96.8	10.7	
Africa		5.3	0.6	
Middle East		29.6	3.3	
Austral-Asia		177.8	19.7	
North America		139.8	15.5	
Latin America		15.8	1.7	
OPEC-12		26.1	2.9	
OPEC-Gulf		24.3	2.7	
OECD		690.2	76.5	
EU-27		397.8	44.1	
European Market		498.3	55.2	
Asian Market		177.8	19.7	
Transition Zone		33.6	3.7	
North American Market		139.8	15.5	
Latin American Market		12.6	1.4	

► Tables

**Table 20: Hard Coal in 2009 [Mt]:**

Country/Region	Production	Reserves	Resources	Remaining Potential
Belgium	—	—	4 100	4 100
Bosnia and Herzegovina	—	484	146	630
Bulgaria	2.0	192	3 920	4 112
Czech Republic	10.6	1 157	15 502	16 660
France	0.2	—	160	160
Germany	15.0	73	82 961	83 034
Hungary	—	276	5 075	5 351
Ireland	—	14	26	40
Italy	0.1	10	600	610
Montenegro	—	142	195	337
Netherlands	—	497	2 750	3 247
Norway	2.6	24	68	92
Poland	78.0	12 726	164 207	176 933
Portugal	—	3	n. s.	3
Romania	2.2	11	2 435	2 446
Serbia	0.1	402	453	855
Slovenia	—	56	39	95
Spain	9.4	868	3 363	4 231
Sweden	—	1	4	5
Turkey	1.9	529	793	1 322
United Kingdom	17.9	367	186 700	187 067
Armenia	—	163	154	317
Georgia	0.1	201	700	901
Kazakhstan	96.2	18 750	129 966	148 716
Kyrgyzstan	0.1	971	27 528	28 499
Russian Federation	232.5	68 655	2 662 155	2 730 810
Tajikistan	0.1	375	3 700	4 075
Turkmenistan	—	—	800	800
Ukraine	72.0	32 039	49 006	81 045
Uzbekistan	0.1	1 425	9 910	11 335
Algeria	—	59	164	223
Botswana	1.0	40	21 200	21 240
Congo, Democratic Republic	< 0.05	88	900	988
Egypt	< 0.05	16	166	182
Madagascar	—	—	150	150
Malawi	0.1	2	800	802
Morocco	—	14	82	96
Mozambique	< 0.05	849	20 022	20 871
Namibia	—	—	350	350
Niger	0.2	n. a.	90	90
Nigeria	< 0.05	292	2 065	2 357
South Africa	250.6	27 981	n. s.	27 981
Swaziland	0.1	144	4 500	4 644
Tanzania, United Republic	—	269	1 141	1 410
Uganda	—	—	800	800
Zambia	0.2	45	900	945



Country/Region	Production	Reserves	Resources	Remaining Potential
Zimbabwe	1.7	502	25 000	25 502
Iran, Islamic Republic	1.6	1 203	40 000	41 203
Afghanistan	0.2	66	n. s.	66
Australia	348.0	43 800	1 573 700	1 617 500
Bangladesh	0.8	293	2 967	3 260
Bhutan	0.1	n. a.	n. a.	n. a.
China	2 930.0	180 600	5 010 000	5 190 600
India	532.1	72 009	167 012	239 021
Indonesia	254.0	5 634	34 391	40 025
Japan	1.0	340	13 543	13 883
Korea, Democratic People*s Republic	28.6	600	10 000	10 600
Korea, Republic	2.5	331	1 036	1 367
Lao, People's Democratic Republic	< 0.05	4	58	62
Malaysia	1.7	141	1 068	1 209
Mongolia	8.3	1 170	39 854	41 024
Myanmar	1.2	3	248	252
Nepal	0.0	1	7	8
New Caledonia	–	2	n. s.	2
New Zealand	4.3	825	2 350	3 175
Pakistan	3.3	89	443	532
Philippines	5.0	211	1 012	1 223
Taiwan	–	1	101	102
Viet Nam	42.1	3 116	3 519	6 635
Canada	52.3	4 346	183 260	187 606
Greenland	–	183	200	383
Mexico	9.5	1 160	3 000	4 160
United States	907.4	226 694	6 465 248	6 691 942
Argentina	0.2	500	300	800
Bolivia	–	1	n. s.	1
Brazil	–	1 547	4 665	6 212
Chile	0.1	1 181	4 135	5 316
Colombia	72.8	5 298	9 929	15 227
Costa Rica	–	–	17	17
Peru	0.2	102	1 465	1 567
Venezuela, Bolivarian Republic	3.7	850	7 803	8 653
World	6 006.2	723 009	17 167 079	17 890 089
Europe	140.0	17 831	473 498	491 329
CIS	401.1	122 578	2 883 919	3 006 497
Africa	254.0	30 300	78 330	108 630
Middle East	1.6	1 203	40 000	41 203
Austral-Asia	4 163.2	309 236	6 861 310	7 170 546
North America	969.2	232 383	6 651 708	6 884 091
Latin America	77.0	9 478	28 314	37 792
Antarktis	–	–	150 000	150 000
OPEC-12	5.3	2 403	50 032	52 435
OPEC-Gulf	1.6	1 203	40 000	41 203
OECD	1 460.8	294 224	8 708 647	9 002 870
EU-27	135.4	16 251	471 843	488.094

n. s. not specified

n. a. not available despite production

– no production or reserves

► Tables

**Table 21: Hard Coal Resources in 2009:**  
Main Countries (Top 20) and Distribution by Regions and Economic Groups

Rank	Country/Region	Mt	Share [%]	
			Country	Cumulative
1	United States	6 465 248	37.7	37.7
2	China	5 010 000	29.2	66.8
3	Russian Federation *	2 662 155	15.5	82.4
4	Australia	1 573 700	9.2	91.5
5	United Kingdom	186 700	1.1	92.6
6	Canada	183 260	1.1	93.7
7	India	167 012	1.0	94.6
8	Poland	164 207	1.0	95.6
9	Kazakhstan	129 966	0.8	96.4
10	Germany	82 961	0.5	96.8
11	Ukraine *	49 006	0.3	97.1
12	Iran, Islamic Republic	40 000	0.2	97.4
13	Mongolia *	39 854	0.2	97.6
14	Indonesia	34 391	0.2	97.8
15	Kyrgyzstan	27 528	0.2	98.0
16	Zimbabwe	25 000	0.1	98.1
17	Botswana	21 200	0.1	98.2
18	Mozambique	20 022	0.1	98.3
19	Czech Republic *	15 502	0.1	98.4
20	Japan	13 543	0.1	98.5
World		17 167 079	100.0	
Europe		473 498	2.8	
CIS		2 883 919	16.8	
Africa		78 330	0.5	
Middle East		40 000	0.2	
Austral-Asia		6 861 310	40.0	
North America		6 651 708	38.7	
Latin America		28 314	0.2	
Antarktis		150 000	0.9	
OPEC-12		50 032	0.3	
OPEC-Gulf		40 000	0.2	
OECD		8 708 647	50.7	
EU-27		471 843	2.7	

\* Hard coal resources contains only bituminous cal and anthracite according to national classification

**Table 22: Hard Coal Reserves in 2009:**  
Main Countries (Top 20) and Distribution by Regions and Economic Groups

Rank	Country/Region	Mt	Share [%]	
			Country	Cumulative
1	United States	226 694	31.4	31.4
2	China	180 600	25.0	56.3
3	India	72 009	10.0	66.3
4	Russian Federation *	68 655	9.5	75.8
5	Australia	43 800	6.1	81.8
6	Ukraine *	32 039	4.4	86.3
7	South Africa	27 981	3.9	90.1
8	Kazakhstan	18 750	2.6	92.7
9	Poland	12 726	1.8	94.5
10	Indonesia	5 634	0.8	95.3
11	Colombia	5 298	0.7	96.0
12	Canada	4 346	0.6	96.6
13	Viet Nam	3 116	0.4	97.0
14	Brazil	1 547	0.2	97.3
15	Uzbekistan	1 425	0.2	97.5
16	Iran, Islamic Republic	1 203	0.2	97.6
17	Chile	1 181	0.2	97.8
18	Mongolia *	1 170	0.2	97.9
19	Mexico	1 160	0.2	98.1
20	Czech Republic *	1 157	0.2	98.3
...				
52	Germany	73	< 0.05	
...				
		723 009	100.0	
World		723 009	100.0	
Europe		17 831	2.5	
CIS		122 578	17.0	
Africa		30 300	4.2	
Middle East		1 203	0.2	
Austral-Asia		309 236	42.8	
North America		232 383	32.1	
Latin America		9 478	1.3	
OPEC-12		2 403	0.3	
OPEC-Gulf		1 203	0.2	
OECD		294 224	40.7	
EU-27		16 251	2.2	

\* Hard coal reserves contains only bituminous coal and anthracite according to national classification

► Tables

**Table 23: Hard Coal Production in 2009:**  
Main Countries (Top 20) and Distribution by Regions and Economic Groups

Rank	Country/Region	Mt	Share [%]	
			Country	Cumulative
1	China	2 930.0	48.8	48.8
2	United States	907.4	15.1	63.9
3	India	532.1	8.9	72.7
4	Australia	348.0	5.8	78.5
5	Indonesia	254.0	4.2	82.8
6	South Africa	250.6	4.2	86.9
7	Russian Federation *	232.5	3.9	90.8
8	Kazakhstan	96.2	1.6	92.4
9	Poland	78.0	1.3	93.7
10	Colombia	72.8	1.2	94.9
11	Ukraine *	72.0	1.2	96.1
12	Canada	52.3	0.9	97.0
13	Viet Nam	42.1	0.7	97.7
14	Korea, Democratic People's Republic	28.6	0.5	98.2
15	United Kingdom	17.9	0.3	98.5
16	Germany	15.0	0.2	98.7
17	Czech Republic *	10.6	0.2	98.9
18	Mexico	9.5	0.2	99.1
19	Spain	9.4	0.2	99.2
20	Mongolia *	8.3	0.1	99.4
World		6 006.2	100.0	
Europe		140.0	2.3	
CIS		401.1	6.7	
Africa		254.0	4.2	
Middle East		1.6	0.0	
Austral-Asia		4 163.2	69.3	
North America		969.2	16.1	
Latin America		77.0	1.3	
OPEC-12		5.3	0.1	
OPEC-Gulf		1.6	0.0	
OECD		1 460.8	24.3	
EU-27		135.4	2.3	

\* Hard coal production contains only bituminous coal and anthracite according to national classification

**Table 24: Hard Coal Consumption in 2009:**  
Main Countries (Top 20) and Distribution by Regions and Economic Groups

Rank	Country/Region	Mt	Share [%]	
			Country	Cumulative
1	China	3 034.3	51.2	51.2
2	United States	841.8	14.2	65.3
3	India	597.6	10.1	75.4
4	South Africa	183.0	3.1	78.5
5	Japan	163.0	2.7	81.3
6	Russian Federation *	157.0	2.6	83.9
7	Korea, Republic	105.5	1.8	85.7
8	Poland	75.9	1.3	87.0
9	Ukraine *	74.6	1.3	88.2
10	Australia	73.8	1.2	89.5
11	Kazakhstan	73.8	1.2	90.7
12	Taiwan	59.4	1.0	91.7
13	Germany	52.2	0.9	92.6
14	United Kingdom	48.8	0.8	93.4
15	Canada	38.0	0.6	94.0
16	Indonesia	30.0	0.5	94.6
17	Korea, Democratic People's Republic	25.6	0.4	95.0
18	Turkey	22.2	0.4	95.4
19	Spain	20.0	0.3	95.7
20	Italy	19.1	0.3	96.0
World		5 931.8	100.0	
Europe		317.1	5.3	
CIS		305.9	5.2	
Africa		194.0	3.3	
Middle East		15.5	0.3	
Austral-Asia		4 173.3	70.4	
North America		895.3	15.1	
Latin America		30.7	0.5	
OPEC-12		3.7	0.1	
OPEC-Gulf		2.8	< 0.05	
OECD		1 549.0	26.1	
EU-27		292.0	4.9	

\* Hard coal consumption contains only bituminous coal and anthracite according to national classification

► Tables

**Table 25: Hard Coal Exports in 2009:**  
Main Countries (Top 20) and Distribution by Regions and Economic Groups

Rank	Country/Region	Mt	Share [%]	
			Country	Cumulative
1	Australia	274.2	29.7	29.7
2	Indonesia	230.3	25.0	54.7
3	Russian Federation	98.1	10.6	65.3
4	Colombia	66.8	7.2	72.6
5	South Africa	60.5	6.6	79.1
6	United States	53.6	5.8	84.9
7	Canada	27.0	2.9	87.9
8	Viet Nam	25.1	2.7	90.6
9	Kazakhstan	22.7	2.5	93.0
10	China	22.3	2.4	95.5
11	Poland	8.4	0.9	96.4
12	Mongolia	7.6	0.8	97.2
13	Czech Republic	5.7	0.6	97.8
14	Ukraine	5.3	0.6	98.4
15	Venezuela, Bolivarian Republic	3.5	0.4	98.8
16	Korea, Democratic People's Republic	3.0	0.3	99.1
17	Norway	2.4	0.3	99.3
18	India	2.2	0.2	99.6
19	New Zealand	2.0	0.2	99.8
20	Myanmar	1.0	0.1	99.9
...				
22	Germany	0.2	< 0.05	
...				
World		922.4	100.0	
Europe		17.2	1.9	
CIS		126.1	13.7	
Africa		60.5	6.6	
Middle East		—	—	
Austral-Asia		567.7	61.5	
North America		80.6	8.7	
Latin America		70.3	7.6	
OPEC-12		3.5	0.4	
OPEC-Gulf		—	—	
OECD		374.0	40.5	
EU-27		14.9	1.6	
— no exports				

**Table 26: Hard Coal Imports in 2009:**  
Main Countries (Top 20) and Distribution by Regions and Economic Groups

Rank	Country/Region	Mt	Share [%]	
			Country	Cumulative
1	Japan	161.9	17.9	17.9
2	China	126.6	14.0	32.0
3	Korea, Republic	102.9	11.4	43.4
4	India	67.7	7.5	50.9
5	Taiwan	59.4	6.6	57.5
6	United Kingdom	38.2	4.2	61.7
7	Germany	36.5	4.0	65.7
8	Russian Federation	23.5	2.6	68.4
9	United States	20.5	2.3	70.6
10	Italy	20.4	2.3	72.9
11	Turkey	20.4	2.3	75.1
12	Thailand	16.3	1.8	77.0
13	Spain	16.1	1.8	78.7
14	France	15.8	1.8	80.5
15	Malaysia	14.5	1.6	82.1
16	Israel	13.0	1.4	83.5
16	Netherlands	13.0	1.4	85.0
18	Canada	12.7	1.4	86.4
19	Brazil	12.7	1.4	87.8
20	Hong Kong	12.3	1.4	89.1
World		902.2	100.0	
Europe		213.4	23.7	
CIS		31.8	3.5	
Africa		7.6	0.8	
Middle East		14.3	1.6	
Austral-Asia		571.6	63.4	
North America		39.2	4.4	
Latin America		24.2	2.7	
OPEC-12		2.2	0.2	
OPEC-Gulf		1.2	0.1	
OECD		513.7	56.9	
EU-27		190.2	21.1	

► Tables

**Table 27: Lignite in 2009 [in Mt]:**

Region	Production	Reserves	Resources	Remaining Potential
Albania	0.1	522	205	727
Austria	–	–	333	333
Bosnia and Herzegovina	9.5	2 369	1 814	4 182
Bulgaria	27.0	2 174	2 400	4 574
Croatia	–	n. s.	300	300
Czech Republic	45.6	2 694	7 270	9 964
France	–	n. s.	114	114
Germany	169.9	40 600	36 500	77 100
Greece	64.7	2 876	3 554	6 430
Hungary	9.0	2 633	2 704	5 337
Italy	–	7	22	29
Kosovo	7.0	1 564	9 262	10 826
Macedonia, former Yugoslav Republic	5.0	332	300	632
Montenegro	1.5	n. a.	n. a.	n. a.
Poland	57.1	3 733	219 647	223 380
Portugal	–	33	33	66
Romania	28.4	280	9 640	9 920
Serbia	31.3	7 112	13 074	20 186
Slovakia	2.6	177	887	1 065
Slovenia	4.4	315	341	656
Spain	–	319	n. s.	319
Turkey	70.5	1 814	9 240	11 054
United Kingdom	–	–	1 000	1 000
Belarus	–	–	1 500	1 500
Kazakhstan	5.3	n. a.	n. a.	n. a.
Kyrgyzstan	0.5	n. a.	n. a.	n. a.
Russian Federation	68.2	91 350	1 279 680	1 371 030
Tajikistan	< 0.05	n. a.	n. a.	n. a.
Ukraine	0.2	2 336	5 381	7 717
Uzbekistan	3.2	n. a.	n. a.	n. a.
Central African Republic	–	3	n. s.	3
Madagascar	–	–	37	37
Mali	–	–	3	3
Morocco	–	–	40	40
Niger	–	6	n. s.	6
Nigeria	–	–	250	250
Sierra Leone	–	–	2	2
Australia	68.0	37 100	174 000	211 100
Bangladesh	–	–	3	3
China	120.0	11 000	307 000	318 000
India	34.1	4 895	33 752	38 647

Region	Production	Reserves	Resources	Remaining Potential
Indonesia	38.2	10 141	51 586	61 727
Japan	—	10	1 026	1 036
Korea, Democratic People's Republic	9.0	n. a.	n. a.	n. a.
Lao, People's Democratic Republic	0.6	499	22	521
Malaysia	—	39	412	451
Mongolia	4.8	1 350	119 426	120 776
Myanmar	0.5	3	2	5
New Zealand	0.3	6 750	4 600	11 350
Pakistan	—	2 870	181 434	184 304
Philippines	—	105	912	1 017
Thailand	17.6	1 063	826	1 889
Viet Nam	1.8	244	199 876	200 120
Canada	10.6	2 236	118 270	120 506
Mexico	—	51	n. s.	51
United States	65.7	30 851	1 367 818	1 398 669
Argentina	—	—	7 300	7 300
Brazil	5.7	5 049	12 587	17 636
Chile	0.5	n. a.	7	7
Dominican Republic	—	—	84	84
Ecuador	—	24	n. s.	24
Haiti	—	—	40	40
Peru	—	—	100	100
World	988.2	277 529	4 186 615	4 464 144
Europe	533.7	69 555	318 639	388 194
CIS	77.3	93 686	1 286 561	1 380 247
Africa	—	9	332	341
Middle East	—	n. a.	n. a.	n. a.
Austral-Asia	294.7	76 069	1 074 878	1 150 946
North America	76.3	33 138	1 486 088	1 519 226
Latin America	6.2	5 073	20 118	25 191
OPEC-12	—	24	250	274
OPEC-Gulf	—	—	—	—
OECD	563.9	131 885	1 947 019	2 078 904
EU-27	408.7	55 842	284 445	340 287

n. s. not specified

n. a. not available despite production

— no production, reserves or resources

► Tables

**Table 28: Lignite Resources in 2009:**  
Main Countries (Top 20) and Distribution by Regions and Economic Groups

Rank	Country/Region	Mt	Share [%]	
			Country	Cumulative
1	United States	1 367 818	32.7	32.7
2	Russian Federation *	1 279 680	30.6	63.2
3	China	307 000	7.3	70.6
4	Poland	219 647	5.2	75.8
5	Viet Nam	199 876	4.8	80.6
6	Pakistan	181 434	4.3	84.9
7	Australia	174 000	4.2	89.1
8	Mongolia *	119 426	2.9	91.9
9	Canada	118 270	2.8	94.8
10	Indonesia	51 586	1.2	96.0
11	Germany	36 500	0.9	96.9
12	India	33 752	0.8	97.7
13	Serbia	13 074	0.3	98.0
14	Brazil	12 587	0.3	98.3
15	Romania	9 640	0.2	98.5
16	Kosovo	9 262	0.2	98.7
17	Turkey	9 240	0.2	99.0
18	Argentina	7 300	0.2	99.1
19	Czech Republic *	7 270	0.2	99.3
20	Ukraine *	5 381	0.1	99.4
World		4 186 615	100.0	
Europe		318 639	7.6	
CIS		1 286 561	30.7	
Africa		332	< 0.05	
Middle East		—	—	
Austral-Asia		1 074 878	25.7	
North America		1 486 088	35.5	
Latin America		20 118	0.5	
OPEC-12		250	< 0.05	
OPEC-Gulf		—	—	
OECD		1 947 019	46.5	
EU-27		284 445	6.8	

\* Lignite resources contains subbituminous coal

**Table 29: Lignite Reserves in 2009:**  
Main Countries (Top 20) and Distribution by Regions and Economic Groups

Rank	Country/Region	Mt	Share [%]	
			Country	Cumulative
1	Russian Federation *	91 350	32.9	32.9
2	Germany	40 600	14.6	47.5
3	Australia	37 100	13.4	60.9
4	United States	30 851	11.1	72.0
5	China	11 000	4.0	76.0
6	Indonesia	10 141	3.7	79.6
7	Serbia	7 112	2.6	82.2
8	New Zealand	6 750	2.4	84.6
9	Brazil	5 049	1.8	86.5
10	India	4 895	1.8	88.2
11	Poland	3 733	1.3	89.6
12	Greece	2 876	1.0	90.6
13	Pakistan	2 870	1.0	91.6
14	Czech Republic *	2 694	1.0	92.6
15	Hungary	2 633	0.9	93.6
16	Bosnia and Herzegovina	2 369	0.9	94.4
17	Ukraine *	2 336	0.8	95.3
18	Canada	2 236	0.8	96.1
19	Bulgaria	2 174	0.8	96.8
20	Turkey	1 814	0.7	97.5
	World	277 529	100.0	
	Europe	69 555	25.1	
	CIS	93 686	33.8	
	Africa	9	< 0.05	
	Middle East	—	—	
	Austral-Asia	76 069	27.4	
	North America	33 138	11.9	
	Latin America	5 073	1.8	
	OPEC-12	24	< 0.05	
	OPEC-Gulf	—	—	
	OECD	131 885	47.5	
	EU-27	55 842	20.1	

\* Lignite reserves contains subbituminous coal

► Tables

**Table 30: Lignite Production in 2009:**  
Main Countries (Top 20) and Distribution by Regions and Economic Groups

Rank	Country/Region	Mt	Share [%]	
			Country	Cumulative
1	Germany	169.9	17.2	17.2
2	China	120.0	12.1	29.3
3	Turkey	70.5	7.1	36.5
4	Russian Federation *	68.2	6.9	43.4
5	Australia	68.0	6.9	50.2
6	United States	65.7	6.7	56.9
7	Greece	64.7	6.5	63.4
8	Poland	57.1	5.8	69.2
9	Czech Republic *	45.6	4.6	73.8
10	Indonesia	38.2	3.9	77.7
11	India	34.1	3.4	81.2
12	Serbia	31.3	3.2	84.3
13	Romania	28.4	2.9	87.2
14	Bulgaria	27.0	2.7	89.9
15	Thailand	17.6	1.8	91.7
16	Canada	10.6	1.1	92.8
17	Bosnia and Herzegovina	9.5	1.0	93.7
18	Hungary *	9.0	0.9	94.6
19	Korea, Democratic People's Republic	9.0	0.9	95.6
20	Kosovo	7.0	0.7	96.3
World		988.2	100.0	
Europe		533.7	54.0	
CIS		77.3	7.8	
Africa		—	—	
Middle East		—	—	
Austral-Asia		294.7	29.8	
North America		76.3	7.7	
Latin America		6.2	0.6	
OPEC-12		—	—	
OPEC-Gulf		—	—	
OECD		563.9	57.1	
EU-27		408.7	41.4	

\* Lignite production contains subbituminous coal

**Table 31: Lignite Consumption in 2009:**  
Main Countries (Top 20) and Distribution by Regions and Economic Groups

Rank	Country/Region	Mt	Share [%]	
			Country	Cumulative
1	Germany	169.9	17.3	17.3
2	China	120.1	12.3	29.6
3	Turkey	70.5	7.2	36.8
4	Australia	68.0	6.9	43.8
5	Russian Federation *	67.8	6.9	50.7
6	United States	65.7	6.7	57.4
7	Greece	64.8	6.6	64.0
8	Poland	57.0	5.8	69.8
9	Czech Republic *	44.6	4.6	74.4
10	India	34.1	3.5	77.9
11	Serbia	31.3	3.2	81.1
12	Indonesia	30.2	3.1	84.2
13	Romania	28.4	2.9	87.1
14	Bulgaria	27.0	2.8	89.8
15	Thailand	17.9	1.8	91.6
16	Canada	10.4	1.1	92.7
17	Bosnia and Herzegovina	9.5	1.0	93.7
18	Hungary *	9.1	0.9	94.6
19	Korea, Democratic People's Republic	9.0	0.9	95.5
20	Kosovo	7.0	0.7	96.2
World		979.2	100.0	
Europe		535.2	54.7	
CIS		76.5	7.8	
Africa		—	—	
Middle East		—	—	
Austral-Asia		285.1	29.1	
North America		76.2	7.8	
Latin America		6.2	0.6	
OPEC-12		—	—	
OPEC-Gulf		—	—	
OECD		564.3	57.6	
EU-27		409.2	41.8	

\* Lignite consumption contains subbituminous coal

► Tables

**Table 32: Uranium in 2009 [kt U]**

Region	Production	Cum. Production	Reserves	Resources	EUR	Remaining Potential
Czech Republic	0.3	111	< 0.5	< 0.5	111	1
Denmark	–	–	–	136	136	136
Finland	–	< 0.5	–	1	1	1
France	< 0.05	76	–	9	85	9
Germany	–	220	–	7	227	7
Greece	–	–	–	13	13	13
Hungary	–	21	–	27	48	27
Italy	–	–	–	6	6	6
Portugal	–	4	5	4	12	9
Romania	0.1	18	–	13	31	13
Slovakia	n. s.	n. s.	–	10	10	10
Slovenia	n. s.	n. s.	–	10	10	10
Spain	–	5	3	9	16	11
Sweden	n. s.	< 0.5	–	10	10	10
Turkey	n. s.	–	–	7	7	7
Kazakhstan	14.0	142	234	1 398	1 774	1 632
Russian Federation	3.6	143	100	648	892	748
Ukraine	0.8	15	39	320	374	359
Uzbekistan	2.4	37	55	144	237	200
Algeria	–	–	–	20	20	20
Central African Republic	n. s.	n. s.	–	12	12	12
Congo, Democratic Republic	n. s.	26	–	3	28	3
Egypt	n. s.	n. s.	–	2	2	2
Gabon	–	25	–	6	31	6
Malawi	0.1	< 0.5	8	7	15	15
Namibia	4.6	101	2	282	385	284
Niger	3.2	114	43	258	414	300
Somalia	n. s.	–	–	8	8	8
South Africa	0.6	157	142	264	563	406
Tanzania, United Republic	n. s.	n. s.	–	28	28	28
Zambia	n. s.	< 0.5	n. s.	22	22	22
Zimbabwe	n. s.	–	–	26	26	26
Iran, Islamic Republic	n. s.	< 0.5	–	20	20	20
Jordan	n. s.	n. s.	44	237	281	281
Australia	8.0	163	1 163	516	1 842	1 679
China	0.8	32	101	78	211	179
India	0.3	9	–	144	153	144
Indonesia	n. s.	–	–	22	22	22
Japan	n. s.	< 0.5	–	7	7	7
Mongolia	–	1	38	1 402	1 440	1 439
Pakistan	0.1	1	n. s.	n. s.	1	–
Viet Nam	–	–	–	114	114	114

Region	Production	Cum. Production	Reserves	Resources	EUR	Remaining Potential
Canada	10.2	437	337	1 058	1 832	1 395
Mexico	n. s.	< 0.5	—	5	5	5
United States	1.5	365	39	2 564	2 968	2 603
Argentina	—	3	7	14	23	21
Brazil	0.3	3	158	421	582	579
Chile	—	—	—	3	3	3
Colombia	n. s.	—	n. s.	228	228	228
Peru	—	—	—	29	29	29
Venezuela, Bolivarian Republic	n. s.	—	n. s.	—	—	—
World	50.8	2 231	2 516	10 572	15 319	13 088
Europe	0.3	455	7	263	725	270
CIS	20.9	337	428	2 511	3 276	2 939
Africa	8.5	424	195	937	1 555	1 132
Middle East	—	< 0.5	44	258	302	302
Austral-Asia	9.1	207	1 301	2 283	3 791	3 584
North America	11.6	802	376	3 627	4 805	4 003
Latin America	0.3	6	165	695	865	859
OPEC-12	—	< 0.5	—	40	40	40
OPEC-Gulf	—	< 0.5	—	20	20	20
OECD	19.9	1 402	1 546	4 389	7 337	5 935
EU-27	0.3	455	7	255	717	263

n. s. not specified

— no production, reserves or resources

Source: NEA/OECD – IAEA (2010)

WNA (2010c)

► Tables

**Table 33: Uranium Reserves in 2009 (< 80 USD/kg U):**  
Main Countries (Top 20) and Distribution by Regions and Economic Groups

Rank	Country/Region	t	Share [%]	
			Country	Cumulative
1	Australia	1 163 000	46.2	46.2
2	Canada	336 800	13.4	59.6
3	Kazakhstan	233 900	9.3	68.9
4	Brazil	157 700	6.3	75.2
5	South Africa	142 000	5.6	80.8
6	China	100 900	4.0	84.8
7	Russian Federation	100 400	4.0	88.8
8	Uzbekistan	55 200	2.2	91.0
9	Jordan	44 000	1.7	92.8
10	Niger	42 500	1.7	94.4
11	United States	39 000	1.6	96.0
12	Ukraine	38 700	1.5	97.5
13	Mongolia	37 500	1.5	99.0
14	Malawi	8 100	0.3	99.3
15	Argentina	7 000	0.3	99.6
16	Portugal	4 500	0.2	99.8
17	Spain	2 500	0.1	99.9
18	Namibia	2 000	0.1	100.0
19	Czech Republic	400	< 0.05	100.0
...				
20	Germany	–	–	
	World	2 516 100	100.0	
	Europe	7 400	0.3	
	CIS	428 200	17.0	
	Africa	194 600	7.7	
	Middle East	44 000	1.7	
	Austral-Asia	1 301 400	51.7	
	North America	375 800	14.9	
	Latin America	164 700	6.5	
	OPEC-12	–	–	
	OPEC-Gulf	–	–	
	OECD	1 546 200	61.5	
	EU-27	7 400	0.3	

Source: NEA/OECD – IAEA (2010)

**Table 34: Uranium Resources 2009 (> 20 kt U) [in kt]:**  
Main Countries and Distribution by Regions and Economic Groups

Country/Region	Discovered		Total	Undiscovered		Total	Share [%]	
	RAR 80-260 USD/kg	Inferred <260 USD/kg		Prognosticated <260 USD/kg	Speculative <260 USD/kg		Country	Cumulative
1	2	3	4=2+3	5	6	7=4+5+6	8	9
United States	433	n. s.	433	1 273	858	2 564	24.3	24.3
Mongolia	–	12	12	–	1 390	1 402	13.3	37.5
Kazakhstan	180	418	598	500	300	1 398	13.2	50.7
Canada	51	157	208	150	700	1 058	10.0	60.7
Russian Federation	81	385	466	182	n. s.	648	6.1	66.9
Australia	16	500	516	n. s.	n. s.	516	4.9	71.8
Brazil	–	121	121	300	n. s.	421	4.0	75.7
Ukraine	104	81	185	15	120	320	3.0	78.8
Namibia	155	127	282	n. s.	n. s.	282	2.7	81.4
South Africa	53	100	154	110	n. s.	264	2.5	83.9
Niger	202	31	233	25	n. s.	258	2.4	86.4
Jordan	–	68	68	85	85	237	2.2	88.6
Colombia	n. s.	n. s.	n. s.	11	217	228	2.2	90.8
Uzbekistan	21	39	59	85	–	144	1.4	92.1
India	55	25	80	64	n. s.	144	1.4	93.5
Denmark	n. s.	86	86	–	50	136	1.3	94.8
Viet Nam	1	5	6	8	100	114	1.1	95.9
China	15	56	71	4	4	78	0.7	96.6
Peru	1	1	3	7	20	29	0.3	96.9
Tanzania, United Republic	9	20	28	n. s.	n. s.	28	0.3	97.1
Hungary	n. s.	9	9	18	n. s.	27	0.3	97.4
Zimbabwe	1	n. s.	1	–	25	26	0.2	97.6
Indonesia	5	1	6	n. s.	16	22	0.2	97.9
Zambia	n. s.	n. s.	n. s.	22	n. s.	22	0.2	98.1
Iran, Islamic Republic	1	1	2	4	14	20	0.2	98.3
Algeria	20	n. s.	20	n. s.	n. s.	20	0.2	98.4
...								
Germany	3	4	7	–	–	7	0.1	99.7
...								
World	1 488	2 302	3 790	2 880	3 902	10 572	100.0	
Europe	44	135	179	30	53	263	2.5	
CIS	386	923	1 308	782	420	2 511	23.7	
Africa	469	286	755	157	25	937	8.9	
Middle East	1	69	70	89	99	258	2.4	
Austral-Asia	99	599	697	75	1 510	2 283	21.6	
North America	485	158	643	1 426	1 558	3 627	34.3	
Latin America	6	132	137	321	237	695	6.6	
OPEC-12	20	1	22	4	14	40	0.4	
OPEC-Gulf	1	1	2	4	14	20	0.2	
OECD	547	782	1 329	1 452	1 608	4 389	41.5	
EU-27	37	135	172	30	53	255	2.4	

n. s. not specified – no resources

Source: NEA/OECD – IAEA (2010)

► Tables

**Table 35: Uranium Mining Production in 2009:**  
Main Countries and Distribution by Regions and Economic Groups

Rank	Country/Region	t	Share [%]	
			Country	Cumulative
1	Kazakhstan	14 020	27.6	27.6
2	Canada	10 173	20.0	47.6
3	Australia	7 982	15.7	63.4
4	Namibia	4 626	9.1	72.5
5	Russian Federation	3 564	7.0	79.5
6	Niger	3 243	6.4	85.9
7	Uzbekistan	2 429	4.8	90.7
8	United States	1 453	2.9	93.5
9	Ukraine	840	1.7	95.2
10	China	750	1.5	96.7
11	South Africa	563	1.1	97.8
12	Brazil	345	0.7	98.5
13	India	290	0.6	99.0
14	Czech Republic	258	0.5	99.5
15	Malawi	104	0.2	99.7
16	Romania	75	0.1	99.9
17	Pakistan	50	0.1	100.0
18	France	8	< 0.05	100.0
...				
19	Germany	—	—	—
...				
		World	50 773	100.0
		Europe	341	0.7
		CIS	20 853	41.1
		Africa	8 536	16.8
		Middle East	—	—
		Austral-Asia	9 072	17.9
		North America	11 626	22.9
		Latin America	345	0.7
		OPEC-12	—	—
		OPEC-Gulf	—	—
		OECD	19 874	39.1
		EU-27	341	0.7

— no production

Source: WNA (2010 c)

**Table 36: Uranium Consumption in 2009:**  
Main Countries (Top 20) and Distribution by Regions and Economic Groups

Rank	Country/Region	t	Share [%]	
			Country	Cumulative
1	United States	19 538	28.5	28.5
2	France	10 153	14.8	43.3
3	Japan	8 003	11.7	54.9
4	Russian Federation	4 135	6.0	60.9
5	Korea, Republic	3 804	5.5	66.5
6	Germany	3 453	5.0	71.5
7	China	2 875	4.2	75.7
8	United Kingdom	2 235	3.3	78.9
9	Ukraine	2 031	3.0	81.9
10	Canada	1 675	2.4	84.3
11	Sweden	1 537	2.2	86.6
12	Spain	1 458	2.1	88.7
13	Finland	1 149	1.7	90.4
14	Belgium	1 052	1.5	91.9
15	India	908	1.3	93.2
16	Taiwan	863	1.3	94.5
17	Czech Republic	678	1.0	95.5
18	Switzerland	557	0.8	96.3
19	South Africa	321	0.5	96.8
20	Brazil	311	0.5	97.2
World		68 646	100.0	
Europe		23 535	34.3	
CIS		6 221	9.1	
Africa		321	0.5	
Middle East		148	0.2	
Austral-Asia		16 521	24.1	
North America		21 466	31.3	
Latin America		434	0.6	
OPEC-12		148	0.2	
OPEC-Gulf		148	0.2	
OECD		56 216	81.9	
EU-27		22 978	33.5	

Source: WNA (2010d)



# Glossary

## A

**API** American Petroleum Institute; main US trade association for the crude oil and natural gas industry

**°API** unit to measure the density of liquid hydrocarbons; low numbers correspond to heavy crude oils

**ARA** Amsterdam, Rotterdam, Antwerp

## B

**b, bbl** barrel; *see also: Measures*

**boe** barrel(s) oil equivalent;

**BP** British Petroleum; international energy company, based in London

**BTL** biomass to liquid; process during which liquid biofuels are produced from biomass

**Btu** British thermal unit(s)

## C

**CBM** coalbed methane; natural gas (methane) found in coal seams

**cif** cost, insurance, freight; term of sale signifying that the price invoiced or quoted by a seller includes insurance and all other charges up to the named port of destination

**clean gas** refers to a specific calorific heating value in natural gas trading, in Germany it is 9,7692 kWh/Nm<sup>3</sup>

**crude oil** naturally occurring, flammable liquid consisting of a complex mixture of hydrocarbons of various molecular weights and other organic compounds

**CTL** coal to liquid; process to produce liquid fuels from coal

**cumulative production** amount of production since production start up

## D

**DOE** Department of Energy in the USA

**downstream** term commonly used to refer to the refining of crude oil as well as the selling and distribution of natural gas and products derived from crude oil

**dry gas** natural gas from wells that does not have a significant content of liquid hydrocarbons or water vapor

E

**EIA**

US Energy Information Administration

**GOR**

enhanced oil recovery; generic term for techniques for increasing the amount of crude oil that can be extracted from an oil field

**EUR**

estimated ultimate recovery; approximation of the quantity of any energy resource that is potentially recoverable or has already been recovered from a reservoir/deposit

F

**field growth**

the term refers to the typical increases in estimated ultimate recovery (EUR) that occur as oil fields are developed and produced (→ *reserve growth*)

**frac**

process which results in the creation of fractures in rocks in order to increase permeability and thus improve the productivity of a well

G

**gas hydrate**

solids formed under certain pressure and temperature conditions (even above 0° C) from water and methane

**GTL**

Gas to liquid is a process during which synthetic fuels are produced from natural gas

H

**hard coal**

anthracite, bituminous coal and hard brown coal; calorific value > 16 500 kJ/kg

**HEU**

highly enriched uranium (> 90 % U-235); predominantly used for military purposes

I

**IAEA**

International Atomic Energy Agency; international center of cooperation in the nuclear field, based in Vienna; *see also: Economic Groups*

**IEA**

International Energy Agency; intergovernmental organisation acting as an energy policy advisor to its member countries, based in Paris

**initial reserves**

cumulative production and remaining reserves

**in-place**

referring to the entire volume in any deposit/reservoir before the commencement of production

**in-situ**

located in the reservoir, but also designation of a response or of a process at the place of origin, also used as a synonym for in-place

**IOC**

International Oil Companies, e.g., Chevron Corp., ExxonMobil Corp., BP plc, Royal Dutch Shell plc, Total, etc.

**IR**

inferred resources of uranium; discovered resources which do not fulfill the criteria for reserves. Corresponds to the earlier definition; EAR I (EAR = estimated additional resources)

**J****J**

Joule; *see also: Measures*

**L****Lignite**

raw coal with an energy content (ash-free) of < 16 500 kJ/kg

**LNG**

liquefied natural gas; natural gas that has been liquefied for transport. 1 t of LNG contains about 1400 Nm<sup>3</sup> natural gas, 1 m<sup>3</sup> of LNG weighs about 0.42 t

**M****methan**

principal component of natural gas (CH<sub>4</sub>)

**mineral oil**

a liquid by-product of the distillation of petroleum to produce gasoline and other petroleum based products from crude oil

**N****natural gas**

it primarily consists of methane, typically with 0-20 % higher hydrocarbons (predominantly ethane). Natural gas can be categorized into two main types on the basis of producing rock characteristics: conventional natural gas and non-conventional natural gas

conventional: is produced by a well drilled into a geologic formation in which the reservoir and fluid characteristics permit the natural gas to readily flow to the wellbore

non-conventional: is produced from gas reservoirs that need to be stimulated before gas can be produced; includes tight gas, shale gas, and coalbed methane (CBM)

**natural uranium [U<sub>nat</sub>]**

uranium with its natural isotopic composition [U-238 (99.2739 %), U-235 (0.7205 %) and U-234 (0.0056 %)]

**NEA**

Nuclear Energy Agency; a specialized agency within the OECD, based in Paris

**NGL**

natural gas liquids; components of natural gas that are liquid at the surface in field facilities or in gas-processing plants. Natural gas liquids can be classified according to their vapor pressures as low (condensate), intermediate (natural gasoline) or high (liquefied petroleum gas).

Natural gas liquids include propane, butane, pentane, hexane and heptane, but not methane and ethane, since these hydrocarbons need refrigeration to be liquefied

## O

<b>OECD</b>	Organisation for Economic Co-operation and Development, based in Paris; <i>see also: Economic Groups</i>
<b>OPEC</b>	Organization of Petroleum Exporting Countries, based in Vienna

## P

<b>Peak Oil</b>	point in time when the maximum rate of global oil production is reached and after which the rate of production enters terminal decline
<b>permeability</b>	measure of the ability of a porous rock to transmit fluids. Unit: Darcy [D]; symbol: k; <i>see also: Measures</i>
<b>porosity</b>	ratio of the pore volume to the total volume of a solid rock in the formation; unit: percent [%]
<b>potential</b>	total potential: cumulative production, reserves and resources remaining potential: reserves and resources
<b>primary energy consumption</b>	amount of energy that has not been subjected to any conversion or transformation process consumed in a specific national economy
<b>primary reserves</b>	sum of cumulative production and remaining reserves

## R

<b>raw gas</b>	volume at natural calorific value and composition as it occurs in the reservoir
<b>recovery factor</b>	percentage of the in-place hydrocarbons discovered that is technically recoverable
<b>reserve growth</b>	(→ <i>field growth</i> )
<b>reserves</b>	the portion of energy resources which is known in detail and can be recovered economically using current technologies. Accordingly, the amount of reserves depends on the current prices as well as on technological progress
<b>resources</b>	the energy resources which are either proved but are at present not economically recoverable, or which are not demonstrated, but can be expected for geological reasons. In the case of oil, natural gas and uranium, only recoverable amounts are considered reserves. For coal this term is used for all in-place resources

## S

<b>SPE</b>	Society of Petroleum Engineers
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**T****tce**ton(s) coal equivalent; *see also: conversion factors***toe**ton(s) oil equivalent; *see also: conversion factors***U****upstream**

refers to the searching for and the recovery and production of crude oil and natural gas. The upstream oil sector is also known as the exploration and production (E&amp;P) sector

**USD**

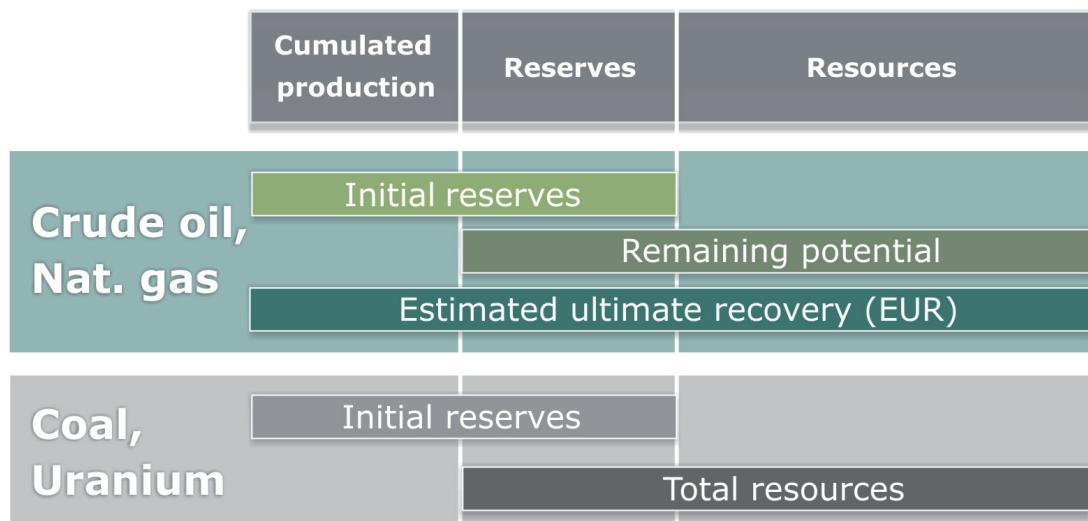
US-Dollar

**USGS**

United States Geological Survey

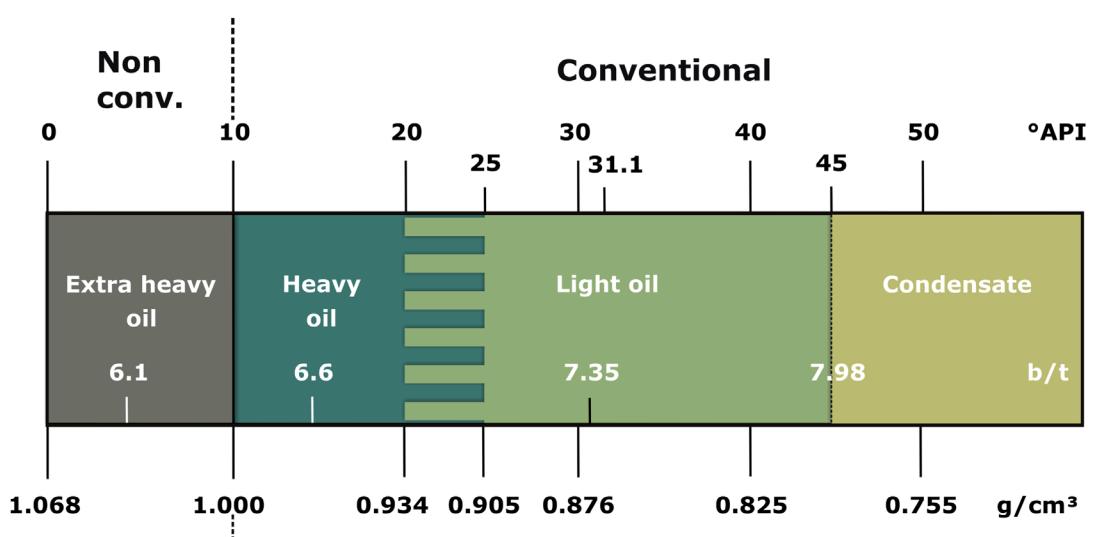
**W****WEC**World Energy Council, based in London,  
organises the World Energy Congress**WPC**World Petroleum Council, based in London,  
organises the World Petroleum Congress

## BGR Definition of Energy Resources



## Classification of Oil According to its Density

Physico-chemical definitions for condensate, light oil, heavy oil, extra heavy oil (bitumen, oil sand)





# Country Groups

## Europe

Albania, Andorra, Austria, Belgium, Bosnia and Herzegovina, Bulgaria, Croatia, Cyprus, Czech Republic, Denmark, Estonia, Faroe Islands, Finland, France, Germany, Gibraltar, Greece, Guernsey, Hungary, Isle of Man, Ireland, Iceland, Italy, Jersey, Kosovo, Latvia, Liechtenstein, Lithuania, Luxembourg, Macedonia (former Yugoslav Republic), Monaco, Montenegro, Netherlands, Norway, Poland, Portugal, Romania, San Marino, Serbia, Slovakia, Slovenia, Spain, Sweden, Switzerland, Turkey, United Kingdom, Vatican City State

## CIS

Armenia, Azerbaijan, Belarus, Georgia, Kazakhstan, Kyrgyzstan, Moldova (Republic), Russian Federation, Tajikistan, Turkmenistan, Ukraine, Uzbekistan

## Africa

Algeria, Angola, Benin, Botswana, Burkina Faso, Burundi, Cameroon, Central African Republic, Chad, Comoros, Congo (Democratic Republic), Congo (Republic), Côte d'Ivoire, Djibouti, Equatorial Guinea, Egypt, Eritrea, Ethiopia, Gabon, Gambia, Ghana, Guinea, Guinea-Bissau, Kap Verde, Kenya, Lesotho, Liberia, Libyan Arab Jamahiriya, Madagascar, Malawi, Mali, Mauritania, Mauritius, Mayotte, Morocco, Mozambique, Namibia, Niger, Nigeria, Rwanda, Sao Tome and Principe, Senegal, Seychelles, Sierra Leone, Somalia, South Africa, Saint Helena, Ascension and Tristan da Cunha, Sudan, Swaziland, Tanzania (United Republic), Togo, Tunisia, Uganda, Western Sahara, Zambia, Zimbabwe

## Middle East

Bahrain, Iraq, Iran (Islamic Republic), Israel, Jordan, Kuwait, Lebanon, Oman, Palestine, Qatar, Saudi Arabia, Syrian (Arab Republic), United Arab Emirates, Yemen

## Austral-Asia

### "Austral"-Part:

Australia, Cook Islands, Fiji, French-Polynesia (Territory), Guam, Kiribati, Marshall Islands, Micronesia (Federated States), Nauru, New Caledonia, New Zealand, Northern Mariana Islands, Norfolk Island, Palau, Pacific Islands (USA), Pitcairn, Ryukyu Islands, Salomon Islands, Samoa, Timor-Leste, Tokelau, Tonga, Tuvalu, Vanuatu, Wallis and Futuna, West-Timor (Indonesia)

### "Asia"-Part:

Afghanistan, Bangladesh, Bhutan, Brunei Darussalam, Cambodia, China, Hong Kong, India, Indonesia, Japan, Korea (Democratic People's Republic), Korea (Republic), Lao (People's Democratic Republic), Malaysia, Maldives, Mongolia, Myanmar, Nepal, Pakistan, Papua New Guinea, Philippines, Singapore, Sri Lanka, Taiwan, Thailand, Viet Nam

## North America

Canada, Greenland, Mexico, United States

## Latin America (Middle- and South America without Mexico)

Anguilla, Antigua and Barbuda, Argentina, Bahamas, Barbados, Belize, Bermudas, Bolivia, Brazil, Cayman Islands, Chile, Colombia, Costa Rica, Cuba, Dominica, Dominican Republic, Ecuador, El Salvador, Falkland Islands (Islas Malvinas), (French) Guiana, Grenada, Guadeloupe, Guatemala, Guyana, Haiti, Honduras, Jamaica, Martinique, Montserrat, Nicaragua, Netherlands Antilles, Panama, Paraguay, Peru, Puerto Rico, Saint Kitts and Nevis, Saint Lucia, Saint Pierre and Miquelon, Saint Vincent and the Grenadines, Suriname, Trinidad and Tobago, Turks and Caicos Islands, Uruguay, Venezuela (Bolivarian Republic), Virgin Islands (Brit.), Virgin Islands (Americ.)

# Economic Groups

## European Union

- EU-15** Austria, Belgium, Denmark, Finland, France, Germany, Greece, Ireland, Italy, Luxembourg, Netherlands, Portugal, Spain, Sweden, United Kingdom
- EU-25** European Union (from 1.5.2004):  
EU-15 plus new Member: Cyprus, Czech Republic, Estonia, Hungary, Latvia, Lithuania, Malta, Poland, Slovakia, Slovenia
- EU-27** European Union (from 1.1.2007):  
EU-25 plus new Member: Bulgaria and Romania

## IAEA (International Atomic Energy Agency; 151 countries)

Afghanistan, Albania, Algeria, Angola, Argentina, Armenia, Australia, Austria, Azerbaijan, Bahrain, Bangladesh, Belarus, Belgium, Belize, Benin, Bolivia, Bosnia and Herzegovina, Botswana, Brazil, Bulgaria, Burkina Faso, Burundi, Cambodia, Cameroon, Canada, Central African Republic, Chad, Chile, China, Colombia, Congo (Democratic Republic), Congo (Republic), Costa Rica, Côte d'Ivoire, Croatia, Cuba, Cyprus, Czech Republic, Denmark, Dominican Republic, Ecuador, Egypt, El Salvador, Eritrea, Estonia, Ethiopia, Finland, France, Gabon, Georgia, Germany, Ghana, Greece, Guatemala, Haiti, Honduras, Hungary, India, Indonesia, Iraq, Iran (Islamic Republic), Ireland, Iceland, Israel, Italy, Jamaica, Japan, Jordan, Kazakhstan, Kenya, Kyrgyzstan, Korea (Republic), Kuwait, Lesotho, Latvia, Lebanon, Liberia, Libyan Arab Jamahiriya, Liechtenstein, Lithuania, Luxembourg, Madagascar, Malawi, Malaysia, Mali, Malta, Marshall Islands, Mauritania, Mauritius, Macedonia (former Yugoslav Republic), Mexico, Moldova (Republic), Monaco, Mongolia, Montenegro, Morocco, Mozambique, Myanmar, Namibia, Nepal, Netherlands, New Zealand, Nicaragua, Niger, Nigeria, Norway, Oman, Pakistan, Palau, Panama, Paraguay, Peru, Philippines, Poland, Portugal, Qatar, Romania, Russian Federation, Saudi Arabia, Senegal, Serbia, Seychelles, Sierra Leone, Singapore, Slovakia, Slovenia, South Africa, Spain, Sri Lanka, Sudan, Sweden, Switzerland, Syrian (Arab Republic), Tajikistan, Tanzania (United Republic), Thailand, Turkey, Tunisia, Uganda, Ukraine, United Arab Emirates, United Kingdom, United States, Uruguay, Uzbekistan, Vatican City State, Venezuela (Bolivarian Republic), Viet Nam, Yemen, Zambia, Zimbabwe

**NAFTA** (North American Free Trade Agreement)

Canada, Mexico, United States

**OECD** (Organisation for Economic Co-operation and Development; 33 countries)

Australia, Austria, Belgium, Canada, Chile, Czech Republic, Denmark, Finland, France, Germany, Greece, Hungary, Ireland, Iceland, Israel, Italy, Japan, Korea (Republic), Luxembourg, Mexico, New Zealand, Netherlands, Norway, Poland, Portugal, Slovakia, Slovenia, Spain, Sweden, Switzerland, Turkey, United Kingdom, United States

**OPEC** (Organization of the Petroleum Exporting Countries; 12 countries)

Algeria, Angola, Ecuador, Iraq, Iran (Islamic Republic), Kuwait, Libyan Arab Jamahiriya, Nigeria, Qatar, Saudi Arabia, United Arab Emirates, Venezuela (Bolivarian Republic)

**OPEC-Gulf** Iraq, Iran (Islamic Republic), Kuwait, Qatar, Saudi Arabia, United Arab Emirates

**OPEC-12** OPEC-Member with Status end-2009

## Natural Gas Markets

### European Gas Market

Algeria, Egypt, Europe, Libyan Arab Jamahiriya, Morocco, other European countries of the CIS, Russian Federation (West of the Yennisey river), Tunisia, Western Sahara

### Asian Gas Market

Austral Asia, Russian Federation (East of the Yennisey river)

### Transition Zone European/Asian Market

Middle East, central Asian countries of the CIS (Kazakhstan, Uzbekistan, Turkmenistan, Tajikistan, Kyrgyzstan)

### North American Market

North America

### Latin American Market

Argentina, Bolivia, Brazil, Chile, Paraguay, Peru, Uruguay



# Measures

<b>b, bbl</b>	barrel	1 bbl = 158.984 liter
<b>cf</b>	cubic feet	1 cf = 0.02832 m <sup>3</sup>
<b>J</b>	Joule	1 J = 0.2388 cal = 1 Ws (Wattsecond)
<b>kJ</b>	Kilojoule	1 kJ = 10 <sup>3</sup> J
<b>MJ</b>	Megajoule	1 MJ = 10 <sup>6</sup> J
<b>GJ</b>	Gigajoule	1 GJ = 10 <sup>9</sup> J = 278 kWh = 0.0341 t tce
<b>TJ</b>	Terajoule	1 TJ = 10 <sup>12</sup> J = 278 x 10 <sup>3</sup> kWh = 34.1 t tce
<b>PJ</b>	Petajoule	1 PJ = 10 <sup>15</sup> J = 278 x 10 <sup>6</sup> kWh = 34.1 x 10 <sup>3</sup> t tce
<b>EJ</b>	Exajoule	1 EJ = 10 <sup>18</sup> J = 278 x 10 <sup>9</sup> kWh = 34.1 x 10 <sup>6</sup> t tce
<b>cm, m<sup>3</sup></b>	cubic meter	
<b>Nm<sup>3</sup></b>	standard cubic meter	amount of Gas in 1 m <sup>3</sup> bei 0°C and 1013 mbar [also m <sup>3</sup> (Vn)]
<b>mcm</b>	million cubic meter	1 mcm = 10 <sup>6</sup> m <sup>3</sup>
<b>bcm</b>	billion cubic meter	1 bcm = 10 <sup>9</sup> m <sup>3</sup>
<b>tcm</b>	trillion cubic meter	1 tcm = 10 <sup>12</sup> m <sup>3</sup>
<b>lb</b>	pound	1 lb = 453.59237 g
<b>t</b>	ton	1 t = 10 <sup>3</sup> kg
<b>t/a</b>	metric ton(s) per year	
<b>toe</b>	ton(s) oil equivalent	
<b>kt</b>	Kiloton	1 kt = 10 <sup>3</sup> t
<b>Mt</b>	Megaton	1 Mt = 10 <sup>6</sup> t
<b>Gt</b>	Gigaton	1 Gt = 10 <sup>9</sup> t
<b>Tt</b>	Teraton	1 Tt = 10 <sup>12</sup> t

# Conversion Factors

<b>1 t crude oil</b>	1 toe = 7.35 bbl = 1.428 t tce = 1101 m <sup>3</sup> natural gas = 41.8 x 10 <sup>9</sup> J
<b>1 t LNG</b>	1380 m <sup>3</sup> natural gas = 1.06 toe = 1.52 t tce = 44.4 x 10 <sup>9</sup> J
<b>1000 Nm<sup>3</sup> nat. gas</b>	35 315 cf = 0.9082 toe = 1.297 t tce = 0.735 t LNG = 38 x 10 <sup>9</sup> J
<b>1 t tce</b>	0.70 toe = 770.7 m <sup>3</sup> natural gas = 29.3 x 10 <sup>9</sup> J
<b>1 EJ (10<sup>18</sup> J)</b>	34.1 Mtce = 23.9 Mtoe = 26.3 G. m <sup>3</sup> natural gas = 278 Mrd. TWh
<b>1 t uranium (nat.)</b>	14 000 to 23 000 t tce; different values depending on the utilization factor
<b>1 kg uranium (nat.)</b>	2.6 lb U <sub>3</sub> O <sub>8</sub>



Federal Institute for Geosciences and Natural Resources (BGR)  
German Mineral Resources Agency (DERA)  
Stilleweg 2  
30655 Hannover, Germany

Contact Office German Mineral Resources Agency:

Phone: +49 (0) 511 643 3200  
Fax: +49 (0) 511 643 53 3200  
E-Mail: energierohstoffe@bgr.de  
Web: <http://www.bgr.bund.de>

