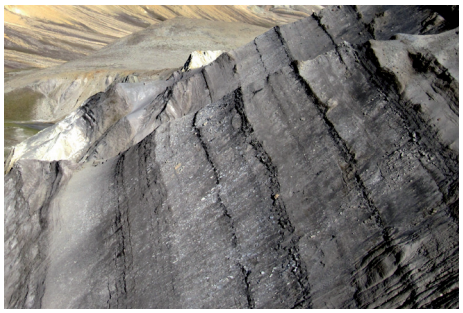
Deutsche Rohstoffagentur

Bundesanstalt für Geowissenschaften und Rohstoffe

DERA Rohstoffinformationen



Annual Report

Reserves, Resources and Availability of Energy Resources 2011

8

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Hannover, February 2012

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FOREWORD

Germany has taken a turnaround on energy policy: distancing itself from fossil fuels and nuclear power, and embracing renewable energy sources. The associated transformation of our energy supply structure requires enormous investment and a huge increase in energy efficiency. The lion's share of primary energy in Germany is currently covered by fossil fuels. And despite all of its planned efforts, Germany will probably still be reliant on an energy mix including these non-renewable energy sources for decades to come. Moreover, and particularly in the context of other countries which have not yet undergone this change of strategy, it will be necessary to evaluate the availability of traditional fuels and make this objective information available.

Notwithstanding the move away from fossil fuels which has now been adopted, exploration will continue to search for new reserves, and technical advances will endeavour to make these new reserves economically producible. A current example is the exploitation of shale gas. Following the developments in the USA, shale gas is now a game changer set to revolutionise the supply situation on the global gas markets. This study analyses this development, and despite the many uncertainties which still exist, reviews the global reserves of non-conventional natural gas and non-conventional crude oil.

This study by the German Mineral Resources Agency (DERA) analyses, evaluates and assesses the regional setting of the reserves, resources, production and consumption of crude oil, natural gas, coal, uranium and thorium around the world at the end of 2010. The study is produced annually to provide information on the natural resource sector to the German Ministry for Economics and Technology (BMWi) and the German business community. The database used incorporates the continuous assessment of information in trade journals, scientific publications, reports from industrial and technical associations, political sources, internet sources, and the results of our own surveys. Unless explicitly explained otherwise, all of the data used in this study is derived from the energy resources database of the Federal Institute for Geosciences and Natural Resources (BGR).

ANNUAL REVIEW 2010

In the face of continuing economic growth worldwide, and in the light of the strong increase in demand in Asia in particular, as well as a consequence of the rise in commodity prices, 2010 has been another year of busy exploration activity for energy resources. These endeavours, and their reflection in the accessible data, have not only led to a growth in the resources and reserves figures, in most cases they have also forced a revision in the resource figures for non-conventional natural gas in particular – in which the enormous, but technically and economically non-producible in-place volumes, have now been adjusted to reflect the BGR definition (see glossary). The apparent reduction in potential by applying plausible recovery factors has therefore gone hand-in-hand with an improvement in accuracy. Also in this context, the continuing technological advancements during the reporting period have further blurred the distinction between conventional and non-conventional deposits.

Important developments affecting specific energy resources:

- The global rise in energy demand in 2010 had an impact on the use of **nuclear fuels**. Stocks, production, demand and prices all grew year-on-year. This was largely attributable to the major demand for energy from China in particular (uranium consumption 2009: 2,875 t; 2010: 4,402 t) as well as the construction of new nuclear power plants around the world (2010: 62 under construction) for instance in China and the Russian Federation. The global mining production of uranium rose again in 2010 by 6 %. The largest contribution here was again made by Kazakhstan: with a growth in production of 27 % compared to 2009, Kazakhstan now accounts for around 33 % of global production. Global resources have also grown by 798 kt U compared to the previous year – this is largely attributable to re-evaluation work.
- Compared to the previous year which was affected by the consequences of the global economic crisis, there was a rise in the demand for coal in almost all regions around the world in 2010. There was a simultaneous rise in global **coal** production of around 5 % to 7,342 Mt in 2010, of which 6,341 Mt was hard coal. Whilst the global consumption of lignite stagnated over the same period, the consumption of hard coal rose by 405 Mt (plus 7 %). As in previous years, the main growth in coal production was largely achieved in the Austral-Asia region with 4,448 Mt hard coal (plus 7 %), with an almost matching rise in hard coal consumption in the same area (4,495 Mt, plus 8 %). Significant growth in consumption in 2010 was also reported from North America and Europe. Despite the rise in coal prices, the global trade in hard coal rose in 2010 by an impressive 14 % year-on-year, breaking the 1 billion t barrier for the first time (1,066 Mt). The significant rise in the trade in hard coal around the world was largely driven by the strong increase in imports, particularly by Asian countries such as China, India, Japan, South Korea and Taiwan. These countries dominated the global hard coal import markets in 2010 with a share of 61 %.
- In 2009, **natural gas** production declined in response to the drop in demand. Things turned around in 2010 with a growth of almost 200 billion m^3, to the highest level ever seen of 3.2 trillion m^3. This extraordinary growth was primarily attributable to the upswing in economic activity, as well as to an increase in demand in non-OECD countries, and weather-related factors such as the unusually cold winter in Europe. The rise in natural gas production over the year was completely compensated for by additions to reserves, of which around two thirds were accounted for by the USA, Iran, China, India and Saudi Arabia. The considerable economic and weather-related rise in demand in Europe in 2010 led to higher spot market prices, although they still lay considerably below the prices for pipeline gas pegged to the oil price. A consequence of this was an increase in the imports of LNG into Europe at the expense of

pipeline-transported exports to Europe. The United States in particular managed to boost its production of non-conventional natural gas again in 2010. DERA has now begun to estimate the potential of shale gas in Germany to determine which contribution German shale gas deposits could make to safeguarding supplies in the country.

- After the decline in global **crude oil** production during the financial and economic crisis in 2008/2009, production and the consumption of oil rose considerably again in 2010, although both still lie slightly below 4 billion t/a. Although the demand declined slightly in some industrial countries (USA minus 1 %, Canada minus 5 %, Mexico minus 3 %) or only rose moderately, such as in Germany (plus 1.5 %), there was a considerable rise in consumption in emerging economies such as China and India. Strong growth in consumption was also reported from the Russian Federation and Brazil. One of the main factors behind this asymmetry in demand is the implementation of measures aimed at boosting efficiency in OECD countries. The Macondo disaster in the Gulf of Mexico in 2010 led to the suspension of some ultra-deep water exploration activities and a rise in oil prices. One of the consequences was the implementation of more stringent regulations and safety standards. In the face of the uncertainties concerning its national energy supplies, the United States decided to import more oil from Canada's oil sands and to use the natural gas liquids (NGL) extracted as a by-product of the production of domestic shale gas. The unrests in North Africa and the Middle East also led to changes in the market. Even though consumers were not aware of any shortages in supply, these events again raised awareness of the dependence on fossil fuels and the countries in which they are produced.

CONTENT

1 ENERGY RESOURCES REVIEW

1.1 Energy Resources in the Global Energy Supply Context

The population of the world is growing rapidly. The planet already has seven billion inhabitants, and according to the UNO, this will grow to eight billion by 2025. Living standards are also improving for a growing number of people. The continuous rise in global energy consumption is therefore not very surprising against this background. The hunger for energy grows almost completely independently of wars and crises, and was predominantly satisfied again in 2010 by non-renewable fuels. This development can only be marginally interrupted even by the only recently shrugged off financial and economic crisis (Fig. 1). It is important though to distinguish today between OECD countries in which economic growth has been largely decoupled from energy consumption, and non-OECD countries, which are characterised by a fast rise in energy consumption. But at the bottom-line, there is a foreseeable growth in the demand for energy whose consequences on transport flows, markets and prices will have a global impact from which hardly any country is immune.

At the start of the new millennium, the rise in energy consumption was primarily attributable to the rapid growth of the emerging economies of China and India. Although the use of nuclear power remained almost stagnant during this period, there was a further rise in the significance of oil, coal and gas as energy sources. Despite all of the criticism, coal was the fuel which accounted for the greatest share of this growth. And even though energy production from coal had remained stagnant up to around 2000, it grew faster than ever between 2000 and 2010 (Fig. 1).

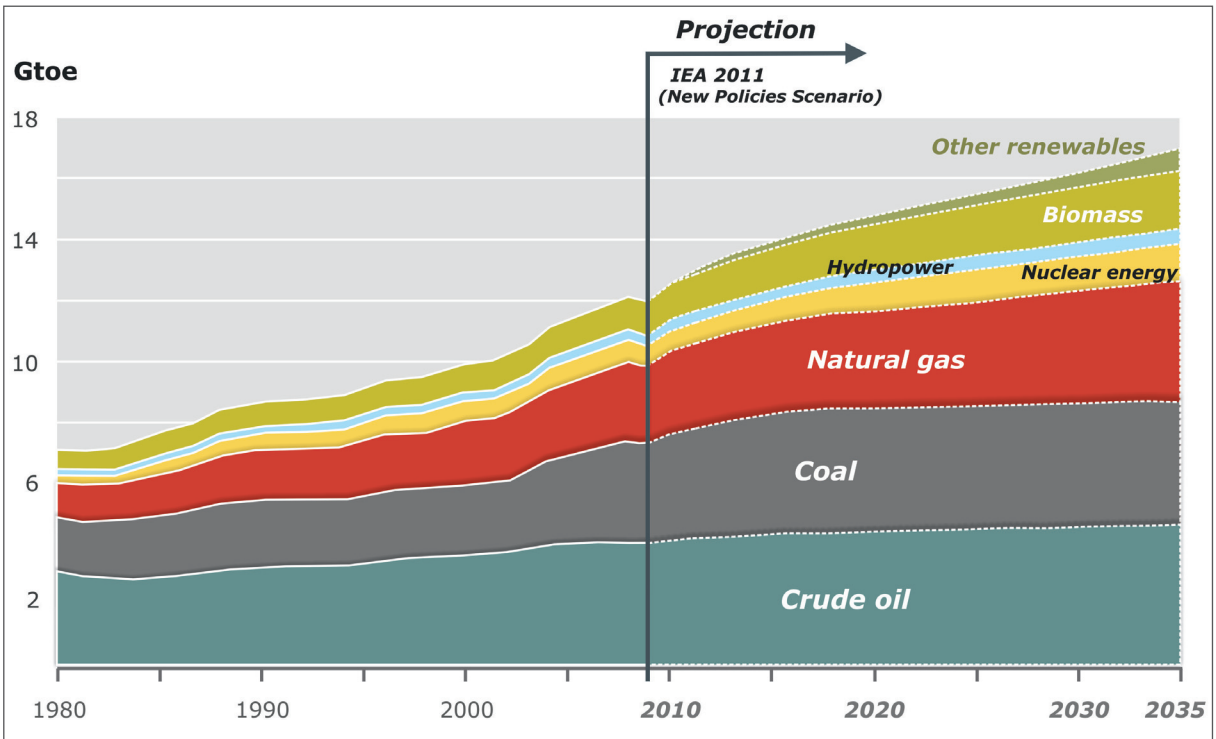

Fig. 1: *Development of global primary energy consumption versus fuels, and a possible future development scenario ("Scenario based on the new energy policy conditions" - New Policies Scenario, IEA 2011a).*

No precise forecasts are possible of how global primary energy consumption (PEC) will develop in future, or the proportion of each energy carrier. However, dramatic changes in the short term are almost ruled out because it takes time to implement energy policy measures. Even such a dramatic event such as the reactor disaster in Fukushima in Japan at the beginning of the year only led to a change in energy policy in some countries – including Germany – but it do not result in any global paradigm switch in the short term. Nuclear fuel will therefore continue to play an important part in the energy mix. The further expansion of coal consumption is a contentious issue. A plateau for coal consumption will only come about after around 2018, if as assumed in the IEA "New Policies Scenario" (NPS) (IEA 2011a), the policy promises announced by governments are actually implemented, and the exogenic assumptions on growth rates, prices and technological developments actually come about (IEA 2011b). Even today, oil has either no substitute or can only be partially substituted by other fuels in many sectors and applications, and its consumption will therefore continue to grow.

According to IEA (2011a), this is primarily attributable to the rise in the number of private cars in China and India. It is questionable though whether these volumes of oil can actually be produced in 2035. A larger share in global energy consumption is predicted for natural gas – a prognosis which appears realistic given the new non-conventional gas potential (e.g. shale gas).

Notwithstanding the many uncertainties and unforeseeable events, one can assume that the non-renewable fuels will dominate energy supplies in the coming 25 years. According to the IEA New Policies Scenario they will still account for 75 % of the energy mix in 2035 and therefore remain just as important then as they are today. Fuel prices reflect the development in the consumption of natural resources for energy production in the last 10 years although there are differences in individual dynamics. Whereas nominal fuel prices fluctuated without any significant upward or downward trend in the 1990s (Fig. 2), the price of oil and gas began to rise significantly from the start of the new millennium. The same applies to coal from 2003 and to a lesser degree to natural uranium from 2004. These price rises only came to an end in the middle of 2008 during the global economic crisis. Despite the strong slump in prices starting in September 2008, this was the year with the highest annual average price for oil. After falling for only a few months, the oil price bottomed out in December 2008 and has never been lower since. With respect to daily spot prices, they plummeted to around one quarter of the maximum spot price in July 2008. Oil prices have grown continually since January 2009, and remained within a relatively tight corridor in 2010, before climbing again in the fourth quarter. In total, the nominal annual average in 2010 was much higher than the previous year, and therefore reflects the general upswing in the global economy. Prices for coal overall tracked the development in oil prices, but uranium prices largely remained constant. The annual average price for natural gas in 2010 was below the 2009 average. This is attributable to the fact that gas prices were still very high at the beginning of 2009. The price dropped until the middle of 2009 before recovering again. It has continued to rise ever since – but without reaching the level seen at the beginning of 2009. It is debatable whether this reflects the six month delay in its pegging to the oil price, or may also be due to the increase in global gas supplies.

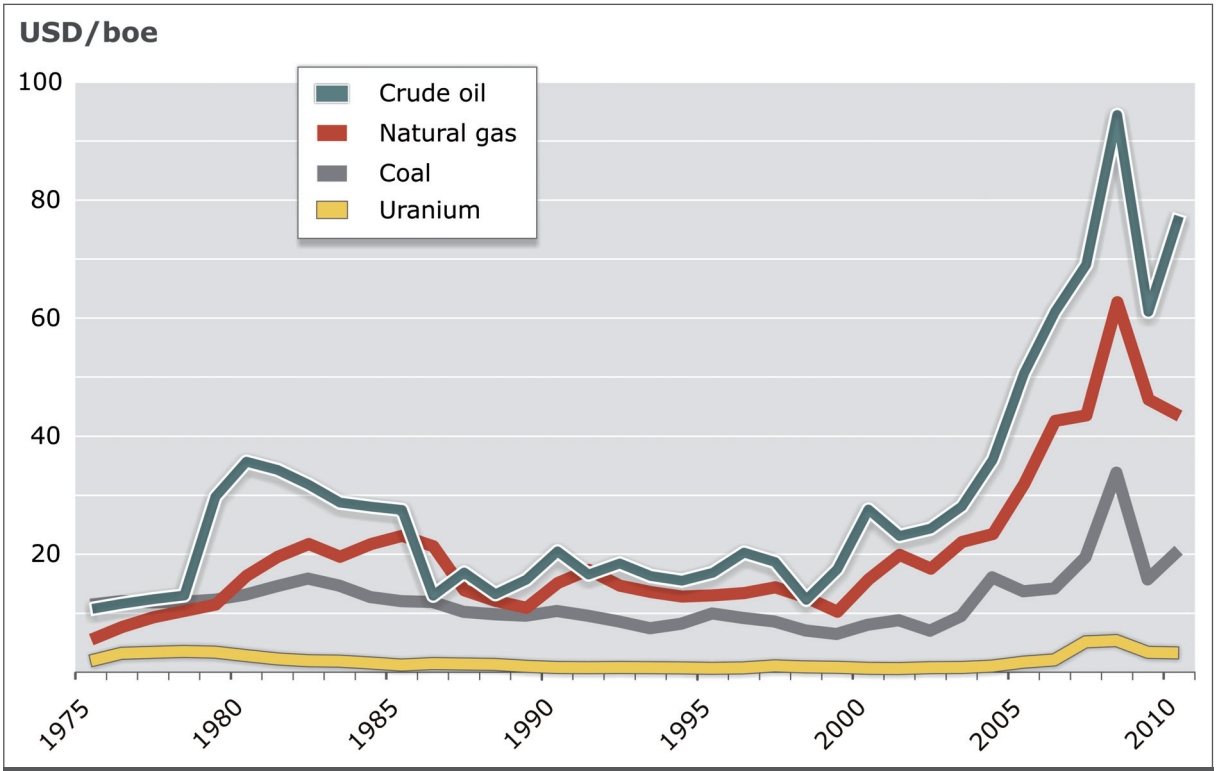

Fig. 2: Historic development in the nominal prices in Europe for non-renewable fuels reported as annual averages from 1975 to 2010 (after BP 2011, ESA 2011, OPEC 2011, VDKI 2011 b).

1.2 Energy resources for Germany

As an industrial country, Germany is dependent on secure supplies of inexpensive energy. Primary energy consumption (PEC) has declined by around 2.5 % overall in the last 10 years. In detail, the use of nuclear fuels has dropped by over 17 %, coal by 16 %, petroleum by more than 14 %, and lignite by almost 2 % (Fig. 3). The only non-renewable fuel with a rise in consumption over this period was natural gas which climbed 3 %.

Germany is largely dependent on imports of energy resources. Domestic production only accounts for 2 % of the oil consumption and around 13 % of gas consumption (Fig. 3). Although tight gas has been produced domestically for many years, exploration activities for other non-conventional gas deposits, such as shale gas and coal bed methane, only began in 2008. If these efforts bear fruit in the production of significant quantities of natural gas, this may either compensate for the declining production of the conventional gas fields, or may even reduce the amount of natural gas imported into Germany in future. The dependence on imports of hard coal in particular will rise because of the planned termination of subsidies for domestic hard coal production in 2018. However, lignite is the only fuel in Germany which boasts large exploitable domestic reserves. Germany can satisfy all of its demands for lignite from domestic production. All of the natural uranium required for the production of nuclear fuel has to be imported. However, all of the fuel rods are produced in Germany from this imported material. In line with international convention nuclear energy is classified as a domestic energy source because the nuclear power plants can be supplied entirely with stocks from Germany for a long period of time.

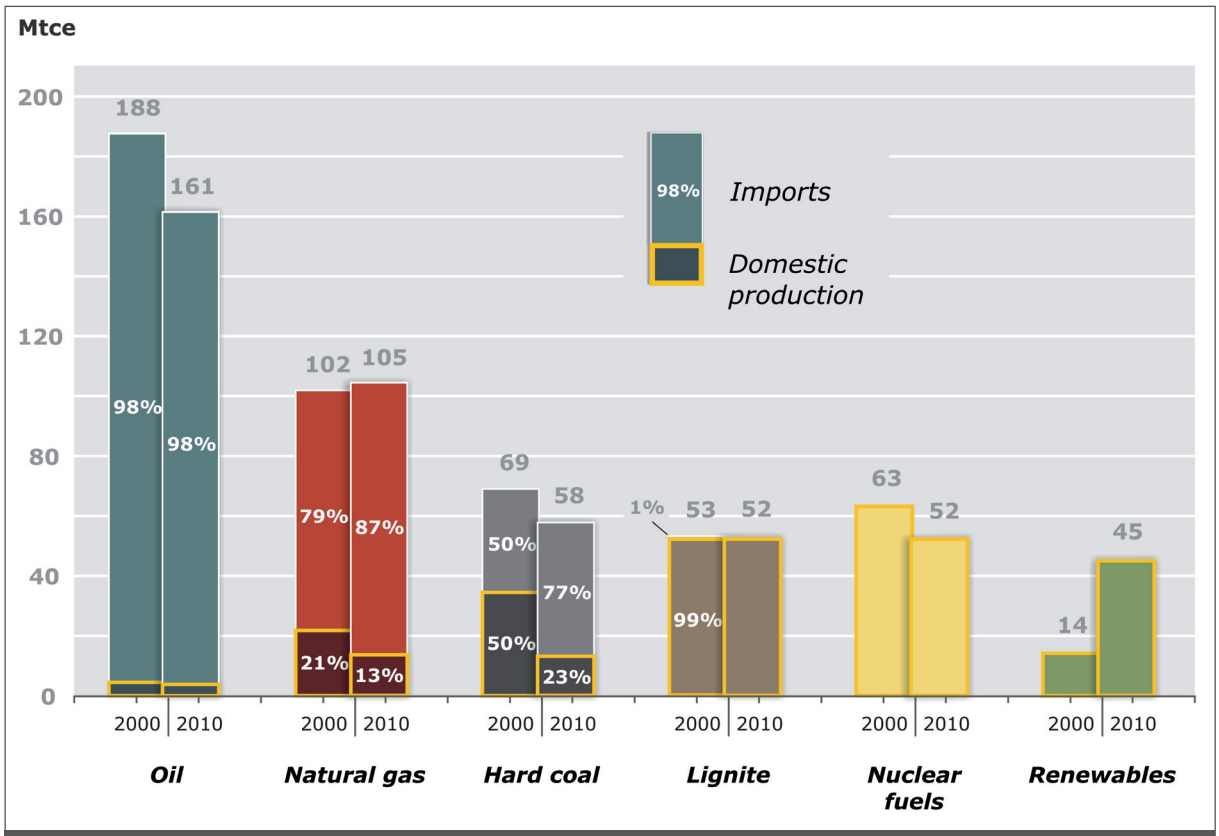

Fig. 3: Comparison of the use of primary energy sources, and the relationship between domestic supply and imported commodities for Germany from 2000 to 2010 (after AGEB 2011, LBEG 2011).

1.3 Global reserves situation

Various approaches can be taken to describe the global energy resource potential. This study provides an overall description, which also includes the potential that can only be estimated at a global scale and with significant uncertainties (Tab. 1), as well as more specific details in Tables 6 to 36 in the Appendix.

Because of the lack of adequate information in some cases, and distributions which cannot be broken down into amounts attributable to individual countries, the potential of thorium, aquifer gas and natural gas from gas hydrates, and oil from oil shales, are only reported in the form of global figures. On the other hand, the resources and reserves of shale gas and coal bed methane are dealt with individually for the first time (Tab. 14 and 15). Because of this new presentation of the data, the potentials here are now lower than in the previous study. Tight gas (natural gas from low permeable rocks) are a special case because although it is defined as non-conventional gas, it is nowadays commonly reported alongside conventional natural gas, and is therefore also reported in this manner in this study. If the reserves (39,375 EJ) and resources (590,003 EJ) of all fossil fuels are added up, the global amount of energy available for future use is around 630,000 EJ.

By far the largest proportion of non-renewable energy commodities are currently defined as resources. Their energy content was around 590,003 EJ at the end of 2010, and thus slightly down year-on-year. These resources are dominated by coal (hard coal and lignite) with a proportion of almost 81 % (Fig. 4) followed well behind in second place by natural gas with 15 %. The other fuels, including crude oil (almost 3 %) play a very subordinate role. The relative proportions have only changed marginally over the year, and primarily by the decrease in non-conventional natural gas (BGR 2009, 2010).

Tab. 1: *Reserves and resources of non-renewable fuels*

Fuel	Units	Reserves	EJ	Resources	EJ
		(cf. left column)		*(cf. left column)*	
Crude Oil	Gt	169	7.056	143	5.975
Natural Gas	Tcm	189	7.173	312	11.858
Conventional Hydocarbons	Gtoe	340	14.229	426	17.832
Oil Sand	Gt	27	1.124	94	3.945
Extra Heavy Oil	Gt	21	886	61	2.541
Oil Shale	Gt	–	–	112	4.664
Non-Conventional Oil	Gtoe	48	2.011	267	11.150
Shale Gas	Tcm	1,7 [5)]	65 [5)]	173	6.570
Tight Gas	Tcm	1,6	62	46	1.733
Aquifer Gas	Tcm	–	–	800	30.400
Gas Hydrates	Tcm	–	–	1.000	38.000
Non-Conventional Gas	Tcm	3,3	127	2.018	76.703
Non-Conventional Hydrocarbons	Gtoe	51	2.138	2.100	87.852
Hydrocarbons Total	Gtoe	391	16.367	2.526	105.685
Hard Coal	Gtoe	615	18.031	14.561	426.758
Lignite	Gtoe	109	3.185	1.684	49.367
Coal Total	Gtoe	724	21.216	16.246	476.125
Fossil Fuels Total			37.583		581.810
Uranium [1)]	Mt	2,8 [2)]	1.377 [2)]	11 [3)]	5.685 [3)]
Thorium [4)]	Mt	0,83	415	5,0	2.508
Nuclear Fuels Total			1.792		8.193
Non-Renewable Fuels Total			39.375		590.003

– no production or reserves

[1)] 1 t U = 14,000 – 23,000 t tce, lower value used, or 1 t U = 0.5 x 1015 J
[2)] RAR exploitable up to 80 USD/kg U
[3)] Total from RAR exploitable from 80–260 USD/kg U, and IR and undiscovered < 260 USD/kg U
[4)] t Th assumed to have same tce value as 1 t U
[5)] only USA (data per 01/2010)

The energy content of the reserves corresponded to 39,375 EJ in 2010. Coal is the dominant fuel in terms of exploitable energy content, accounting for 54 % of the reserves. Crude oil (conventional and non-conventional) accounts for 23 % of the total reserves, natural gas 18.5 % and nuclear fuel 4.6 %. There are therefore hardly any changes in this context in terms of absolute proportions or relative proportions compared to the previous year. The energy resources produced during this period were compensated for by the reclassification of resources into reserves.

Non-renewable energy resources with an energy content of around 479 EJ were produced in 2010. This corresponds to an increase in production of around 3.7 % year-on-year. The relative changes are again only marginal.

If one compares global annual production of all of the fuels in 2010, with the figures for reserves and resources, this reveals a relationship of around 1 : 82 : 1,232 (Fig. 4). This means that from a geological point of view, the global reserves and resources of energy commodities can in principle

cover the growing demand for energy in future. It is questionable though whether all of the energy resources individually can always be supplied in adequate quantities to satisfy the demand. This question is particularly urgent given the relatively low resources of crude oil. Moreover, the deposits of fossil and nuclear fuel are not uniformly distributed around the world: regions and countries with significant deposits or high energy resource production rates are not automatically identical with the regions and countries characterised by high energy consumption. More energy resources are consumed than produced for instance in Europe, Austral-Asia and North America (regions defined in the Appendix) (Fig. 5). On the other hand, the production of energy resources considerably exceeds domestic consumption in Africa, the CIS and the Middle East. No basic change in this constellation is expected in the short and medium term. Particularly revealing is Europe's and the EU's high level of dependence on imports of energy resources, whereas North America has a more favourable ratio – also due to the large oil sand and non-conventional gas potential. Tables 2 to 5 in the Appendix provide detailed information on the distribution of resources, reserves, production and consumption in each region. A world-wide comparison of the remaining amounts of fuel (reserves and resources) and the already consumed fuels, reveals that there is still considerable to enormous potential in all regions (Fig. 6). Whilst the potential in the Austral-Asia, CIS and North American regions appears to be barely touched, even in Europe, only a small amount appears to have been exploited. This wealth of energy resources is primarily attributable to the large deposits of coal found on all continents, and not to conventional oil and gas which are concentrated in specific regions. Interestingly, this reveals that although the Middle East is a very important region for oil and gas, it actually has relatively low overall potential.

According to the geological information currently available, there are huge volumes of fossil fuels available overall. Whether and when they can be utilised depends on various factors, including the technological-economic exploitability, demand-oriented availability, environmental compatibility, and public acceptance. Answers to these complex questions are not part of the brief of this study.

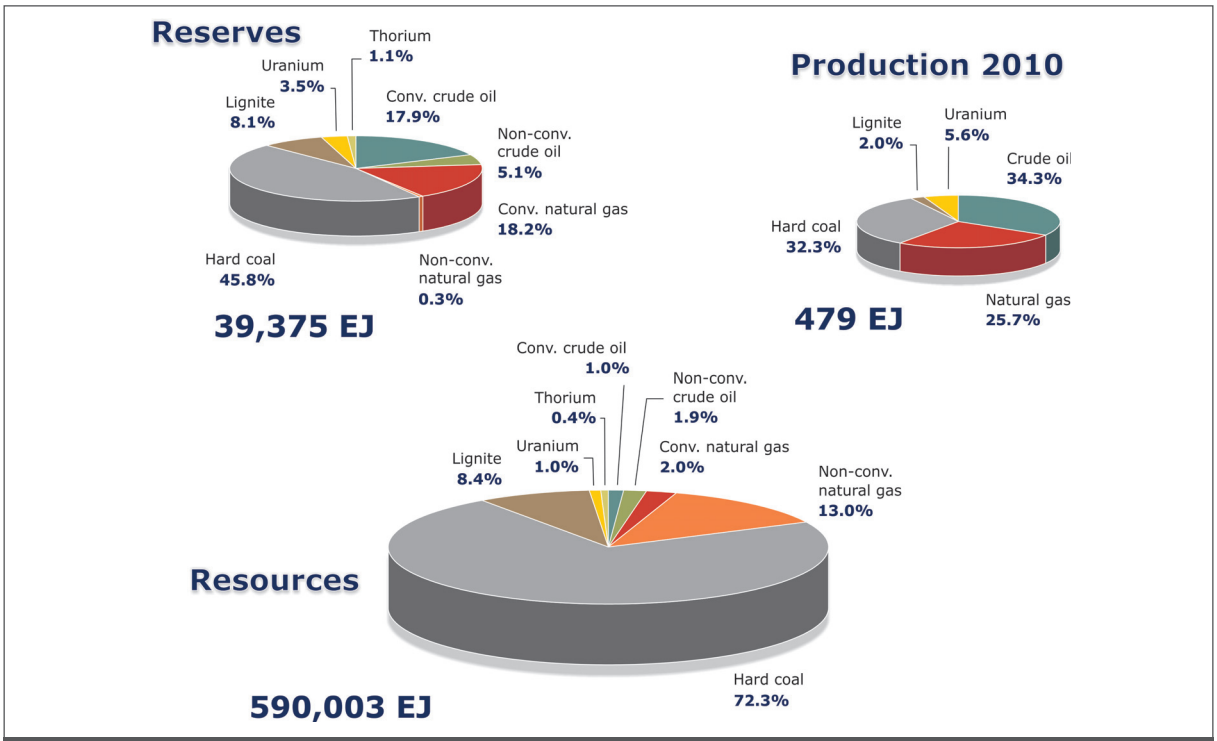

Fig. 4: Proportions of non-renewable fuels in production, reserves and resources world-wide at the end of 2010.

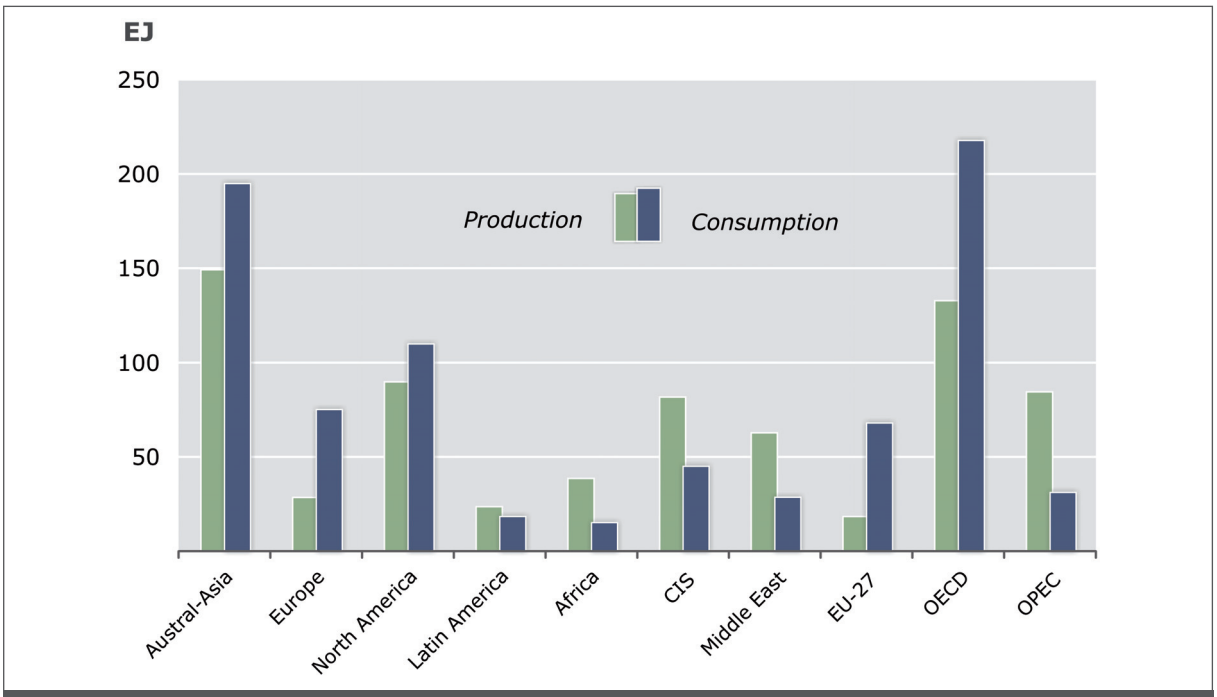

Fig. 5: Comparison of the production and consumption of energy resources (EJ) according to regions and groups of countries.

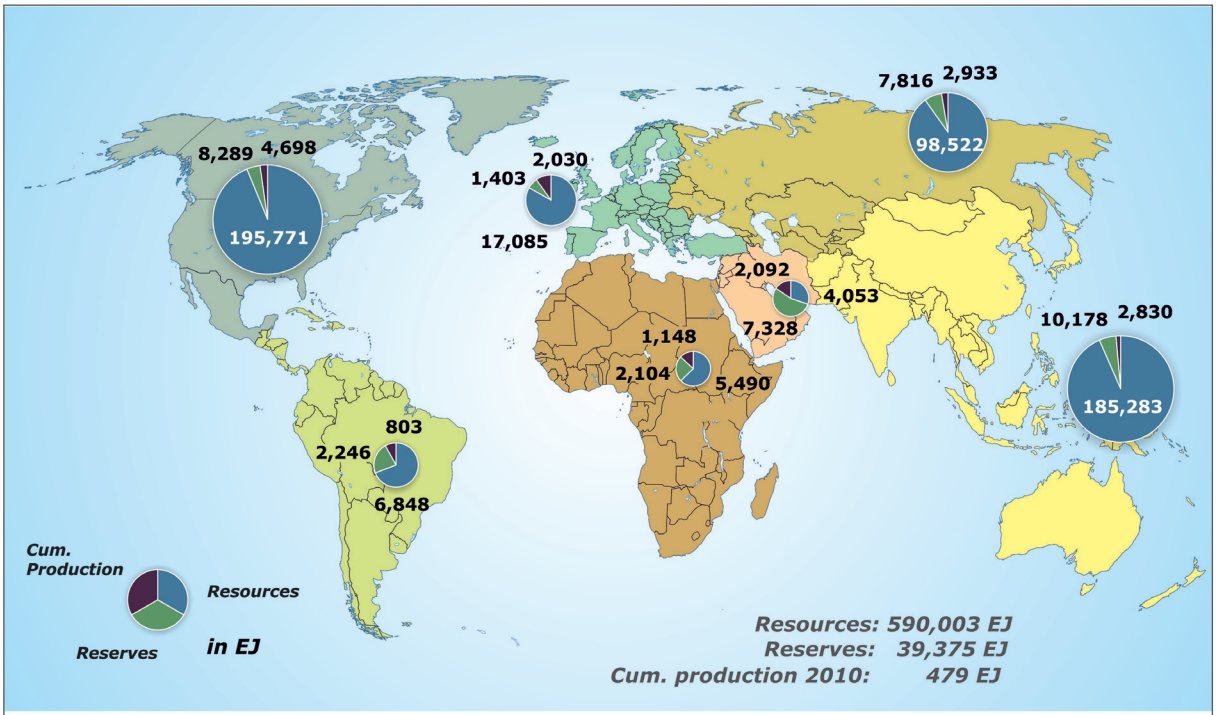

Fig. 6: Total potential of energy resources 2010: regional distribution (excluding the coal resources in the Antarctic as well as resources of aquifer gas, natural gas from gas hydrate, and thorium because they cannot be broken down into specific regions), (cumulative production of coal since 1950).

2 ENERGY RESOURCES LOOKED AT INDIVIDUALLY

2.1 CRUDE OIL

With a share of around 34 % of primary energy consumption (excluding biomass) world-wide, oil continues to be the most important fuel, and will probably remain so in the foreseeable future.

The public awareness of the risks of exploring for hydrocarbons, particularly at great water depths, rose dramatically after the explosion and sinking of the Deepwater Horizon drilling rig above BP's Macondo field in the Gulf of Mexico on 20 April 2010, and the subsequent uncontrolled outflow of oil and gas (until 15 July). The response of the US authorities to the accident was to tighten regulations and stipulate much stricter safety standards for offshore oil and gas drilling activities (Boemre 2011). These measures are now coming into effect one and a half years after the accident, so that BP and other companies can continue to explore for oil and gas in the Gulf of Mexico.

The upswing in the global economy was paralleled by a rise in the demand for oil compared to the previous years. Oil production increased considerably (3,937 Mt, plus 3.3 %) although the consumption of petroleum products only rose moderately (3,937 Mt, plus 1.4 %). This means that oil production in 2010 exceeded the previous record level of 3,894 Mt in 2008 by more than 40 Mt. The Russian Federation with oil production exceeding 505 Mt (a rise of 4.3 %) continued to be the largest oil producer in the world ahead of Saudi Arabia and the United States. To highlight their overall potential better, the study presents the reserves and resources of conventional and non-conventional oil (oil sand and extra heavy oil) together for the first time (Tab. 6). In the associated figures, this appears to show an apparent rise in the values for reserves and resources. This is why the values for the two different types are also shown individually to enable a comparison with the previous year's figures. Because the data available for oil shales and shale oil is still rather inadequate, these will continue to be considered separately, and are presented in terms of their global potential for the time being.

The remaining potential for oil (reserves and resources) in total was around 515 billion tonnes at the end of 2010. Because this now also includes the non-conventional oil in oil sands and extra heavy oils (totalling 312 billion t), the figure reported now is much higher than the previous year which only included the data on conventional potential. Around 70 % of the remaining oil potential is located in OPEC and OECD countries, Africa, Austral-Asia and Europe have the lowest proportions.

Figure 7 shows the regional distribution of the overall potential of 678 billion t (resources, reserves and cumulative production) in 2010. After merging the conventional and non-conventional resources, the total resources figure for oil (excluding oil shale) is 298 billion t, of which over 70 % are accounted for by North America and OPEC. Because oil sands and extra heavy oils are now also incorporated in this figure, Canada and Venezuela now top the resource ranking, ahead of the Russian Federation and the United States (Tab. 7). China has now also risen to number five in the ranking because it is assumed to have resources of over 100 Mt extra heavy oil. Oil reserves have also grown considerably by incorporating the non-conventional potential, and are now at a level of 217 billion t. This already includes the growth in conventional reserves of around 7 billion t attributable to new discoveries and new evaluations. Oil sand reserves are only assigned to Canada, whilst extra heavy oil reserves are only assigned to Venezuela and the United States because these are the only countries which are currently exploiting these energy carriers. Around 70 % of the reserves are located in OPEC countries, with almost 53 % alone in the Middle East and North Africa (MENA). The ranking list of the countries with the largest reserves is headed by Saudi Arabia, but now followed by Venezuela and Canada because of their extra heavy oil and oil sand deposits respectively (Tab. 8). These figures highlight the importance of

OPEC for the continuing supply of oil, particularly the regions accounted for by the OPEC Gulf states and MENA. The upgrading of Canada means that an OECD member country is now ranked in the top ten reserves locations. More than 80 % of global oil reserves are owned by state-controlled companies.

Since the beginning of industrial oil production, almost 163 billion t oil have been produced world-wide, accounting for around 43 % of the original oil reserves (cumulative production and reserves) of around 380 billion t. The most important producing regions continue to be the Middle East, CIS and North America.

The consumption of petroleum products rose by more than 56 Mt in 2010 compared to 2009, to a level of 3,940 Mt (plus 1.4 %). On a regional basis, the highest rises in consumption were reported in the CIS, the Middle East and Austral-Asia, whereas consumption continued to decline in Europe and North America (OECD minus almost 2 %). Over half (54 %) of the oil produced in 2010 was exported and transported by tanker or pipeline. Around 2,100 Mt crude oil was traded world-wide (exports: 2,081 Mt crude oil (plus 35 Mt, plus 1.7 %) and imports: 2,151 Mt crude oil) around 70 Mt less than the previous year (minus 3.1 %) – primarily because of the reduction in imports in Africa and the Middle East. As in previous years, the amount of crude oil imported by Germany dropped again and declined by 4.8 Mt in 2010 to 93.3 Mt (minus 4.6 %).

Germany's main oil suppliers continue to be the Russian Federation, the United Kingdom and Norway. Only a few German companies produce oil overseas, including Bayerngas Norge AS, E.ON Ruhrgas AG, RWE Dea AG, VNG-Verbundnetz Gas AG and Wintershall AG.

The annual average price of Brent oil in 2010 rose by almost 29 % from 61.7 USD/b (2009) to 79.5 USD/b. From its lowest point in January/February of the reporting year, the oil price recovered relentlessly from slightly below 70 USD/b to almost 95 USD/b at the end of the year, and since then (2011) has mainly

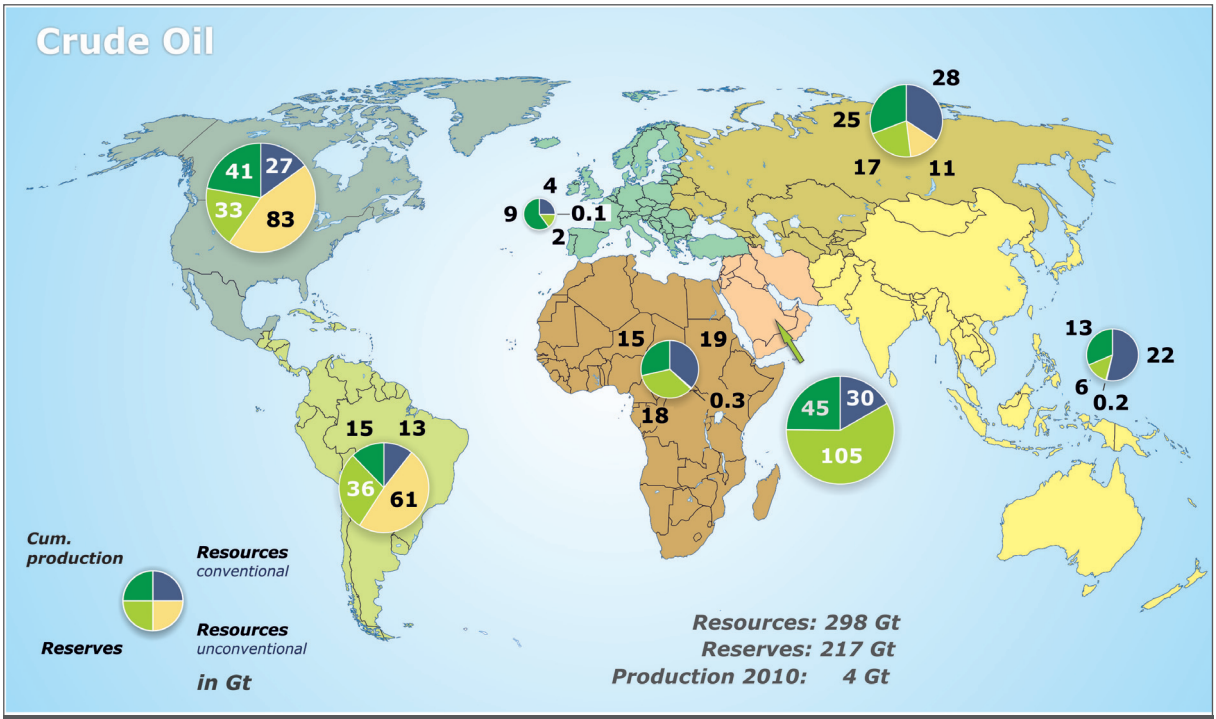

Fig 7: Total crude oil potential in 2010 (678 billion t): Regional distribution.

fluctuated in the window between 110 USD/b and 120 USD/b. A medium-term forecast of the way oil prices will develop in future is not possible in the view of the political instability in the MENA region (Egypt, Libya, Syria, Tunisia and Yemen). In the long term, higher oil prices seem unavoidable because the production of oil from increasingly complex and less accessible deposits is more difficult, and therefore more expensive. On the other hand, technological advances also show how new potential can be exploited economically. This means that as prices rise, oil resources previously classified as uneconomic can then be reclassified as reserves. The differentiation between "conventional" and "non-conventional" oil is becoming increasingly blurred, and fails to provide a meaningful insight into the economic efficiency of the production.

Analogously to the successes achieved in the exploration and production of shale gas in the United States, it has also been possible in recent years to develop shale oil deposits in the United States and Canada. Although previous estimates for the resources in North America are very vague, they are in the range of several billion tonnes. Shale oil production in the United States has grown from very small quantities in 2005 to over 13 Mt in 2010. Additional potential is also expected on all continents, especially in regions and countries such as Africa, Argentina, Australia, China and Europe.

Tables 7 to 12 in the Appendix list the country-specific production, consumption, imports and exports, as well as the reserves and resources of crude oil.

The new oil database has been used to update the BGR projection for possible changes in oil production over time until 2050 (Fig. 8). The projection incorporates the production of oil, including production from the expected extension of oil fields (field growth), and natural gas liquids (NGL) including condensate. The oil production forecast does not take into consideration extra heavy oil, oil from oil shales, shale oil, oil from coal liquefaction, and hydrocarbons from biomass, because of the unreliability of the data. The dynamics of the projection is oriented to the production curve over the last 25 years, which reflects global, largely free world trade, with uniform prices. During this period, the reserves were continually topped up again by the reclassification of resources (including field growth) – as a result, reserves over the whole of this period have corresponded to around 40 times annual production. This trend is continued in the projection. The projection therefore represents an optimistic scenario (BGR 2009) and is restricted to geoscientific and technological aspects because of the complexity of the issue. The change in global oil production over time in this projection needs to be considered critically in terms of the future availability, and particularly the future consumption, of oil in individual countries or groups of countries. The differentiation of the potential into reserves and resources alone is a major simplification. A more differentiated prognosis would require each oil deposit to be characterised individually in terms of its geological exploration status, technical practicability, and socio-economic feasibility. Data required for such an analysis are either not available or only exist in rudimentary form.

Under the current geological and technical framework, our projection indicates that a moderate boost in global production can be achieved until approximately 2036 (Fig. 8). No increase in the production of conventional oil alone is expected overall. Any growth in production is attributable to condensate and non-conventional crude oil. Conventional oil without condensate has no growth potential in the projection. Because of the mutual dependencies, it is not possible to consider the isolated development of separate components for the future production, and especially their maximum production rates – this is also not critical for the global dynamics of the market. A discussion about the peak production of conventional oil is therefore irrelevant. According to our projection, a peak annual production of over 4.6 billion t/a can be achieved. This means that the demand of almost 4.8 billion t (Fig. 1) specified by the IEA in their New Policies Scenario for 2035 would not be satisfied (IEA 2011a). Moreover, there are many credible factors and developments which could cause oil production to peak earlier.

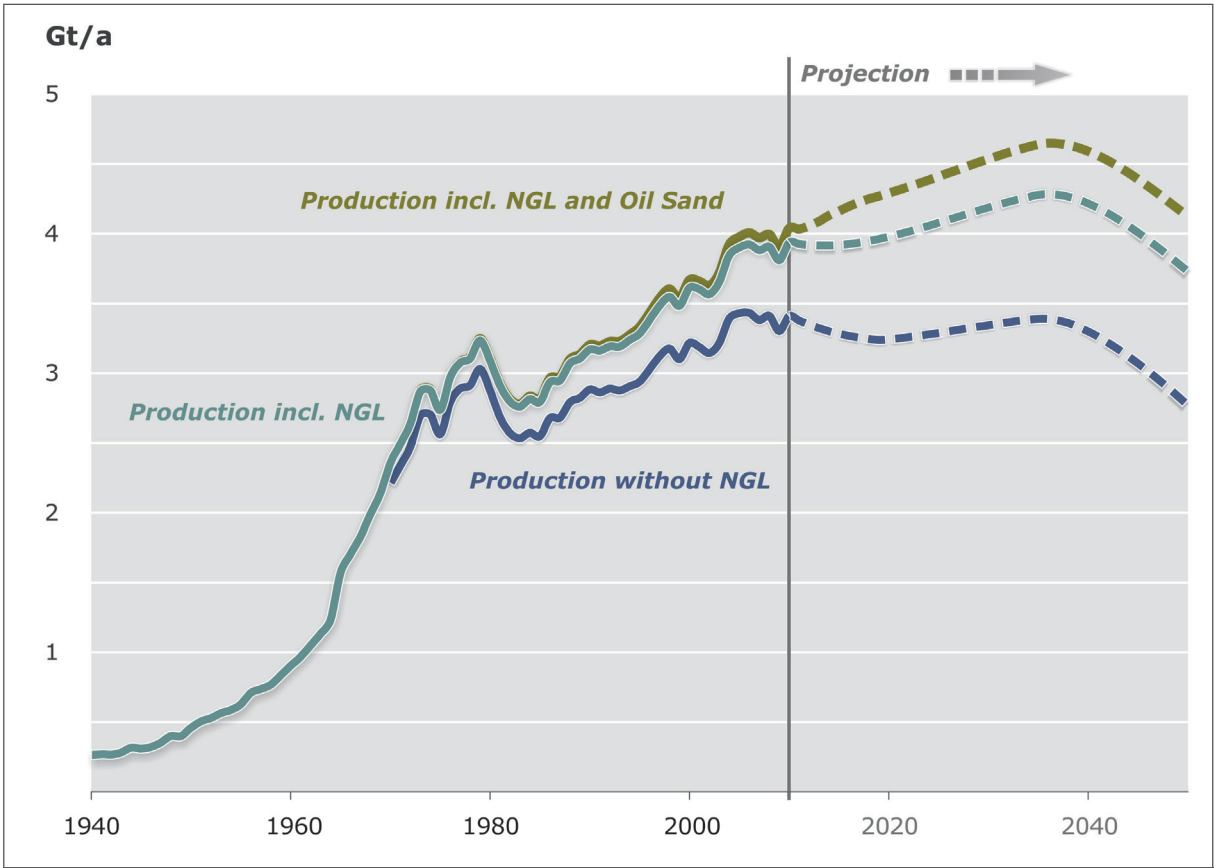

Fig. 8: Historic development of the production of conventional and non-conventional oil, as well as condensate, and a projected oil production curve to 2050 based on geoscientific and technological aspects.

CRUDE OIL: KEY CONCLUSIONS

- **From a geological point of view, supplies of crude oil could be maintained in the next few years against the background of a moderate rise in oil consumption.** According to this "optimistic" BGR projection, global oil production could be boosted until around 2036 and reach 4.6 billion t/a.
- **After the slump in demand in the crisis-plagued year 2009, the rise in global demand in 2010 was covered by an increase in production.** Oil production rose by 127 Mt (plus 3.3 %) compared to the rise in the consumption of petroleum products of 56 Mt (plus 1.4 %).
- **Crude oil will continue to be the world's most important fuel.** Its proportion of primary energy consumption (PEC) is only expected to fall below 30 % in the long term.
- **OPEC will play an even more important role in the future**. The share of oil produced by OPEC countries (especially OPEC Gulf) is already almost 40 % today, and is forecast to rise even further in the future.
- **The market share of oil from oil sands, from Canada in particular, as well as NGL will continue to grow in the years to come.** According to the BGR projection, their respective shares of total production by 2036 are almost 8 % for oil sand and 19 % for NGL.

- **It is not possible to predict future oil prices.** Important influencing factors will continue to be the development of the global economy and oil consumption, the behaviour of OPEC, and political events in the main production countries. A part can also be played by a shortage or increase in production and refinery capacities. More stringent safety regulations governing the production of oil in deep offshore locations, and the growing proportion of non-conventional oil, will add further to the costs of producing oil.
- **Crude oil is the only non-renewable energy resource which will no longer be able to keep up with growing demand in future decades.** The timely development of alternative energy systems will therefore be necessary given the long time periods involved in bringing about major changes in the energy sector.

2.2 NATURAL GAS

Natural gas was again the third most important fuel behind oil and hard coal in 2010, with a share of more than 24 % of global primary energy consumption (excluding biomass). After natural gas production dropped in 2009 in response to the decline in demand, it rose again in 2010 by almost 200 billion m³ to a new record level of 3.2 trillion m³. This extraordinary growth is mainly attributable to the positive development of the global economy, associated with the higher demand in OECD as well as non-OECD countries. Moreover, weather-related factors such as the cold winter in Europe also played a part in this rise in demand. These factors led to a considerable rise in production in many countries, and particularly in the Russian Federation and Qatar, the latter of which produced around 30 % more compared to 2009. The United States was also able to produce more gas, primarily due to the production of non-conventional gas deposits, and now stands side-by-side with the Russian Federation as one of the two largest natural gas producers in the world. Together, both accounted for almost 38 % of global natural gas production in 2010.

Global natural gas consumption of 3.2 trillion m³, as well as production, was much higher in 2010 than in the preceding year. The largest natural gas consumers are the United States, followed by the Russian Federation, Iran and China. The latter consolidated its position as the largest consumer in Asia. As the fifth largest consumer, Germany is largely dependent on imported natural gas, which comes primarily from the Russian Federation and Norway (Fig. 3).

The natural gas resource database was thoroughly updated and revised at a country level. These figures now also merge the data on conventional natural gas and non-conventional natural gas which has been economically produced for several years now, and therefore also incorporates shale gas, coal bed methane (CBM) as well as natural gas in tight sandstones and carbonates (tight gas). Tight gas is currently mainly produced in the United States, and is no longer strictly differentiated from conventional natural gas. Natural gas from tight sandstones has already been produced in Germany for many years and is also reported in one figure alongside conventional natural gas. The reserves and resources of tight gas in this study are therefore incorporated in the figures for conventional natural gas and hence are no longer reported separately – unlike the separate figures for shale gas and coal bed methane. There are still major uncertainties concerning the figures for shale gas in particular. To be able to determine the potential contribution of German shale gas deposits to domestic supplies, DERA has begun a study on behalf of BMWi to estimate the resource potential for Germany in detail.

At the end of 2010, global natural gas resources totalled around 531 trillion m³ (Fig. 9). The largest proportion is located in the Russian Federation, followed by the United States, China, Canada, Argentina and Mexico. Argentina and Mexico have been hoisted into the top ten ranking of the most resource-rich countries in the world for the first time thanks to their considerable shale gas potential. These figures do not include the resources of aquifer gas and natural gas in gas hydrates because it is currently still unclear when and whether this potential can be commercially exploited. In the case

of gas hydrates, countries with very small resources of conventional fuels, such as South Korea and Japan, are pushing ahead with ambitious projects to exploit domestic gas hydrate deposits as potential sources of energy in their own exclusive economic zones. However, no breakthroughs in this regard have been reported to date.

Overall natural gas reserves have only risen marginally compared to 2009, and were estimated at around 192 trillion m³ at the end of 2010. This means that the annual natural gas production of 3.2 trillion m³ in 2010 was compensated for by a growth in the reserves. Around two thirds of this addition to the reserves is located in the United States, Iran, China, India and Saudi Arabia. The significant discoveries in the Levantine Basin in the eastern Mediterranean also contributed new reserves. Over half of the remaining natural gas reserves around the world are concentrated in the Russian Federation, Iran and Qatar. More than 70 % of the conventional reserves world-wide are owned by state organisations. The five largest international oil companies only have access to around 3 % of the natural gas reserves, although they account for around 11 % of natural gas production.

The combined production in the Russian Federation and the United States in 2010 was more than 1.2 trillion m³. This accounts for almost 38 % of global natural gas production in 2010. The production of non-conventional natural gas was boosted again in the United States in particular. Estimates of the global resources of non-conventional natural gas indicate the presence of very large volumes. However, these evaluations are still associated with considerable uncertainties because of the patchiness of the data. Nevertheless, it would appear that the potential for non-conventional natural gas considerably exceeds the known potential of conventional natural gas (Tab. 1). In general, the non-conventional natural gas is also present in countries with only minor deposits of conventional natural gas – the distribution of non-conventional natural gas will therefore change the natural gas map of the world. In Europe, including Germany,

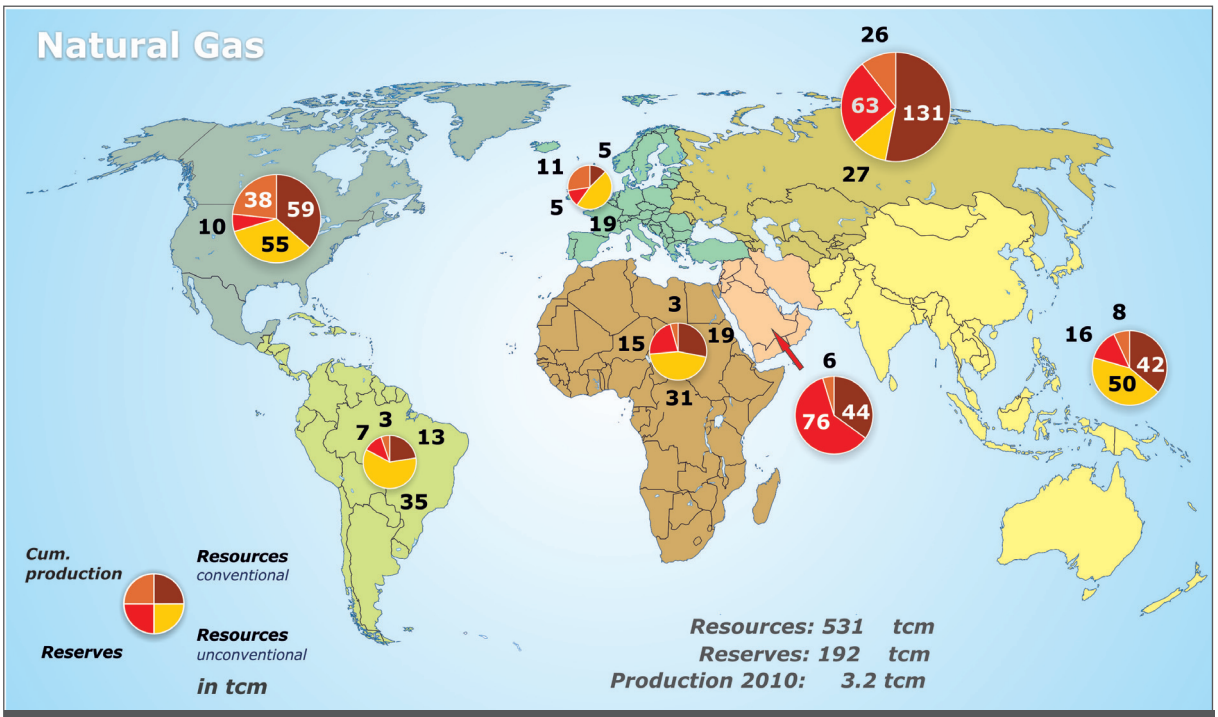

Fig. 9: Total natural gas potential 2010 (819 trillion m³): regional distribution.

it is geologically feasible for the supply of natural gas to be put on a more secure footing by developing domestic shale gas and coal bed methane deposits, and thus compensate for the declining production of domestic conventional natural gas fields.

In 2010, around 975 billion m³ natural gas (around 30 % of global natural gas production) was traded internationally (excluding transit trade) of which around 31 % (298 billion m³) was in the form of liquefied natural gas (LNG). There are currently still four supra-regional natural gas markets in the world (the European market, the North American market, the Asian market, and the growing South American market). These function largely independently of one another. In the medium to long term, the situation is expected to evolve into a global market because of the new non-conventional natural gas potential, and the increasing marine transport of liquefied natural gas. With its integrated and growing supply network, Europe is connected to over half of the global natural gas reserves, either directly via pipelines, or indirectly via LNG. The European natural gas market enjoys a comfortable position. The considerable economic and weather-related rise in demand in Europe in 2010 stimulated a rise in spot market prices, but these were still much lower than those for oil-price-tied pipeline gas. This disparity led to a rise in LNG imports into Europe at the expense of pipeline-tied exports to Europe. The border transit prices for natural gas entering Germany during 2010 rose during the year and were 27 % higher in December 2010 than they were in January 2010. Nevertheless, the annual average price for natural gas was still slightly cheaper than in 2009. In contrast, natural gas in the North American market was traded at the most favourable conditions of all liberalised markets owing to the abundant supply (BP 2011). In general, the price of natural gas is significantly influenced by the much higher specific transport costs compared to oil and coal.

Tables 13 to 19 in the Appendix provide country-by-country figures on production, consumption, imports and exports, as well as natural gas reserves and resources.

NATURAL GAS: KEY CONCLUSIONS

- **From a geological point of view, natural gas is still available in very large quantities.** Even in the face of the forecast growth in demand, the very high remaining natural gas potential will be able to safeguard global supplies for many decades to come.
- **Natural gas production in Europe is already beyond its peak.** The further decline in domestic production will increase dependency on gas imports from CIS, Africa and the Middle East.
- **The recent successes in developing non-conventional natural gas deposits have improved the global supply situation.** The supply situation in Europe could be enhanced if these resources can also be successfully developed here.
- **There is considerable growth world-wide in the proportion of LNG trading.** A number of new LNG liquefication plants have been commissioned and have revitalised the LNG trade (plus 23 %). Qatar succeeded in further expanding its position as the world's largest supplier of LNG.
- **The production of synthetic fuels from natural gas (GTL) increased.** This could have a long-term influence on the natural gas market in future.

2.3 COAL

Coal has far and away the largest reserves and resources of any of the energy commodities, and accounted for almost 30 % of global primary energy consumption (PEC) in 2010 (hard coal 27.9 %, lignite 1.7 %). Coal is therefore the second most important fuel behind oil (BP 2011). Coal was the most important fuel for power production in 2009 with a proportion of around 40 % world-wide (IEA 2011c). The global demand for coal has risen

by around 49 % since the beginning of the new millennium, and therefore enjoyed much higher growth than natural gas and oil with around 32 % (natural gas) and 8 % (oil) respectively (BP 2011).

To enable a comparison between the data, coal in this study is only divided into lignite and hard coal. Hard coal with an energy content of > 16,500 kJ/kg includes sub-bituminous coal (hard brown coal), bituminous coal and anthracite. These benefit from favourable transport costs and are traded world-wide. Lignite, however, (energy content < 16,500 kJ/kg) is primarily used for power production close to the extraction site because of its lower energy content and higher water content.

Confirmed coal reserves world-wide at the end of 2010 amounted to 1,004 Gt, of which 728 Gt hard coal and around 276 Gt lignite. There are therefore no major changes year-on-year in either the reserves or the resources (BGR 2010).

Global coal production in 2010 rose by almost 5 % to around 7,342 Mt. In detail this is broken down into 6,341 Mt hard coal (plus 5.5 %), and 1,001 Mt (unchanged) lignite. Unlike oil and conventional natural gas, coal deposits and their production sites are located in many countries and exploited by many companies. Tables 20 to 31 in the Appendix list country-by-country production, consumption, imports and exports, as well as reserves and resources of hard coal and lignite.

Hard Coal

Figure 10 shows the regional distribution of hard coal reserves and resources, and the estimated cumulative production since 1950. The Austral-Asia region has the largest remaining potential of hard coal with 7,219 Gt, followed by North America with 6,875 Gt, and CIS with 3,006 Gt. The world's largest reserves of hard coal are in the United States with 226 Gt (31 % global share), followed by China (25 %), and India (10 %). These are followed by the Russian Federation (9.4 %), Australia (6 %), and the Ukraine (4.4 %). The subsidised producible volumes of hard coal (reserves) in Germany up to 2018 are 0.06 Gt hard coal. In terms of resources, the United States alone accounts for 6,457 Gt or almost 38 % of global hard coal resources, followed by China (29 %) and the Russian Federation (16 %).

The three biggest hard coal producers in 2010 were China with a share of 49 % (3,115 Mt), the United States (14 %) and India (8.5 %). Unlike China, which again significantly boosted its production by around 6 %, India and the United States only increased their production by around 1 %. Approximately 17 % of the hard coal produced around the world was traded in 2010 (1,067 Mt) of which 963 Mt was transported by sea. This corresponds to a considerable increase in the globally traded volumes of hard coal (around 14 %) compared to the previous year which lay under the cloud of the global economic crisis. The global hard coal market continues to be dominated by Australia with exports of 300.3 Mt (28 %), followed by Indonesia (26 %) and the Russian Federation (11 %). The largest hard coal importers are Japan, China and South Korea with a combined volume of 464.3 Mt (46 %). China, which already imported 126.9 Mt the previous year, and had therefore tripled its import volume within the course of one year, boosted its imports again in 2010 to 166.2 Mt. With imports of 90.1 Mt (8.9 %), India also increased its imports by almost a quarter year-on-year. Other important importing countries in 2010 were Taiwan (6.2 %), Germany (4.1 %) and Turkey (2.7 %). The hard coal imported by Germany (41.1 Mt, excluding coke) was primarily sourced from the Russian Federation (23 %), Colombia (17 %), the United States (13 %), Australia (9.5 %), Poland (8.1 %), and South Africa (7.4 %). Whilst hard coal imports from Poland in 2010 bucked the trend of recent years by increasing to 3.7 Mt (plus 46 %), imports from South Africa dropped by more than a third to 3.3 Mt compared to the previous year. The trend to reduce imports of South African coal to Europe and Germany began around 2005 and therefore continued. This situation is attributable to South Africa's strengthening exports of coal to Asia (primarily India) (VDKI 2011a). At 186.5 Mt, around 4.6 Mt lower than the previous year, less than one fifth of global hard coal imports were accounted for by the European Union (EU-27).

The north-west European spot market prices for steam coal (ports of Amsterdam, Rotterdam and Antwerp; cif ARA) rose on an annual average basis from 81.75 USD/tce in 2009 to 107.16 USD/tce in 2010 (31 % plus). The spot prices in spring 2010, however, were below 87 USD/tce. Prices rose in the subsequent months to 137.10 USD/tce in December 2010. By September 2011, north-west European spot market prices for steam coal had risen to around 146 USD/tce (VDKI 2011 b) – the spot prices were less influenced by the European coal demand than by Chinese and Indian coal demand (imports) and the inner-Chinese coal prices. The prices for coking coal also rose significantly year-on-year (price level between 120 – 130 USD/t). The coking coal prices on the world market rose in 2010 to around 200 to 220 USD/t due to the growing global steel production. Additional price rises were largely attributable to weather-related production shut-downs in Australia in winter 2010/11. This pushed the price of coking coal in the first half of 2011 to over 320 USD/t. The return to normal operations in most Australian coking coal pits, and the restoration of the infrastructure, combined with a downward trend on the steel market, caused coking coal prices to drop to around 270 USD/t in autumn 2011.

Lignite

The North American region has the largest remaining potential of lignite with 1,519 Gt, followed by the CIS (1,380 Gt including sub-bituminous coal) and Austral-Asia (1,111 Gt) (Fig. 11). Of the known global lignite reserves of 275.5 Gt in 2010, 91.4 Gt (including sub-bituminous coal) corresponding to one third, was located in the Russian Federation (33 % global share), followed by Germany (15 %), Australia (14 %), United States (11 %) and China (4 %). With 1,368 Gt (33 % global share), the United States has the largest lignite resources, followed by the Russian Federation (31 %, including sub-bituminous coal), and China (7.4 %).

81 % of the global lignite production of 1,005.7 Mt was accounted for in 2010 by only 11 of the 36 producing countries. Germany was the largest producer of lignite with a share of 17 % (169.4 Mt) followed by China (13 %) and the Russian Federation (7.6 %).

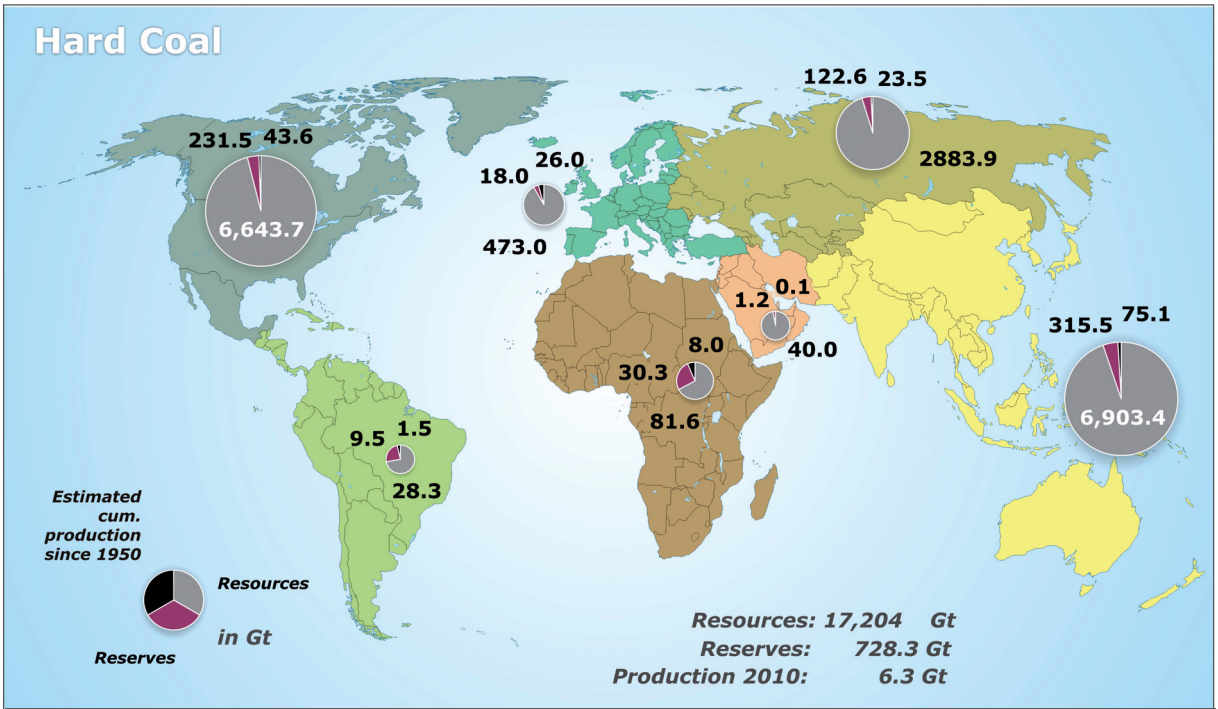

Fig. 10: Total hard coal potential 2010 (17,932 Gt): Regional distribution

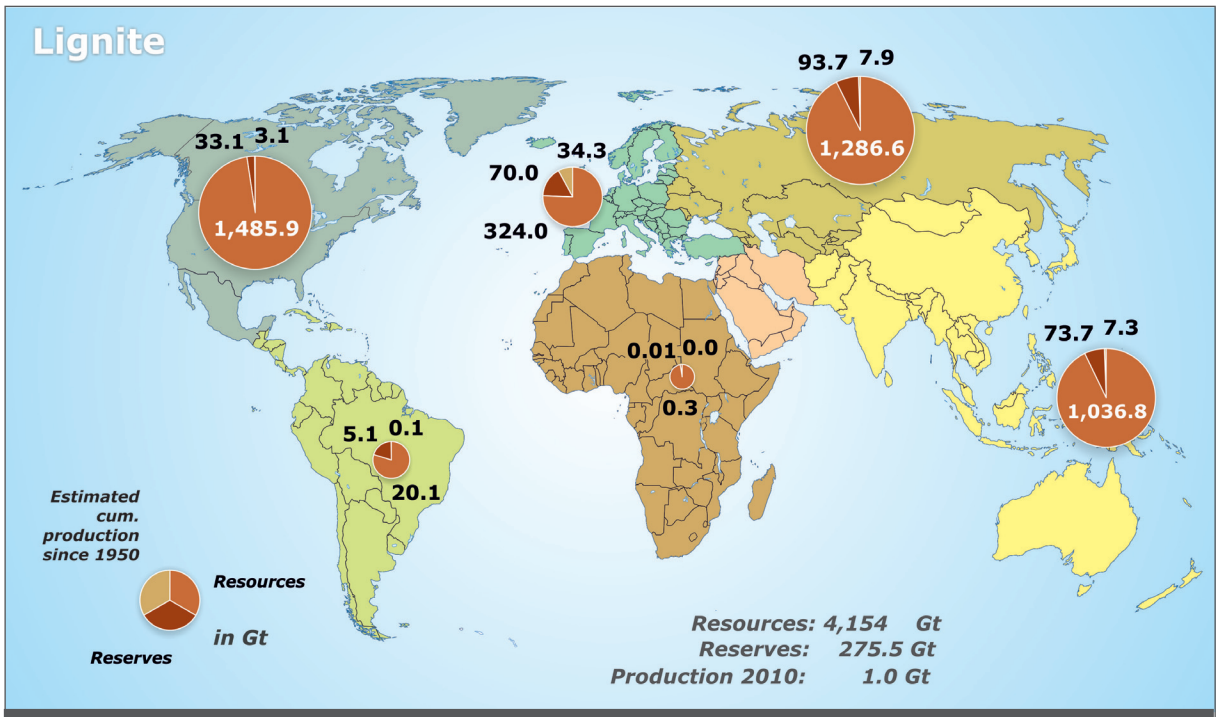

Fig. 11: Total lignite potential 2010 (4,429 Gt): Regional distribution

COAL: KEY CONCLUSIONS

- **The remaining potential of hard coal and lignite is adequate to cover the foreseeable demand for many decades.** Coal boasts the largest potential of all non-renewable energy resources with a share of around 54 % (724 Gtce) of the reserves and around 81 % (16,246 Gtce) of the resources.
- **Coal will continue to play a significant role in global energy supplies in future.** Coal covered around 30 % of global primary energy consumption (PEC) in 2010. Around half of the global growth in PEC since 2000 has been covered by coal (IEA 2011a).
- **The global, and therefore also the European coal prices, have been increasingly influenced since 2009 by the rising Chinese and Indian coal imports.** The annual average north-west European spot market price for steam coal and coking coal rose to 107.16 USD/tce (plus 31 % year-on-year) and around 210 USD/t (plus 66 % year-on-year) respectively because of the rise in imports primarily in Asian countries. This rise in prices is still continuing and led to a new record price (nominal) for coking coal in the first half of 2011 of around 320 USD/t.

2.4 NUCLEAR FUELS

Uranium

The accident at the Daiichi nuclear power plant in Fukushima, Japan, on 11 March 2011 stimulated a global discussion on the future of nuclear power. This led to safety checks on nuclear power plants in numerous countries and a reappraisal of the role of nuclear power. With the adoption of the 13th act to modify the Nuclear Act on 30 June 2011, Germany enforced legislation to completely withdraw from the use of nuclear power for the commercial production of electricity from 2022. Also in Europe, Italy, Switzerland and Belgium have shelved their plans to expand nuclear power production. On the other hand, countries such as the United States, the United Kingdom, the Russian Federation, the Czech Republic, Finland, France,

Hungary, Slovenia, Slovakia, Sweden and South Korea continue to back the use of nuclear power as an important contribution to their national energy mix. There is therefore clearly continued interest around the world in expanding the use of nuclear power.

At the end of 2010, 62 nuclear power plants were under construction in 15 countries, including in China, the Russian Federation, South Korea, India, Slovakia and Bulgaria. The 443 nuclear power plants operating around the world, with a total gross output of 396.2 GWe (DATF 2011), consumed around 68,971 t natural uranium. Most of this uranium (53,671 t) was derived from mining output. With uranium reserves of around 2.8 Mt (cost category < 80 USD/kg U) there is therefore enough potential available from a geological point of view to satisfy global demand in the coming decades even when faced with the foreseeable growing demand.

Unlike the other energy resources uranium reserves are classified according to production costs. According to the definition for reserves – proven volumes economically exploitable using present day technologies – the limit for extraction costs is < 80 USD/kg U. The reserves in 2010 only changed marginally compared to the previous year (2,516 kt in 2009 compared to 2,755 kt in 2010). The largest additions to reserves were reported in Canada, Brazil, Australia, Mongolia and Kazakhstan.

Uranium deposits occur in almost every region around the world. However, the defined uranium reserves are currently limited to a few countries. 95 % of the total reserves of 2.8 Mt are located in only 11 countries, headed by Australia, and followed by Canada, Kazakhstan, Brazil and South Africa. These five countries account for around 82 % of the currently defined global reserves of uranium (Fig. 12).

Global resources grew by 798 kt compared to the previous year, primarily due to reassessments and only marginally due to new discoveries. Whereas Australia, Kazakhstan, Namibia and South Africa merely raised the volumes of their proven resources, the Ukraine and Mongolia mainly enlarged their speculative resources compared with the previous year. Important producing countries such as Brazil, Kazakhstan, the Russian Federation, South Africa and the United States stopped providing details on speculative resources for the first time in 2009, which led to a reduction in the resources reported in 2009. Australia stopped providing information on speculative resources some time ago. Subject to reservations associated with this reporting uncertainty, the rise in the resource figure for uranium is primarily based on proven resources (plus 588 kt, increase of 16 %), and to a lesser extent on speculative resources (plus 220 kt, growth of 6 %). The resource figures given in this figure should therefore be treated conservatively.

The global output of uranium from mining activities in the last five years lay between 39,670 t U and 53,671 t U, balanced by an annual consumption exceeding 60,000 t U. The difference revealed here between annual demand and primary production is covered by civil and military stocks, particularly those held in the Russian Federation and the United States. These stocks were established from uranium overproduction between 1945 and 1990, built up in response to forecasts of growing civil demand as well as in response to military strategy. The military stocks in particular are currently being successively reduced. This is also in response to the treaties signed by the United States and the Russian Federation in 1992 to convert highly enriched weapons-grade uranium (HEU) into low enriched uranium (LEU). This means that demand in future can continue to be satisfied by mine output as well as stocks and the reduction in nuclear weapon stockpiles. Uranium is also derived from the reprocessing of fuel rods. More research is currently being carried out in this respect to enhance the efficiency of reprocessed material.

Most of the mined uranium to satisfy global demand is produced by only a few countries. The main producer of uranium in 2010 was again Kazakhstan with 17,803 t U (2009: 14,020 t U), plus 27 %), which corresponds to around 33 % (2009: 27 %) of global production. Another 60 % of global production was accounted for by the combined output of Canada, Australia, Namibia, Niger, the Russian Federation, Uzbekistan and the United States.

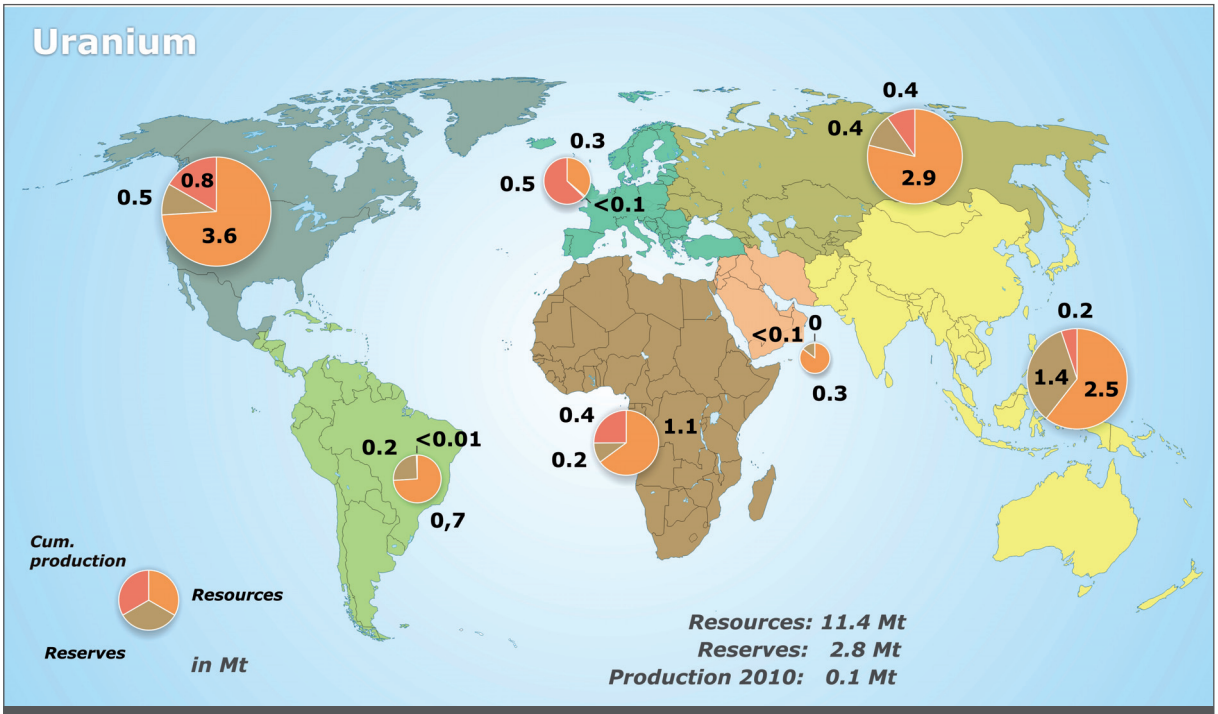

Fig. 12: Total potential uranium 2010 (16.4 Mt U): Regional distribution

Global production overall rose by 6 % from 50,773 t U (2009) to 53,671 t U (2010). The major consumption countries – United States, France, Japan, China, the Russian Federation, South Korea, Germany and the United Kingdom (accounting for 79 % of global consumption) – only have limited domestic production (United States, Russian Federation, China) or are totally reliant on imports. The volume of natural uranium required for the production of fuel rods in Germany (3,453 t in 2010) is almost exclusively derived from producers in France, the United Kingdom, Canada and the United States on the basis of long-term contracts.

The growing interest in nuclear power around the world in recent years led to a significant rise in exploration activities. The World Nuclear Association (WNA 2011a) reports that USD 5.7 billion was spent on exploration between 2003 and 2009. This exploration activity, which also takes place in countries with no previous production, continued in 2011 and will probably enlarge the circle of producing countries and increase the level of reserves. On the other hand, there is a clear concentration in the uranium producers. 87 % of global production in 2010 was accounted for by only 10 mining companies. In addition to western companies - Cameco in Canada (16 % world share), Areva in France (16 %), Rio Tinto in Namibia and Australia (12 %), Uranium One from Canada (4 %), and BHP Billiton in Australia (4 %), the other main producers were KazAtomProm in Kazakhstan (15 %), ARMZ from Russia (8 %), and Navoi Mining from Uzbekistan (4 %). The largest single mine is the major deposit at McArthur River in Saskatchewan/Canada (7,654 t U, 14 % of global production), followed by Ranger in Australia (3,216 t U, 6 %), Rössing in Namibia (3,077 t U, 6 %), Krasnokamensk in the Russian Federation (2,920 t U, 5 %) and Arlit in Niger (2,650 t U, 5 %).

The higher demand drove up uranium prices, particularly between 2003 to 2007, to reach an all-time spot market price high of 353.69 USD/kg U in summer 2007. Uranium prices declined again in 2008 and 2009 before experiencing another significant upswing in 2010: during the course of the year the spot market prices rose from 110 USD/ kg U at the

beginning of the year to 162 USD/kg U at the end of the year. One of the main reasons for this rise is the large demand for energy in China (uranium consumption 2009: 2,875 t; 2010: 4,402 t) and the announcement that it would be building new power plants.

Uranium around the world is largely traded on the basis of long-term supply contracts. Uranium in the EU is also primarily traded on the basis of long-term contracts (around 96 % in 2010). The average price in long-term contracts is 86 USD/kg U corresponding to a rise of around 11 % compared to 2009. The uranium price only accounts for a small proportion of the electricity generation costs. According to calculations published by the World Nuclear Association (WNA 2011b), a doubling of uranium prices from 65 USD/kg U to 130 USD/kg U would only increase fuel prices from 0.50 to 0.62 US-Cent/kWh.

Tables 32 to 36 in the Appendix provide a country-by-country listing of production, consumption, and the reserves and resources of uranium.

Thorium

Thorium is considered by the scientific community to be a potential alternative to uranium. However, it is currently not used for power generation. There are no commercial reactors operating anywhere in the world using thorium as the fuel. Nevertheless, thorium deposits have been discovered and evaluated in recent years as a by-product of the increasing exploration for other elements (uranium, rare earths, phosphate). In 2010, the thorium reserves were reported as more than 0.8 Mt, with 5 Mt of resources.

NUCLEAR FUELS: KEY CONCLUSIONS

- **From a geological point of view, no shortage in the supply of nuclear fuels is expected in the foreseeable future.** The global quantities of uranium are very large and currently reported as 2.8 Mt reserves (cost category < 80 USD/kg U) and 11.4 Mt uranium resources.
- **Production is primarily in politically stable countries**. Kazakhstan, Canada and Australia are the largest uranium producing countries in the world with a combined share of over 60 % of global production. Canada's major McArthur River deposit alone supplies 14 % of the global uranium.
- **A larger number of producing countries can be expected in future.** The commodity prices of uranium have risen in recent years particularly due to the higher demand, especially in Asia. This rise in demand stimulated exploration activity around the world, even in countries with no previous production history.
- **The interest in nuclear power around the world has grown.** A number of countries around the world announced that they will be constructing new nuclear power plants in coming decades or are already building new power plants: these countries include China (27), Russian Federation (10), South Korea (5) and India (5).
- **Germany has very secure supplies of uranium on the commodities side.** The volumes of natural uranium required for fuel production in Germany (3,453 t in 2010) were almost exclusively covered by long-term contracts with producers in France, the United Kingdom, Canada and the United States.
- **The uranium price only accounts for a small proportion of electricity generation costs.** Unlike the fossil fuels, the cost of the raw materials only plays a subordinate role in the overall costs for nuclear power production.

3 SUMMARY AND OUTLOOK

The current status of the data on the potential of fossil fuels was updated and analysed in this study. It is much more difficult though to look into the future and answer the question of how long the available reserves and resources will be capable of covering potential demand. One approach to answering this question uses the projected consumption predicted in the New Policies Scenario published by IEA (2011a). Accordingly, the situation from a geological point of view is considered to be comfortable with respect to the energy carriers uranium, coal and natural gas. It appears that the projected demand can be satisfied. However, these resource figures also include aquifer gas and natural gas from gas hydrates whose economic utilisation for the production of energy still remains unproven. Unlike the aforementioned fuels, the situation for crude oil is critical because production from a technical point of view will already begin to decline even when there are still large remaining reserves and resources. According to the IEA scenario, a large portion of the oil reserves proven today will be consumed by 2035.

In conclusion, the evaluation of the current figures on the reserves, resources, and availability of non-renewable fuels – oil, natural gas, coal and nuclear fuel – gives rise to the following outlook based on the data available at the end of 2010:

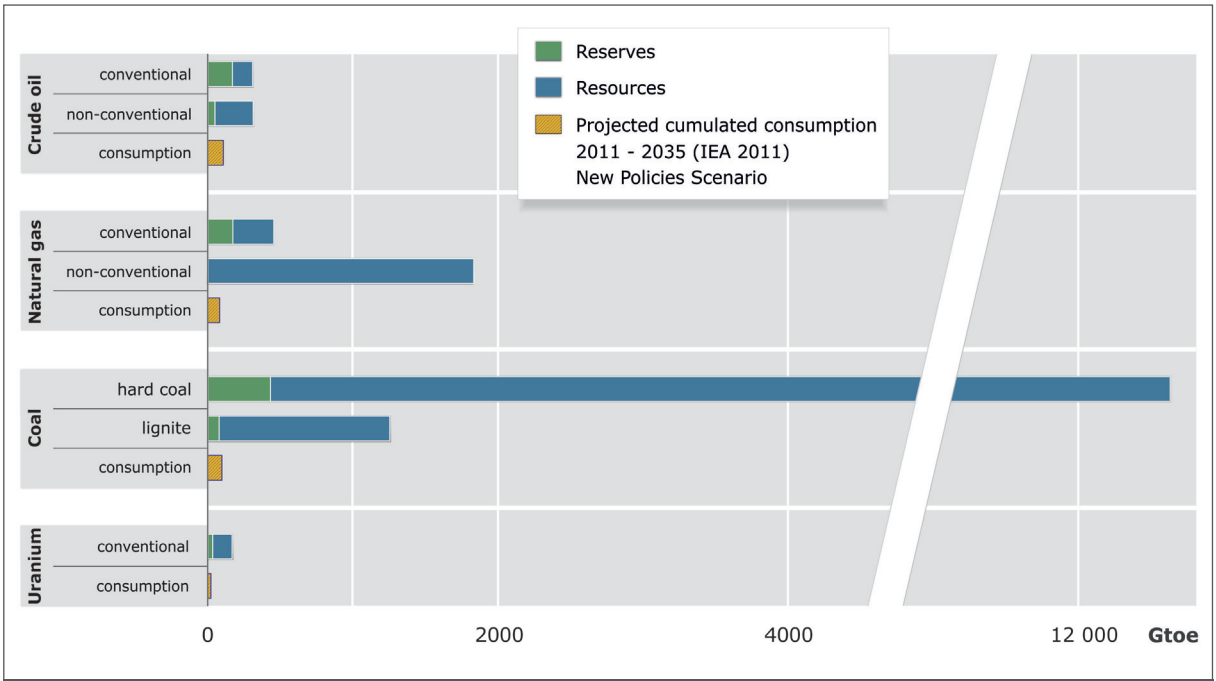

Fig. 13: Supply situation for fossil fuels at the end of 2010.

CRUDE OIL

Crude oil supplies in coming years should be maintainable from a geological point of view even in the face of a moderate rise in consumption. After recovering from the 2008/2009 economic crisis, oil production in 2010 was significantly enhanced and will probably rise further. The proportion of oil production from OPEC countries, particularly the region around the Persian Gulf, will increase further in future because this region has the largest reserves potential and already has a very well established infrastructure. Despite crises and production shut-downs, global oil supplies remained stable because of OPEC's reserve capacities. No supply risks are expected in the near future, with the proviso that there are no unforeseen events.

In accordance with BGR's updated projection, oil production could be increased until around 2036. The growing proportion of NGL and oil from oil sands and extra heavy oil have no significant influence on the projected time of peak oil production but does boost the maximum production level. According to the projection, this maximum will be around 4.6 billion t annual production. Crude oil will therefore be the first fuel which will no longer be able to satisfy rising demand.

NATURAL GAS

Unlike oil, the production of energy using natural gas will not be limited by any shortage in reserves and resources in the coming decades, even in the face of growing demand. As shown by shut-downs in production in the MENA region and the rising demand in Asia and Latin America, even these volumes could be made available quickly by the market. The liquefied natural gas market will continue to grow, particularly because of the rise in demand in Japan, Asia and Latin America. The European natural gas market is in a comfortable position with its access to production in the CIS countries, North Africa and the Middle East, and will also profit from the growing supply of LNG. The emerging non-conventional production potentials and the increasing marine transport of liquefied natural gas are expected to lead to the development of a global market.

COAL

The growth in global coal demand in coming years will continue to be largely determined by the Asia region. Because of the growing demand for coal in Asia, supplies of steam coal from the Atlantic market, from countries such as South Africa, the United States, Canada and Columbia, and heading for the Pacific market, to Japan, China, South Korea and India, are likely to increase further. Asian coal imports will probably rise even more significantly depending on the demand, the expansion of domestic production and transport capacities, and the development of international coal prices and freight rates. The increasing transfer of large quantities of steam coal from the Atlantic to the Pacific market will have an increasing influence on the international as well as the European prices of steam coal. The inner-Chinese steam coal price, which temporarily exceeded the price of Australian or South African steam coal after 2008, and was the main reason for the explosive rise in Chinese imports, will probably continue to drive relatively high and stable coal prices around the world. Despite the highest specific CO_2 emissions of all fossil fuels, coal will continue to play an important role in global energy supplies in the medium term.

NUCLEAR FUELS

Even after the accident at the Daiichi nuclear power plant in Fukushima, Japan, on 11 March 2011, there is still a clear growing interest world-wide in the expansion of nuclear power as a response to growing energy requirements and to avoid CO_2 emissions. With world-wide uranium reserves of around 2.8 Mt (cost category < 80 USD/kg U) and another 11.4 Mt uranium resources, no shortage is expected in the supplies of nuclear fuel in the next decades from a geological point of view, even in the face of the observable rise in demand. Global production in 2010 rose 6 % year-on-year. The largest uranium producer in future will probably continue to be Kazakhstan. Production in Kazakhstan rose around 27 % in 2010, and the strong upward trend will probably also continue beyond 2011.

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5 APPENDIX

Tables

Sources

Glossary

Definitions

Country Groups

Economic Policy Organisations

Natural Gas Markets

Units

Conversion Factors

Tab. 2: *Regional Distribution of Reserves of Non-Renewable Fuels in 2010 [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	94	< 0.5	187	–	477	635	9	–	1,403	3.6
CIS	719	–	2,402	2	3,083	1,363	209	38	7,816	19.8
Africa	738	–	558	–	711	< 0.5	86	9	2,102	5.3
Middle East	4,391	–	2,885	–	30	–	22	–	7,328	18.6
Austral-Asia	253	–	577	38	7,674	752	703	183	10,178	25.8
North America	261	1,125	289	88	5,820	391	228	88	8,289	21.1
Latin America	600	886	275	–	237	43	119	86	2,246	5.7
World	**7,056**	**2,011**	**7,173**	**127**	**18,031**	**3,185**	**1,377**	**415**	**39,375**	**100.0**
OECD	375	1,125	539	114	7,457	1,336	848	111	11.904	30.2
EU-27	51	–	106	–	441	507	5	–	1,110	2.8
OPEC-12	5,421	886	3,458	–	62	< 0.5	–	–	9,826	25.0

Tab. 3: *Regional Distribution of Resources of Non-Renewable Fuels in 2010 [EJ]*

Region	Crude Oil		Natural Gas		Coal		Uranium	Thorium	Total	
	konven-tionell	non-con-ventional	konven-tionell	non-con-ventional[1)]	Hard Coal	Lignite			EJ	Share [%]
Europe	160	2	189	730	12,642	3,018	145	198	17,085	3.3
CIS	1,154	469	4,997	1,016	70,573	18,823	1,452	38	98,522	19.1
Africa	780	14	705	1,192	1,922	3	560	314	5,491	1.1
Middle East	1,253	–	1,662	–	1,008	–	129	–	4,053	0.8
Austral-Asia	930	9	1,588	1,921	169,195	9,807	1,244	589	185,283	35.8
North America	1,145	3,460	2,227	2,104	166,857	17,543	1,808	627	195,771	37.9
Latin America	552	2,530	488	1,340	736	173	347	681	6,848	1.3
World	**5,975**	**6,485**	**11,858**	**8,303**	**426,758[2)]**	**49,367**	**5,685**	**2,508[3)]**	**516,939**	**100.0**
OECD	1,342	3,463	2,502	3,391	221,244	21,925	2,235	1,254	257,355	49.8
EU-27	74	2	103	614	12,600	2,702	140	–	16,235	3.1
OPEC-12	1,737	2,541	1,756	571	1,274	2	23	300	8,206	1.6

1) without natural gas from gas hydrates and aquifer gas (30,400 EJ))
2) including hard coal in the Antarctic (3,825 EJ)
3) including Thorium without country allocation (62 EJ)

Tab. 4: *Regional Distribution of Production of Non-Renewable Fuels in 2010 [EJ]*

Region	Crude Oil	Natural Gas	Hard Coal	Lignite	Uranium	Total	Share [%]
Europe	8.6	11.4	3.7	4.7	0.2	28.6	6.0
CIS	27.5	30.0	10.8	1.2	12.3	81.8	17.1
Africa	19.6	8.2	6.1	–	5.0	38.8	8.1
Middle East	49.7	17.5	< 0.05	–	–	67.3	14.0
Austral-Asia	16.7	18.5	107.6	2.9	3.6	149.2	31.1
North America	27.1	31.4	24.7	0.9	5.7	89.8	18.7
Latin America	15.3	6.1	2.1	< 0.05	0.1	23.7	4.9
World	**164.6**	**123.1**	**154.9**	**9.7**	**26.8**	**479.1**	**100.0**
OECD	36.6	44.5	37.8	5.1	8.8	132.8	27.7
EU-27	4.0	7.2	3.6	3.5	0.2	18.5	3.9
OPEC-12	67.7	21.5	0.1	–	–	89.3	18.6

Tab. 5: *Regional Distribution of Consumption of Non-Renewable Fuels in 2010 [EJ]*

Region	Crude Oil	Natural Gas	Hard Coal	Lignite	Uranium	Total	Share [%]
Europe	28.6	21.7	9.1	4.7	11.0	75.1	15.4
CIS	8.6	24.5	7.8	1.2	2.9	45.0	9.2
Africa	6.4	4.0	4.7	–	0.2	15.2	3.1
Middle East	14.3	13.9	0.4	–	0.1	28.7	5.9
Austral-Asia	52.6	21.7	108.4	2.9	9.3	194.9	40.0
North America	42.4	32.2	23.8	0.8	10.8	109.9	22.6
Latin America	11.6	5.6	0.9	< 0.05	0.3	18.4	3.8
World	**164.6**	**123.5**	**155.0**	**9.6**	**34.5**	**487.1**	**100.0**
OECD	84.0	59.3	42.1	5.0	27.3	217.7	44.7
EU-27	25.9	19.7	8.2	3.5	10.7	68.0	14.0
OPEC-12	16.0	14.9	0.1	–	0.1	31.1	6.4

– no reserves, resources, production or consumption

Tab. 6: *Crude Oil in 2010 [Mt]:*

Country / Region	Production	Cum. Production	Reserves	Resources	EUR	Reamining Potential
Albania	0.5	53	30	20	103	50
Austria	1.0	120	6	10	136	16
Belgium	< 0.05	–	–	–	–	–
Bulgaria	0.1	9	2	5	16	7
Croatia	0.8	101	10	20	130	30
Cyprus	–	–	–	35	35	35
Czech Republic	0.2	10	1	29	40	30
Denmark	14.0	309	127	45	481	172
Estonia	0.5	–	–	–	–	–
France	1.6	123	12	70	206	82
Germany	2.5	292	41	20	353	61
Greece	0.1	16	1	35	53	36
Hungary	0.7	97	4	20	121	24
Ireland	–	–	–	10	10	10
Italy	5.1	169	132	164	465	296
Lithuania	0.1	4	2	20	25	22
Malta	–	–	–	5	5	5
Netherlands	1.5	142	42	60	244	102
Norway	106.2	3,270	934	1,935	6,139	2,869
Poland	0.7	61	11	20	92	31
Romania	4.3	755	77	160	992	237
Serbia	0.7	42	11	20	72	31
Slovakia	0.2	2	1	5	8	6
Spain	0.3	37	20	20	78	40
Turkey	2.5	135	43	70	248	113
United Kingdom	63.0	3,443	751	1,090	5,284	1,841
Azerbaijan	50.9	1,673	952	1,245	3,870	2,197
Belarus	1.5	132	25	30	188	55
Georgia	0.1	23	5	50	78	55
Kazakhstan	81.6	1,377	5,337	10,700	17,414	16,037
Kyrgyzstan	0.2	11	5	10	27	15
Moldova, Republic	–	–	–	10	10	10
Russian Federation	505.1	20,669	10,531	24,501	55,701	35,032
Tajikistan	< 0.05	8	2	30	39	32
Turkmenistan	10.7	499	225	1,700	2,424	1,925
Ukraine	3.8	354	50	150	554	200
Uzbekistan	2.9	186	78	400	663	478
Algeria	77.7	2,718	1,582	1,600	5,900	3,182
Angola	90.7	1,215	1,752	5,200	8,167	6,952
Benin	–	–	1	70	71	71
Cameroon	3.2	174	24	350	548	374
Chad	6.4	54	204	260	518	464

Cont'd of Tab. 6

Country / Region	Production	Cum. Production	Reserves	Resources	EUR	Reamining Potential
Congo, Democratic Republic	1.1	41	24	145	211	169
Congo, Republic	15.1	310	249	451	1,010	700
Côte d'Ivoire	2.0	26	14	300	340	314
Egypt	35.0	1,486	612	1,608	3,706	2,220
Equatorial Guinea	13.6	166	218	350	735	568
Eritrea	–	–	–	10	10	10
Ethiopia	–	–	–	20	20	20
Gabon	12.2	499	501	1,400	2,400	1,901
Gambia	–	–	–	20	20	20
Ghana	0.3	5	90	210	305	300
Guinea	–	–	–	150	150	150
Guinea-Bissau	–	–	–	40	40	40
Kenya	–	–	–	50	50	50
Libyan Arab Jamahiriya	73.8	3,641	6,316	1,200	11,157	7,516
Madagascar	–	–	–	55	55	55
Marocco	0.3	2	< 0,5	30	32	30
Mauretania	0.6	4	14	150	168	164
Mozambique	–	–	2	20	22	22
Namibia	–	–	–	150	150	150
Nigeria	101.7	3,980	4,960	3,090	12,030	8,050
Sao Tome and Principe	–	–	–	180	180	180
Senegal	–	–	–	140	140	140
Seychelles	–	–	–	5	5	5
Sierra Leone	–	–	–	260	260	260
Somalia	–	–	1	20	21	21
South Africa	8.4	22	2	20	44	22
Sudan	23.9	188	888	730	1,806	1,618
Tanzania, United Republic	–	–	–	10	10	10
Togo	–	–	–	70	70	70
Tunisia	3.9	194	58	300	552	358
Uganda	–	–	136	300	436	436
Western Sahara	–	–	–	30	30	30
Zimbabwe	–	–	–	10	10	10
Bahrain	9.0	212	17	200	429	217
Iran, Islamic Republic	203.2	8,994	20,450	7,200	36,644	27,650
Iraq	117.1	4,538	19,470	6,100	30,108	25,570
Israel	< 0.05	2	< 0,5	370	373	370
Jordan	< 0.05	–	< 0,5	5	5	5
Kuwait	120.3	5,598	13,810	700	20,108	14,510
Lebanon	–	–	–	150	150	150
Oman	41.0	1,262	700	700	2,662	1,400
Qatar	71.0	1,355	3,375	700	5,430	4,075
Saudi Arabia	467.8	17,645	34,000	11,800	63,445	45,800
Syrian Arab Republic	19.1	714	321	450	1,485	771

Cont'd of Tab. 6

Country / Region	Production	Cum. Production	Reserves	Resources	EUR	Reamining Potential
United Arab Emirates	128.9	4,036	12,544	1,100	17,680	13,644
Yemen	12.5	366	350	500	1,216	850
Afghanistan	–	–	–	140	140	140
Australia	23.8	960	555	1,100	2,615	1,655
Bangladesh	0.3	3	4	30	36	34
Brunei Darussalam	8.4	492	150	160	801	310
Cambodia	–	–	–	25	25	25
China	203.0	5,463	2,011	16,344	23,818	18,355
India	36.7	1,144	1,201	600	2,945	1,801
Indonesia	47.8	3,219	495	1,570	5,284	2,065
Japan	0.7	49	6	10	65	16
Korea, Republic	1.0	–	–	–	–	–
Lao People's Democratic Republic	–	–	–	< 0,5	< 0,5	< 0,5
Malaysia	32.1	972	789	850	2,611	1,639
Mongolia	–	–	2	50	52	52
Myanmar	1.0	53	7	150	210	157
New Zealand	2.5	53	21	50	124	71
Pakistan	3.4	89	39	150	278	189
Papua New Guinea	1.5	62	12	50	124	62
Philippines	1.2	14	19	270	303	289
Taiwan	< 0.05	5	< 0,5	5	10	5
Thailand	13.8	148	59	310	518	369
Timor-Leste	4.3	–	75	–	75	75
Viet Nam	18.0	272	599	600	1,470	1,199
Canada	162.8	4,928	27,400	85,354	117,682	112,754
Greenland	–	–	–	3,600	3,600	3,600
Mexico	146.3	5,867	1,551	3,000	10,419	4,551
United States	339.1	30,091	4,203	18,226	52,521	22,429
Argentina	32.5	1,448	342	500	2,290	842
Barbados	< 0.05	2	< 0,5	100	102	100
Belize	0.2	1	1	3	4	4
Bolivia	2.2	72	61	200	333	261
Brazil	106.1	1,704	1,938	6,000	9,642	7,938
Chile	0.2	61	20	75	157	95
Colombia	39.9	1,046	259	705	2,010	964
Cuba	2.8	53	17	608	678	625
Ecuador	25.2	661	838	157	1,656	995
Falkland Islands (Islas Malvinas)	–	–	–	500	500	500
(French) Guiana	–	–	–	400	400	400
Guatemala	0.6	19	11	10	40	21
Guyana	–	–	–	100	100	100
Paraguay	–	–	–	100	100	100
Peru	6.9	356	169	501	1,026	670

Cont'd of Tab. 6

Country / Region	Production	Cum. Production	Reserves	Resources	EUR	Reamining Potential
Suriname	0.8	11	11	50	72	61
Trinidad and Tobago	6.5	500	113	215	828	328
Uruguay	–	–	–	20	20	20
Venezuela, Bolivarian Republic	141.7	9,289	31,780	63,500	104,569	95,280
World	**3,936.7**	**162,681**	**216,912**	**298,081**	**677,674**	**514,993**
Europe	206.5	9,190	2,258	3,888	15,337	6,146
CIS	656.8	24,932	17,211	38,826	80,969	56,037
Africa	469.9	14,727	17,648	19,004	51,379	36,652
Middle East	1,190.0	44,724	105,037	29,975	179,736	135,012
Austral-Asia	399.7	12,997	6,044	22,464	41,505	28,508
North America	648.2	40,886	33,155	110,180	184,221	143,335
Latin America	365.7	15,225	35,559	73,744	124,529	109,303
OPEC-12	1,619.3	63,672	150,876	102,347	316,895	253,223
OPEC-Gulf	1,108.4	42,167	103,649	27,600	173,415	131,249
MENA	1,404.6	52,952	114,493	35,443	202,888	149,936
OECD	875.8	50,175	35,864	114,943	200,982	150,807
EU-27	95.9	5,590	1,231	1,823	8,644	3,054

– no reserves, resources or production

Tab. 7: *Crude Oil Resources in 2010 [Mt]:*

Main Coutries (Top 20) and Distribution by Regions and Economic Policy Organisations

Rank	Country / Region	Total	Conventional	Non-Conventional	
				Oil Sand	Extra Heavy Oil
1	Canada	85,354	3,500	81,853	1
2	Venezuela, Bolivarian Republic	63,500	3,000	–	60,500
3	Russian Federation	24,501	20,000	4,500	1
4	United States	18,226	17,300	850	76
5	China	16,344	16,200	25	119
6	Saudi Arabia	11,800	11,800	–	–
7	Kazakhstan	10,700	4,000	6,700	–
8	Iran, Islamic Republic	7,200	7,200	–	–
9	Iraq	6,100	6,100	–	–
10	Brazil	6,000	6,000	–	–
11	Angola	5,200	5,000	200	–
12	Greenland	3,600	3,600	–	–
13	Nigeria	3,090	3,000	90	–
14	Mexico	3,000	3,000	–	< 0.5
15	Norway	1,935	1,935	–	–
16	Turkmenistan	1,700	1,700	–	–
17	Egypt	1,608	1,600	–	8
18	Algeria	1,600	1,600	–	–
19	Indonesia	1,570	1,500	70	–
20	Gabon	1,400	1,400	–	–
	...				
99	Germany	20	20	–	–
	...				
	World	**298,078**	**142,935**	**94,369**	**60,774**
	Europe	3,888	3,832	30	26
	CIS	38,826	27,605	11,200	21
	Africa	19,004	18,665	331	8
	Middle East	29,975	29,975	n. s.	n. s.
	Austral-Asia	22,464	22,250	95	119
	North America	110,180	27,400	82,703	77
	Latin America	73,744	13,208	10	60,526
	OPEC-12	102,347	41,550	290	60,507
	OPEC-Gulf	27,600	27,600	n. s.	n. s.
	MENA	35,443	35,435	n. s.	8
	OECD	114,943	32,107	82,733	103
	EU–27	1,823	1,767	30	26

n. s. not specified

– no resources

Tab. 8: *Crude Oil Reserves in 2010 [Mt]:*

Main Coutries (Top 20) and Distribution by Regions and Economic Policy Organisations

Rank	Country / Region	Total	Conventional	Non-Conventional	
				Oil Sand	Extra Heavy Oil
1	Saudi Arabia	34,000	34,000	-	-
2	Venezuela, Bolivarian Republic	31,780	10,580	–	21,200
3	Canada	27,400	500	26,900	–
4	Iran, Islamic Republic	20,450	20,450	–	–
5	Iraq	19,470	19,470	–	–
6	Kuwait	13,810	13,810	–	–
7	United Arab Emirates	12,544	12,544	–	–
8	Russian Federation	10,531	10,531	–	–
9	Libyan Arab Jamahiriya	6,316	6,316	–	–
10	Kazakhstan	5,337	5,337	–	–
11	Nigeria	4,960	4,960	–	–
12	United States	4,203	4,200	–	3
13	Qatar	3,375	3,375	–	–
14	China	2,011	2,011	–	–
15	Brazil	1,938	1,938	–	–
16	Angola	1,752	1,752	–	–
17	Algeria	1,582	1,582	–	–
18	Mexico	1,551	1,551	–	–
19	India	1,201	1,201	–	–
20	Azerbaijan	952	952	–	–
	...				
56	Germany	41	41	–	–
	...				
	World	**216,912**	**168,806**	**26,900**	**21,206**
	Europe	2,258	2,255	n. s.	3
	CIS	17,211	17,211	n. s.	n. s.
	Africa	17,648	17,648	n. s.	n. s.
	Middle East	105,037	105,037	n. s.	n. s.
	Austral-Asia	6,044	6,044	n. s.	n. s.
	North America	33,155	6,252	26,900	3
	Latin America	35,559	14,359	n. s.	21,200
	OPEC-12	150,876	129,676	n. s.	21,200
	OPEC-Gulf	103,649	103,649	n. s.	n. s.
	MENA	114,493	114,493	n. s.	n. s.
	OECD	35,864	8,961	26,900	3
	EU-27	1,231	1,231	n. s.	n. s.

n. s. not specified

– no reserves

Tab. 9: *Crude Oil Production in 2010:*

Main Coutries (Top 20) and Distribution by Regions and Economic Policy Organisations

Rank	Country / Region	Mt	Share [%]	
			Country	Cumulative
1	Russian Federation	505.1	12.8	12.8
2	Saudi Arabia	467.8	11.9	24.7
3	United States	339.1	8.6	33.3
4	Iran, Islamic Republic	203.2	5.2	38.5
5	China	203.0	5.2	43.6
6	Canada	162.8	4.1	47.8
7	Mexico	146.3	3.7	51.5
8	Venezuela, Bolivarian Republic	141.7	3.6	55.1
9	United Arab Emirates	128.9	3.3	58.4
10	Kuwait	120.3	3.1	61.4
11	Iraq	117.1	3.0	64.4
12	Norway	106.2	2.7	67.1
13	Brazil	106.1	2.7	69.8
14	Nigeria	101.7	2.6	72.4
15	Angola	90.7	2.3	74.7
16	Kazakhstan	81.6	2.1	76.8
17	Algeria	77.7	2.0	78.7
18	Libyan Arab Jamahiriya	73.8	1.9	80.6
19	Qatar	71.0	1.8	82.4
20	United Kingdom	63.0	1.6	84.0
	...			
56	Germany	2.5	0.1	
	...			
	World	**3,936.7**	**100.0**	
	Europe	206.5	5.2	
	CIS	656.8	16.7	
	Africa	469.9	11.9	
	Middle East	1,190.0	30.2	
	Austral-Asia	399.7	10.2	
	North America	648.2	16.5	
	Latin America	365.7	9.3	
	OPEC-12	1,619.3	41.1	
	OPEC-Gulf	1,108.4	28.2	
	MENA	1,404.6	35.7	
	OECD	875.8	22.2	
	EU-27	95.9	2.4	

Tab. 10: *Oil Demand in 2010:*

Main Coutries (Top 20) and Distribution by Regions and Economic Policy Organisations

Rank	Country / Region	Mt	Share [%]	
			Country	Cumulative
1	United States	833.6	21.2	21.2
2	China	428.6	10.9	32.1
3	Japan	203.1	5.2	37.2
4	India	155.5	3.9	41.2
5	Russian Federation	147.6	3.7	44.9
6	Brazil	116.9	3.0	47.9
7	Saudi Arabia	112.8	2.9	50.8
8	Germany	105.7	2.7	53.4
9	Korea, Republic	98.8	2.5	55.9
10	Canada	90.2	2.3	58.2
11	Mexico	89.5	2.3	60.5
12	Iran, Islamic Republic	88.8	2.3	62.8
13	France	86.3	2.2	65.0
14	United Kingdom	72.6	1.8	66.8
15	Italy	72.5	1.8	68.6
16	Spain	62.3	1.6	70.2
17	Singapore	62.2	1.6	71.8
18	Indonesia	59.6	1.5	73.3
19	Thailand	50.2	1.3	74.6
20	Taiwan	46.2	1.2	75.8
	World	**3,937.1**	**100.0**	
	Europe	684.3	17.4	
	CIS	205.9	5.2	
	Africa	153.3	3.9	
	Middle East	343.1	8.7	
	Austral-Asia	1,258.6	32.0	
	North America	1,013.3	25.7	
	Latin America	278.6	7.1	
	OPEC-12	383.5	9.7	
	OPEC-Gulf	288.9	7.3	
	MENA	427.8	10.9	
	OECD	2,009.1	51.0	
	EU-27	619.1	15.7	

Tab. 11: *Crude Oil Export in 2010:*

Main Coutries (Top 20) and Distribution by Regions and Economic Policy Organisations

Rank	Country / Region	Mt	Share [%]	
			Country	Cumulative
1	Saudi Arabia	332.2	16.0	16.0
2	Russian Federation	280.5	13.5	29.4
3	Nigeria	123.2	5.9	35.4
4	Iran, Islamic Republic	112.4	5.4	40.8
5	United Arab Emirates	101.3	4.9	45.6
6	Canada	98.2	4.7	50.3
7	Iraq	94.5	4.5	54.9
8	Angola	84.2	4.0	58.9
9	Norway	79.5	3.8	62.7
10	Venezuela, Bolivarian Republic	78.1	3.8	66.5
11	Kazakhstan	74.0	3.6	70.0
12	Mexico	72.3	3.5	73.5
13	Kuwait	71.5	3.4	77.0
14	Libyan Arab Jamahiriya	55.9	2.7	79.6
15	United Kingdom	41.7	2.0	81.6
16	Oman	37.3	1.8	83.4
17	Algeria	35.5	1.7	85.1
18	Azerbaijan	30.0	1.4	86.6
19	Qatar	29.3	1.4	88.0
20	Colombia	24.1	1.2	89.1
	...			
54	Germany	0.7	< 0.05	
	...			
	World	**2,081.4**	**100.0**	
	Europe	142.9	6.9	
	CIS	389.5	18.7	
	Africa	367.4	17.7	
	Middle East	791.1	38.0	
	Austral-Asia	76.8	3.7	
	North America	179.6	8.6	
	Latin America	134.2	6.4	
	OPEC-12	1,135.0	54.5	
	OPEC-Gulf	741.2	35.6	
	MENA	909.8	43.7	
	OECD	340.9	16.4	
	EU-27	63.4	3.0	

Tab. 12: *Crude Oil Import in 2010:*

Main Coutries (Top 20) and Distribution by Regions and Economic Policy Organisations

Rank	County / Region	Mt	Share [%]	
			Country	Cumulative
1	United States	456.1	21.2	21.2
2	China	234.6	10.9	32.1
3	Japan	180.4	8.4	40.5
4	India	129.9	6.0	46.5
5	Korea, Republic	118.1	5.5	52.0
6	Germany	93.3	4.3	56.3
7	Italy	85.6	4.0	60.3
8	France	64.4	3.0	63.3
9	Netherlands	62.7	2.9	66.2
10	Spain	56.2	2.6	68.8
11	United Kingdom	54.8	2.5	71.3
12	Taiwan	43.8	2.0	73.4
13	Thailand	40.8	1.9	75.3
14	Canada	39.2	1.8	77.1
15	Singapore	35.7	1.7	78.8
16	Belgium	34.9	1.6	80.4
17	Poland	23.3	1.1	81.5
18	Australia	21.9	1.0	82.5
19	Greece	21.5	1.0	83.5
20	Sweden	20.2	0.9	84.4
	World	**2,152.8**	**100.0**	
	Europe	636.2	29.6	
	CIS	32.1	1.5	
	Africa	22.4	1.0	
	Middle East	27.3	1.3	
	Austral-Asia	872.5	40.5	
	North America	495.7	23.0	
	Latin America	66.6	3.1	
	OPEC-12	–	–	
	OPEC-Gulf	–	–	
	MENA	38.4	1.8	
	OECD	1,414.9	65.7	
	EU-27	599.6	27.9	

– no imports

Tab. 13: *Natural Gas in 2010 [Mrd. m³]:*

Country / Region	Production	Cum. Production	Reserves	Resources	EUR	Reamining Potential
Albania	< 0.05	8	1	10	19	11
Austria	1.7	93	16	820	929	836
Bulgaria	0.1	6	5	660	671	665
Croatia	2.7	64	25	50	139	75
Cyprus	–	–	–	250	250	250
Czech Republic	0.3	14	5	20	39	25
Denmark	8.2	159	66	671	897	737
France	0.7	227	5	5,302	5,534	5,307
Germany	14.2	975	146	827	1,947	973
Greece	< 0.05	1	1	10	12	11
Hungary	2.9	220	8	377	605	385
Ireland	0.4	55	10	50	115	60
Italy	8.3	720	66	500	1,286	566
Lithuania	–	–	–	113	113	113
Malta	–	–	–	10	10	10
Netherlands	82.9	3,216	1,232	1,181	5,629	2,413
Norway	106.4	1,542	2,069	4,351	7,962	6,420
Poland	4.5	244	98	5,536	5,878	5,634
Portugal	–	–	–	40	40	40
Romania	10.9	1,254	595	420	2,269	1,015
Serbia	0.3	31	40	10	81	50
Slovakia	0.1	25	13	10	48	23
Slovenia	–	–	–	15	15	15
Spain	0.1	11	3	404	418	406
Sweden	–	–	–	1,161	1,161	1,161
Turkey	0.7	12	6	908	925	914
United Kingdom	54.6	2,337	520	490	3,347	1,010
Azerbaijan	18.2	495	1,880	1,900	4,275	3,780
Belarus	0.2	12	3	20	35	23
Georgia	< 0.05	3	8	102	113	110
Kazakhstan	33.6	413	3,250	3,750	7,413	7,000
Kyrgyzstan	< 0.05	7	6	20	33	26
Moldova, Republic	–	–	–	20	20	20
Russian Federation	610.6	19,215	47,578	142,050	208,843	189,628
Tajikistan	< 0.05	8	6	100	114	106
Turkmenistan	42.4	2,308	8,030	5,000	15,338	13,030
Ukraine	20.6	1,928	935	3,790	6,653	4,725
Uzbekistan	64.7	2,020	1,560	1,500	5,079	3,060
Algeria	83.9	1,989	4,503	7,914	14,405	12,417
Angola	0.7	19	305	1,200	1,524	1,505
Benin	–	–	1	100	101	101

Cont'd of Tab. 13

Country / Region	Production	Cum. Production	Reserves	Resources	EUR	Reamining Potential
Botswana	–	–	–	1,840	1,840	1,840
Cameroon	–	–	155	200	355	355
Chad	–	–	–	100	100	100
Congo, Democratic Republic	< 0.05	–	1	10	11	11
Congo, Republic	0.4	–	127	200	327	327
Côte d'Ivoire	1.4	21	28	400	449	428
Egypt	61.3	597	2,185	8,200	10,982	10,385
Equatorial Guinea	6.1	23	37	120	179	157
Eritrea	–	–	–	100	100	100
Ethiopia	–	–	25	20	45	45
Gabon	0.2	4	28	600	632	628
Gambia	–	–	–	25	25	25
Ghana	–	–	27	300	327	327
Guinea	–	–	–	200	200	200
Guinea-Bissau	–	–	–	50	50	50
Kenya	–	–	–	20	20	20
Liberia	–	–	–	200	200	200
Libyan Arab Jamahiriya	15.8	266	1,522	8,813	10,602	10,335
Madagascar	–	–	–	5	5	5
Marocco	< 0.05	2	1	317	321	318
Mauretania	–	–	28	200	228	228
Mozambique	3.5	18	127	200	346	327
Namibia	–	–	62	250	312	312
Nigeria	32.9	340	5,292	2,000	7,632	7,292
Rwanda	–	–	–	50	50	50
Sao Tome and Principe	–	–	–	100	100	100
Senegal	–	–	10	200	210	210
Seychelles	–	–	–	20	20	20
Sierra Leone	–	–	–	300	300	300
Somalia	–	–	6	400	406	406
South Africa	3.7	37	12	13,824	13,873	13,836
Sudan	–	–	85	300	385	385
Tanzania, United Republic	0.8	–	34	100	134	134
Togo	–	–	–	100	100	100
Tunisia	3.8	41	65	710	816	775
Uganda	–	–	14	–	14	14
Western Sahara	–	–	–	228	228	228
Zimbabwe	–	–	–	10	10	10
Bahrain	12.9	225	92	200	517	292
Iran, Islamic Republic	138.5	1,738	30,065	11,000	42,803	41,065
Iraq	1.3	102	3,168	4,000	7,269	7,168
Israel	3.2	10	198	2,000	2,209	2,198
Jordan	0.3	5	4	50	59	54

Cont'd Tab. 13

Country / Region	Production	Cum. Production	Reserves	Resources	EUR	Reamining Potential
Kuwait	11.9	278	1,784	500	2,562	2,284
Lebanon	–	–	–	900	900	900
Oman	27.1	287	690	1,500	2,477	2,190
Palestina	–	–	30	300	330	330
Qatar	116.7	805	25,322	2,000	28,127	27,322
Saudi Arabia	83.9	1,393	7,794	19,000	28,186	26,794
Syrian Arab Republic	7.8	110	258	300	668	558
United Arab Emirates	51.0	987	6,031	1,500	8,517	7,531
Yemen	6.4	9	488	500	998	988
Afghanistan	–	–	50	420	470	470
Australia	50.4	890	2,920	18,245	22,056	21,166
Bangladesh	20.0	260	366	900	1,527	1,266
Brunei Darussalam	12.2	360	301	200	862	501
Cambodia	–	–	–	50	50	50
China	96.8	1,053	2,808	55,100	58,961	57,908
India	50.9	604	1,450	3,864	5,918	5,315
Indonesia	82.8	1,769	3,068	4,781	9,618	7,849
Japan	3.3	123	37	5	165	42
Korea, Republic	0.5	n. s.	20	50	70	70
Lao People's Democratic Republic	–	–	–	5	5	5
Malaysia	63.9	1,006	2,397	1,950	5,353	4,347
Mongolia	–	–	–	23	23	23
Myanmar	12.1	134	333	700	1,167	1,033
New Zealand	4.3	141	34	153	329	187
Pakistan	39.5	679	824	3,044	4,547	3,868
Papua New Guinea	0.3	3	442	350	795	792
Philippines	3.2	25	89	502	616	591
Taiwan	0.3	50	6	5	62	11
Thailand	36.3	412	312	550	1,274	862
Timor-Leste	–	–	105	–	105	105
Viet Nam	9.4	63	617	1,442	2,122	2,059
Canada	159.8	5,361	1,701	24,413	31,475	26,114
Greenland	–	–	–	3,950	3,950	3,950
Mexico	55.3	1,425	490	20,717	22,632	21,208
United States	611.0	31,536	7,717	64,880	104,133	72,597
Argentina	40.1	989	379	23,021	24,390	23,400
Barbados	–	–	< 0.5	200	200	200
Bolivia	14.4	185	281	2,059	2,526	2,340
Brazil	14.4	211	417	11,901	12,528	12,317
Chile	1.8	104	43	1,993	2,140	2,036
Colombia	11.3	208	124	1,412	1,744	1,536
Cuba	1.2	11	71	20	101	91
Ecuador	0.3	5	7	20	32	27
Grenada	–	–	–	25	25	25

Cont'd of Tab. 13

Country / Region	Production	Cum. Production	Reserves	Resources	EUR	Reamining Potential
Guatemala	–	–	–	5	5	5
Guyana	–	–	–	100	100	100
Paraguay	–	–	–	1,856	1,856	1,856
Peru	7.2	66	353	200	619	553
Suriname	–	–	–	100	100	100
Trinidad and Tobago	42.4	460	365	900	1,724	1,265
Uruguay	–	–	–	995	995	995
Venezuela, Bolivarian Republic	28.5	987	5,199	3,312	9,497	8,511
World	**3,239.5**	**96,050**	**192,115**	**530,542**	**818,707**	**722,657**
Europe	299.8	11,215	4,930	24,196	40,341	29,126
CIS	790.3	26,409	63,255	158,251	247,915	221,506
Africa	214.6	3,357	14,682	49,926	67,965	64,608
Middle East	461.0	5,948	75,923	43,750	125,621	119,673
Austral-Asia	486.0	7,573	16,179	92,340	116,093	108,519
North America	826.1	38,322	9,908	113,960	162,190	123,868
Latin America	161.6	3,226	7,238	48,118	58,582	55,357
OPEC-12	565.5	8,907	90,990	61,259	161,157	152,249
OPEC-Gulf	403.4	5,302	74,162	38,000	117,464	112,162
MENA	625.9	8,843	84,254	69,704	162,802	153,959
OECD	1,170.5	49,328	17,183	155,072	221,583	172,254
EU-27	189.8	9,558	2,789	18,868	31,215	21,657
European Market	1,087.8	35,571	59,328	123,690	218,589	183,018
Asian Market	512.0	7,766	20,461	144,840	173,067	165,301
Norrth American Market	826.1	38,322	9,908	113,960	162,190	123,868
Latin American Market	77.9	1,556	1,473	42,025	45,053	43,497
Transition Zone	601.7	10,704	88,774	54,120	153,598	142,894

n. s. no specified

– no production, reserves or resources

Tab. 14: *Natural Gas Resources in 2010 [Mrd. m³]:*

Main Coutries (Top 20) and Distribution by Regions and Economic Policy Organisations

Rank	Country / Region	Total	Conventional	Non-Conventional	
				Shale Gas	CBM
1	Russian Federation	142,050	120,000	9,500	12,550
2	United States	64,880	36,000	24,410	4,470
3	China	55,100	27,000	17,200	10,900
4	Canada	24,413	17,250	3,600	3,563
5	Argentina	23,021	1,100	21,921	–
6	Mexico	20,717	1,400	19,287	30
7	Saudi Arabia	19,000	19,000	–	–
8	Australia	18,245	2,600	11,215	4,430
9	South Africa	13,824	50	13,736	38
10	Brazil	11,901	5,500	6,401	–
11	Iran, Islamic Republic	11,000	11,000	–	–
12	Libyan Arab Jamahiriya	8,813	600	8,213	–
13	Egypt	8,200	8,200	–	–
14	Algeria	7,914	1,400	6,514	–
15	Poland	5,536	150	5,296	90
16	France	5,302	200	5,098	4
17	Turkmenistan	5,000	5,000	–	–
18	Indonesia	4,781	3,150	–	1,631
19	Norway	4,351	2,000	2,351	–
20	Iraq	4,000	4,000	–	–
	...				
49	Germany	827	150	227	450
	...				
	World	**530,542**	**312,045**	**172,904**	**45,593**
	Europe	24,196	4,985	17,734	1,478
	CIS	158,251	131,510	10,690	16,052
	Africa	49,926	18,565	30,483	878
	Middle East	43,750	43,750	n. s.	n. s.
	Austral-Asia	92,340	41,785	31,644	18,911
	North America	113,960	58,600	47,297	8,063
	Latin America	48,118	12,850	35,056	212
	OPEC-12	61,259	46,220	15,039	n. s.
	OPEC-Gulf	38,000	38,000	n. s.	n. s.
	MENA	69,704	54,155	15,549	n. s.
	OECD	155,072	65,835	75,303	13,934
	EU-27	18,868	2,715	14,958	1,195
	European Market	123,690	85,740	34,670	3,279
	Asian Market	144,840	94,285	31,644	18,911
	Norrth American Market	113,960	58,600	47,297	8,063
	Latin American Market	42,025	8,180	33,845	n. s.
	Transition Zone	54,120	52,420	n. s.	1,700

n. s. no specified – no resources

Tab. 15: *Natural Gas Reserves in 2010 [Mrd. m³]:*

Main Coutries (Top 20) and Distribution by Regions and Economic Policy Organisations

Rank	Country / Region	Total	Conventional	Non-Conventional	
				Shale Gas	CBM
1	Russian Federation	47,578	47,532	–	–
2	Iran, Islamic Republic	30,065	30,065	–	–
3	Qatar	25,322	25,322	–	–
4	Turkmenistan	8,030	8,030	–	–
5	Saudi Arabia	7,794	7,794	–	–
6	United States	7,717	5,472	1,718	526
7	United Arab Emirates	6,031	6,031	–	–
8	Nigeria	5,292	5,292	–	–
9	Venezuela, Bolivarian Republic	5,199	5,199	–	–
10	Algeria	4,503	4,503	–	–
11	Kazakhstan	3,250	3,250	–	–
12	Iraq	3,168	3,168	–	–
13	Indonesia	3,068	3,068	–	–
14	Australia	2,920	2,233	–	687
15	China	2,808	2,745	–	62
16	Malaysia	2,397	2,397	–	–
17	Egypt	2,185	2,185	–	–
18	Norway	2,069	2,069	–	–
19	Azerbaijan	1,880	1,880	–	–
20	Kuwait	1,784	1,784	–	–
	...				
48	Germany	146	146	–	–
	...				
	World	**192,115**	**188,770**	**1,718**	**1,626**
	Europe	4,930	4,930	–	–
	CIS	63,255	63,209	–	46
	Africa	14,682	14,682	–	–
	Middle East	75,923	75,923	–	–
	Austral-Asia	16,179	15,192	–	987
	North America	9,908	7,596	1,718	594
	Latin America	7,238	7,238	–	–
	OPEC-12	90,990	90,990	–	–
	OPEC-Gulf	74,162	74,162	–	–
	MENA	84,254	84,254	–	–
	OECD	17,183	14,184	1,718	1,281
	EU-27	2,789	2,789	–	–
	European Market	59,328	59,328	–	–
	Asian Market	20,461	19,474	–	987
	Norrth American Market	9,908	7,596	1,718	594
	Latin American Market	1,473	1,473	–	–
	Transition Zone	88,774	88,774	–	–

– no reserves

Tab. 16: *Natural Gas Production in 2010:*

Main Coutries (Top 20) and Distribution by Regions and Economic Policy Organisations

Rank	Country / Region	Mrd. m³	Share [%]	
			Country	Cumulative
1	United States	611.0	18.9	18.9
2	Russian Federation	610.6	18.8	37.7
3	Canada	159.8	4.9	42.6
4	Iran, Islamic Republic	138.5	4.3	46.9
5	Qatar	116.7	3.6	50.5
6	Norway	106.4	3.3	53.8
7	China	96.8	3.0	56.8
8	Saudi Arabia	83.9	2.6	59.4
9	Algeria	83.9	2.6	62.0
10	Netherlands	82.9	2.6	64.5
11	Indonesia	82.8	2.6	67.1
12	Uzbekistan	64.7	2.0	69.1
13	Malaysia	63.9	2.0	71.1
14	Egypt	61.3	1.9	73.0
15	Mexico	55.3	1.7	74.7
16	United Kingdom	54.6	1.7	76.3
17	United Arab Emirates	51.0	1.6	77.9
18	India	50.9	1.6	79.5
19	Australia	50.4	1.6	81.0
20	Trinidad and Tobago	42.4	1.3	82.3
	...			
35	Germany	14.2	0.4	
	...			
	World	**3,239.5**	**100.0**	
	Europe	299.8	9.3	
	CIS	790.3	24.4	
	Africa	214.6	6.6	
	Middle East	461.0	14.2	
	Austral-Asia	486.0	15.0	
	Nord Amerika	826.1	25.5	
	Latin America	161.6	5.0	
	OPEC-12	565.5	17.5	
	OPEC-Gulf	403.4	12.5	
	MENA	625.9	19.3	
	OECD	1,170.5	36.1	
	EU-27	189.8	5.9	
	European Market	1,087.8	33.6	
	Asian Market	512.0	15.8	
	Norrth American Market	826.1	25.5	
	Latin American Market	77.9	2.4	
	Transition Zone	601.7	18.6	

Tab. 17: *Natural Gas Consumption in 2010:*

Main Coutries (Top 20) and Distribution by Regions and Economic Policy Organisations

Rank	Country / Region	Mrd. m³	Share [%]	
			Country	Cumulative
1	United States	683.4	21.0	21.0
2	Russian Federation	458.1	14.1	35.1
3	Iran, Islamic Republic	136.9	4.2	39.3
4	China	108.9	3.4	42.7
5	Germany	95.9	3.0	45.7
6	Japan	94.5	2.9	48.6
7	United Kingdom	93.8	2.9	51.4
8	Canada	93.8	2.9	54.3
9	Saudi Arabia	83.9	2.6	56.9
10	Italy	83.0	2.6	59.5
11	Mexico	68.9	2.1	61.6
12	India	61.9	1.9	63.5
13	United Arab Emirates	60.5	1.9	65.4
14	Ukraine	52.1	1.6	67.0
15	Uzbekistan	50.6	1.6	68.5
16	France	46.9	1.4	70.0
17	Netherlands	46.8	1.4	71.4
18	Egypt	45.1	1.4	72.8
19	Thailand	45.1	1.4	74.2
20	Argentina	43.3	1.3	75.5
	World	**3.249.0**	**100.0**	
	Europe	571.4	17.6	
	CIS	645.0	19.9	
	Africa	104.3	3.2	
	Middle East	364.5	11.2	
	Austral-Asia	569.9	17.5	
	North America	846.1	26.0	
	Latin America	147.8	4.5	
	OPEC-12	392.8	12.1	
	OPEC-Gulf	317.5	9.8	
	MENA	450.9	13.9	
	OECD	1,561.5	48.1	
	EU-27	518.5	16.0	
	European Market	744.6	22.9	
	Asian Market	569.9	17.5	
	Norrth American Market	846.1	26.0	
	Latin American Market	83.1	2.6	
	Transition Zone	462.6	14.2	

Tab. 18: *Natural Gas Export in 2010:*

Main Coutries (Top 20) and Distribution by Regions and Economic Policy Organisations

Rank	Country / Region	Mrd. m³	Share [%]	
			Country	Cumulative
1	Russian Federation	199.9	20.4	20.4
2	Norway	100.6	10.3	30.7
3	Qatar	94.9	9.7	40.4
4	Canada	92.7	9.5	49.9
5	Algeria	55.8	5.7	55.6
6	Netherlands	53.3	5.5	61.0
7	Indonesia	42.4	4.3	65.4
8	Malaysia	32.0	3.3	68.6
9	United States	32.0	3.3	71.9
10	Australia	25.4	2.6	74.5
11	Nigeria	24.0	2.5	77.0
12	Trinidad and Tobago	20.4	2.1	79.0
13	Turkmenistan	19.7	2.0	81.0
14	United Kingdom	15.7	1.6	82.6
15	Egypt	15.2	1.6	84.2
16	Uzbekistan	14.9	1.5	85.7
17	Germany	14.1	1.4	87.2
18	Kazakhstan	11.9	1.2	88.4
19	Bolivia	11.7	1.2	89.6
20	Oman	11.5	1.2	90.7
	World	**978.5**	**100.0**	
	Europe	201.2	20.6	
	CIS	252.9	25.8	
	Africa	112.9	11.5	
	Middle East	128.2	13.1	
	Austral-Asia	121.2	12.4	
	North America	125.5	12.8	
	Latin America	36.4	3.7	
	OPEC-12	200.8	20.5	
	OPEC-Gulf	111.2	11.4	
	MENA	208.9	21.3	
	OECD	351.6	35.9	
	EU-27	99.5	10.2	
	European Market	480.7	49.1	
	Asian Market	128.8	13.2	
	Norrth American Market	125.5	12.8	
	Latin American Market	13.9	1.4	
	Transition Zone	174.7	17.9	

Tab. 19: *Natural Gas Imports in 2010:*

Main Coutries (Top 20) and Distribution by Regions and Economic Policy Organisations

Rank	Country / Region	Mrd. m³	Share [%]	
			Country	Cumulative
1	United States	105.5	10.7	10.7
2	Germany	97.9	9.9	20.6
3	Japan	93.5	9.5	30.1
4	Italy	75.3	7.6	37.8
5	United Kingdom	53.6	5.4	43.2
6	France	48.9	5.0	48.2
7	Korea, Republic	44.4	4.5	52.7
8	Russian Federation	38.2	3.9	56.6
9	Turkey	36.7	3.7	60.3
10	Spain	36.4	3.7	64.0
11	Ukraine	33.0	3.4	67.4
12	Canada	22.9	2.3	69.7
13	Belgium	20.8	2.1	71.8
14	Belarus	19.5	2.0	73.8
15	United Arab Emirates	17.4	1.8	75.5
16	Netherlands	17.0	1.7	77.3
17	China	16.4	1.7	78.9
18	Mexico	15.2	1.5	80.5
19	Taiwan	14.9	1.5	82.0
20	Brazil	12.6	1.3	83.3
	World	**985.0**	**100.0**	
	Europe	468.1	47.5	
	CIS	99.8	10.1	
	Africa	4.9	0.5	
	Middle East	34.0	3.5	
	Austral-Asia	211.1	21.4	
	North America	143.5	14.6	
	Latin America	23.5	2.4	
	OPEC-12	29.2	3.0	
	OPEC-Gulf	27.0	2.7	
	MENA	35.7	3.6	
	OECD	741.8	75.3	
	EU-27	424.4	43.1	
	European Market	525.6	53.4	
	Asian Market	211.1	21.4	
	Norrth American Market	143.5	14.6	
	Latin American Market	19.7	2.0	
	Transition Zone	38.8	3.9	

Tab. 20: *Hard Coal in 2010 [Mt]:*

Country / Region	Production	Reserves	Resources	Reamining Potential
Belgium	–	–	4,100	4,100
Bosnia and Heregovina	–	484	146	630
Bulgaria	2.2	192	3,920	4,112
Czech Republic	11.2	1,152	15,475	16,628
France	0.3	–	160	160
Germany	14.1	59	82,962	83,021
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	1.9	8	70	78
Poland	76.7	13,070	163,668	176,739
Portugal	–	3	n. s.	3
Romania	2.2	11	2,435	2,446
Serbia	0.1	402	453	855
Slovakia	–	–	19	19
Slovenia	–	56	39	95
Spain	8.8	868	3,363	4,231
Sweden	–	1	4	5
Turkey	2.6	386	804	1,191
United Kingdom	18.4	371	186,700	187,071
Armenia	–	163	154	317
Georgia	< 0.05	201	700	901
Kazakhstan	105.2	18,750	129,966	148,716
Kyrgyzstan	0.1	971	27,528	28,499
Russian Federation	247.9	68,655	2,662,155	2,730,810
Tajikistan	0.2	375	3,700	4,075
Turkmenistan	–	–	800	800
Ukraine	75.0	32,039	49,006	81,045
Uzbekistan	0.2	1,425	9,910	11,335
Algeria	–	59	164	223
Botswana	0.7	40	21,200	21,240
Congo, Democratic Republic	0.1	88	900	988
Egypt	< 0.05	16	166	182
Madagascar	–	–	150	150
Malawi	0.1	2	800	802
Marocco	–	14	82	96
Mozambique	< 0.05	849	23,338	24,187
Namibia	–	–	350	350
Niger	0.2	–	90	90
Nigeria	< 0.05	292	2,065	2,357
South Africa	254.7	27,981	n. s.	27,981
Swaziland	0.1	144	4,500	4,644
Tanzania, United Republic	< 0.05	269	1,141	1,410
Uganda	–	–	800	800
Zambia	< 0.05	45	900	945

Cont'd of Tab. 20

Country / Region	Production	Reserves	Resources	Reamining Potential
Zimbabwe	2.6	502	25,000	25,502
Iran, Islamic Republic	1.5	1,203	40,000	41,203
Afghanistan	0.5	66	n. s.	66
Australia	355.4	43,800	1,573,700	1,617,500
Bangladesh	0.9	293	2,967	3,260
Bhutan	0.1	n. s.	n. s.	n. s.
China	3.115.0	180,600	5,010,000	5,190,600
India	537.6	74,629	171,861	246,490
Indonesia	327.0	9,317	71,335	80,652
Japan	0.9	340	13,543	13,883
Korea, Democratic People's Republic	24.0	600	10,000	10,600
Korea, Republic	2.1	326	1,360	1,686
Lao People's Democratic Republic	< 0.05	4	58	62
Malaysia	2.4	141	1,068	1,209
Mongolia	20.6	1,170	39,854	41,024
Myanmar	1.1	3	248	252
Nepal	< 0.05	1	7	8
New Caledonia	–	2	n. s.	2
New Zealand	5.0	825	2,350	3,175
Pakistan	3.3	89	443	532
Philippines	7.1	211	1,012	1,223
Taiwan	–	1	101	102
Viet Nam	44.7	3,116	3,519	6,635
Canada	57.8	4,346	183,260	187,606
Greenland	–	183	200	383
Mexico	11.2	1,160	3,000	4,160
United States	918.2	225,845	6,457,242	6,683,087
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	74.4	4,945	9,928	14,873
Costa Rica	–	–	17	17
Peru	0.1	102	1,465	1,567
Venezuela, Bolivarian Republic	4.0	850	7,803	8,653
World	**6,341.0**	**728,278**	**17,203,972**	**17,932,250**
Europe	138.6	18,004	472,965	490,969
CIS	428.6	122,578	2,883,919	3,006,497
Africa	258.6	30,300	81,646	111,946
Middle East	1.5	1,203	40,000	41,203
Austral-Asia	4,447.8	315,535	6,903,426	7,218,960
North America	987.2	231,534	6,643,702	6,875,236
Latin America	78.7	9,126	28,313	37,439
Antarktis	–	–	150,000	150,000
OPEC-12	5.5	2,403	50,032	52,435
OPEC-Gulf	1.5	1,203	40,000	41,203
MENA	1.5	1,291	40,412	41,703
OECD	1,484.7	293,542	8,700,431	8,993,973
EU27	134.0	16,581	471,297	487,878

n. s. no specified – no production, reserves or resources

Tab. 21: *Hard Coal Resources in 2010:*

Main Coutries (Top 20) and Distribution by Regions and Economic Policy Organisations

Rank	Country / Region	Mt	Share [%]	
			Country	Cumulative
1	United States	6,457,242	37.5	37.5
2	China	5,010,000	29.1	66.7
3	Russian Federation*	2,662,155	15.5	82.1
4	Australia	1,573,700	9.1	91.3
5	United Kingdom	186,700	1.1	92.4
6	Canada	183,260	1.1	93.4
7	India	171,861	1.0	94.4
8	Poland	163,668	1.0	95.4
9	Kazakhstan	129,966	0.8	96.1
10	Germany	82,962	0.5	96.6
11	Indonesia	71,335	0.4	97.0
12	Ukraine*	49,006	0.3	97.3
13	Iran, Islamic Republic	40,000	0.2	97.5
14	Mongolia*	39,854	0.2	97.8
15	Kyrgyzstan	27,528	0.2	97.9
16	Zimbabwe	25,000	0.1	98.1
17	Mozambique	23,338	0.1	98.2
18	Botswana	21,200	0.1	98.3
19	Czech Republic*	15,475	0.1	98.4
20	Japan	13,543	0.1	98.5
	World	**17,203,972**	**100.0**	
	Europe	472,965	2.7	
	CIS	2,883,919	16.8	
	Africa	81,646	0.5	
	Middle East	40,000	0.2	
	Austral-Asia	6,903,426	40.1	
	North America	6,643,702	38.6	
	Latin America	28,313	0.2	
	Antarktis	150,000	0.9	
	OPEC-12	50,032	0.3	
	OPEC-Gulf	40,000	0.2	
	MENA	40,412	0.2	
	OECD	8,700,431	50.6	
	EU-27	471,297	2.7	

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

Tab. 22: *Hard Coal Reserves in 2010:*

Main Coutries (Top 20) and Distribution by Regions and Economic Policy Organisations

Rank	Country / Region	Mt	Share [%]	
			Country	Cumulative
1	United States	225,845	31.0	31.0
2	China	180,600	24.8	55.8
3	India	74,629	10.2	66.1
4	Russian Federation*	68,655	9.4	75.5
5	Australia	43,800	6.0	81.5
6	Ukraine*	32,039	4.4	85.9
7	South Africa	27,981	3.8	89.7
8	Kazakhstan	18,750	2.6	92.3
9	Poland	13,070	1.8	94.1
10	Indonesia	9,317	1.3	95.4
11	Colombia	4,945	0.7	96.1
12	Canada	4,346	0.6	96.7
13	Viet Nam	3,116	0.4	97.1
14	Brazil	1,547	0.2	97.3
15	Uzbekistan	1,425	0.2	97.5
16	Iran, Islamic Republic	1,203	0.2	97.7
17	Chile	1,181	0.2	97.8
18	Mongolia*	1,170	0.2	98.0
19	Mexico	1,160	0.2	98.1
20	Czech Republic*	1,152	0.2	98.3
	...			
53	Germany**	59	< 0.05	–
	...			
	World	**728,278**	**100.0**	
	Europe	18,004	2.5	
	CIS	122,578	16.8	
	Africa	30,300	4.2	
	Middle East	1,203	0.2	
	Austral-Asia	315,535	43.3	
	North America	231,534	31.8	
	Latin America	9,126	1.3	
	OPEC-12	2,403	0.3	
	OPEC-Gulf	1,203	0.2	
	MENA	1,291	0.2	
	OECD	293,542	40.3	
	EU–27	16,581	2.3	

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

** Deviating from the BGR reserves definition, RAG AG refers to a „Technically extractable planned inventory“ of 2.5 billion t.

Tab. 23: *Hard Coal Production in 2010:*

Main Coutries (Top 20) and Distribution by Regions and Economic Policy Organisations

Rank	Country / Region	Mt	Share [%]	
			Country	Cumulative
1	China	3.115.0	49.1	49.1
2	United States	918.2	14.5	63.6
3	India	537.6	8.5	72.1
4	Australia	355.4	5.6	77.7
5	Indonesia	327.0	5.2	82.8
6	South Africa	254.7	4.0	86.9
7	Russian Federation*	247.9	3.9	90.8
8	Kazakhstan	105.2	1.7	92.4
9	Poland	76.7	1.2	93.6
10	Ukraine*	75.0	1.2	94.8
11	Colombia	74.4	1.2	96.0
12	Canada	57.8	0.9	96.9
13	Viet Nam	44.7	0.7	97.6
14	Korea, Democratic People's Republic	24.0	0.4	98.0
15	Mongolia*	20.6	0.3	98.3
16	United Kingdom	18.4	0.3	98.6
17	Germany	14.1	0.2	98.8
18	Mexico	11.2	0.2	99.0
19	Czech Republic*	11.2	0.2	99.2
20	Spain	8.8	0.1	99.3
	World	**6,341.0**	**100.0**	
	Europe	138.6	2.2	
	CIS	428.6	6.8	
	Africa	258.6	4.1	
	Middle East	1.5	0.0	
	Austral-Asia	4,447.8	70.1	
	North America	987.2	15.6	
	Latin America	78.7	1.2	
	OPEC-12	5.5	0.1	
	OPEC-Gulf	1.5	0.0	
	MENA	1.5	0.0	
	OECD	1,484.7	23.4	
	EU-27	134.0	2.1	

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

Tab. 24: *Hard Coal Consumption in 2010:*

Main Coutries (Top 20) and Distribution by Regions and Economic Policy Organisations

Rank	Country / Region	Mt	Share [%]	
			Country	Cumulative
1	China	3.262.3	51.4	51.4
2	United States	895.5	14.1	65.5
3	India	625.7	9.9	75.3
4	South Africa	187.1	2.9	78.3
5	Japan	185.5	2.9	81.2
6	Russian Federation*	147.0	2.3	83.5
7	Korea, Republic	119.5	1.9	85.4
8	Poland	85.3	1.3	86.7
9	Ukraine*	81.2	1.3	88.0
10	Kazakhstan	77.7	1.2	89.2
11	Australia	64.5	1.0	90.3
12	Taiwan	62.9	1.0	91.3
13	Germany	54.1	0.9	92.1
14	United Kingdom	51.5	0.8	92.9
15	Indonesia	50.0	0.8	93.7
16	Canada	37.0	0.6	94.3
17	Turkey	29.7	0.5	94.8
18	Viet Nam	23.2	0.4	95.1
19	Italy	22.0	0.3	95.5
	Malaysia	22.0	0.3	95.8
	World	**6,349.5**	**100.0**	
	Europe	347.1	5.5	
	CIS	306.6	4.8	
	Africa	198.4	3.1	
	Middle East	16.3	0.3	
	Austral-Asia	4,494.9	70.8	
	North America	950.8	15.0	
	Latin America	35.6	0.6	
	OPEC-12	4.5	0.1	
	OPEC-Gulf	3.7	0.1	
	MENA	21.4	0.3	
	OECD	1,658.4	26.1	
	EU-27	313.8	4.9	

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

Tab. 25: *Hard Coal Export in 2010:*

Main Coutries (Top 20) and Distribution by Regions and Economic Policy Organisations

Rank	Country / Region	Mt	Share [%]	
			Country	Cumulative
1	Australia	300.3	28.2	28.2
2	Indonesia	277.0	26.0	54.1
3	Russian Federation	115.7	10.8	65.0
4	United States	74.1	7.0	71.9
5	South Africa	70.6	6.6	78.5
6	Colombia	68.1	6.4	84.9
7	Canada	32.7	3.1	88.0
8	Kazakhstan	27.8	2.6	90.6
9	Viet Nam	22.3	2.1	92.7
10	China	18.9	1.8	94.5
11	Mongolia	16.6	1.6	96.0
12	Poland	10.0	0.9	97.0
13	Czech Republic	6.7	0.6	97.6
14	Ukraine	6.7	0.6	98.2
15	Korea, Democratic People‘s Republic	4.6	0.4	98.7
16	Venezuela, Bolivarian Republic	3.8	0.4	99.0
17	Philippines	3.0	0.3	99.3
18	New Zealand	2.3	0.2	99.5
19	India	2.1	0.2	99.7
20	Norway	1.6	0.1	99.9
	...			
23	Germany	0.3	< 0.05	
	...			
	World	**1,066.6**	**100.0**	
	Europe	19.2	1.8	
	CIS	150.1	14.1	
	Africa	70.6	6.6	
	Austral-Asia	647.8	60.7	
	North America	106.8	10.0	
	Latin America	72.0	6.7	
	OPEC-12	3.8	0.4	
	OPEC-Gulf	–	–	
	MENA	–	–	
	OECD	428.6	40.2	
	EU-27	17.6	1.7	

– no export

Tab. 26: *Hard Coal Import in 2010:*

Main Coutries (Top 20) and Distribution by Regions and Economic Policy Organisations

Rank	Country / Region	Mt	Share [%]	
			Country	Cumulative
1	Japan	184.6	18.2	18.2
2	China	166.2	16.4	34.6
3	Korea, Republic	113.5	11.2	45.8
4	India	90.1	8.9	54.7
5	Taiwan	63.2	6.2	60.9
6	Germany	41.1	4.1	65.0
7	Turkey	26.9	2.7	67.6
8	United Kingdom	26.5	2.6	70.3
9	Italy	22.0	2.2	72.4
10	Malaysia	19.9	2.0	74.4
11	France	18.9	1.9	76.3
12	United States	17.6	1.7	78.0
13	Thailand	16.7	1.6	79.6
14	Brazil	15.3	1.5	81.1
15	Russian Federation	14.8	1.5	82.6
16	Poland	13.5	1.3	83.9
17	Canada	12.9	1.3	85.2
18	Ukraine	12.9	1.3	86.5
19	Spain	12.8	1.3	87.7
20	Israel	12.3	1.2	89.0
	World	**1,013.6**	**100.0**	
	Europe	216.9	21.4	
	CIS	28.1	2.8	
	Africa	6.6	0.7	
	Middle East	14.5	1.4	
	Austral-Asia	681.0	67.2	
	North America	37.4	3.7	
	Latin America	29.0	2.9	
	OPEC-12	3.2	0.3	
	OPEC-Gulf	2.2	0.2	
	MENA	19.6	1.9	
	OECD	545.7	53.8	
	EU-27	186.5	18.4	

Tab. 27: *Lignite in 2010 [in Mt]:*

Region	Production	Reserves	Resources	Reamining Potential
Albania	< 0.05	522	205	727
Austria	–	–	333	333
Bosnia and Heregovina	11.0	2,369	1,814	4,182
Bulgaria	27.2	2,174	2,400	4,574
Croatia	–	n. s.	300	300
Czech Republic	43.9	2,348	7,598	9,946
France	–	n. s.	114	114
Germany	169.4	40,500	36,500	77,000
Greece	56.5	2,876	3,554	6,430
Hungary	9.1	2,633	2,704	5,337
Italy	–	7	22	29
Kosovo	7.8	1,564	9,262	10,826
Mazedonien, ehemalige jugoslawische Republik	6.8	332	300	632
Montenegro	1.2	n. s.	n. s.	n. s.
Poland	56.5	4,579	223,604	228,183
Portugal	–	33	33	66
Romania	27.7	280	9,640	9,920
Serbia	37.6	7,112	13,074	20,186
Slovakia	2.4	175	886	1,061
Slovenia	4.4	315	341	656
Spain	–	319	n. s.	319
Turkey	70.0	1,814	10,300	12,114
United Kingdom	–	–	1,000	1,000
Belarus	–	–	1,500	1,500
Kazakhstan	5.6	n. s.	n. s.	n. s.
Kyrgyzstan	0.5	n. s.	n. s.	n. s.
Russian Federation	76.0	91,350	1,279,680	1,371,030
Tajikistan	< 0.05	n. s.	n. s.	n. s.
Ukraine	0.2	2,336	5,381	7,717
Uzbekistan	3.3	n. s.	n. s.	n. s.
Central African Republic	–	3	n. s.	3
Madagascar	–	–	37	37
Mali	–	–	3	3
Marocco	–	–	40	40
Niger	–	6	n. s.	6
Nigeria	–	–	250	250
Sierra Leone	–	–	2	2
Australia	67.2	37,100	174,000	211,100
Bangladesh	–	–	3	3
China	125.0	11,000	307,000	318,000
India	37.7	4,858	34,760	39,618

Cont'd of Tab. 27

Region	Production	Reserves	Resources	Reamining Potential
Indonesia	40.0	7,838	12,474	20,312
Japan	–	10	1,026	1,036
Korea, Democratic People's Republic	7.0	n. s.	n. s.	n. s.
Lao People's Democratic Republic	0.6	499	22	521
Malaysia	–	39	412	451
Mongolia	5.0	1,350	119,426	120,776
Myanmar	0.2	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	18.2	1,063	826	1,889
Viet Nam	–	244	199,876	200,120
Canada	10.1	2,236	118,270	120,506
Mexico	–	51	n. s.	51
United States	66.4	30,775	1,367,588	1,398,363
Argentina	–	–	7,300	7,300
Brazil	5.2	5,049	12,587	17,636
Chile	0.5	n. s.	7	7
Dominican Republic	–	–	84	84
Ecuador	–	24	n. s.	24
Haiti	–	–	40	40
Peru	–	–	100	100
World	**1,000.6**	**275,510**	**4,153,625**	**4,429,135**
Europe	531.6	69,951	323,983	393,935
CIS	85.6	93,686	1,286,561	1,380,247
Africa	–	9	332	341
Middle East	–	n. s.	n. s.	n. s.
Austral-Asia	301.3	73,729	1,036,774	1,110,503
North America	76.5	33,062	1,485,858	1,518,920
Latin America	5.7	5,073	20,118	25,191
OPEC-12	–	24	250	274
OPEC-Gulf	–	–	–	–
MENA	–	–	40	40
OECD	551.9	132,206	1,952,132	2,084,338
EU-27	397.2	56,239	288,729	344,968

n. s. no specified

– no production, reserves or resources

Tab. 28: *Lignite Resources in 2010:*

Main Coutries (Top 20) and Distribution by Regions and Economic Policy Organisations

Rank	Country / Region	Mt	Share [%]	
			Country	Cumulative
1	United States	1,367,588	32.9	32.9
2	Russian Federation*	1,279,680	30.8	63.7
3	China	307,000	7.4	71.1
4	Poland	223,604	5.4	76.5
5	Viet Nam	199,876	4.8	81.3
6	Pakistan	181,434	4.4	85.7
7	Australia	174,000	4.2	89.9
8	Mongolia*	119,426	2.9	92.8
9	Canada	118,270	2.8	95.6
10	Germany	36,500	0.9	96.5
11	India	34,760	0.8	97.3
12	Serbia	13,074	0.3	97.6
13	Brazil	12,587	0.3	97.9
14	Indonesia	12,474	0.3	98.2
15	Turkey	10,300	0.2	98.5
16	Romania	9,640	0.2	98.7
17	Kosovo	9,262	0.2	98.9
18	Czech Republic*	7,598	0.2	99.1
19	Argentina	7,300	0.2	99.3
20	Ukraine*	5,381	0.1	99.4
	World	**4,153,625**	**100.0**	
	Europe	323,983	7.8	
	CIS	1,286,561	31.0	
	Africa	332	0.0	
	Middle East	–	–	
	Austral-Asia	1,036,774	25.0	
	North America	1,485,858	35.8	
	Latin America	20,118	0.5	
	OPEC-12	250	0.0	
	OPEC-Gulf	–	–	
	MENA	40	0.0	
	OECD	1,952,132	47.0	
	EU-27	288,729	7.0	

* Lignite resources contains subbituminous coal

– no resources

Tab. 29: *Lignite Reserves in 2010:*

Main Coutries (Top 20) and Distribution by Regions and Economic Policy Organisations

Rank	Country / Region	Mt	Share [%]	
			Country	Cumulative
1	Russian Federation*	91,350	33.2	33.2
2	Germany	40,500	14.7	47.9
3	Australia	37,100	13.5	61.3
4	United States	30,775	11.2	72.5
5	China	11,000	4.0	76.5
6	Indonesia	7,838	2.8	79.3
7	Serbia	7,112	2.6	81.9
8	New Zealand	6,750	2.5	84.4
9	Brazil	5,049	1.8	86.2
10	India	4,858	1.8	88.0
11	Poland	4,579	1.7	89.6
12	Greece	2,876	1.0	90.7
13	Pakistan	2,870	1.0	91.7
14	Hungary	2,633	1.0	92.7
15	Bosnia and Heregovina	2,369	0.9	93.5
16	Czech Republic*	2,348	0.9	94.4
17	Ukraine*	2,336	0.8	95.2
18	Canada	2,236	0.8	96.0
19	Bulgaria	2,174	0.8	96.8
20	Turkey	1,814	0.7	97.5
	World	**275,510**	**100.0**	
	Europe	69,951	25.4	
	CIS	93,686	34.0	
	Africa	9	0.0	
	Middle East	–	–	
	Austral-Asia	73,729	26.8	
	North America	33,062	12.0	
	Latin America	5,073	1.8	
	OPEC-12	24	0.0	
	OPEC-Gulf	–	–	
	MENA	–	–	
	OECD	132,206	48.0	
	EU-27	56,239	20.4	

* lignite reserves contains subbituminous coal

– no reserves

Tab. 30: *Lignite Production in 2010:*

Main Coutries (Top 20) and Distribution by Regions and Economic Policy Organisations

Rank	Country / Region	Mt	Share [%]	
			Country	Cumulative
1	Germany	169.4	16.9	16.9
2	China	125.0	12.5	29.4
3	Russian Federation*	76.0	7.6	37.0
4	Turkey	70.0	7.0	44.0
5	Australia	67.2	6.7	50.7
6	United States	66.4	6.6	57.4
7	Greece	56.5	5.6	63.0
8	Poland	56.5	5.6	68.7
9	Czech Republic*	43.9	4.4	73.0
10	Indonesia	40.0	4.0	77.0
11	India	37.7	3.8	80.8
12	Serbia	37.6	3.8	84.6
13	Romania	27.7	2.8	87.3
14	Bulgaria	27.2	2.7	90.1
15	Thailand	18.2	1.8	91.9
16	Bosnia and Heregovina	11.0	1.1	93.0
17	Canada	10.1	1.0	94.0
18	Hungary*	9.1	0.9	94.9
19	Kosovo	7.8	0.8	95.7
20	Korea, Democratic People's Republic	7.0	0.7	96.4
	World	**1,000.6**	**100.0**	
	Europe	531.6	53.1	
	CIS	85.6	8.6	
	Africa	–	–	
	Middle East	–	–	
	Austral-Asia	301.3	30.1	
	North America	76.5	7.6	
	Latin America	5.7	0.6	
	OPEC-12	–	–	
	OPEC-Gulf	–	–	
	MENA	–	–	
	OECD	551.9	55.1	
	EU-27	397.2	39.7	

* Lignite production contains subbituminous coal

– no production

Tab. 31: *Lignite Consumption in 2010:*

Main Coutries (Top 20) and Distribution by Regions and Economic Policy Organisations

Rank	Country / Region	Mt	Share [%]	
			Country	Cumulative
1	Germany	168.2	17.0	17.0
2	China	125.0	12.7	29.7
3	Russian Federation*	76.0	7.7	37.4
4	Turkey	70.0	7.1	44.5
5	Australia	67.2	6.8	51.3
6	Poland	56.6	5.7	57.1
7	United States	55.5	5.6	62.7
8	Greece	54.8	5.6	68.3
9	Czech Republic*	43.0	4.4	72.6
10	Indonesia	40.0	4.1	76.7
11	India	37.7	3.8	80.5
12	Serbia	37.4	3.8	84.3
13	Romania	27.7	2.8	87.1
14	Bulgaria	27.2	2.8	89.8
15	Thailand	18.0	1.8	91.7
16	Bosnia and Heregovina	11.0	1.1	92.8
17	Canada	10.0	1.0	93.8
18	Hungary*	9.2	0.9	94.7
19	Kosovo	7.8	0.8	95.5
20	Korea, Democratic People's Republic	7.0	0.7	96.2
	World	**986.6**	**100.0**	
	Europe	529.1	53.6	
	CIS	85.5	8.7	
	Africa	–	–	
	Middle East	–	–	
	Austral-Asia	300.8	30.5	
	North America	65.5	6.6	
	Latin America	5.7	0.6	
	OPEC-12	–	–	
	OPEC-Gulf	–	–	
	MENA	–	–	
	OECD	538.6	54.6	
	EU-27	394.9	40.0	

* Lignite consumption contains subbituminous coal

– no consumption

Tab. 32: *Uranium in 2010 [kt U]:*

Region	Production	Cum. Production	Reserves	Resources	EUR	Reamining Potential
Belgium	–	–	–	–	–	–
Bulgaria	–	–	–	–	–	–
Czech Republic	0.3	111	< 0.5	< 0.5	112	1
Denmark	–	–	–	136	136	136
Finnland	–	< 0.5	–	20	20	20
France	< 0.05	76	–	12	88	12
Germany	< 0.05	220	–	7	227	7
Greece	–	–	–	13	13	13
Hungary	–	21	< 0.5	24	45	24
Italy	–	–	–	6	6	6
Portugal	–	4	5	4	12	9
Romania	0.1	19	n. s.	13	31	13
Slovakia	n. s.	n. s.	–	16	16	16
Slovenia	n. s.	n. s.	2	11	13	13
Spain	–	5	3	9	16	11
Sweden	n. s.	< 0.5	–	10	10	10
Turkey	n. s.	–	9	9	18	18
Kazakhstan	17.8	159	263	1,487	1,909	1,750
Russian Federation	3.6	147	56	786	989	842
Ukraine	0.9	16	45	486	547	531
Uzbekistan	2.4	40	55	144	239	200
Algeria	–	–	–	26	26	26
Central African Republic	–	–	–	12	12	12
Congo, Democratic Republic	–	26	–	3	28	3
Egypt	n. s.	n. s.	–	2	2	2
Gabon	–	25	–	6	31	6
Malawi	0.7	1	11	18	30	29
Namibia	4.5	106	2	353	461	355
Niger	4.2	118	43	258	418	300
Somalia	–	–	–	8	8	8
South Africa	0.6	158	115	339	612	454
Tanzania, United Republic	n. s.	–	–	28	28	28
Zambia	–	< 0.5	2	42	43	43
Zimbabwe	–	–	–	26	26	26
Iran, Islamic Republic	–	< 0.5	–	21	21	21
Jordan	–	–	44	237	281	281
Australia	5.9	169	1,223	581	1,973	1,804
China	0.8	33	101	78	212	179
India	0.4	10	< 0.5	220	230	220
Indonesia	–	–	7	18	25	25
Japan	–	< 0.5	–	7	7	7
Mongolia	–	1	75	1,470	1,546	1,545

Cont'd of Tab. 32

Region	Production	Cum. Production	Reserves	Resources	EUR	Reamining Potential
Pakistan	< 0.05	1	n. s.	n. s.	n. s.	n. s.
Viet Nam	–	–	–	114	114	114
Canada	9.8	447	417	1,048	1,911	1,464
Mexico	–	< 0.5	–	5	5	5
United States	1.7	367	39	2,564	2,970	2,603
Argentina	–	3	7	14	23	21
Brazil	0.1	3	229	421	653	650
Chile	–	–	–	3	3	3
Colombia	–	–	–	228	228	228
Peru	–	–	2	28	30	30
Venezuela, Bolivarian Republic	–	–	–	–	–	–
World	**53.7**	**2,283**	**2,755**	**11,370**	**16,408**	**14,125**
Europe	0.3	455	19	289	763	308
CIS	24.6	362	419	2,904	3,684	3,323
Africa	9.9	434	173	1,120	1,727	1,293
Middle East	–	< 0.5	44	258	302	302
Austral-Asia	7.2	213	1,406	2,488	4,107	3,894
North America	11.4	814	456	3,616	4,886	4,072
Latin America	0.1	6	238	694	937	932
OPEC-12	–	< 0.5	< 0.5	47	47	47
OPEC-Gulf	–	< 0.5	< 0.5	21	21	21
MENA	–	< 0.5	44	286	330	330
OECD	17.6	1,420	1,695	4,470	7,585	6,165
EU-27	0.3	455	10	280	745	290

n. s. no specified

– no production, reserves or resources

Tab. 33: *Uranium Resources in 2010 (> 20 kt U) [in kt]:*

Main Coutries and Distribution by Regions and Economic Policy Organisations

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	22.6	22.6
Kazakhstan	209	478	687	500	300	1,487	13.1	35.6
Mongolia	–	12	12	–	1,458	1,470	12.9	48.6
Canada	52	146	198	150	700	1,048	9.2	57.8
Russian Federation	162	432	594	192	n. s.	786	6.9	64.7
Australia	14	567	581	n. s.	n. s.	581	5.1	69.8
Ukraine	117	92	209	23	255	486	4.3	74.1
Brazil	–	121	121	300	n. s.	421	3.7	77.8
Namibia	194	159	353	n. s.	n. s.	353	3.1	80.9
South Africa	78	151	229	110	n. s.	339	3.0	83.9
Niger	202	31	233	25	n. s.	258	2.3	86.1
Jordan	–	68	68	85	85	237	2.1	88.2
Colombia	–	n. s.	–	11	217	228	2.0	90.2
India	103	37	140	64	17	220	1.9	92.2
Uzbekistan	21	39	59	85	–	144	1.3	93.4
Denmark	–	86	86	n. s.	50	136	1.2	94.6
Viet Nam	1	5	6	8	100	114	1.0	95.6
China	15	56	71	4	4	78	0.7	96.3
Zambia	24	18	42	n. s.	n. s.	42	0.4	96.7
Tanzania, United Republic	9	20	28	n. s.	n. s.	28	0.2	96.9
Peru	–	2	2	7	20	28	0.2	97.2
Zimbabwe	1	n. s.	1	–	25	26	0.2	97.4
Algeria	26	n. s.	26	n. s.	n. s.	26	0.2	97.6
Hungary	–	12	12	13	n. s.	24	0.2	97.9
Iran, Islamic Republic	1	2	3	4	14	21	0.2	98.0
Finnland	1	19	20	n. s.	n. s.	20	0.2	98.2
...								
Germany	3	4	7	–	–	7	0.1	99.7
...								
World	**1,764**	**2,615**	**4,379**	**2,869**	**4,122**	**11,370**	**100.0**	
Europe	52	159	212	25	53	289	2.5	
CIS	509	1,041	1,549	799	555	2,904	25.5	
Africa	572	388	960	135	25	1,120	9.9	
Middle East	1	70	70	89	99	258	2.3	
Austral-Asia	139	679	818	75	1,595	2,488	21.9	
North America	486	146	632	1,426	1,558	3,616	31.8	
Latin America	4	132	136	321	237	694	6.1	
OPEC-12	27	2	29	4	14	47	0.4	
OPEC-Gulf	1	2	3	4	14	21	0.2	
MENA	27	72	98	89	99	286	2.5	
OECD	556	859	1,415	1,446	1,608	4,470	39.3	
EU-27	43	159	203	25	53	280	2.5	

n. s. no specified

– no resources

Tab. 34: *Uranium Reserves in 2010 (extractable at costs < 80 USD/kg U):*

Main Coutries (Top 20) and Distribution by Regions and Economic Policy Organisations

Rank	Country / Region	t	Share [%]	
			Country	Cumulative
1	Australia	1,223,000	44.4	44.4
2	Canada	416,800	15.1	59.5
3	Kazakhstan	262,859	9.5	69.1
4	Brazil	229,300	8.3	77.4
5	South Africa	114,868	4.2	81.6
6	China	100,900	3.7	85.2
7	Mongolia	75,425	2.7	88.0
8	Russian Federation	56,298	2.0	90.0
9	Uzbekistan	55,200	2.0	92.0
10	Ukraine	44,641	1.6	93.6
11	Jordan	44,000	1.6	95.2
12	Niger	42,500	1.5	96.8
13	United States	39,064	1.4	98.2
14	Malawi	11,266	0.4	98.6
15	Turkey	9,129	0.3	98.9
16	Argentina	7,000	0.3	99.2
17	Indonesia	6,797	0.2	99.4
18	Portugal	4,500	0.2	99.6
19	Spain	2,500	0.1	99.7
20	Namibia	2,480	0.1	99.8
	...			
25	Germany	–	–	
	...			
	World	**2,754,649**	**100.0**	
	Europe	18,761	0.7	
	CIS	418,998	15.2	
	Africa	172,814	6.3	
	Middle East	44,000	1.6	
	Austral-Asia	1,406,122	51.0	
	North America	455,864	16.5	
	Latin America	238,090	8.6	
	OPEC-12	–	–	
	OPEC-Gulf	–	–	
	MENA	44,000	1.6	
	OECD	1,695,425	61.5	
	EU-27	9,632	0.3	

– no reserves

Tab. 35: *Natur Uranium Produktion in 2010:*

Main Coutries and Distribution by Regions and Economic Policy Organisations

Rank	Country / Region	t	Share [%]	
			Country	Cumulative
1	Kazakhstan	17,803	33.2	33.2
2	Canada	9,783	18.2	51.4
3	Australia	5,900	11.0	62.4
4	Namibia	4,496	8.4	70.8
5	Niger	4,198	7.8	78.6
6	Russian Federation	3,562	6.6	85.2
7	Uzbekistan	2,400	4.5	89.7
8	United States	1,660	3.1	92.8
9	Ukraine	850	1.6	94.4
10	China	827	1.5	95.9
11	Malawi	670	1.2	97.2
12	South Africa	583	1.1	98.3
13	India	400	0.7	99.0
14	Czech Republic	254	0.5	99.5
15	Brazil	148	0.3	99.7
16	Romania	77	0.1	99.9
17	Pakistan	45	0.1	100.0
18	Germany*	8	< 0.05	100.0
19	France*	7	< 0.05	100.0
	World	**53,671**	**100.0**	
	Europe	346	0.6	
	CIS	24,615	45.9	
	Africa	9,947	18.5	
	Middle East	–	–	
	Austral-Asia	7,172	13.4	
	North America	11,443	21.3	
	Latin America	148	0.3	
	OPEC-12	–	–	
	OPEC-Gulf	–	–	
	MENA	–	–	
	OECD	17,612	32.8	
	EU-27	346	0.6	

* only in the form of uranium concentrate as part of the remediation of production sites

– no produktion

Tab. 36: *Uranium Consumption in 2010:*

Main Coutries (Top 20) and Distribution by Regions and Economic Policy Organisations

Rank	Country / Region	t	Share [%]	
			Country	Cumulative
1	United States	19,427	28.2	28.2
2	France	9,221	13.4	41.5
3	Japan	8,195	11.9	53.4
4	China	4,402	6.4	59.8
5	Russian Federation	3,757	5.4	65.2
6	Korea, Republic	3,586	5.2	70.4
7	Germany	3,453	5.0	75.5
8	United Kingdom	2,235	3.2	78.7
9	Ukraine	2,037	3.0	81.6
10	Canada	1,884	2.7	84.4
11	Sweden	1,537	2.2	86.6
12	Spain	1,458	2.1	88.7
13	Taiwan	1,344	1.9	90.7
14	India	1,053	1.5	92.2
15	Belgium	1,052	1.5	93.7
16	Czech Republic	680	1.0	94.7
17	Schweiz	557	0.8	95.5
18	Finnland	468	0.7	96.2
19	South Africa	321	0.5	96.7
20	Brazil	311	0.5	97.1
	World	**68,971**	**100.0**	
	Europe	21,925	31.8	
	CIS	5,850	8.5	
	Africa	321	0.5	
	Middle East	150	0.2	
	Austral-Asia	18,648	27.0	
	North America	21,558	31.3	
	Latin America	519	0.8	
	OPEC-12	150	0.2	
	OPEC-Gulf	150	0.2	
	MENA	150	0.2	
	OECD	54,669	79.3	
	EU-27	21,368	31.0	

SOURCES

Advanced Resources International Inc. – ARI (USA)

Agência Nacional do Petróleo, Gás Natural e Biocombustíveis - Ministério de Minas e Energia (Brazil)

Australian Bureau of Agricultural and Resource Economics and Sciences – ABARES

Australian Government

British Petroleum – BP

British Geological Survey – BGS

Bundesamt für Wirtschaft und Ausfuhrkontrolle – BAFA

Bundesverband Braunkohle e.V. – DEBRIV

Bureau of Energy, Ministry of Economic Affairs (Taiwan)

Bureau of Ocean Energy Management, Regulation and Enforcement – BOEMRE (USA)

Canadian Society for Unconventional Gas – CSUG

Canadian Society for Unconventional Resources – CSUR

CBM Energy Ltd (USA)

Census and Statistics Department – C&SD (Hong Kong)

Chamber of Mines of Zimbabwe

China Mining Association – CMA

China National Administration of Coal Geology – CCGC

Contrafed Publishing Co. Ltd. (New Zealand)

Cubapetroleo – CUPET (Cuba)

Dart Energy (United Kingdom)

Debswana (Botswana)

Departamento Nacional de Produção Mineral – DNPM (Brazil)

Department of Business Enterprise & Regulatory Reform – BERR (United Kingdom)

Department of Energy & Climate Change – DECC (United Kingdom)

Department of Energy – DOE (Philippines)

Department of Geology and Mines (Lao PDR)

Department of Mineral Resources (South Africa)

Department of Energy (South Africa)

Department of Mines and Geology (Lesotho)

Department of Resources, Energy and Tourism (Australia)

DTEK (Ukraine)

Ecopetrol (Colombia)

Elektroprivreda Srbije – EPS (Serbia)

Energética (Colombia)

Energy Company of Ukraine

Energy Resources Conservation Board – ERCB (Canada)

Energistyrelsen – ENS (Denmark)

Euratom Supply Agency, European Commission – ESA

European Association for Coal and Lignite – EURACOAL (Belgium)

European Union of the Natural Gas Industry – EuroGas (Belgium)

Evonik Industries AG

Frost & Sullivan Market Insight (Viet Nam)

Gazprom (Russian Federation)

GEOFOND (Czech Republic)

Geoinform (Ukraine)

Geological Survey and Mines Department of Swaziland

Geological Survey of India – GSI

Geological Survey of Namibia

Geological Survey of Norway – NGU

Geoscience Australia

Gesamtverband Steinkohle e.V. – GVSt

Global Methan Initiative – GMI (USA)

Grubengas Deutschland e. V. – IVG

Hungarian Geological Survey

IHS McCloskey (United Kingdom)

Indian Bureau of Mines

Informationszentrum MINERAL (Russian Federation)

Institut national de la statistique et des études économiques – INSEE (France)

Instituto Colombiano de Geología y Minería – INGEOMINAS (Colombia)

Instituto Geológico y Minero de España

Interfax Russia & CIS

International Atomic Energy Agency – IAEA

International Energy Agency – IEA

International Gas Union – IGU (Norway)

JP PEU Resavica (Serbia)

Kimberly Oil NL – KBO (France)

KNOC (Korea Republik)

Korea Energy Economics Institute (KEEI)

Korea Gas Corporation – KOGAS

L&M Energy Ltd. – LME (New Zealand)

Malaysian Chamber of Mines

Methane Center of Kazakhstan, Azimut Energy Services

Mineral Resources of Russia. Economics & Management

Ministere de l'Energie et des Mines (Ethiopia)

Ministerio de Minas y Energia, Sistema de Information Minero Colombiano – Simco (Colombia)

Ministerio de Energia y Minas (Peru)

Ministério de Minas e Energia (Brazil)

Ministerio del Poder Popular para la Energía y Petróleo (Venezuela)

Ministry of Commerce Industry and Tourism (Cyprus)

Ministry of Economic Development (New Zealand)

Ministry of Energy and Energy Affairs of Trinidad & Tobago

Ministry of Energy and Mineral Resources – ESDM (Indonesia)

Ministry of Energy and Mining (Algeria)

Ministry of Energy and Natural Resources (Turkey)

Ministry of Energy Myanmar

Ministry of Energy, Energy Policy and Planning Office – EPPO (Thailand)

Ministry of Energy (Islamische Republik Iran)

Ministry of Energy (United Arab Emirates)

Ministry of Energy, Water and Communcations – MEWC (Malaysia)

Ministry of Environment (Slovakia)

Ministry of Environment, Wildlife and Tourism Department of Meteorological Services – MEWT (Botswana)

Ministry of Finance (Tanzania)

Ministry of Industry and Trade of the Russian Federation

Ministry of Internal Affairs and Communication/Statistics Bureau and the Director-General for Policy Planning of Japan

Ministry of Minerals, Energy and Water Resources, Department of Mines (Botswana)

Ministry of Mines (India)

Ministry of Mines and Steel Development (Nigeria)

Ministry of Mines, Industry and Energy (Equatorial Guinea)

Ministry of Petroleum and Natural Gas (India)

Ministry of Petroleum (Egypt)

Ministry of the Economy (Slovenia)

Nadra Luganshching LLC (Ukraine)

Natural Gas Europe – NGE

Natural Resources Canada – NRCAN

Netherlands Organization for Applied Scientific Research – TNO

NPD, Norway

Nuclear Energy Agency – NEA

Organisation for Economic Co-operation and Development – OECD (France)

Office National des Hydrocarbures et des Mines (Morocco)

Oficina Nacional de Estadisticas (Cuba)

Petrobangla (Bangladesh)

Philippine Department of Energy – DOE

Polish Geological Institute - National Research Institute; Department of Deposits and Mining Areas Information – PSH (Poland)

Raven Ridge Resources Inc. (USA)

Research Institute of Petroleum Exploration & Development – PetroChina

Rosinformugol (Russian Federation)

Secretariat of Mining Ministry of Economy (Mexico)

Servicio Nacional de Geología y Minería – SERNAGEOMIN (Chile)

Servico Geologico Mexicano – SGM

Solid Energy New Zealand Ltd

Spanish Geological Survey – IGME

Statistics Finland

Statistics Iceland

Statistics Norway

Statistik der Kohlenwirtschaft e.V. – SdK

Store Norske Spitsbergen Grubekompani

Tansania Chamber of Minerals and Energy

The Coal Authority (United Kingdom)

The Institute of Energy Economics – IEEJ (Japan)

The Israel Electric Corporation Ltd. – IEC

Turkish Petroleum Corporation

U.S. Energy Information Administration – EIA

U.S. Environmental Protection Agency

U.S. Geological Survey – USGS

Universidad Nacional de Colombia

University of Miskolc, Department of Geology and Mineral Resources (Hungary)

University of Oviedo, Department of Mining and Exploration Engineering (Spain)

Verein der Kohlenimporteure e.V. – VDKI

World Coal Association

World Energy Council – WEC

World Nuclear Association – WNA

World Steel Association

GLOSSARY

AGEB
Arbeitsgemeinschaft Energiebilanzen e. V.; headquaters in Berlin

API
American Petroleum Institute; umbrella organisation of the oil, gas and petroleum industry in the USA

°API
unit for the density of liquid hydrocarbons; the lower the degree, the heavier the oil

ARA
abbreviation for Amsterdam, Rotterdam, Antwerp

b, bbl
barrel; standard American unit for oil and oil products; cf. Units

BGR
Bundesanstalt für Geowissenschaften und Rohstoffe (Federal Institute for Geosciences and Natural Resources); based in Hannover

BMWi
Bundesministerium für Wirtschaft und Technologie, (German Federal Ministry for Economics and Technology); based in Berlin

boe
barrel(s) oil equivalent: energy unit corresponding to the amount of energy released when combusting one barrel of oil

BP
British Petroleum; internationally active energy corporation; headquarters in London

Brent
the most important crude oil type in Europe

BTL
biomass to liquid: synthetic fuel made from biomass

Btu
British thermal unit(s); english energy unit

CBM
coal bed methane; gas contained in coal

cif
cost, insurance, freight: a typical transport clause incorporated in maritime transport transactions, corresponding to the 'free on board' (fob) clause where the seller also bears the cost of delivery, insurance and freight to a defined port

clean gas
Standardised natural gas with a calorific value of 9.7692 kWh / Nm^3 in Germany

crude oil
natural mixture of liquid hydrocarbons

conventional oil: flowing oil in an oilfield with an API grade higher than 10 per cent, heavy oil, light oil, condensate

non-conventional oil: marginally or non-flowing in the oilfield, with an API degree less than 10 per cent, extra heavy oil, oil sand (bitumen, asphalt), oil shale

CTL
coal to liquid: synthetic fuel made from coal

cumulative production
total production since the start of production operations

DOE
Department of Energy (USA)

downstream
activities in the production chain after the crude oil or natural gas has been produced from the production well: such as processing, transport, handling, sales

dry gas
natural gas from a pure natural gas field, usually with a very high proportion of methane

EIA
U.S. Energy Information Administration

EOR
enhanced oil recovery; processes used to improve the natural recovery rate of an oilfield

ESA
European Space Agency

EUR
estimated ultimate recovery (see total potential)

field growth
Increase/growth in original reserves during the production of an oil or gas field as a result of improvements in production technology, and better understanding of the deposit and production processes (see reserve growth)

gas hydrate
solid (ice-like) molecular compound consisting of gas and water which is stable under high pressures and low temperatures

GTL
gas to liquid; using different methods to produce synthetic fuel from natural gas. Methods include Fischer-Tropsch synthesis

hard coal
anthracite, bituminous coal, hard lignite with an energy content > 16,500 kJ/kg (ash-free)

HEU
highly enriched uranium: (> 90 % U-235), mainly used for military purposes

IAEA
International Atomic Energy Agency; UN agency; headquarters in Vienna (see also Economic Policy Organisations)

IEA
International Energy Agency, OECD organisation; headquarters in Paris

in-place
total natural resource contained in a deposit/field (volume figure)

in-situ
located within the deposit: also refers to a reaction or a process occurring at the point of origin; also a synonym for in-place

IOC
International Oil Companies, including the super majors: BP plc, Chevron Corp., ExxonMobil Corp., Royal Dutch Shell plc, Total, etc. .

IR
inferred resources: resources of uranium comprising those proven resources which do not satisfy the reserves criteria. Corresponds to the now obsolete class EAR I (estimated additional resources)

J
Joule; *cf. Units*

LBEG
Landesamt für Bergbau, Energie und Geologie (State Authority for Mining, Energy and Geology); headquarters in Hannover

LEU
low enriched uranium

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

LNG
liquefied natural gas. Natural gas liquefied at -162 °C for transport (1 t LNG contains approx. 1,400 Nm³ natural gas, 1 m³ LNG weighs approx. 0.42 t)

methane
simplest hydrocarbon (CH_4)

natural gas
natural gas is found in deep underground natural rock formations or associated with other hydrocarbon reservoirs, in coal beds, and in the form of gas hydrates. Gases can have variable chemical compositions but in this context are understood to be combustible natural gases

conventional gas: free natural gas or oil gas

non-conventional gas: tight gas, shale gas, coal bed methane, aquifer gas and natural gas from gas hydrates

natural uranium [U_{nat}]
standard uranium in the isotopic composition that occurs in nature. Natural uranium is a mixture of U-238 (99.2739 %), U-235 (0.7205 %) and U-234 (0.0056 %)

NEA
Nuclear Energy Agency; part of OECD; headquarters in Paris

NGL
natural gas liquids; condensate

OECD
Organisation for Economic Co-operation and Development, headquarters in Paris; cf. Economic Policy Organisations

OPEC
Organization of Petroleum Exporting Countries; headquarters in Vienna; cf. Economic Policy Organisations

Peak Oil
point when maximum oil production level is reached

permeability
measure of the hydraulic transmissivity of a rock; unit: Darcy [D]; symbol: k; cf.: Units

porosity
pore space in a rock: unit: [%]

primary energy consumption [PEC]
describes the total amount of energy required to supply an economy

raw gas
untreated natural gas recovered during production

recovery rate
amount of oil which can be recovered from an oilfield in per cent

remaining potential
*r*eserves and resources

reserve growth
(see field growth)

reserves
proven volumes of energy resources economically exploitable at today's prices and using today's technology

original reserves: cumulative production plus remaining reserves

resources
proven amounts of energy resources which cannot currently be exploited for technical and/or economic reasons, as well as unproven but geologically possible energy resources which may be exploitable in future

shale gas
natural gas from very fine-grained rocks (shales)

SPE
Society of Petroleum Engineers

tce
ton(s) coal equivalent; see also: conversion factors

tight gas
natural gas from tight rocks

tce
ton(s) coal equivalent, corresponds to approx. 29.308 x 109 Joules; Cf.: Conversion factors

toe
ton(s) oil equivalent: an energy unit corresponding to the energy released when burning one tonne of crude oil; cf.: conversion factors

upstream
all activities in the production chain which take place before hydrocarbons leave the production site. Exploration, development and exploitation/ production

USD
US-Dollars: currency of the United States of America

USGS
United States Geological Survey

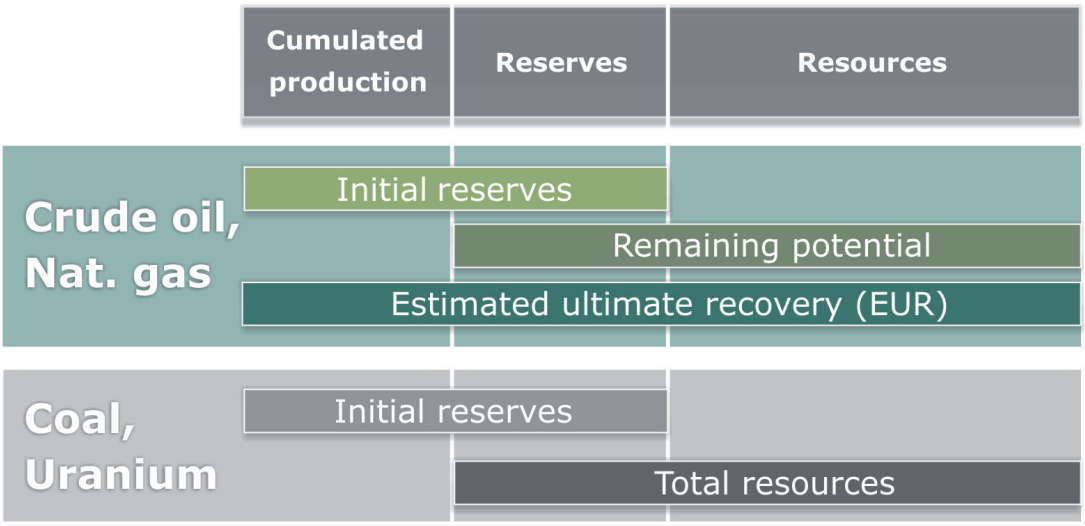
VDKI
Verein der Kohlenimporteure e.V. (German Coal Importer Association); headquarters in Hamburg

WEC
World Energy Council; headquarters in London; organises the World Energy Congress

WNA
World Nuclear Association; headquarters in London

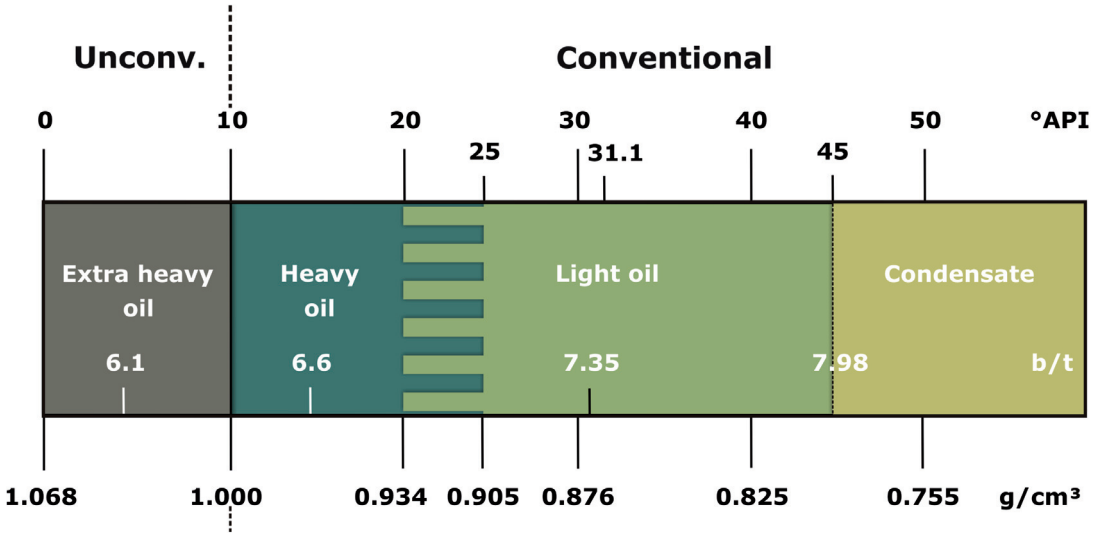
WPC
World Petroleum Council; headquarters in London; organises the World Petroleum Congress

DIFFERENTIATION BETWEEN RESERVES AND RESOURCES



CLASSIFICATION OF CRUDE OIL ACCORDING TO ITS DENSITY

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



COUNTRY GOUPS

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 Pricipe, 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)

„Asien"-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, Maledives, 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.)

MENA
(Middle East and North Africa)

Algeria, Bahrain, Egypt, Iran (Islamische Republik), Iraq, Israel, Jordan, Lebanon, Libyan Arab Jamahiriya, Marocco, Oman, Qatar, Saudi Arabia, Sudan, Tunisia, United Arab Emirates, Yemen

ECONOMIC POLICY ORGANISATIONS

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, Liechenstein, 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 Arabiea, 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
(Organization 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 Gas Market

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

Norrth American Gas Market

North America

Latin American Gas Market

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

UNITS

b, bbl	barrel	1 bbl = 158.984 liter
cf	cubic feet	1 cf = 0.02832 m^3
J	Joule	1 J = 0.2388 cal = 1 Ws (Wattsecond)
kJ	Kilojoule	1 kJ = 10^3 J
MJ	Megajoule	1 MJ = 10^6 J
GJ	Gigajoule	1 GJ = 10^9 J = 278 kWh = 0.0341 t tce
TJ	Terajoule	1 TJ = 10^{12} J = 278 x 10^3 kWh = 34.1 t tce
PJ	Petajoule	1 PJ = 10^{15} J = 278 x 10^6 kWh = 34.1 x 10^3 t tce
EJ	Exajoule	1 EJ = 10^{18} J = 278 x 10^9 kWh = 34.1 x 10^6 t tce
cm, m^3	cubic meter	
Nm^3	standard cubic meter	amount of Gas in 1 m^3 bei 0° C and 1,013 mbar [also m^3(Vn)]
mcm	million cubic meter	1 mcm = 10^6 m^3
bcm	billion cubic meter	1 bcm = 10^9 m^3
tcm	trillion cubic meter	1 tcm = 10^{12} m^3
lb	pound	1 lb = 453.59237 g
t	ton	1 t = 10^3 kg
t/a	metric ton(s) per year	
toe	ton(s) oil equivalent	
kt	Kiloton	1 kt = 10^3 t
Mt	Megaton	1 Mt = 10^6 t
Gt	Gigaton	1 Gt = 10^9 t
Tt	Teraton	1 Tt = 10^{12} t

CONVERSION FACTORS

1 t crude oil	1 toe = 7.35 bbl = 1.428 t tce = 1,101 m^3 natural gas = 41.8 x 10^9 J
1 t LNG	1,380 m^3 natural gas = 1.06 toe = 1.52 t tce = 44.4 x 10^9 J
1,000 Nm^3 nat. gas	35 315 cf = 0.9082 toe = 1.297 t tce = 0.735 t LNG = 38 x 10^9 J
1 t tce	0.70 toe = 770.7 m^3 natural gas = 29.3 x 10^9 J
1 EJ (10^{18} J)	34.1 Mtce = 23.9 Mtoe = 26.3 G. m^3 natural gas = 278 Mrd. TWh
1 t uranium (nat.)	14,000 to 23,000 t tce; different values depending on the utilization factor
1 kg uranium (nat.)	2.6 lb U_3O_8

Deutsche
Rohstoffagentur

Bundesanstalt für Geowissenschaften und Rohstoffe

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