A World of Energy

2017 Edition

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Strategy Department – Foresight Division

As part of its analysis activities, ENGIE's Strategy Department produces an annual report aiming at identifying future trends in the global energy framework.

Today, a quarter of the electricity comes from renewable sources, and 30% in Europe.

Gas is also gaining ground in tomorrow's energy mix. Climate policies operate in its favor, as shown by the sharp rise in gas demand in Europe in 2016 and 2017 related to the disengagement of coal in the electricity sector. From the IEA to Greenpeace, every 2030 forecast maintains and even strengthens the position of gas, as it is the case for biomethane.

Regarding energy efficiency, the weakening correlation between growth in energy demand – which went from around +2% in the previous decade to +1% today – and global economic growth reflects the progress achieved.

Carbon regulations are spreading worldwide. In 2017, China launched its national ETS and the European Union managed to reinvigorate CO_2 prices thanks to the market reform decided in November 2017. Moreover non-State actors – especially local authorities, but also companies pressed by non-financial ratings - appeared at COP 22 as the new drivers in the battle against global warming.

However, temperatures have once again beaten all heat records in 2017, and CO_2 emissions were on the rise after three years of stabilization, driven by the global economic recovery. This upturn, particularly strong in Europe and in emerging countries, ended the imbalance within the energy market and allowed prices to bounce back after a period of severe depression; but it also brought back the coal consumption, which was losing ground.

These few observations from the 2017 report obviously reflect a mixed picture of the energy sector, but it is facing the challenges of the energy transition and it is reshaping itself step by step.

ENGIE collaborators can find further details in this report, and also in the new digital support Energy Essentials Hub developed by the Strategy Department at the following address:
Link to the site: https://engie.sharepoint.com/sites/dshub

More than the direct access to data and their regular updating, this support offers access to all the information available to the Strategy Department.

I hope this report will prove useful and benefits your work,

Adeline Duterque

Director of Foresight Division

We are a global energy and services group, focused on three core activities : low-carbon power generation, mainly based on natural gas and renewable energy; global networks and customer solutions.
Driven by our ambition to contribute to a harmonious progress, we take up major global challenges such as the fight against global warming, access to energy to all, or mobility, and offer our residential customers, businesses and communities energy production solutions and services that reconcile individual and collective interests.

Our integrated – low-carbon, high-performing and sustainable – offers are based on digital technologies. Beyond energy, they facilitate the development of new uses and promote new ways of living and working.

Our ambition is conveyed by each of our 150,000 employees in 70 countries. Together with our customers and partners, they form a community of imaginative builders who invent and build today solutions for tomorrow.

ENGIE profile

Key figures at December 31, 2017

- **150,000** employees throughout the world
- **65 billion** in 2017 revenues
- Operations in **70** countries
- **€16 billion** of growth investment over 2016-2018, inc. **€1 billion** or innovative and digital projects
- An investment fund of **€50 million** committed to energy access
- **1,100** researchers and experts at **11** R&D centers
- An investment fund of **115 million** dedicated to innovative startups.

ÉLECTRICITY*

112.7 GW of installed power-production capacity of which **19.5%** in renewable energy

5.2 GW power-production capacity under construction of which **29%** in renewable energy

506.2 TWh electicity generated in 2016

*** Including 100% of capacity of the Group's assets regardless of actual holding rate**

NATURAL GAS

supply portfolio of **1,082 TWh** (100 bcm)

No.3 seller in Europe

No.1 distribution network in Europe

No.2 transport network in Europe

No.1 vendor of storage capacity in Europe

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Summary

The energy market in 2016 and 2017: overview and key issues

Overview of 2016-2017 economic developments

In 2017 the world economic growth is dynamic with +2.9% in actual data, driven by the recovery in the exporting countries of raw materials, the dynamism of developing countries and good performance in Europe and the United States. The growth is projected to edge up to +3.1% in 2018 (World Bank).

- The US economy regains momentum thanks to the return of household demand and private investment; Europe shows excellent results, despite the uncertainties due to Brexit. In both cases, poor productivity growth remains a factor of concern.
- China and India maintain high growth rates of +6.9% and +7.0%, respectively.
- Major commodity exporting countries return to positive growth rates: +0.2% in Brazil and +1.4% in Russia, but remain weakened by many structural problems. Gulf countries face budget deficits concern.

In 2016 global economic growth had evolved quite modestly, by +2.4%, reflecting poor performance in developed countries, difficulties in countries exporting raw materials and resilience in China and India.

CO_2 and climate: 2016–2017 overview

Though world CO_2 emissions increased 2% in 2017 after three years of decline (down 0.4% in 2016), the longer-term downtrend appears intact. This results from energy efficiency gains and the continuing expansion of renewable energies and natural gas within the world electricity mix, to the expense of coal.

Nearly half of world emissions come from Asia (15 Gt out of 31 Gt). India is, after China, the main driver of CO_2 emissions growth. It has successfully engaged in voluntarist climate policies.

Carbon market prices are still too low. The markets themselves have multiplied rapidly over the recent years, but most are trading at levels far below where they would need to be to produce the desired mitigation effects and meet the Paris Agreement's objectives.

In November 2017 the EU revealed the basis of the carbon market reform intended to deal with this issue. An agreement between the European Parliament and the EU Council aims at rebalancing supply and demand to lastingly promote bullish carbon prices. Carbon prices have already risen past €8/t by the end of 2017, whereas they had been persistently stuck between €4 and €6/t in 2016.

A growing number of countries and regions are opting for a carbon tax. Among them are several European countries (for sectors outside the EU-ETS), but also Japan, Mexico and British Colombia. The highest tax rates are in Europe. In France, the 2017 Finance Law provides for the implementation of a carbon tax at €30/tonne to start with, going up to €100/tonne by 2030.

Electricity: 2016–2017 overview

World generating capacity is changing rapidly towards greater use of renewable sources. Coal and renewables are now neck-and-neck in the capacity mix, at one-third each. In 2016 and 2017, renewables accounted for two-thirds of world's incremental capacity, with score in 2017 by 70% in India, 60% in China and 50% in United States. In Europe, however, renewable power capacity growth is slowing, mainly because of lower subsidies. China and India are now leading the charge. China accounted for half of world incremental capacity.

The more moderate rise in electricity generation over the last few years (around 2%) has not prevented continuing decarbonisation. RES now accounts for a quarter of world electricity generation, and over the past two years production from coal-fired plants has decreased.

Asia's economic vitality and electrification have been the main factors behind the rise in world electricity consumption. While China (+6% in 2017) accounts for over half of the increase, India, Indonesia, Malaysia and Thailand also played their part. In contrast, economic weakness and improved energy efficiency allowed OECD countries to curtail their consumption.

Electricity prices were particularly low in Europe in 2016 and over the first half of 2017, thanks to the collapse of most energy commodity prices. They subsequently rallied vigorously as a result of higher coal prices from May onwards and higher CO_2 prices from July onwards.

Natural gas: 2016–2017 overview

After moderate +0.7% growth in 2016, world natural gas production may have risen +1.4% in 2017 (ENGIE estimates).
In the USA, natural gas output contracted in 2016 (-2.3%) and again in 2017 (-1.6%), suggesting difficulties in maintaining the pace of cost cutting efforts made up until now in unconventional gas production. This sector represents 55% of total US output.
In contrast, Russian production increased by a modest +0.9% in 2016 and surged +9% to 701 bcm in 2017, its highest level for 25 years. This followed strong demand on the domestic market and in Europe. Although structurally depleting, European natural gas production expanded moderately in 2017 (+1.4%) thanks to Norwegian fields; Dutch production from its Groningen fields is increasingly vulnerable to earthquakes. Natural gas production in China has been rapidly expanding over the last decade, reaching 148 bcm in 2017 (+9%). This is greater than total EU output.
Shale gas production has become an integral part of the world gas market but has barely developed outside North America

After inching higher in 2015 and 2016 (by +1.2% and +1%, respectively), natural gas consumption is expected to have accelerated in 2017, driven by Europe and Asia. A stronger world economy in 2017 and environmental policies have favoured natural gas, but exceptionally high temperatures over the last three years have weighed on demand.
In Europe, natural gas consumption jumped 6% in 2016 and 10% (up 49 bcm) in 2017, despite unusually mild weather. This call for natural gas is closely related to electricity production and reflects its complementarity with renewable energies in a context of low prices and the move away from coal. In the USA, natural gas demand barely rose in 2016 (+0.9%) and is expected to have dropped 3% in 2017 because of slightly higher Henry Hub prices, greater use of coal and, to a lesser extent, an increase in electricity production from renewable sources. The Asia-Pacific region renewed with a rapid expansion in natural gas consumption in 2016 and 2017 (+5% in 2016 and +14% over the first 9 months of 2017).

IEA 2017 forecasts (published in the 2017 World Energy Outlook) confirm the prominence of natural gas: it is the only fossil energy likely to post a higher share in the total energy mix out to 2040, to 25% in both the New Policies and the Sustainable Development scenarios. In the latter scenario, natural gas is actually the leading energy source in 2040.

World gas trade is expected to have expanded in 2017: up 25% for LNG, boosted by worldwide demand (except in Latin America), and up 10% for pipeline gas in Europe. A recovery in international trade flows started in in 2016 (+4.8%), driven by regional imbalances in Europe and shortages in Asia. Floating Storage and Regasification Units (FSRUs) also opened new LNG markets.

Natural gas prices had weakened until 2016 on the back of abundant supply but picked up slightly on the three regional markets in 2017 as supply and demand moved closer into line.

Oil: 2016–2017 overview

A gradual rebalancing of the oil market takes place in the second half of 2017, after a period of overproduction that weighed on prices in 2016 and the first half of 2017. The recovery of prices is confirmed at the end of 2017.

Oil production has benefited in 2015 and 2016 (+3.5% and +0.4% respectively) from a supply policy on the part of OPEC and the vitality of unconventional oil production in the USA. Yet, at the end of 2016, the financial difficulties following the prices fall, push OPEC to tighten its quotas, while american drilling decreased. **This led to stabilize world supply in 2017.**

On the other hand, oil consumption continued to increase in 2017 (+1.7% estimated) after rising +1.5% in 2016, supported by low prices and the global economic recovery. The transport sectors in China, India and the USA were major contributors to stronger demand.

Prices remained low in 2016 and through to October 2017, due to abundant stocks. **They have since regained some ground in reaction to the extension of the OPEC agreement and renewed tension in the Middle East;** the barrel of Brent ends the year 2017 at $60.

Coal: 2016–2017 overview

The fall in world coal consumption continued in 2016, accelerating to a 3% decline after a 2% drop in 2015 and a 1% fall in 2014. The trend is particularly marked in the EU and North America (both down 8% in 2016) but mixed in Asia, where a substantial 5% drop in Chinese demand only partially offset stable growth in India and Indonesia (up 4% and up 10%, respectively).

In the light of coal import figures, demand appears to have picked up in 2017. The outlook for the medium to long term is for flatlining or decreasing consumption as a result of environmental constraints.

World coal output contracted by an extraordinary 6% in 2016, with most producer countries reporting declines. India, Russia and Columbia were conspicuous exceptions to the rule. China, the world's leading producer, reduced its output by 9% following a series of measures aimed at putting the industry on a healthier footing and at better control over prices (mine closures, fewer working days).

Some of these measures were cancelled or suspended in 2017 however, allowing a gradual rebound in production (estimated +1% at world scale in 2017). The Chinese government intends to use output control as a means of regulating international coal prices and has a clear objective of restricting them to between CNY 450 and CNY 525 per tonne (USD 65-75).

Prices picked up strongly in 2016 and held at around USD 85/tonne in 2017. Having bottomed out below USD 44/tonne CIF ARA in February 2016, coal rallied to USD 90/tonne by the end of the year and fluctuated between USD 70 and USD 90/tonne in 2017. Prices averaged around USD 85/tonne over the year as a whole.

France: 2016–2017 overview

- **The French economy was in 2017 more dynamic than expected, with +2%,** after a moderate growth of +1.2% in 2016.
- **Exceptionally, primary energy production contracted -6% in 2016 and -1,7% in 2017 with the decline of nuclear production because of continued control operations.** The fall-back to gas-fired thermal plants combined with lower electricity exports weighed on the energy balance as well as on CO_2 emissions.
- **Energy consumption declined in 2016** both in real terms (-1%) and in temperature-adjusted terms (-2%) against a backdrop of slightly warmer than normal conditions (+0.5°). **Primary energy demand was nearly in 2017 with -0,5%,** within a better economic situation but comparatively warm temperatures.
- **Final consumption has been contracting steadily since 2000** because of French deindustrialisation, energy efficiency measures and a sluggish economy.
- **France intends to play a leading role on climate issues.** The new climate plan follows the Energy Transition Act; it presents the country's ambitions and the framework in which they are to be implemented.

GDP

Weakened in 2016 by the fall in raw material prices, and the US slowdown the world economy is rebounding in 2017, thanks to better economic performances in the US and in Europe as well as a rebound in commodity exporting countries

GEOPOLITICS

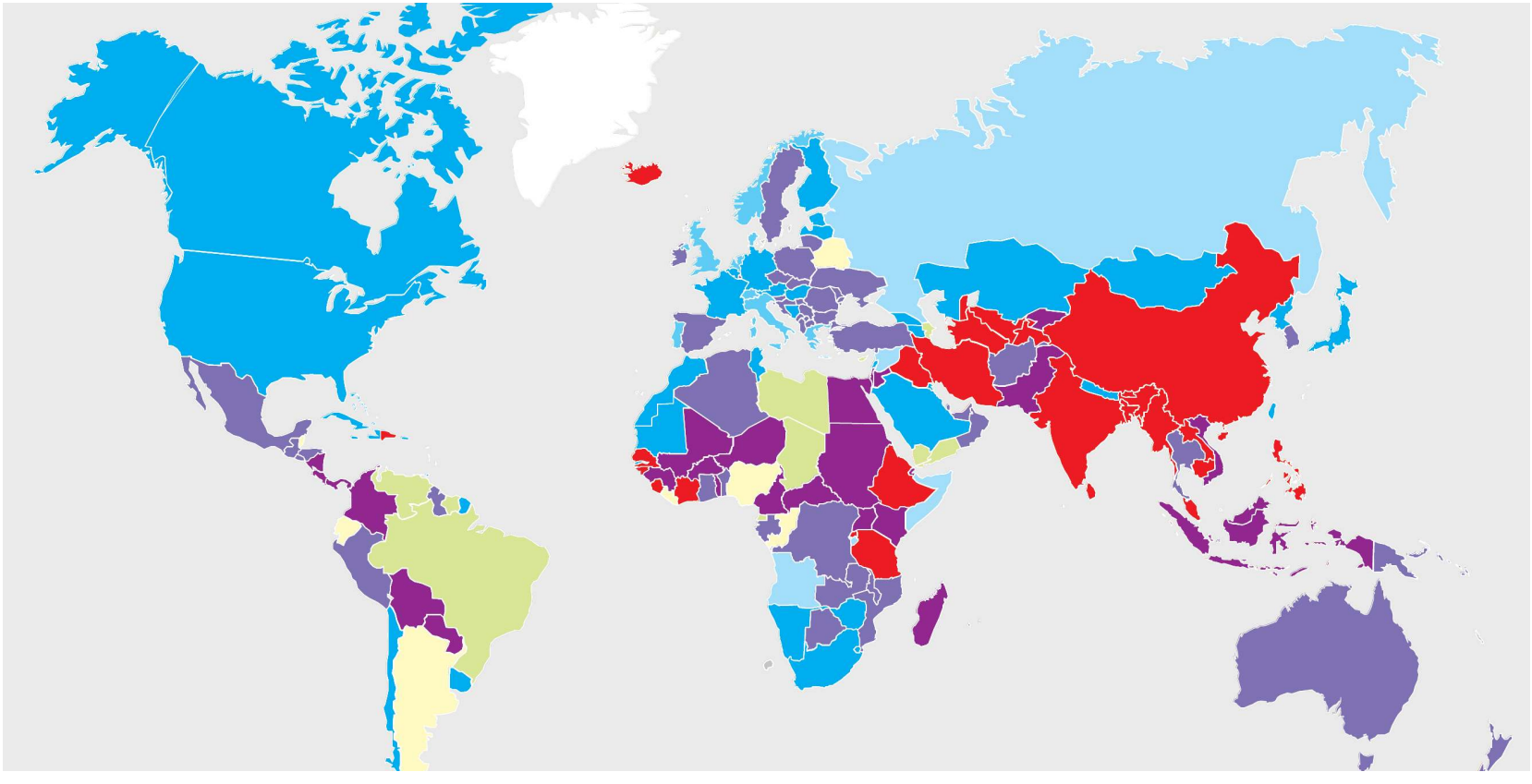
Nationalism and independence movements dominate political discourse around the globe, leading in some cases to worrying international tension. Examples would include the Trump/Kim Jong-un dispute and the difficult negotiations between Britain and the EU

Economy & energy context

World economy

World economic growth of +3% in 2017 should continue in the coming years

GDP GROWTH RATE BY COUNTRY IN 2016



Source: Enerdata, Global Energy & CO2 Data (2017)

World economy

2017 marks the recovery of most economies

WORLD

World real GDP growth rebounded in 2017 (+2,9%), driven by firmer activity in Europe and in the USA, recovery in raw material exporting countries and the growing share of developing countries, led by China and India, in the global economy. Developing countries reported average real GDP growth of 4,0% in 2017, the World Bank expects growth 4,5% in 2018 and 4,7% in 2019.

In 2016, world growth was slowing, with +2.4%, compared with 2.8% in 2015. This deceleration reflected slower growth in the USA, the UK's vote to leave the European Union and a recession among major raw material exporting countries (Brazil, Russia Nigeria, Argentina) that offset resilient activity in China and India.

2018 be a pivotal year as for the first time since the GFC the negative output gap is expected to be closed: the economy is expected to return to its full potential. The current growth trend ought to stabilize in the coming years (the World Bank expects 3,1% growth in 2018 and 3,0% in 2019). Uncertainties remain about the sustainability of long term growth, stemming particularly from the weakness of productivity growth.

GDP and population	Real GDP growth rate		GDP current (billions USD)		Per capita GDP (USD thousands)		population (millions)	
	2010-2016	2015-2016	2015	2016	2015	2016	2015	2016
Europe	0.9%	1.4%	18,395	18,529	30	30	620	623
European Union	0.9%	1.5%	16,376	16,533	32	32	509	511
North America	1.1%	0.8%	19,589	20,099	55	56	357	359
Canada	0.8%	0.2%	1,553	1,530	43	42	36	36
USA	1.1%	0.9%	18,037	18,569	56	57	321	323
Latin America	-0.1%	-4.3%	5,866	6,612	9	10	627	634
Brazil	-0.5%	-4.4%	1,804	1,795	9	9	206	208
Asia	3.6%	3.9%	22,890	23,908	6	6	3,968	4,007
China	6.1%	6.1%	11,065	11,199	8	8	1,371	1,379
South Korea	2.1%	2.4%	1,383	1,411	27	28	51	51
India	4.5%	5.7%	2,133	2,260	2	2	1,292	1,309
Japan	1.0%	1.1%	4,383	4,939	34	39	127	127
Pacific	1.0%	1.2%	1,414	1,438	37	37	38	39
Australia	1.0%	1.3%	1,215	1,230	51	51	24	24
CIS	1.0%	-0.1%	1,902	1,743	7	6	287	289
Russia	0.8%	-0.4%	1,366	1,283	9	9	144	144
Middle East	1.2%	1.7%	2,400	2,418	10	10	237	242
Saudi Arabia	1.5%	-0.5%	654	646	21	20	32	32
Iran	-0.5%	5.3%	393	427	5	5	79	80
Qatar	-0.8%	-1.3%	165	152	66	59	2	3
Africa	0.3%	-0.7%	2,251	2,091	2	2	1,193	1,224
South Africa	0.3%	-1.3%	317	295	6	5	55	56
World	**1.3%**	**1.2%**	**74,707**	**76,838**	**10**	**10**	**7,327**	**7,416**
OECD	**1.0%**	**1.1%**	**46,373**	**47,525**	**36**	**37**	**1,279**	**1,288**
Non OECD	**2.8%**	**2.1%**	**28,334**	**29,313**	**5**	**5**	**6,048**	**6,128**

Source: Enerdata, Global Energy & CO2 Data (2017)

World economy

USA

US growth picks up again in 2017 (+2.2%), after the slowdown of 2016 (+1.6% against +2.6% in 2015). In 2016, the trade deficit weighed on the growth, as well as the contiguous decline in household demand and in private and public investment spending. These trends reversed in 2017, with a return of household consumption and business investment.

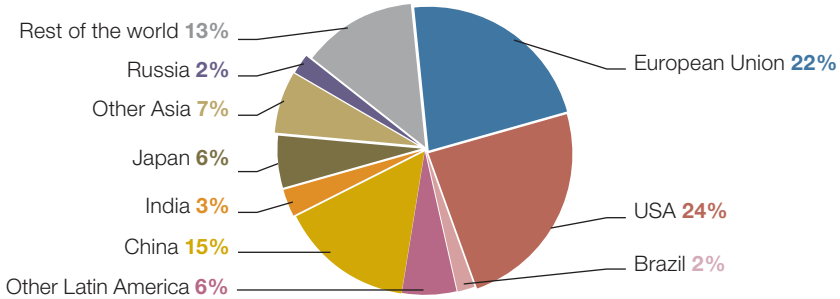
Despite a 17 year low unemployment rate (4.1%), this slight rebound seems more cyclical than structural; in the long run, the US economy is penalized by the low participation in the labor market and sluggish growth in productivity. On the short term, it remains subject to the unpredictable policy measures of President Donald Trump.

EUROPEAN UNION

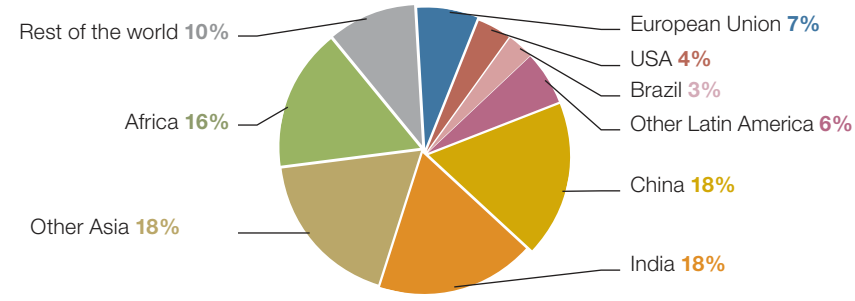
In 2017, the European economy enjoys an "insolent" health, after 2016 growth which, although higher than analysts' forecasts, represented a decrease compared to 2015 (+1.9% vs. +2.2%). Unemployment, down since 2016, reached 7.4% at the end of 2017, the lowest rate since 2009 and the ECB started to slow down the pace of its asset purchases, which bodes for an upcoming normalization of its policy. The strength of domestic demand and the rebound in investment are all positive signals, even if the competitiveness of the euro could weigh on growth in 2018 (+1.9% according World Bank).

However, uncertainties remain regarding the banking sector in certain countries (Italy, Portugal), and the conduct of Brexit.

WORLD GDP IN 2016 TOTAL 76,838 BILLIONS USD (CURRENT)



WORLD POPULATION IN 2016 – TOTAL: 7,416 MILLION



Source: Enerdata, Global Energy & CO2 Data (2017)

World economy

ASIA

The Japanese economy remains sluggish, and GDP rose just +1,2% in 2017, up from +1% in 2016. Conjonctural increases in household consumption and exports drove the economy in 2017. Structural barriers to growth remain in Japan, such as negative or zero bound interest rates and a lack of wage growth. Despite the implementation of Prime Minister Abe's reforms (fiscal stimulus, monetary easing and structural reform), Japan appears likely to suffer several more years of stagnation.

Beijing announced growth of +6.9% in 2017, a stability since three years (+ 6.7% in 2016 and + 6.9% in 2015). This result exceeded government expectations, thanks to an upturn in exportations. Despite scepticism over their reliability, official GDP statistics are closely scrutinised because China accounts for 30% of the world economy. The 'rebalancing' policy currently underway is focused on the domestic market and services rather than exports and the industrial sector. Exports have been China's main engine of growth: they picked up in 2017 after but slumping in 2016 (down -7%) because of softer consumption among the country's major trading partners. An ambitious policy of investment in the industrial sector and in infrastructure (up 7%), together with rising consumption (up 10%), boosted the development of domestic markets. The 13th five-year plan adopted in March 2016 sets an annual average growth objective of 6.5% out to 2020. Some experts question the sustainability of such vigorous economic performance, however, as Chinese private and public debt now amounts to 250% of GDP. This level is worrying the rating agencies and international institutions.

Indian growth is table around +7% (+7,2% in 2017 and +7,1% in 2016). In 2017, growth was hindered by the introduction of the new "Good and Services Tax" as well as weak private investment that public infrastructure investment and pay hikes in the public sector could not offset. Forecasts are upbeat and assume a recovery in international trade, high public spending and growing demand.

ECONOMIES TIED TO RAW MATERIAL PRICES

Countries affected by lower raw material prices stabilised in 2016, to find positive growth rates again in 2017.

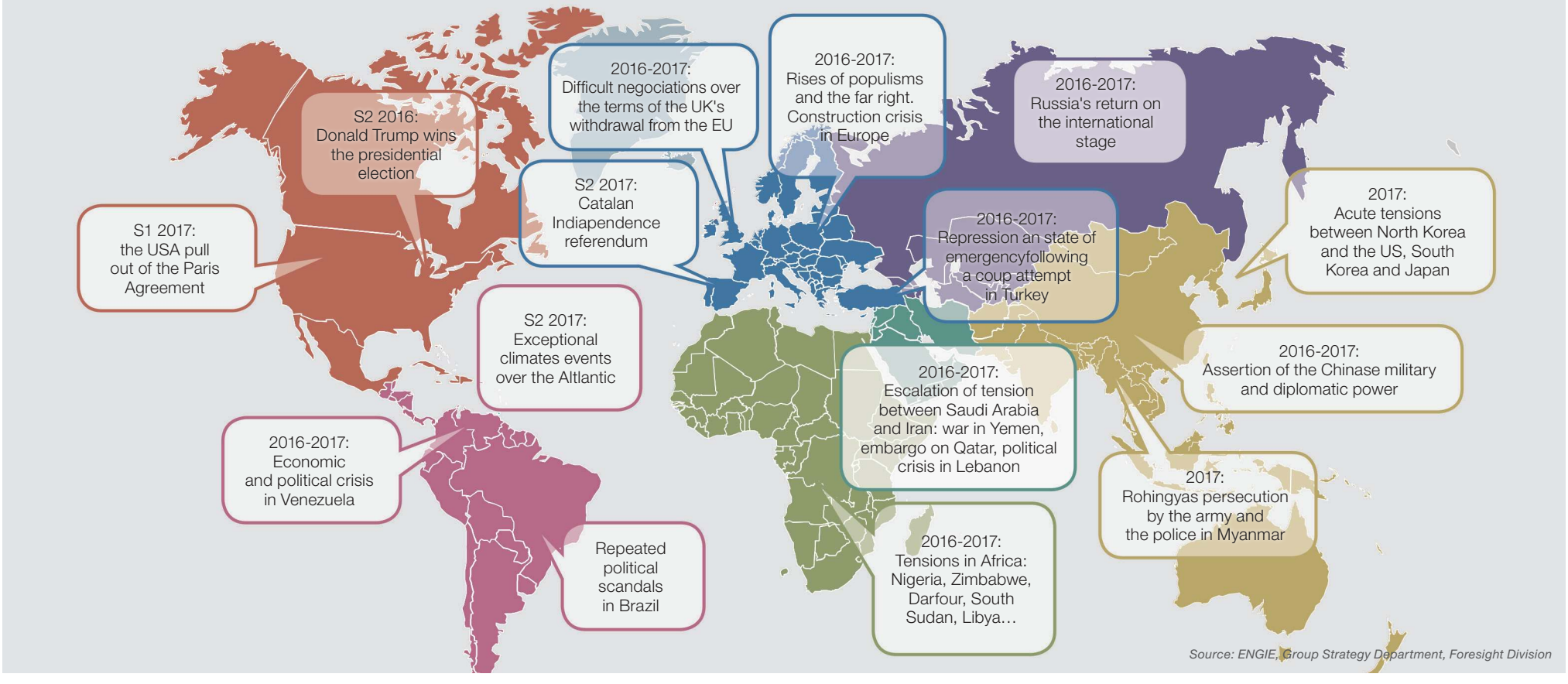
Brazil posts positive growth rates in 2017 (+0,2%). Falling raw material prices and political scandals had cut Brazilian GDP by -3.6% in 2016, following a -3.8% drop in 2015. Strong domestic demand driven by looser monetary conditions and returning confidence drove the 2017 upturn, yet the market remain wary of political uncertainty.

Russian growth found momentum in 2017 (+1,4%), driven by higher oil prices, a targeted fiscal stimulus and state support to the banks. Yet this progress does not solve the underlying weaknesses of the Russian economy. Russia has been severely hit by lower oil prices and by EU and US trade sanctions related to the Ukrainian conflict (-2.8% in 2015 and -0.2% in 2016). According to the IMF, Russia's GDP will have expanded 1.8% in 2017 on the back of substantial government spending. But investment is still at historically low levels, including that from foreign countries; capital outflows surged 50% to $13 billion over the first half of 2017 and no structural reform is in sight. **Without investment or modernisation, Russia risks economic stagnation.**

OPEC members, and particularly the Gulf states, also suffered heavily from the decrease in oil prices, which resulted in budget deficits and social unrest. On Saudi Arabia's initiative, an agreement to reduce oil production in an attempt to boost depressed and volatile oil prices was signed at the end of 2016. The deal included non-OPEC members such as Russia and Mexico. Other affected OPEC members such as Nigeria and Ecuador also pushed for the agreement. **Yet these production curbs have so far failed to drive prices substantially higher.** This is a particularly disturbing situation for countries unable to diversify their economies.

Geopolitics A rising number of political and religious conflicts and the deterioration of diplomatic and military relations across the globe has further undermined the world's major geopolitical equilibria.

MAP OF MAJOR EVENTS IN 2016-2017



Source: ENGIE, Group Strategy Department, Foresight Division

Geopolitics

2016-2017 saw the prolongation of the main conflicts and the emergence of new areas of tension

Three years after the caliphate was declared, its governing project in the Middle East seems to have failed, yet the threat remains. AQIM and Boko Haram jihadists plague the whole Sahelian belt, while Al-Shabab still controls vast stretches of rural Somalia.

The international climate around North Korea has deteriorated severely over the past few months as the regime launched several missiles. It is now apparently able to build and deliver a nuclear weapon.

War remains a tragic reality in Donbass, in Eastern Ukraine. Peace negotiations are at a standstill.

Donald Trump's first year as President of the United States have featured an aggressive foreign policy, with withdrawal from several partnerships and agreements and threats to delicate diplomatic and geopolitical equilibria that raised questions and concern among US allies. He disavowed the Obama-era nuclear agreement with Iran and announced new 'tough' sanctions. He demanded both a revision of the NATO cost sharing system and firmer politics. Tensions arose after he notified the UN of the US withdrawal from the Paris Agreement on climate change (see chapter CO_2 and climate).

Latin America is still subject to major upheaval. In Brazil, Dilma Roussef was impeached in august 2016, in the wake of the Petrobras scandal. Michel Termer, who replaced her, has also been repeatedly accused of corruption. The next presidential elections (2018) seems to call for a renewal of Brazil's political class. **In Argentina and in Ecuador, the left loses ground.** The 'Cambiemos' coalition (centre-right) won the latest general election in October 2017 in Argentina. In Ecuador, president Lenin Morano (elected in April 2017) announced the partial liberalization of economic policy. **In Venezuela,** Nicolas Maduro's government's seems to have utterly lost control of the country.

The European Union still faces political difficulties. The issue of the reception and integration of large immigrant populations exacerbates tensions between EU member states against a backdrop of nationalism and populism. The new integration dynamic clashes with Eurosceptic populations and the desire for independence of some regions (Catalonia, Lombardy and Venetia, Flanders, Scotland etc.). In the UK, the 'Leave' campaigners succeed in the 2016 referendum. The negotiations over the terms of the UK withdrawal from the EU started in March 2017. The British government is in disarray and struggles to makes the negotiations go forward .

Africa still features numerous crises and areas of tension. Continued tribal conflicts in South Sudan have already displaced 1.8 million people. Ethnic tensions in Ethiopia and the Democratic Republic of the Congo threaten the regional balance of power. In South Africa, President Jacob Zuma is mired in corruption scandals and narrowly escaped another no-confidence vote in parliament during the summer of 2017. This situation has weakened political authority a country already at economic standstill.

Energy reserves According to current estimates, fossil fuel reserves far exceed future needs

Reserves Gteo	Coal & Lignite		Crude oil & NGL				Natural gas				Uranium			Total
	Volume	Share in world total	Conventional volume	Non-conventional volume	Total volume	Share in world total	Conventional volume	Non-conventional volume	Total volume	Share in world total	Volume	Share in world total	Volume	Share in world total
Europe	46	7%	2	0	2	1%	4	0	4	2%	1	2%	53	5%
North America	169	27%	8	22	30	13%	4	6.3	10	6%	8	15%	217	20%
Canada	4	1%	1	22	23	10%	2	0.4	2	1%	6	11%	35	3%
USA	165	27%	7	0.3	7	3%	2	6	8	5%	2	3%	182	17%
Latin America	9	1%	16	29	45	20%	7	0	7	4%	2	4%	64	6%
Asia	176	28%	5	0	5	2%	10	0.6	11	6%	5	9%	197	18%
China	90	15%	2	0	2	1%	2	0.4	3	1%	2	3%	97	9%
India	64	10%	1	0	1	0.3%	1	0.1	1	1%	2	3%	67	6%
Pacific	81	13%	1	0	1	0.2%	2	1	3	2%	15	27%	100	9%
CIS	127	21%	19	0	19	8%	62	0.04	62	34%	11	19%	218	20%
Kazakhstan	18	3%	4	0	4	2%	2	0	2	1%	5	8%	28	3%
Russia	85	14%	14	0	14	6%	47	0.04	47	26%	4	6%	149	14%
Turkmenistan	0	0%	0.08	0	0	0.04%	9	0	9	5%	0	0%	9	1%
Middle East	1	0%	106	0	106	47%	75	0	75	41%	0.02	0.03%	181	17%
Saudi Arabia	0	0%	35	0	35	16%	8	0	8	4%	0	0%	43	4%
Iraq	0	0%	19	0	19	8%	4	0	4	2%	0	0%	22	2%
Qatar	0	0%	3	0	3	2%	22	0	22	12%	0	0%	26	2%
Africa	9	1%	17	0	17	8%	12	0	12	7%	13	24%	52	5%
Namibie	0	0%	0	0	0	0%	0.1	0	0.1	0.04%	4	7%	4	0.4%
Niger	0	0%	0.02	0	0.02	0.01%	0	0	0	0%	4	7%	4	0.4%
World	**619**	**100%**	**173**	**52**	**224**	**100%**	**176**	**8**	**184**	**100%**	**56**	**100%**	**1,082**	**100%**
Total years of production	**166**		**50**				**62**				**82**		**92**	

Source: Enerdata, Global Energy & CO2 Data (2017)

WORLD ENERGY RESERVES

Fossil fuel reserves will easily cover the consumption expected over the coming decades. Proven reserves* alone cover 54 years of oil consumption, 67 years of natural gas consumption and 120 years of coal consumption (at current production levels). **Above and beyond these conventional reserves, we can now add unconventional oil and gas,** for which reserves are far greater and where technical progress – notably in hydraulic fracturing – has made exploitation viable. This is subject to considerable economic and environmental constraints, however, which is why unconventional oil and gas production is still largely undeveloped outside North America. **Uranium reserves** are estimated to last another 70 years.

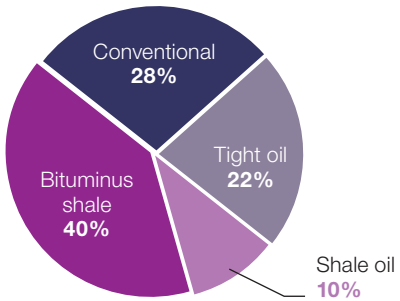
***Recoverable reserves are broken down by likelihood of production: 90% for proven reserves, 50% for probable reserves and 10% for possible reserves (see Reserves in the Glossary)**

Energy reserves: unconventional oil (tight oil / shale oil)

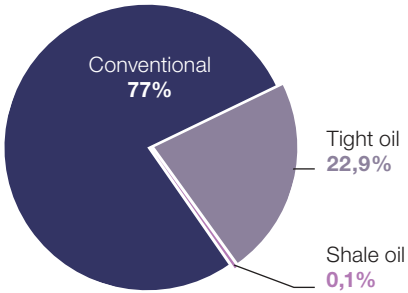
Shale oil (or light tight oil) refers to oil extracted directly from bedrock (shale) or from other rocks showing very low permeability (tight). Extraction involves horizontal drilling and hydraulic fracturing (fracking). This type of oil is usually of high quality (light, low sulphur content, etc.).

Exploitation of tight oil offers unrivalled flexibility compared to conventional oil (notably offshore), in terms of costs and both drilling and producing times. The plasticity of the production facility resulting from major technological advances is an important advantage in a highly volatile world. Close to null in 1990, the share of unconventional sources in world oil production is expected to reach 20% by 2035, according to PIRA's estimates.

WORLD OIL RESERVES IN 2016

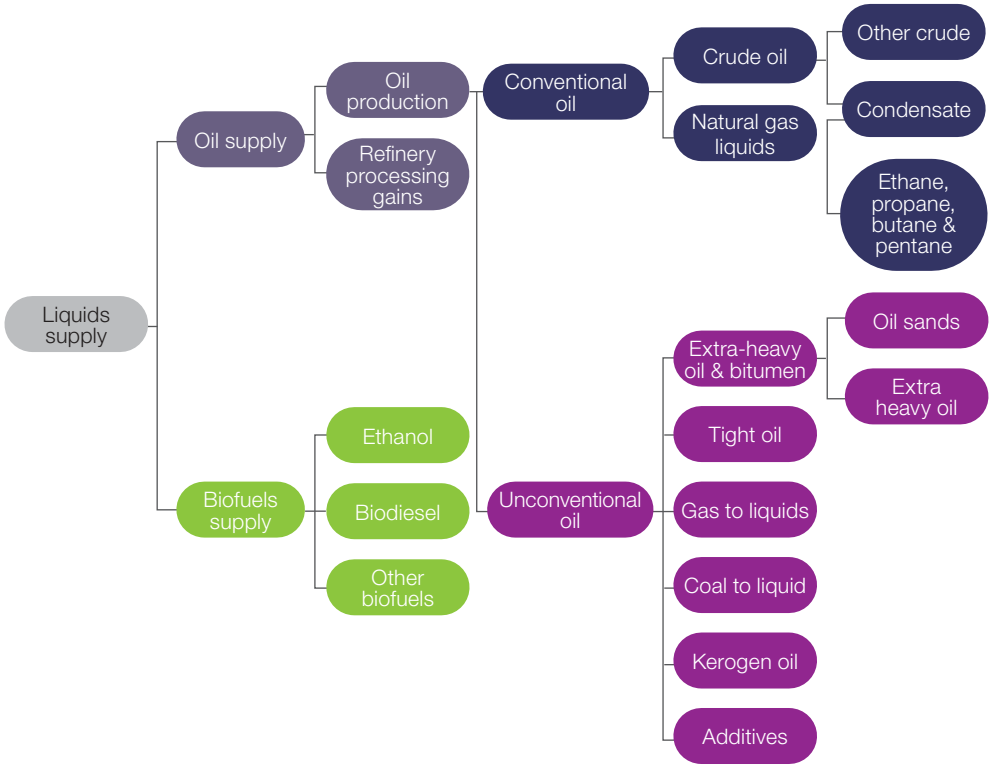


WORLD NATURAL GAS RESERVES IN 2016



Source: Enerdata, Global Energy & CO2 Data (2017)

CONVENTIONAL AND UNCONVENTIONAL OIL CLASSIFICATION



Source: PIRA

Energy reserves: the world's unconventional and conventional gas resources

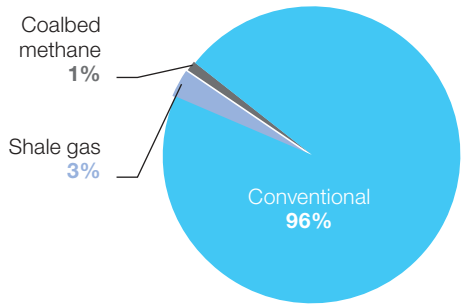
Unconventional natural gas comprises coal bed methane (CBM), tight gas and shale gas. Shale gas represents the largest share of unconventional resources (64%, compared with 23% for tight gas and 14% for CBM).
Exploitation of unconventional resources started with CBM at the end of the twentieth century. Shale and tight gas production is more complex and requires specific drilling technics (horizontal drilling and hydraulic fracturing).

Shale gas production is practically non-existent outside the USA and Canada. Australia produces CBM. Other regions intending to exploit shale gas are still in the exploration stage or produce only limited volumes (Asia-Pacific, China, India, Argentina, South Africa, Algeria, etc.). In Europe, disappointing initial drilling results in 2014-2015 combined with the energy transition programme have ended the development of unconventional gas.

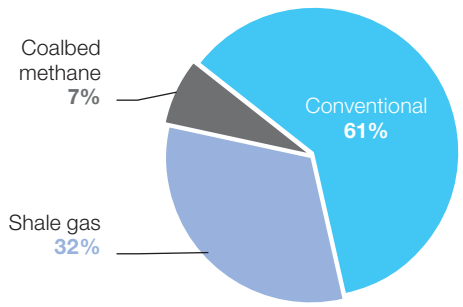
World unconventional gas accounts for 45% (364 Tm^3) of total recoverable gas reserves. The latter (conventional and unconventional) amount to 795 Tm^3 (+11 Tm^3 from 2016 estimates), enough to meet at least 220 years of consumption. Note that unconventional gas reserves are spread more evenly around the planet than conventional gas.

World conventional gas reserves lie mostly part in Eurasia (31%) and the Middle East (24%). The Middle East will have to develop its gas production capacity to satisfy growing domestic demand as well as export needs.

NATURAL GAS RESSOURCES IN 2016



RESSOURCES DE NATURAL GAS EN 2016

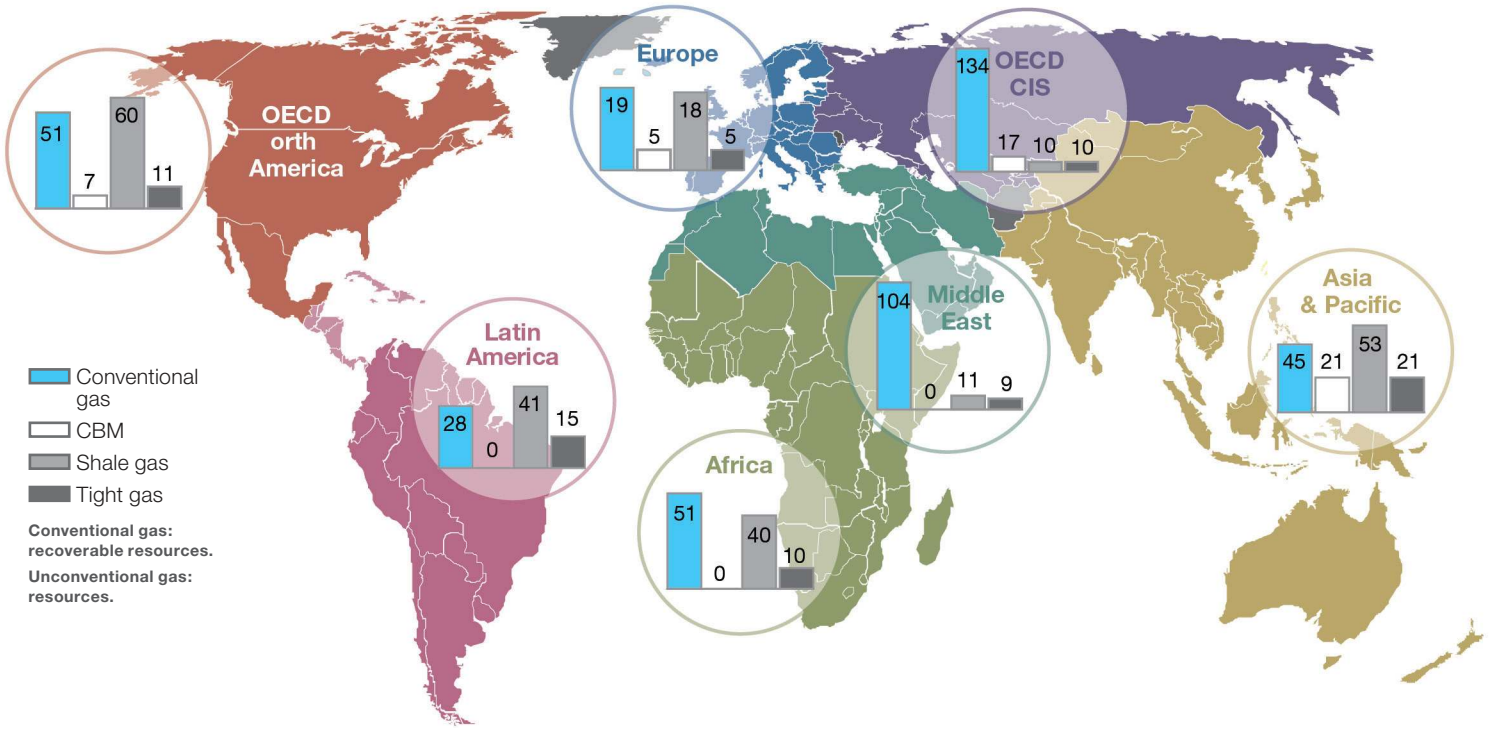


Recoverable reserves are broken down by likelihood of production: 90% for proven reserves, 50% for probable reserves and 10% for possible reserves (see Reserves in the Glossary)

Source: Enerdata, Global Energy & CO2 Data (2017)

Energy reserves: the world's unconventional and conventional gas resources

RECOVERABLE CONVENTIONAL AND UNCONVENTIONAL GAS RESOURCES IN 2015, BY REGION (TM³)



Source: International Energy Agency, World Energy Outlook 2017 © OECD/IEA

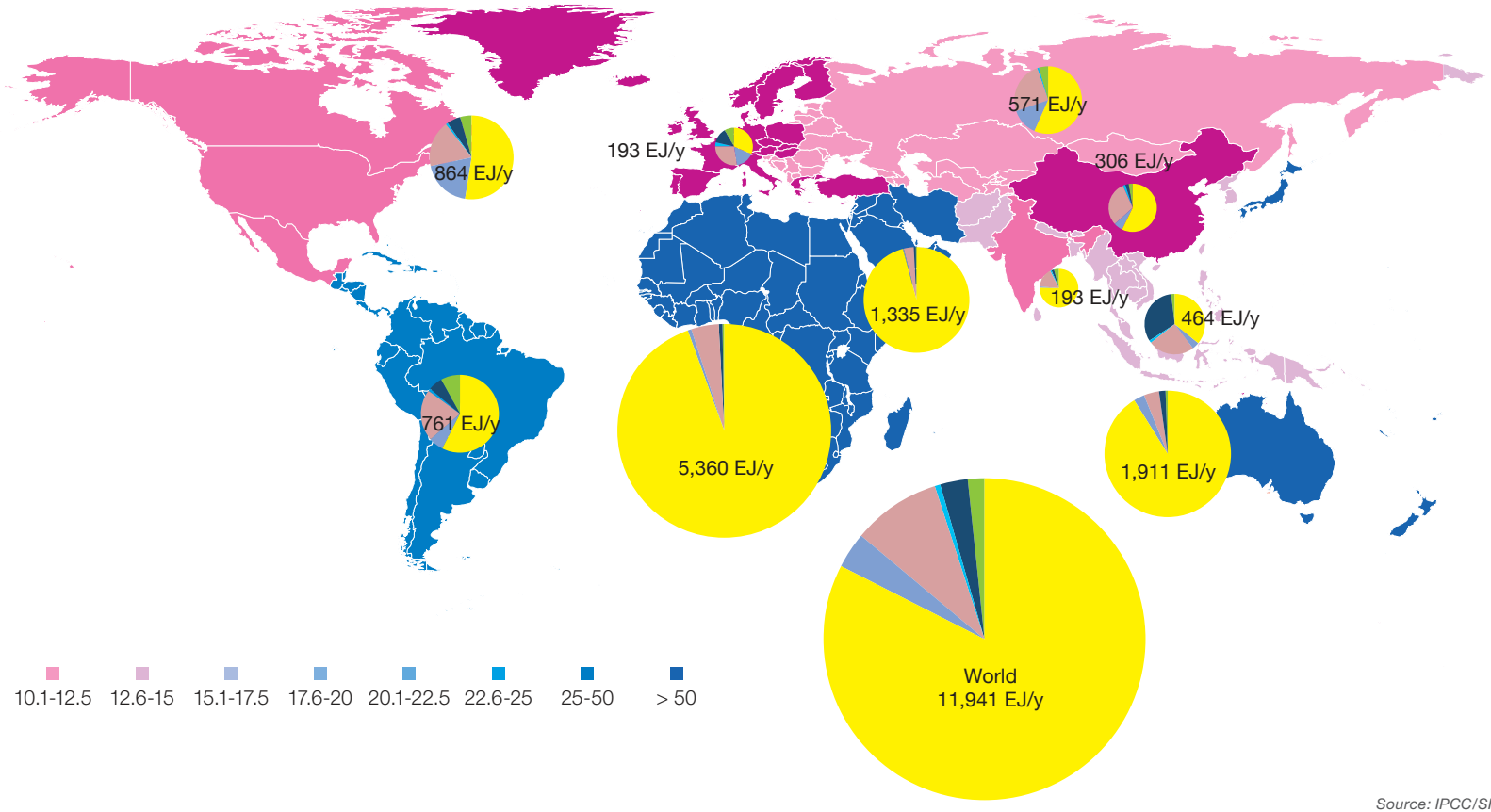
Energy reserves: renewable energy sources

RENEWABLE ENERGY POTENTIAL ANALISYS IN THE WORLD

Total technical renewable energy potential in EJ/y for 2050 by renewable energy source:

EJ/y

- Solar
- Wind
- Geothermal
- Hydro
- Ocean
- Bio energy



Technical renewable energy potential can supply the 2007 primary energy demand by a factor of:

0-2.5 | 2.6-5 | 5.1-7.5 | 7.6-10 | 10.1-12.5 | 12.6-15 | 15.1-17.5 | 17.6-20 | 20.1-22.5 | 22.6-25 | 25-50 | > 50

Source: IPCC/SRREN (2015)

Energy reserves: renewable energy sources

Renewable energy sources are sufficient to meet all world energy demand. The technical potential of renewable energies – in other words the achievable output, were the current techniques to be implemented with the greatest efficiency – is not a constraint to their expansion. It is even likely to increase as new technologies develop.

Solar power has the greatest technical potential and breakthroughs are regularly announced. One of them is the installation of solar panels on waterways or water bodies. This alternative combines the advantages of limiting both water evaporation and use of land.

Potential from hydro power is better known and exploited (48%). However, in this instance too, the available resources could be far greater with a wider use of small hydro, low head, and even very low head, turbines.

The technical potential of renewables is often difficult to measure precisely because of the sheer variety of assessment methods. It depends on many factors, but particularly on political will, technology's cost reduction, and economic and population growth.

Climate change will have an impact on the distribution and the availability of resources. Even if the overall impact of climate change on hydrology is limited (<0.1%), variations between regions will be substantial. Wind sources will also be affected. Bioenergy sources are also very sensitive to the consequences of climate change.

Primary energy balance

Following a period of excess supply, world energy production had to adjust in to rebalance the markets and halt the slide in prices. The 0.7% contraction of world production in 2016 came mainly from coal (-4.7%), driven by China aiming to absorb oversupply. Production contracted among other fossil fuels: oil down 0.7% in 2016 after a 2.2% increase in 2015; natural gas down 0.2% in 2016 after a 1.6% gain in 2015. Low prices hurt OPEC producers as well as US unconventional oil and gas producers.

The situation gradually rebalanced in 2017, thanks to OPEC and China reducing oil and coal production, respectively, against a backdrop of growing demand. The year is likely to have resulted in a modest recovery in energy production.

Fossil fuels still dominate energy production with an 81% share, but renewable sources are progressing faster: 3% per year since 2010 and 6% per year for renewable electricity sources. Their share in the production mix currently stands at 14% and is expected to rise to 20% for the most moderate scenarios, and as high as 30% in scenarios in line with the Paris Agreement.

World energy consumption growth has slowed gradually since the beginning of the decade, from an average +2% in 2010-2015 to +0.8% in 2016, with a dip to +0.5% in 2015. It is expected to amount to +1% in 2017, extending the 2016 trend.

Energy efficiency, close to its structural trend (1%:year), is scarcely enough to reach the 2°C objective which requires a 3,2% improvement per year. This was less impressive than the 2% recorded over the previous two years, which reflected progress in China and in India (about 5%) and in the USA.

Analysis of world demand by type of energy shows that fossil fuels are losing ground to renewables (up 1.7% per year since 2010, compared with +3%). In 2016, world coal consumption declined (by +1.4%) for the second year in a row, following a marked decline in China (down 1% after a 2% drop in 2015). Oil demand has been slowing over the past three years and rose just 1.2% in 2016. Natural gas demand growth has stabilised at around 1% over the past two years. RES for electricity generation and biomass have been growing steadily (3% per year), while electricity consumption from nuclear plants increased 1.5% in 2016.

The modest pickup in 2016 masks generally weak world demand, with the exception of India (up 4.8%). India's contribution to additional demand was 40% in 2016, equal with that of China, which weighs far greater in world consumption (22% against 6%). Chinese demand recovered slightly in 2016 (up 1.4%, after a 0.7% increase in 2015), while most regions saw lower energy consumption: -0.3% in the USA, -2.5% in Latin America (including -3.3% in Brazil), -1.4% in Japan, and -0.5% in the CIS. Demand growth slowed in the EU to 0.7% (from 1.7% in 2015), in the Middle East (to 0.6%, against 3.3% in 2015) and in Africa (1.5% after 1.7% in 2015).

2017 indicators confirm higher consumption across all energy types and a rebound in Chinese consumption.

Primary energy production

Primary energy production in 2016 Mteo	Fossils									Biomass			Electricity			Heat			Total		
	Coal & Lignite			Crude oil & NGL			Natural gas			Biomass & wastes			Primary electricity			Geothermal & Solar					
	Volume	Share in world total	Change 2015-2016	Volume	Share in world total	Change 2015-2016	Volume	Share in world total	Change 2015-2016	Volume	Share in world total	Change 2015-2016	Volume	Share in world total	Change 2015-2016	Volume	Share in world total	Change 2015-2016	Volume	Share in world total	Change 2015-2016
Europe	169	5%	-3%	175	4%	3%	203	7%	-2%	151	11%	1%	332	27%	-1%	7	16%	2%	1,038	8%	-1%
European Union	136	4%	-6%	76	2%	-0.1%	103	3%	-2%	143	11%	2%	292	24%	-2%	3	7%	4%	754	5%	-2%
Germany	42	1%	-4%	4	0%	16%	6	0%	-8%	31	2%	2%	34	3%	-5%	1	2%	1%	118	1%	-2%
North America	387	10%	-16%	785	18%	-3%	755	25%	-3%	119	9%	3%	341	28%	3%	3	6%	4%	2,389	17%	-4%
Canada	31	1%	-1%	222	5%	1%	139	5%	0.3%	16	1%	5%	63	5%	2%	0	0.1%	0%	471	3%	1%
USA	356	10%	-17%	563	13%	-4%	616	21%	-3%	103	8%	3%	277	23%	3%	3	6%	4%	1,918	14%	-5%
Latin America	73	2%	5%	535	12%	-5%	182	6%	-3%	143	11%	1%	83	7%	3%	1	3%	20%	1,017	7%	-2%
Brazil	3	0%	-13%	137	3%	3%	20	1%	1%	87	7%	0.4%	40	3%	9%	1	2%	12%	288	2%	3%
Asia	2,369	64%	-4%	371	8%	-4%	375	13%	0.1%	532	40%	3%	326	27%	9%	29	69%	6%	4,004	29%	-2%
China	1,774	48%	-5%	202	5%	-7%	114	4%	1%	113	8%	-0.1%	183	15%	14%	28	66%	7%	2,415	18%	-3%
India	276	7%	5%	41	1%	-2%	26	1%	-1%	208	16%	6%	27	2%	5%	1	2%	0%	578	4%	4%
Indonesia	255	7%	-7%	43	1%	6%	66	2%	-1%	53	4%	0%	20	2%	7%	0	0%	-	437	3%	-3%
Pacific	300	8%	-0.4%	18	0.4%	-10%	74	2%	8%	8	1%	3%	11	1%	8%	1	2%	7%	412	3%	1%
Australia	298	8%	-0.3%	17	0.4%	-9%	60	2%	8%	6	0.4%	4%	3	0.3%	27%	0.4	1%	12%	384	3%	1%
Middle East	1	0.02%	5%	1,476	33%	7%	505	17%	3%	1	0.1%	0.1%	4	0.3%	37%	1	3%	0%	1,988	14%	6%
United Arab Emirates	0	0%	-	169	4%	4%	48	2%	1%	0	0%	-	0.03	0.002%	0%	0	0%	-	217	2%	3%
Iran	1	0.02%	6%	189	4%	19%	161	5%	4%	1	0.04%	0%	3	0.3%	42%	0	0%	-	355	3%	12%
Qatar	0	0%	-	81	2%	-1%	147	5%	1%	0	0%	-	0	0%	-	0	0%	-	228	2%	0.4%
CIS	275	7%	-0.3%	693	16%	1%	705	24%	-0.1%	13	1%	5%	96	8%	1%	0.03	0.1%	15%	1,782	13%	1%
Russia	207	6%	3%	550	12%	3%	529	18%	1%	8	1%	6%	68	6%	3%	0.01	0.01%	17%	1,362	10%	2%
Africa	153	4%	-1%	389	9%	-4%	173	6%	4%	370	28%	1%	19	2%	5%	0.2	0.4%	12%	1,105	8%	-1%
Nigeria	0.03	0.0007%	0%	105	2%	-7%	32	1%	-9%	111	8%	1%	0	0.04%	-9%	0	0%	-	249	2%	-4%
World	**3,727**	**100%**	**-5%**	**4,443**	**100%**	**1%**	**2,972**	**100%**	**-0.2%**	**1,337**	**100%**	**2%**	**1,211**	**100%**	**3%**	**42**	**100%**	**5%**	**13,734**	**100%**	**-1%**
OECD	**843**	**23%**	**-9%**	**1,106**	**25%**	**-2%**	**1,060**	**36%**	**-2%**	**308**	**23%**	**2%**	**741**	**61%**	**1%**	**12**	**29%**	**3%**	**4,071**	**30%**	**-3%**
Non OECD	**2,885**	**77%**	**-3%**	**3,337**	**75%**	**2%**	**1,912**	**64%**	**1%**	**1,029**	**77%**	**2%**	**470**	**39%**	**7%**	**30**	**71%**	**7%**	**9,664**	**70%**	**0.2%**

Source: Enerdata, Global Energy & CO2 Data (2017)

Primary energy consumption

Primary energy consumption in 2016 Mtoe	Fossils									Biomass			Electricity			Heat			Total		
	Coal &Lignite			Crude oil & NGL			Natural gas			Biomass & wastes			Primary electricity			Geothermal & Solar					
	Volume	Share in world total	Change 2015-2016	Volume	Share in world total	Change 2015-2016	Volume	Share in world total	Change 2015-2016	Volume	Share in world total	Change 2015-2016	Volume	Share in world total	Change 2015-2016	Volume	Share in world total	Change 2015-2016	Volume	Share in world total	Change 2015-2016
Europe	291	8%	-7%	601	14%	3%	429	14%	5%	157	12%	1%	332	27%	-1%	8	18%	2%	1,818	13%	1%
European Union	237	6%	-9%	528	12%	1.8%	384	13%	7%	149	11%	2%	293	24%	-2%	4	8%	3%	1,595	12%	1%
Germany	75	2%	-4%	102	2%	1%	73	2%	9%	31	2%	3%	30	2%	-6%	0.8	2%	1%	311	2%	1%
France	9	0%	-1%	70	2%	0%	38	1%	9%	15	1%	-1%	109	9%	-6%	0.2	1%	2%	243	2%	-1%
North America	363	10%	-8%	902	20%	1%	731	25%	0%	121	9%	5%	342	28%	3%	3	6%	4%	2,461	18%	0%
Canada	18	0%	-6%	95	2%	1%	85	3%	-2.5%	16	1%	3%	58	5%	2%	0.04	0.1%	0%	273	2%	0%
USA	345	9%	-8%	806	18%	1%	646	22%	0%	104	8%	5%	283	23%	3%	3	6%	4%	2,187	16%	0%
Latin America	41	1%	-11%	366	8%	-4%	202	7%	-1%	141	11%	0%	83	7%	3%	1	3%	19%	834	6%	-3%
Brazil	16	0%	-10%	112	3%	-6%	30	1%	-15%	87	6%	-0.2%	43	4%	9%	0.9	2%	12%	289	2%	-3%
Asia	2,740	72%	0%	1,365	31%	3%	567	19%	4.2%	531	40%	3%	329	27%	10%	29	67%	6%	5,563	40%	2%
China	1,966	52%	-1%	556	13%	4%	171	6%	8%	113	8%	-0.1%	183	15%	15%	28	64%	7%	3,017	22%	1%
South Korea	78	2%	-5%	108	2%	7%	41	1%	4%	18	1%	20.3%	43	4%	-1%	0.2	1%	2%	288	2%	3%
India	393	10%	4%	216	5%	5%	47	2%	9%	208	15%	6%	27	2%	4%	0.7	2%	0%	892	6%	5%
Indonesia	45	1%	12%	64	1%	1%	37	1%	-1%	52	4%	0%	20	2%	7%	0	0%	-	218	2%	3%
Japan	117	3%	-1%	179	4%	-3%	102	3%	2%	9	1%	-22%	18	1%	13%	0.4	1%	-24%	424	3%	-1%
Pacific	44	1%	-1%	53	1.2%	-0.04%	24	1%	-35%	8	1%	3%	11	1%	8%	0.7	2%	7%	140	1%	-8%
CIS	187	5%	-2%	209	5%	2%	509	17%	-1.3%	12	1%	5%	94	8%	0%	0.4	1.0%	-24%	1,011	7%	-1%
Russia	117	3%	1%	161	4%	3%	357	12%	-2%	8	1%	6%	66	5%	3%	0.01	0.01%	17%	710	5%	0%
Middle East	9	0.2%	1%	354	8%	-2%	408	14%	3%	1	0.1%	0.1%	4	0.3%	44%	1	3%	0%	777	6%	1%
Saudi Arabia	0	0%	-	149	3%	-2%	73	2%	4%	0	0%	0%	0	0%	0%	n.d.	-	-	223	2%	0%
Iran	1	0.03%	5%	85	2%	-1%	159	5%	3%	1	0.04%	0%	3	0.2%	70%	n.d.	-	-	248	2%	2%
Africa	110	3%	3%	174	4%	0.4%	112	4%	3%	369	28%	1%	19	2%	2%	0.3	0.6%	8%	785	6%	1%
World	**3,785**	**100%**	**-1%**	**4,411**	**100%**	**1%**	**2,980**	**100%**	**1.1%**	**1,341**	**100%**	**2%**	**1,215**	**100%**	**3%**	**44**	**100%**	**5%**	**13,776**	**100%**	**1%**
OECD	**891**	**24%**	**-6%**	**1,925**	**44%**	**1%**	**1,387**	**47%**	**1%**	**317**	**24%**	**3%**	**742**	**61%**	**1%**	**13**	**29%**	**3%**	**5,275**	**38%**	**0%**
Non OECD	**2,893**	**76%**	**0%**	**2,099**	**48%**	**1%**	**1,593**	**53%**	**1%**	**1,024**	**76%**	**2%**	**473**	**39%**	**7%**	**31**	**71%**	**6%**	**8,114**	**59%**	**1.1%**

Source: Enerdata, Global Energy & CO2 Data (2017)

Final energy consumption

Final energy consumption in 2016 Mtoe	Fossils									Biomass			Electricity			Heat			Total		
	Coal & Lignite			Crude oil & NGL			Natural gas			Biomass & wastes			Primary electricity			Geothermal & Solar					
	Volume	Share in world total	Change 2015-2016	Volume	Share in world total	Change 2015-2016	Volume	Share in world total	Change 2015-2016	Volume	Share in world total	Change 2015-2016	Volume	Share in world total	Change 2015-2016	Volume	Share in world total	Change 2015-2016	Volume	Share in world total	Change 2015-2016
Europe	68	6%	-1%	534	14%	2%	275	20%	2%	93	9%	2%	278	16%	1%	56	18%	1%	1,306	14%	2%
European Union	52	4%	-4%	472	12%	2%	250	18%	3%	87	8%	2%	237	13%	1%	49	15%	1%	1146	12%	1%
Germany	13	1%	-4%	94	2%	2%	54	4%	5%	15	1%	5%	45	3%	0.2%	11	3%	0.1%	231	2%	2%
France	5	0.4%	-1%	66	2%	-1%	30	2%	1%	11	1%	-1%	37	2%	2%	2	1%	0.1%	152	2%	-0.1%
North America	25	2%	-11%	855	22%	1%	358	26%	-1%	97	9%	7%	361	20%	-1%	9	3%	0.1%	1,704	18%	-0.1%
Canada	4	0.3%	-4%	92	2%	1%	45	3%	-3%	14	1%	2%	39	2%	-4%	0.7	0.2%	0%	195	2%	-1%
USA	21	2%	-12%	763	20%	1%	313	23%	-1%	83	8%	8%	322	18%	-1%	8	3%	0.1%	1,509	16%	0.03%
Latin America	16	1%	-17%	299	8%	-2%	78	6%	1%	101	10%	-1%	110	6%	0.2%	1	0%	20%	605	6%	-1%
Brazil	10	1%	-12%	101	3%	-2%	12	1%	-3%	61	6%	-0.8%	42	2%	-0.1%	0.8	0%	12%	227	2%	-2%
Asia	1,024	84%	-3%	1,208	31%	3%	266	19%	5%	462	44%	3%	772	44%	4%	124	39%	6%	3,856	40%	2%
China	779	64%	-5%	499	13%	4%	117	8%	8%	90	8%	-0.1%	441	25%	5%	116	37%	6%	2,043	21%	1%
South Korea	20	2%	-7%	96	2%	7%	21	2%	2%	15	1%	16%	44	2%	3%	5	2%	10%	201	2%	5%
India	124	10%	3%	182	5%	5%	31	2%	9%	187	18%	6%	93	5%	6%	0.7	0%	0%	619	6%	5%
Indonesia	9	1%	12%	64	2%	2%	16	1%	-5%	51	5%	0%	19	1%	6%	0	0%	-	159	2%	2%
Japan	44	4%	1%	153	4%	1%	30	2%	1%	2	0.2%	-42%	80	5%	-1%	0.9	0%	-12%	310	3%	-0.3%
Pacific	4	0.3%	-6%	49	1.3%	-1%	16	1%	-2%	7	1%	1%	22	1%	1%	0.7	0%	7%	99	1%	-1%
CIS	60	5%	1%	181	5%	2%	167	12%	-5%	6	1%	5%	91	5%	1%	126	39.6%	1%	630	7%	-0.3%
Russia	36	3%	1%	139	4%	3%	107	8%	-6%	3	0.3%	6%	62	3%	2%	106	33.21%	2%	453	5%	0.4%
Middle East	3	0.2%	2%	243	6%	-1%	185	13%	1%	1	0.1%	0.1%	81	5%	5%	1	0%	0%	515	5%	1%
Saudi Arabia	0	0%	-	96	2%	-1%	30	2%	4%	0	0%	0%	25	1%	1%	0	-	-	150	2%	0.2%
Iran	1	0.09%	5%	64	2%	-4%	102	7%	3%	1	0.05%	0%	21	1%	6%	0	-	-	189	2%	1%
Africa	20	2%	1%	152	4%	0.1%	36	3%	3%	294	28%	1%	54	3%	1%	0.2	0.1%	8%	556	6%	1%
World	**1,220**	**100%**	**-3%**	**3,908**	**100%**	**2%**	**1,380**	**100%**	**0.5%**	**1,061**	**100%**	**2%**	**1,769**	**100%**	**2%**	**319**	**100%**	**3%**	**9,657**	**100%**	**1%**
OECD	**161**	**13%**	**-3%**	**1,753**	**45%**	**1%**	**705**	**51%**	**0%**	**214**	**20%**	**4%**	**803**	**45%**	**0%**	**69**	**22%**	**1%**	**3,705**	**38%**	**1%**
Non OECD	**1,059**	**87%**	**-3%**	**1,767**	**45%**	**2%**	**676**	**49%**	**1%**	**847**	**80%**	**2%**	**966**	**55%**	**4%**	**250**	**78%**	**3%**	**5,565**	**58%**	**1.2%**

Source: Enerdata, Global Energy & CO2 Data (2017)

Final energy consumption rose 1.1% in 2016 after a 1.2% increase in 2015. **Electricity accounts for a growing share of final consumption** (up 2.1% in 2016). That share has risen to 18% of the final mix, up from 15% in 2000, as a result of two phenomena: increased uses of electricity, and the level of electrification worldwide. The number of people without access to electricity has been reduced from 1.7 billion in 2000 to 1.1 billion.z

Oil has the lion's share (40%), thanks to its captive use in transport (up 1.7% in 2016). **The natural gas share is very stable,** at around 14%. Its consumption varies little (up 0.5% in 2016), but is very diverse: from heating to industry and increasingly for transport (NGV, CNG). **Coal is barely used as a final energy outside the steel industry.** Most of its consumption is to generate electricity. Final coal demand declined 3% in 2016, with a 13% market share.

CO_2 & climate

CO_2 EMISSIONS

Led by China, world CO_2 emissions rose 2% in 2017 after 3 years of stagnation

PARIS AGREEMENT

The shift towards climate change scepticism within the US government has not altered an international consensus favouring action against global warming

CO_2 & climate: CO_2 emissions

Though CO_2 emissions did rebound in 2017, their longer term growth rate is sagging

CO_2 emissions from fuel combustion $MtCo_2$ (sector approach)	1990	2000	2010	2012	2013	2014	2015	2016	Change		
									1990-2016	2000-2016	2015-2016
Europe	4,352	4,207	4,107	3,951	3,852	3,683	3,751	3,761	-0.5%	-0.7%	0.3%
European Union	4,055	3,857	3,668	3,484	3,398	3,218	3,261	3,244	-0.8%	-1.0%	-0.5%
North America	5,252	6,229	5,966	5,672	5,752	5,819	5,641	5,544	0.2%	-0.7%	-1.7%
USA	4,824	5,700	5,419	5,112	5,180	5,243	5,086	4,993	0.1%	-0.8%	-1.8%
Latin America	843	1,193	1,541	1,647	1,665	1,690	1,680	1,575	2.3%	1.6%	-6.3%
Asia	4,680	6,713	12,439	13,680	14,194	14,413	14,504	14,642	4.3%	4.7%	0.9%
China	2,205	3,084	7,523	8,397	8,799	8,842	8,868	8,862	5.3%	6.4%	-0.1%
India	514	900	1,567	1,766	1,818	1,979	2,027	2,132	5.4%	5.2%	5.2%
Japan	1,015	1,122	1,081	1,174	1,190	1,140	1,102	1,087	0.3%	-0.2%	-1.4%
Pacific	286	372	428	427	424	415	421	414	1.4%	0.6%	-1.8%
CIS	3,485	2,167	2,352	2,459	2,427	2,309	2,237	2,230	-1.6%	0.2%	-0.3%
Russia	2,169	1,503	1,594	1,651	1,627	1,565	1,533	1,533	-1.3%	0.1%	0.0%
Middle East	585	954	1,594	1,729	1,767	1,844	1,956	1,955	4.6%	4.3%	-0.1%
Africa	532	675	1,010	1,066	1,083	1,115	1,122	1,124	2.8%	3.0%	0.3%
Appendix, 1	**13,721**	**13,689**	**13,406**	**13,113**	**13,070**	**12,814**	**12,587**	**12,486**	**-0.3%**	**-0.5%**	**-0.8%**
World	**20,015**	**22,509**	**29,432**	**30,626**	**31,158**	**31,283**	**31,310**	**31,200**	**1.7%**	**1.9%**	**-0.4%**

Source: Enerdata Global Energy&CO2 Data (2017)

CHANGES IN CO_2 EMISSIONS

World CO_2 emissions increased again in 2017 (estimated up 2%) after three years of flatlining (-0.4% in 2016), driven mainly by China and other developing countries.

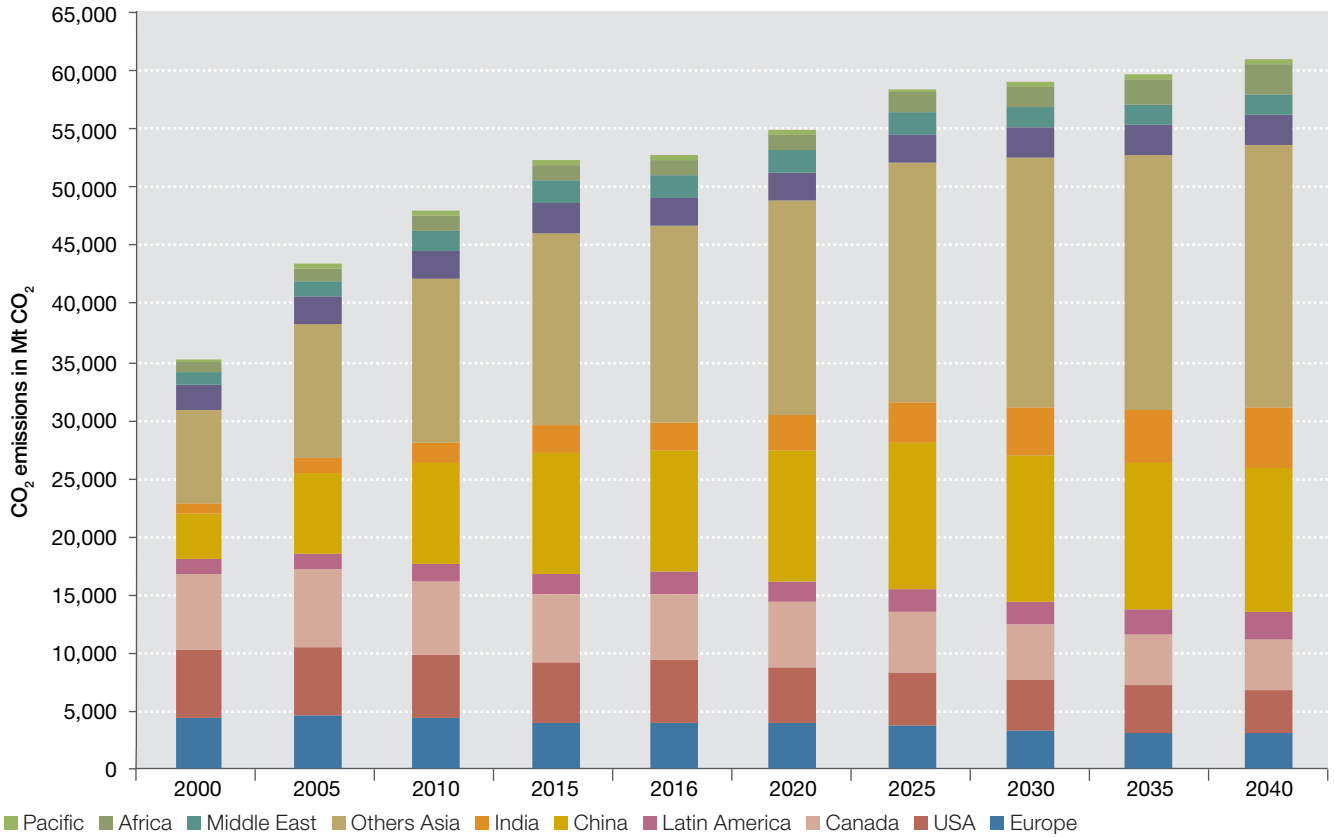
Estimated up 3.5% in 2017, the rise in Chinese emissions reflects a recovery in industrial activity still based on coal and the revival of infrastructure projects. Moreover, coal plants made up or lower hydro power production after floods and drought. China accounts for nearly 30% of world emissions.

Emissions also increased in the USA in 2017 (estimated at up 1% or so), halting a decade-long downtrend (-1.2% per year). A return to coal use explains this poorer performance, although a direct link with Donald Trump's pro-coal policy cannot be ascertained.

India managed to keep its emissions under control: the increase on 2017 is estimated at between 2% and 4%, against 6% per year over the last decade. This is a major improvement, attributable to a particularly proactive environmental policy.

CO_2 & climate: CO_2 emissions to 2040

TOTAL CO_2 EMISSIONS TO 2040, ACCORDING TO ENERDATA'S CENTRAL SCENARIO



Source: Enerdata, Ener-Blue scenario - reference scenario (2017)

Despite disappointing performance in 2017, some positive trends are emerging. In China, the combat against atmospheric pollution has translated into limitations on steel and cement production, the replacement of coal by natural gas for heating and a planned reduction of coal in power production. More generally, **consideration of climate change issues has led to a shift in the evolution of world CO_2 emissions, with their rate of increase halving since 2000.** RES and the preference given to natural gas over coal in the electricity mix have been major drivers in this performance; slower economic growth in some of the highest emission countries (Middle East, Russia, Latin America) also played a part.

THE CURRENT TREND IMPLIES A 3°C RISE

The National Determined Contributions (NDCs) that were submitted over COP 21 remain insufficient to meet the 2°C objective. More drastic requirements are expected from the NDC update in 2020.

CO_2 in the atmosphere is not diminishing. By the end of 2016, total CO_2 volume emitted since the beginning of the industrial era was 565 bn CO_2 tonnes-equivalent, i.e. 92% of the carbon budget for a 1.5°C rise. In 2016, and for the first time, CO_2 concentration in the atmosphere consistently remained above 400 ppm.

The Earth Overshoot Day, marking the date on which humanity's resource consumption for the year exceeds the planet's capacity to regenerate those resources in one year, fell to early August in 2017. It was December in 1970.

CO_2 & climate: CO_2 emissions by sector

CO_2 emissions from fuel combustion $MtCO_2$	Energy sector CO_2 emission				Industrial CO_2 emissions				Residential, services and agriculture CO_2 emissions				Transport CO_2 emissions				Total emissions				Per capita emissions tCO_2			
	1990	2016	Change		1990	2016	Change		1990	2016	Change		1990	2016	Change		1990	2016	Change		1990	2016	Change	
			1990/2016	2015/2016			1990/2016	2015/2016			1990/2016	2015/2016			1990/2016	2015/2016			1990/2016	2015/2016			1990/2016	2015/2016
Europe	1,672	1,404	-16%	-2%	1,022	688	-33%	0%	855	687	-20%	3%	811	1,012	25%	2%	4,360	3,790	-13%	0%	8	6	-21%	0%
European Union	1,570	1,182	-25%	-4%	951	603	-37%	0%	791	599	-24%	3%	751	895	19%	2%	4,062	3,279	-19%	0%	9	6	-25%	-1%
North America	2,280	2,356	3%	-4%	802	657	-18%	-1%	660	643	-3%	-3%	1,509	1,888	25%	1%	5,252	5,544	6%	-2%	19	15	-19%	-2%
USA	2,135	2,155	1%	-4%	716	569	-21%	-1%	580	556	-4%	-3%	1,392	1713	23%	1%	4,824	4,993	4%	-2%	19	15	-20%	-3%
Latin America	230	458	99%	-16%	223	368	65%	-7%	104	148	42%	-6%	286	596	108%	1%	844	1,570	86%	-7%	2	2	30%	-8%
Asia	1,590	7,381	364%	2%	1,672	4,221	152%	-1%	855	1,190	39%	2%	562	1,868	232%	1%	4,679	14,659	213%	1%	2	4	127%	0%
China	717	4,789	568%	1%	891	2,542	185%	-3%	491	703	43%	1%	106	829	683%	0%	2,205	8,862	302%	0%	2	6	231%	-1%
India	204	1,008	395%	6%	162	690	325%	6%	84	179	112%	4%	64	256	301%	2%	514	2,132	315%	5%	1	2	168%	4%
Japan	372	465	25%	-3%	319	297	-7%	-1%	125	116	-7%	1%	200	210	5%	0%	1,015	1,087	7%	-1%	8	9	4%	-1%
Pacific	151	216	44%	-3%	55	66	20%	-2%	15	23	55%	-2%	72	108	51%	0%	292	413	42%	-2%	11	11	-5%	-3%
Australia	146	209	43%	-3%	47	52	12%	-4%	12	20	68%	-1%	61	91	48%	0%	266	373	40%	-2%	16	15	-1%	-4%
CIS	1,937	1,265	-35%	-2%	585	479	-18%	0%	618	300	-51%	-4%	340	249	-27%	1%	3,480	2,293	-34%	-1%	12	8	-36%	-2%
Russia	1,268	898	-29%	2%	300	363	21%	-1%	378	159	-58%	-2%	219	177	-19%	2%	2,164	1,597	-26%	1%	15	11	-24%	0%
Middle East	192	796	315%	-1%	167	553	232%	2%	76	174	129%	2%	151	423	181%	-2%	585	1,947	233%	0%	4	8	82%	-2%
United Arab Emirates	14	128	839%	10%	27	66	145%	-8%	0	2	562%	6%	11	41	268%	6%	52	236	356%	4%	28	26	-8%	2%
Africa	237	550	132%	2%	134	188	41%	2%	50	116	133%	2%	111	303	172%	-1%	532	1,156	117%	1%	1	1	13%	-1%
World	**8,290**	**14,426**	**74%**	**-1%**	**4,659**	**7,220**	**55%**	**-1%**	**3,233**	**3,280**	**1%**	**0%**	**3,843**	**6,446**	**68%**	**1%**	**20,024**	**31,372**	**57%**	**0%**	**4**	**4**	**11%**	**-1%**
OECD	**4,432**	**4,859**	**10%**	**-3%**	**2,233**	**1,932**	**-14%**	**0%**	**1,702**	**1,535**	**-10%**	**0%**	**2,694**	**3,459**	**28%**	**1%**	**11,061**	**11,784**	**7%**	**-1%**	**10**	**9**	**-12%**	**-1%**
Non OECD	**3,858**	**9,567**	**148%**	**1%**	**2,425**	**5,288**	**118%**	**-1%**	**1,531**	**1,745**	**14%**	**1%**	**1,149**	**2,987**	**160%**	**0%**	**8,963**	**19,588**	**119%**	**0%**	**2**	**3**	**50%**	**-1%**

Source: Enerdata Global Energy & CO2 Data (2017)

CO_2 & climate: CO_2 emissions by sector

CO_2 EMISSIONS BY SECTOR, ACCORDING TO THE IEA'S CENTRAL SCENARIO

Nearly half of world CO_2 emissions come from the energy sector (mostly electricity production, but also refining and mining). Although power demand is expected to increase (up 60% by 2040), emissions from this sector should stabilise (up 4% by 2040), as the use of renewable sources will significantly reduce carbon intensity: from 500g of CO_2 per kWh in 2016 to 325g in 2040, according to the New Policies scenario. RES will provide two thirds of additional capacity, and the vast majority of new fossil fuel plants will be highly efficient CCG turbines.

Emissions from the industrial sector represent 24% of total emissions. They will rise another 25% over the period, as the reduction in energy intensity (>25%) will not be enough to offset vigorous production.

21% of global emissions come from transport. Oil dependency makes the sector's decarbonisation a difficult process. It is expected to produce a quarter of total emissions in 2040, as aviation and freight transport will expand, and even though car emissions should diminish from 2030 onwards.

Emissions from the residential and service sector (6% share in 2016) remain stable over the period, despite intensifying urbanisation. Better energy efficiency and electrification will offset the increase in energy demand.

All in all, world CO_2 emissions will increase 11% by 2040 in this scenario.

All forecasts are from the IEA's New Policies scenario (World Energy Outlook 2017)

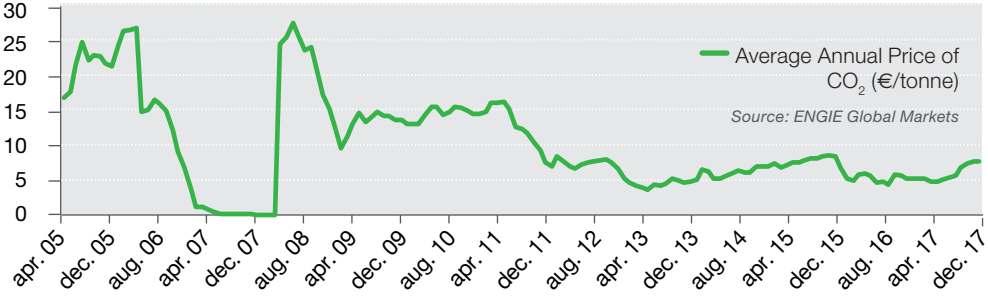
CO_2 & climate: prices & carbon markets

THE EUROPEAN EMISSION ALLOWANCE MARKET (EU-ETS)

After two years of negotiations, the EU reached a provisional agreement at the end of 2017 to revise the carbon market for the 2021-2030 period (phase 4). Its objective is to restore a balance between supply and demand via two measures: the first is raising the annual linear reduction factor from 1.74% to 2.2% (equivalent to yearly reduction of 48.5 million tonnes of CO_2), and up to 2.4% by the end of the period; the second is to double possible injections into the Market Stability Reserve (MSR), a mechanism that will enter into force in January 2019. In addition, 2% of allowances will be monetised and allocated to the energy industries' modernisation.

These measures aim at supporting carbon prices, with a objective of €24 in 2020 and €31 in 2030. The announcement of this agreement drove carbon prices to €8/tonne on the EU-ETS end 2017, against €4 to €6 since early 2016.

CO_2 ALLOWANCE PRICES ON THE EU ETS, €/TONNE



CARBON MARKETS ACROSS THE WORLD

Although not included in the COP21 negotiations, the implementation of a universal and truly binding carbon price would be a significant step forward in the fight against global warming, according to many institutions including the World Bank.

The number of carbon markets continued to rise worldwide in 2017: 43 national and over 25 local authorities have implemented carbon pricing systems, covering 15% of world GHG emissions (8 Mt of CO_2).

The problem is that carbon prices are still too low in the vast majority of these markets to have any effect.

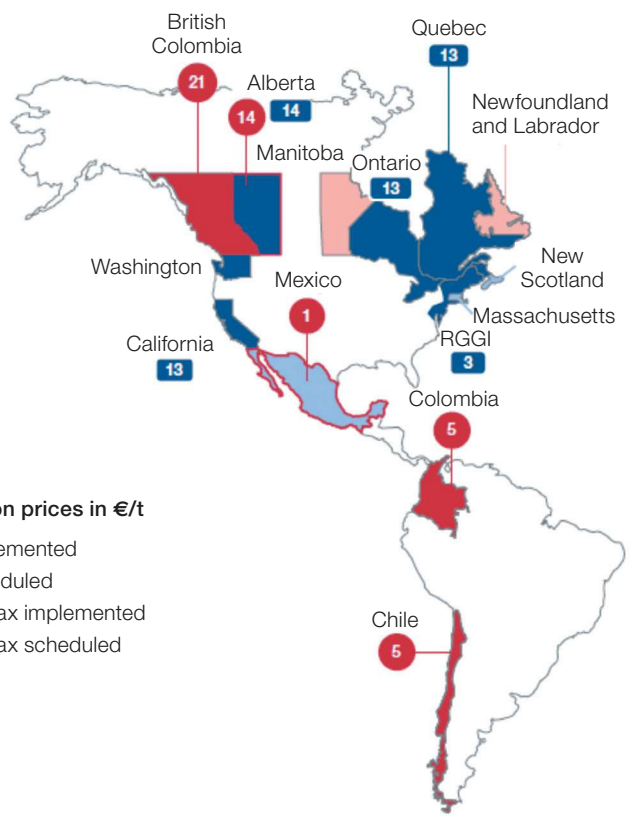
China launched its own carbon market in December 2017. Set to become the world largest ETS, its success depends on a even more significant transformation of the energy sector. To begin with, the new exchange system will only cover the electricity sector, which represents a third of the country's emissions.

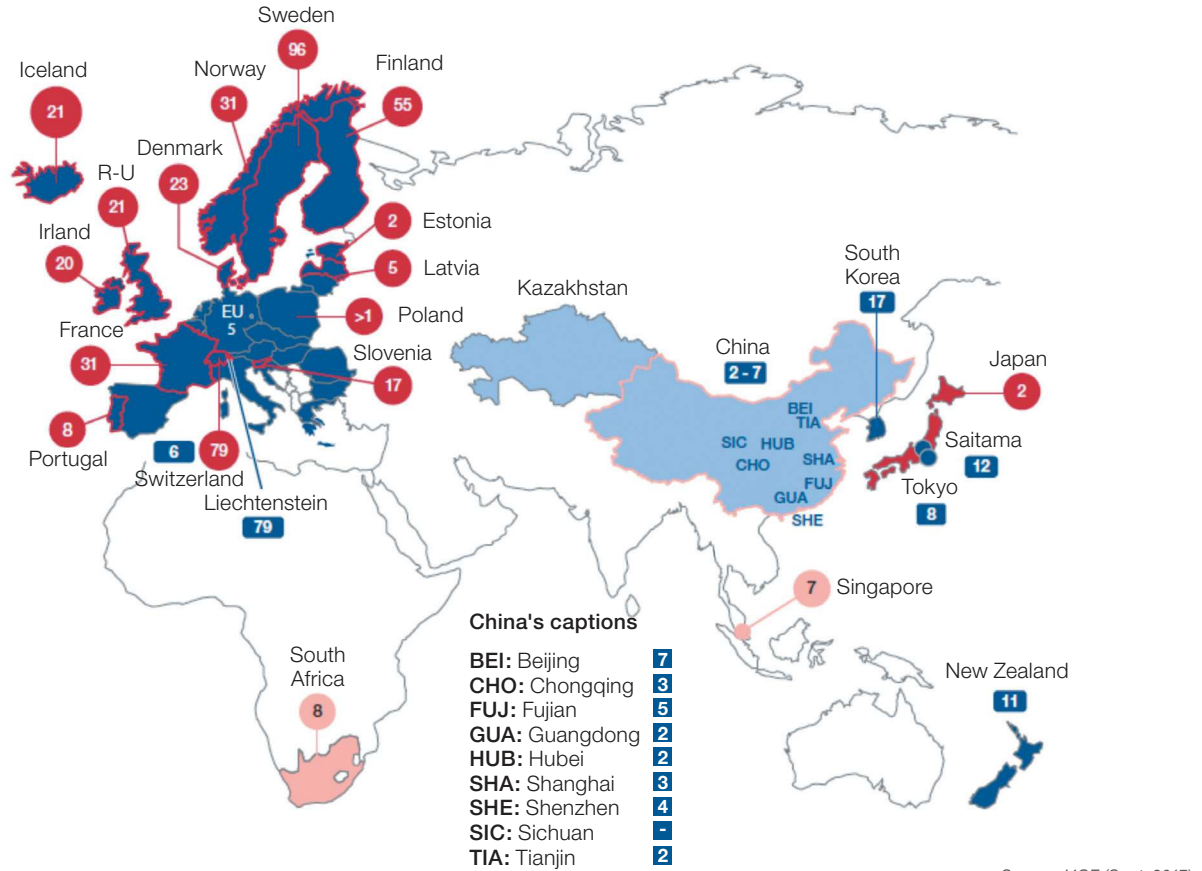
CARBON TAXES

A growing number of countries and regions are introducing carbon taxes. Among them are several European countries (for sectors outside the EU-ETS scope), but also Japan, Mexico and British Colombia. The highest tax rates are in Europe (Finland: $60-65/tonne; Switzerland: $86/tonne; Sweden: $131/tonne). **In France, the 2017 Finance Law provides for the implementation of a carbon tax** at €30/tonne to start with, going up to €100/tonne by 2030

CO_2 & climate: prices & carbon markets

WORLD VIEW OF CARBON PRICES





Source: I4CE (Sept. 2017)

CO_2 & climate: climate change and GHG

2017 will be the third-warmest year ever recorded, behind 2015 and 2016

TEMPERATURES

After temperature records in 2015 and 2016, 2017 was in the top three warmest years ever recorded and confirmed the trend towards global warming (source: World Meteorological Organisation). Current average temperatures are now 1.1°C above pre-industrial levels. The rates at which sea ice is melting and temperature and sea level are rising are also records.

The El Niño phenomenon could partly explain higher temperatures in 2016 but not in 2017, which also saw hurricanes of unprecedented intensity in the Caribbean and in the Atlantic Ocean.

WEATHER

The links between climate disasters (floods, storms, tropical cyclones, heat/cold waves, droughts and wildfires) and anthropogenic global warming are increasingly evident in the data. The measurement of contributing factors such as tides, atmospheric humidity and surface heat has established a relationship between global warming and over half of the extreme events of the last five years.

POLLUTION

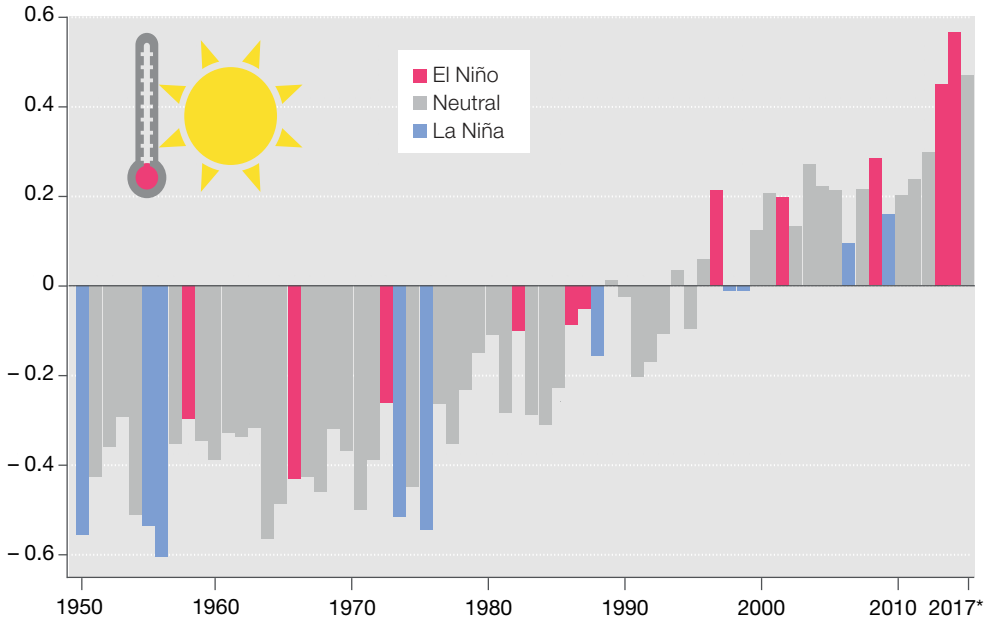
Pollution causes the premature death of nearly nine million people per year (WHO 2015 data), representing 16% of the annual world total and three times more than deaths caused by AIDS, tuberculosis and malaria combined.

Global warming can have a direct impact on mortality. Farmers are particularly exposed to the consequences of draught, as revealed by a Berkley University study showing that in India a 1°C rise above normal causes on average 67 suicides and a 5°C rise 335. Over the last 30 years, 59,300 Indian farmers have committed suicide.

CO_2 & climate: climate change and GHG

The link between climate change and the number of extreme climate events is increasingly clear

WORLD AVERAGE TEMPERATURE DIFFERENCE COMPARED TO THE AVERAGE 1981-2010 (IN DEGREES CELSIUS)

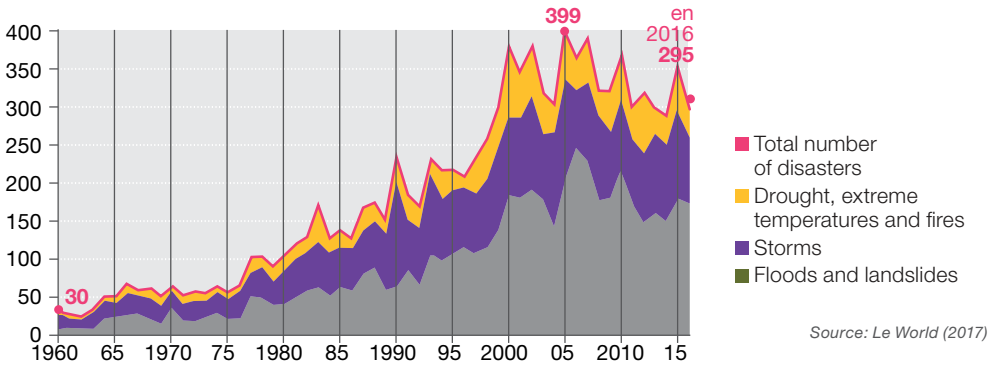


* Value calculated over the first eleven months

Source: Le World (2017)

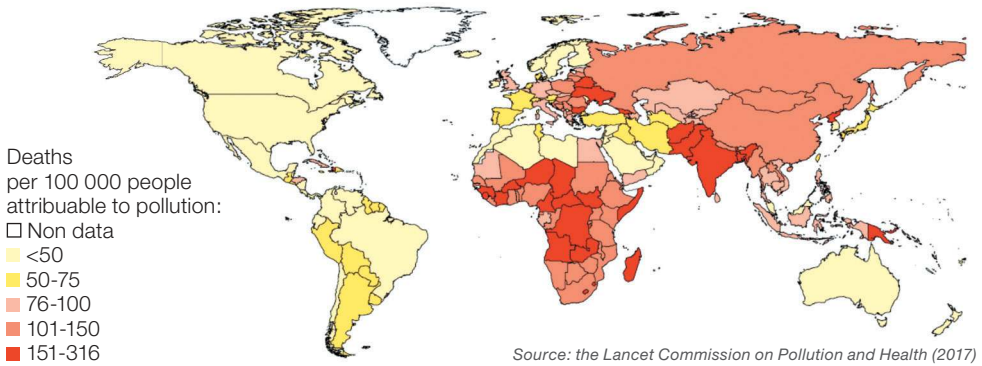
Years marked by the so-called El Niño phenomenon tend to be warmer than neutral years. And conversely, those marked by the opposite phenomenon, El Niña, are cooler.

MULTIPLICATION OF WEATHER DISASTERS (NUMBER PER YEAR)



Source: Le World (2017)

MORTALITY RATE ATTRIBUTABLE TO POLLUTION



Source: the Lancet Commission on Pollution and Health (2017)

CO_2 & climate: climate change and GHG

CO_2 EMISSIONS BY SOURCE

CO_2 emissions - $MtCO_2$		UE	Germany	Belgium	France	Italy	United Kingdom	Russia	USA	Canada	Australia	Japan	Total appendix 1
Fuel combustion (sectoral approach)	1990	4,055	939	104	353	395	549	2,169	4,813	427	260	1,008	13,703
	2005	3,968	783	109	379	456	535	1,529	5,809	552	374	1,143	14,064
	2015	3,261	732	95	303	333	395	1,533	5,107	555	381	1,105	12,611
	AAGR	-0.9%	-1%	-0.4%	-0.6%	-0.7%	-1.3%	-1.4%	0.2%	1.1%	1.5%	0.4%	-0.3%
Fugitive emissions (including flaring)	1990	191	38	1	11	13	42	789	394	49	37	5	2,056
	2005	113	16	1	6	9	17	718	310	61	39	1	1,588
	2015	89	11	1	4	8	11	765	316	57	45	1	1,536
	AAGR	-3.0%	-4.9%	-2.5%	-3.8%	-2.1%	-5.2%	-0.1%	-0.9%	0.6%	0.7%	-5.5%	-1.2%
Industrial processes	1990	517	97	26	67	40	298	298	340	56	26	110	2,575
	2005	460	75	26	53	46	210	210	353	54	32	87	2,273
	2015	374	62	20	45	30	210	210	376	51	32	93	2,047
	AAGR	-1.3%	-1.8%	-1.2%	-1.6%	-1.2%	-1.4%	-1.4%	0.4%	-0.4%	0.9%	-0.7%	-0.9%
Wastes	1990	241	38	4	17	23	67	77	199	24	20	29	912
	2005	203	21	3	22	25	49	86	158	28	14	27	811
	2015	139	11	2	18	19	18	115	139	25	11	21	640
	AAGR	-2.2%	-4.8%	-3.9%	0.1%	-0.9%	-5.0%	1.6%	-1.4%	0.1%	-2.2%	-1.2%	-1.4%
Agriculture	1990	548	80	12	84	36	54	315	495	49	80	38	2,896
	2005	440	63	10	79	33	46	135	526	61	76	35	2,338
	2015	437	67	10	79	30	45	132	522	59	70	34	2,334
	AAGR	-0.9%	-0.7%	-0.8%	-0.2%	-0.7%	-0.7%	-3.4%	0.2%	0.8%	-0.5%	-0.4%	-0.9%
LULUCF	1990	-232	-31	-3	-26	-3	6	162	-820	-99	160	-63	-1,497
	2005	-316	-12	-4	-49	-28	-3	-458	-731	-37	76	-92	-2,314
	2015	-305	-15	-2	-36	-36	-7	-518	-759	-34	-8	-61	-2,415
	AAGR	1.1%	-3%	-1.5%	1.2%	10.1%	-201.0%	-204.8%	-0.3%	-4.2%	-188.6%	-0.2%	1.9%
Total (including LULUCF)	1990	5,411	1,220	144	524	517	803	3,930	5,543	512	579	1,205	29,751
	2005	4,895	980	142	509	551	690	2,042	6,582	702	597	1,304	27,122
	2015	4,003	887	116	428	397	499	2,132	5,828	688	526	1,262	23,719
	AAGR	-1.2%	-1.3%	-0.9%	-0.8%	-1.1%	-1.9%	-2.4%	0.2%	1.2%	-0.4%	0.2%	-0.9%

Source: Enerdata Global Energy & CO2 Data (2017); UNFCCC Greenhouse Gas Inventory Data (2017)

CO_2 & climate: climate change and GHG

OTHER GHG

The Kyoto Protocol defined six greenhouse gases (GHG): CO_2 (carbon dioxide), CH_4 (methane), N_2O (nitrous oxide), HFCs (hydrofluorocarbons), PFCs (perfluorocarbons) and SF_6 (sulphur hexafluoride).

CO2 accounts for 78% of all GHG emissions, and 90% of it is related to fuel combustion. Methane accounts for 13% (related mainly to agriculture and to a smaller extent to fugitive emissions and discharges) and nitrous oxide 6% (related to agriculture). The final three GHGs – HFCs, PFCs and SF_6 – account for the remaining 3%. This breakdown is based on Annex I countries total GHGs emissions.

Fossil fuel combustion contributes 76% of GHG emissions, excluding LULUCF CO_2 capture (see Glosssary for definitions).

Other GHG $MtCO_2$ eq	CH_4			N_2O			HFC			PFC			SF_6		
	1990	2015	2016	1990	2015	2016	1990	2015	2016	1990	2015	2016	1990	2015	2016
European Union	735.3	552.6	461.1	398.1	298.0	249.7	29.1	73.3	107.6	25.9	7.4	3.6	11.0	7.9	6.4
Germany	121.2	69.3	56.5	65.8	44.2	39.9	0.1	9.0	11.1	3.1	0.8	0.3	4.4	3.3	3.6
Belgium	12.2	9.2	8.1	10.2	8.6	6.1	0.0	1.7	2.8	2.2	0.2	0.3	1.6	0.1	0.1
France	71.0	66.8	60.5	68.6	49.6	43.6	4.4	13.4	19.3	5.2	1.8	0.5	2.2	1.4	0.5
Italy	55.8	51.3	43.5	27.8	28.9	18.8	0.4	6.1	12.3	2.9	1.9	1.7	0.4	0.5	0.4
Ru	135.3	89.4	52.6	51.3	27.3	23.2	14.4	13.2	16.0	1.7	0.4	0.3	1.3	1.1	0.5
Russia	963.3	810.8	886.9	193.8	104.9	105.1	35.9	19.8	21.2	15.1	6.3	3.6	1.1	1.3	0.8
USA	787.5	694.2	667.0	363.4	371.4	343.2	46.3	114.1	162.4	24.3	6.7	5.2	28.8	11.7	5.8
Canada	94.8	114.9	103.4	42.8	41.2	39.3	1.0	5.1	11.0	7.6	3.8	1.0	3.2	1.4	0.4
Japan	44.3	35.3	31.4	31.7	25.0	21.0	15.9	12.8	39.2	6.5	8.6	3.3	12.9	5.1	2.1
Australia	1,32.7	118.3	109.6	21.9	26.1	23.9	1.4	5.0	11.5	4.6	1.8	0.2	0.2	0.2	0.1
Total appendix I	**4,630.6**	**3,697.7**	**3,422.5**	**1,984.1**	**1,560.8**	**1,392.6**	**187.9**	**381.1**	**579.7**	**24.3**	**6.7**	**5.2**	**28.8**	**11.7**	**5.8**

CO_2 equivalent means the global warming potential (GWP) of a greenhouse gas, calculated by equivalence with a quantity of CO2 that would have the same PRG. The lifetime of CO2 in the atmosphere is estimated at around 100 years.

Source: Enerdata Global Energy & CO2 Data (2017); UNFCCC Greenhouse Gas Inventory Data (2017)

CO_2 & climate: climate change and GHG

CO_2 EMISSION FACTOR OF CURRENT FUELS DATA FOR FRANCE (IN GRAM OF CO_2 EQUIVALENT/THERMAL KWH – PCI)

Combustibles	Direct emissions	LCA emissions
Coal	345	377
Heavy fuel	283	324
Domestic fuel	272	324
Diesel	256	323
Petrol (AVSR, unleaded 95 and 98)	253	314
LPG	233	260
Natural gas	204	243
Wood energy	18.8	29.5

Source: "Base Carbone de l'ADEME", January 2015

CO_2 content is estimated using one of two conventions:

- **Direct emissions:** emissions from energy use solely at the level of the consumer, or
- **Life Cycle Analysis (LCA):** emissions from extraction to final use: extraction, production, transport, distribution, use and even waste management.

CO_2 EMISSIONS FROM POWER GENERATION (IN GRAM OF CO_2 EQUIVALENT/KWH OF ELECTRICITY PRODUCED)

	Coal	Fioul	Gas combined cycle	Gas cogeneration	HWIP*	Nuclear	Wind	Hydro
Excluding life cycle analysis	915	676	404	from 230 to 380**	from 860 to 1,548	0	0	0
With a life cycle analysis	1,038	704	406			6	7.3	4

Source: "Base Carbone de l'ADEME", January 2015

*HWIP: Household Waste Inceneration Plant.
**Emission from gas cogeneration depend on yield and techniques used (turbine or motor).

CO_2 & climate: the Paris Agreement and the follow-up

EACH SIGNATORY, WITH THE RECENT EXCEPTION OF THE UNITED STATES, ACKNOWLEDGES THE NECESSITY AND THE IRREVERSIBLE NATURE OF THE PARIS AGREEMENT.
ITS IMPLEMENTATION MODALITIES ARE STILL AN ISSUE.

CITIES AND LOCAL AUTHORITIES ARE TURNING OUT TO BE MAJOR PLAYERS IN THE FIGHT AGAINST CLIMATE CHANGE.

THE PARIS AGREEMENT

In force since 4 November 2016, the Paris Agreement is not legally binding in terms of results but includes legally binding procedural commitments: signatories must prepare, communicate and maintain the nationally determined contributions that they intend to achieve. They must pursue domestic mitigation measures with the aim of achieving the objectives of such contributions (Art 4-2). They must also account for their contributions and revise them upwards every five years (Art 4).

As it is an additional protocol of the United Nation Framework Convention on Climate Change (UNFCCC), the Paris Agreement has the status of an international treaty, and is therefore subject to the obligation of performance in good faith by the parties (Vienna Convention on Treaties, 1969). It does not provide for sanctions, however: it is based on soft-law and naming and shaming dynamics.

The US defection reignited North/South tensions. While every single party reaffirmed its support to the agreement after the US withdrew, the most vulnerable countries fear the consequences, first and foremost regarding the Green Climate Fund. Clashes between developed and developing countries that the Paris Agreement were thought to have overcome re-emerged.

AFTER THE AGREEMENT

COP22 (2016-Makkarech) stuck to technicalities. The main objective of clarifying the agenda has been successfully met, with the adoption of a rule book brought forward two years to 2018. The conference made no substantial progress on financing and did not discuss the need for enhanced efforts. The initiatives and decisions that did emerge came from non-state groups during parallel forums.

COP 23 (Nov. 2017, Bonn-Fiji) met its modest objectives. The parties expanded on the agreement's formal rules, notably regarding stocktaking, transparency, implementation and compliance. Negotiations will take place in 2018 within a special framework called the Talanoa dialogue, meaning "speaking with the heart" in Fijian. Non-state players and experts have been invited to contribute. The Paris Agreement's formal rules are to be adopted at COP24 in 2018, in Katowice, Poland.

Non-state players are emerging as major drivers in combatting climate change, notably local authorities:

- Over 3,000 local and regional authorities have committed to implementing the Paris Agreement at every level. In addition, 25 of the C40 cities (the world's largest city network, representing 115 million people) have committed carbon neutrality by 2050.
- The Institutional Investors Group on Climate Change works on changing practices in order to better take into account climate risks. In 2017, along with five other institutional investor groups (representing 22 billion USD in assets), the IIGCC urged the G20 and the G7 to respect commitments made in the Paris Agreement.
- Major private companies are cooperating too. Unilever and Norway have set up a $400 million fund for more sustainable agriculture; HSBC is to dedicate $100 billion "green investments"; Walmart, the world's leading retailer, is tackling deforestation. Within the EV 100 initiative, many companies have committed themselves to clean mobility. In December 2017, at the One Planet Summit, ENGIE joined the Breakthrough Energy Coalition, a $1 billion dollar fund for science and innovation in green energies.

CO_2 & climate: International regulatory and political environment

Working on the adoption of a Clean Energy Act in late 2017, Europe is trying to accelerate its energy transition

EUROPE

REFORM OF THE EUROPEAN MARKET

The European Commission intends to take energy transition onto a faster track by adopting the Clean Energy Package (CEP). Energy efficiency, Europe's leadership on renewables and the assertion of consumers' central role as market players are the guidelines of this legislative package to take effect in the 2021-2030 period. The main proposals presented in November 2016 and still under discussions are as follows:

Revision of the directive on energy efficiency with a binding objective of a 30% improvement by 2030. It includes 1.5% mandatory energy savings for energy suppliers and distributors. This revision is linked to that of the directive on buildings' energy performance, aiming decarbonisation by 2050.

Revision of the directive on renewables. RES is to represent 27% of energy consumption by 2030. Simpler administrative procedures and policy harmonisation at European level are to facilitate the development of renewable energies. Heat and cooling networks must incorporate a growing proportion of renewables (objective: +1% per year).

New governance rules for the Energy Union, similar to that of the Paris Agreement. The EU is to set a mitigation objective and member states will set targets for a ten year period (2021-2030). The Commission could impose sanctions to the US if its efforts prove insufficient, thereby helping to finance the transition.

Revision of the directive on the electricity market's organisation, with three objectives:

- Rationalising and increasing market flexibility thanks to a common framework that eases risk management, coordination between operators, as well as capacity integration – large renewable capacities would loose their priority access to the network.
- Making the consumer a market player, notably by removing restrictions to self-consumption and sale, giving better access to information and making it easier to switch supplier.
- Ending price regulation. The most vulnerable consumers would be protected, however, through targeted social policies that will eventually disappear on the basis that energy efficiency efforts will reduce energy poverty.

Economic benefits of the Clean Energy Package: the CEP could generate up to 1% in growth and create 900,000 jobs. Its implementation would require nearly €177 billion per year, mainly from private investors. The Commission intends to use existing reliable financing mechanisms as well as new ad hoc tools.

THE CONSEQUENCES OF BREXIT:

The EU is losing a major player in the combat against climate change, but it might gain an opportunity in terms of setting stricter rules. Thanks to its vast diplomatic network and its excellent relations with China and the United States, the UK certainly played a major part in climate negotiations, but on the other hand Westminster has always been resentful at European interference, and especially imposed numerical objectives on renewables, energy efficiency and chemicals regulations.

Within the UK, Brexit might slow energy transition, which had been driven largely by the EU. That is particularly relevant to the development of RES and wind power, and the closure of the most polluting coal-fired plants. The loss of CAP subsidies (€3 billion per year), combined with a risk of losing access to the common market (30% of the food consumed in the UK is imported from the EU) could encourage a return to intensive agriculture. In addition, the UK will have to translate European regulations, representing 70% of its environmental rules, into domestic law.

CO_2 & climate: International regulatory and political environment

Donald Trump's administration is firmly denying climate change, but the global move in favour of energy transition remains robust

UNITED STATES

By governing in denial of climate change, Donal Trump is fighting economic realities: CO_2 emissions have declined in the US (-1.3 % in 2016 and -10% since 2000) and will continue to do so. Coal is losing ground, RES's share in the energy mix is on the rise and energy intensity is declining (-3.3% in 2016). These trends may well slow because of some of Mr Trump's initiatives, such as the appointment of the climate change denier Scott Pruitt as head of the Environmental Protection Agency (EPA) and the revival of the Keystone XL et Dakota Access pipeline projects. The federal budget for 2018 does not include any subsidies for renewable energies and cuts the EPA's budget by 25%.

Donald Trump's desire to revitalise the coal industry collides with the economic reality of coal. In March 2017, the US president signed a decree ordering the review of his predecessor's Clean Power Plan, and more specifically the thermal plants' obligation to reduce their CO_2 emissions. In addition, the ban on new coal mining operations has been cancelled. However, the greatest threat to the US coal industry has more to do with market conditions than federal regulations: natural gas and solar energy prices have slumped. The US administration proposes to introduce an obligation to purchase at a price securing nuclear and coal plants' profits, holding electricity prices to an artificially high level. The proposal came under heavy fire from the energy sector. Even companies owning coal capacity rejected it.

The US administration does not wish to walk away from the negotiations table, but the international community is not inclined to make concessions.

On 4 August 2017 the USA declared to the UN Secretary General its intention to leave the Paris Agreement. The exit will not be effective before 2020 at the earliest: the formal processes of the agreement does not allow for a notice of withdrawal to be submitted in the 3 years following its entry into force, after which it will take one year to become effective. This makes the move more of a way to formalise the non-observance of US climate commitments than a formal withdrawal. Until its has withdrawn, the US will continue to participate in the negotiations. In COP23 in 2017, the USA co-chaired the task force dedicated to transparency rules with China. The small US delegation maintained constructive neutrality and did not impede debates.

The international community remains united against US withdrawal. In July, the heads of state and government meeting for the G20 summit in Hamburg declared in the final statement that the Paris Agreement was "irreversible", marginalising the USA in the summit results on climate and energy (the USA is mentioned only in a footnote indicating that the country "reserves its position on this document").

Despite this cohesion, there are threats to the Paris Agreement, notably because of an implied financial shortfall at the main UN instrument, UNFCCC, to which the USA contributes 25%.

Some US local authorities favour the Paris Agreement: 9 states, 15 towns, 900 companies and investors, and nearly 200 university colleges have joined the "We are still in" group. Representing over 37% of the population, this initiative intends to create an information system covering various actions countrywide. "America's pledge" encourages cities and states to meets the commitments that were submitted in Paris. Both these organisations were present at COP23, along with the official US delegation.

CO_2 & climate: International regulatory and political environment

CHINA

China is on the front line in the combat against climate change. China is both the world's top polluter in volume terms and the world's leading RES investor and producer. The country will account for nearly 38% of additional RES capacity by 2021. Its ambitious policy enabled it to hit objectives set for 2020 as early as 2017 (112 GW of renewable capacity). In January 2017 it abandoned the construction of over 100 projected coal plants.

Chinese growth emits less and less GHG: GHG emissions now grow at a much slower pace than the economy: GDP increased by around 7% in 2016 and 2017 while CO_2 emissions went down 1% in 2016 and up 3,5% in 2017. This decorrelation is caused by the growing share of nuclear power and RES, and especially hydro, in electricity generation along with measures favouring gas in the industry and construction sectors.

The 13th five-year plan (2016-2020) is the greenest Chinese plan ever. It endorses the rebalancing of the economy towards domestic demand and less energy intensity. Objectives on carbon and energy intensity, as well as in the share of fossil fuels within the energy mix, have been enhanced. For the first time, an energy consumption cap has been set for 2020 (to 5 bn tonnes coal equivalent). The plan also provides for €344 billion in investment in renewable energies by 2020, and the replacement of coal by natural gas or electricity for heating. Total gas consumption is to reach 10% of primary energy consumption in 2020, against 6% in 2016.

China launched a national emission allowance trading market in December 2017. Less ambitious than expected, with only power generation concerned in the first times (8 industrial sectors, including construction and steel, were supposed to be covered originally), but with 1,700 plants involved, this ETS represents a third of the country's annual emissions at 3.3 Gt CO_2, which is more than the European ETS (2 Gt CO2) or the Californian market (400 Mt CO_2). The Chinese authorities scaled back their ambitions in view of the inherent technical difficulties of implementing a carbon market on such a scale. They have also dampened expectations: over the first years, carbon prices may be too low to change behaviour, and the market may not be efficient before 2020

INDIA

India has adopted ambitious climate policies ever since 2010 and intends to make investment in clean energy and transport into an economic growth engine. As fourth emitter in volume behind China, the USA and Europe, but one of the lowest emitters per capita, India is feeling the full force of global warming, with heat waves and air pollution proving deadly in major cities in particular.

Thanks to aggressive investment, solar energy has become competitive in India (24% cheaper than coal). Its objective to reduce the share of fossil fuel in power production to 60% should be reached in 2022, instead of 2030 as originally planned.

Spurred by President Modi, India wants to be a leader in the combat against climate change. It is at the origin for instance of the International Solar Alliance, a treaty gathering 121 countries so far and intended at the development of synergies and research in the solar industry with an investment objective of $1,000 bn.

Electricity

PRODUCTION

Renewable energy sources now account for 26% of the world electricity generation mix, up from 20% ten years ago

Coal has been losing ground in the world's electricity production mix over the past two years

CONSUMPTION

Growth in world electricity consumption has been stable at +2% since 2014

Electricity consumption will continue to grow at this pace over the next two decades, as a result of economic growth in developing countries, growing electrification and a shift away from fossil fuels and toward electricity

Electricity: generating capacity

World generating capacity is changing rapidly towards greater use of renewable sources. Coal and renewables are now neck-and-neck in the capacity mix, at one-third each

World electricity capacity has been expanding by almost 4% per year for several years now (3.69% in 2016). Asia is the main driver of this gain, with a 7% increase in 2016 lifting its share of the world's total capacity to 42%. It was 35% in 2010. Conversely, OECD capacity has been rising by barely 1% per year (up 1.3% in Europe and 1.2% in the USA in 2016), albeit with a few exceptions such as Japan (up 3.4%) and South Korea (up 8.5%).

This vigorous growth reflects the priority given to the development of renewable capacity in the major consumption regions. Renewables accounted for two thirds of the world's incremental capacity in 2016 and 2017. In 2017, RES accounted for 60% of additional capacity in China, 70% in India and, thanks to fossil fuel substitution, over 100% in OECD' countries. This resulted from 15 years of supportive policies in the three leading regions – Europe, USA and China – as well as a spectacular drop in renewable technologies' costs. The levelized cost of photovoltaic energy has been cut by three since 2010, for example (source: BNEF).

The EU is posting the largest share of renewables in total installed capacity (26%, excluding hydro power), compared with 13% in Asia and 10% in the USA. New capacity growth is slowing, however, mainly because of lower subsidies. The world's growth engines are now China and India. Solar power is booming in both countries, where capacities, after having almost doubled in 2016, have increased by 50% in 2017.

Up 3% in 2016, world capacity from coal-fired plants is expanding only to meet Asia's needs (up 5% in 2016), and far less vigorously than before (9% per year over the previous decade). This structural shift permeates the IEA's long term forecasts, which are more and more pessimistic over coal's future. Even in its New Policies scenario, the IEA expects no more substantial gains in coal capacity between now and 2040 (2017 WEO).

Natural gas capacity is barely rising (up 1% in 2016) but remains the only fossil fuel that is expected to increase its share in the world's electricity mix (to 23% by 2040 under the IEA's New Policies scenario and 18% under its proactive Sustainable Development scenario).

Nuclear installed capacity also expanded (up 2.6% in 2016) led by China and Russia, while in the OECD countries only South Korea posted an increase in capacity in 2016.

Electricity: generating capacity by power station type

Installed electricity generation capacity, GW	Total capacity			Hydro capacity			Nuclear capacity			Thermal capacity			Wind capacity			Solar capacity			Geothermal capacity		
	2000	2016	Change 2015-2016	2000	2016	Change 2015-2016	2000	2016	Change 2015-2016	2000	2016	Change 2015-2016	2000	2016	Change 2015-2016	2000	2016	Change 2015-2016	2000	2016	Change 2015-2016
Europe	804	1,164	1%	203	240	1%	141	124	0.01%	447	531	-2%	12	161	9%	0.2	105	7%	1	2	12%
European Union	712	1,007	1%	140	154	1%	138	120	0.01%	421	474	-2%	12	154	8%	0.2	103	6%	1	1	7%
Germany	122	203	1%	10	11	0.1%	22	11	0.1%	85	89	-5%	5	50	11%	0.1	41	4%	0	0.03	4%
France	114	138	1%	25	26	4%	63	63	0%	25	29	-5%	0.08	12	16%	0.01	7	8%	0	0	0%
North America	980	1,323	1%	167	182	1%	118	118	1%	688	901	-0.4%	3	94	11%	0.4	25	49%	3	4	-1%
Canada	111	143	2%	67	81	2%	10	14	0.2%	33	34	0.4%	0.1	12	6%	0.01	3	12%	0	0	-
USA	869	1,180	1%	100	101	0.3%	108	105	1%	655	867	-0.4%	2	82	12%	0.4	22	56%	3	4	-1%
Latin America	222	400	4%	123	182	4%	4	5	2%	93	190	2%	0.10	18	29%	0.03	3	74%	1	2	1%
Brazil	74	150	5%	61	97	3%	2	2	0%	10	41	5%	0.02	10	33%	0	0.1	281%	0	0	-
Asia	934	2,823	7%	185	502	3%	66	107	8%	678	1,887	5%	2	184	14%	0.4	139	59%	3	4	2%
China	336	1,687	8%	79	332	4%	2	31	20%	254	1,098	5%	0.3	149	13%	0.1	77	82%	0.03	0.03	0%
South Korea	49	104	9%	3	6	0.2%	14	23	6%	32	69	8%	0.01	1	26%	0.004	4	45%	0	0	-
India	115	351	9%	24	43	1%	3	6	9%	87	263	8%	1	29	16%	0.01	10	96%	0	0	-
Japan	258	330	3%	46	50	0.3%	42	40	2%	169	194	1%	0.1	3	6%	0.3	42	25%	0.5	1	0%
Pacific	55	79	0.2%	15	14	0%	0	0	-	40	53	-1%	0.07	5	3%	0.03	6	12%	0.4	1	0%
CIS	329	392	0.5%	64	73	0.4%	31	40	3%	234	277	0.1%	0.002	1	3%	0	1	16%	0.02	0.1	0%
Russia	211	255	1%	44	49	0.5%	20	26	4%	147	179	0.005%	0.002	0.02	0%	0	0.1	40%	0.02	0.1	0%
Middle East	120	301	2%	7	16	0%	0	1	0%	113	283	2%	0.001	0.3	4%	0	1	36%	0	0	-
Saudi Arabia	31	84	2%	0	0	-	0	0	-	31	83	2%	0	0	-	0	0.05	0%	0	0	-
Iran	33	73	0.02%	2	11	0%	0	1	0%	31	61	0%	0	0.1	0%	0	0.03	78%	0	0	-
Africa	101	192	4%	21	35	14%	2	2	0%	78	148	1%	0.1	4	16%	0.002	3	43%	0	1	79%
World	**3,545**	**6,674**	**4%**	**785**	**1,243**	**3%**	**363**	**397**	**3%**	**2,370**	**4,270**	**2%**	**17**	**467**	**12%**	**1**	**283**	**32%**	**9**	**14**	**6%**

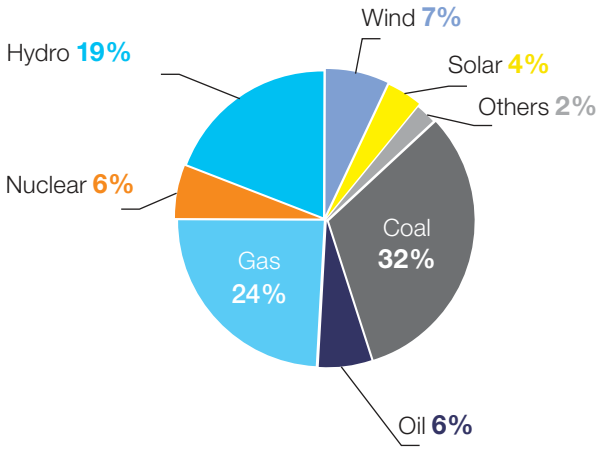
Source: Enerdata Global Energy & CO2 Data (2017)

Electricity: detail of thermal capacities

Detail of installed thermal capacity GW	Thermal capacity Oil			Thermal capacity Natural gas			Thermal capacity Coal & lignite			Thermal capacity Biomass & waste		
	2000	2016	Change 2015-2016	2000	2016	Change 2015-2016	2000	2016	Change 2015-2016	2000	2016	Change 2015-2016
Europe	84	55	-3%	137	245	0.1%	216	196	-5%	10	36	1%
European Union	81	52	-4%	129	217	1%	201	169	-6%	9	35	1%
Germany	8	2	0%	21	25	-0.03%	54	54	-7%	2	9	0%
France	15	11	-19%	2	11	8%	8	5	-0.2%	0.5	2	14%
North America	61	44	-1%	268	532	1%	345	303	-3%	14	21	-0.3%
Canada	8	2	0%	7	18	1%	18	9	0%	1	5	0%
USA	53	42	-1%	262	514	1%	327	294	-3%	13	16	-0.4%
Latin America	43	55	-2%	36	95	3%	11	20	2%	3	20	7%
Brazil	5	9	4%	1	13	5%	2	5	0.04%	2	14	7%
Asia	135	122	2%	122	284	3%	416	1,448	5%	5	33	10%
China	20	15	0%	8	47	9%	225	1,027	5%	0.5	9	0%
South Korea	4	3	0%	13	29	0%	14	35	16%	1	2	14%
India	5	4	-2%	10	29	3%	72	218	8%	0	11	28%
Japan	66	55	0%	37	59	2%	63	72	0.1%	3	8	0%
Pacific	4	3	-0.1%	8	20	-2%	28	29	-1%	0.5	1	0.1%
CIS	24	26	1%	130	168	-0.1%	78	81	0.3%	1	1	0%
Russia	16	16	0%	88	120	-0.1%	42	43	0.4%	1	1	0%
Middle East	49	87	0.2%	59	191	2%	4	5	0%	0	0.03	0%
Saudi Arabia	18	45	0.4%	13	38	5%	0	0	-	0	0	-
Iran	8	14	0%	23	47	0%	0	0	-	0	0.01	0%
Africa	13	24	2%	24	79	1%	40	44	2%	0	1	0%
World	**414**	**417**	**0%**	**784**	**1,614**	**1%**	**1,139**	**2,126**	**3%**	**34**	**113**	**4%**

Source: Enerdata Global Energy & CO2 Data (2017)

WORLD INSTALLED CAPACITY BY ENERGY 2016 (TOTAL 6,674 GW)



Source: Enerdata Global Energy & CO2 Data (2017)

Electricity: generating capacity – long series

In MW	2000	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	Change 2015-2016	AAGR 2000-2016	AAGR 2010-2016	Market share 2016
Europe	804,461	870,766	893,285	916,222	945,103	974,053	1,018,964	1,062,789	1,101,786	1,116,192	1,141,185	1,152,769	1,165,132	1.1%	2.2%	1.9%	17.5%
European Union	712,113	765,919	785,440	806,710	832,813	857,869	897,431	936,312	969,828	975,951	994,503	1,000,171	1,007,691	0.8%	2.1%	1.7%	15.1%
Germany	122,115	130,966	134,705	139,121	144,523	151,602	163,755	168,679	178,250	182,342	196,451	200,604	202,906	1.1%	3.0%	3.1%	3.0%
Spain	55,112	76,626	82,228	91,839	97,836	101,382	103,845	105,944	108,315	107,825	107,831	108,543	108,391	-0.1%	4.1%	0.6%	1.6%
France	113,565	115,762	117,018	118,123	119,763	121,490	125,289	132,621	135,459	134,671	135,487	135,979	137,684	1.3%	1.1%	1.4%	2.1%
Italy	77,223	85,279	89,192	93,345	99,851	102,162	107,256	119,146	124,715	125,144	122,474	116,825	117,615	0.7%	2.5%	1.3%	1.8%
United Kingdom	78,392	82,274	83,539	83,430	85,730	87,742	94,013	94,195	96,610	94,346	96,282	96,148	95,011	-1.2%	1.1%	0.2%	1.4%
North America	979,857	1,187,544	1,199,018	1,211,675	1,229,811	1,253,310	1,268,421	1,285,812	1,304,138	1,296,961	1,308,507	1,306,171	1,322,919	1.3%	1.8%	0.6%	19.8%
Canada	110,825	121,921	122,294	123,661	124,767	129,908	130,615	131,072	135,411	132,492	136,921	140,455	143,144	1.9%	1.5%	1.3%	2.1%
USA	869,031	1,065,623	1,076,723	1,088,014	1,105,044	1,123,402	1,137,806	1,154,740	1,168,727	1,164,469	1,171,586	1,165,716	1,179,775	1.2%	1.8%	0.5%	17.7%
Latin America	221,324	261,784	271,195	282,109	289,242	298,445	312,933	323,302	339,174	349,327	366,484	384,101	400,349	4.2%	3.5%	3.6%	6%
Brazil	73,713	92,867	96,100	100,354	102,894	106,569	112,402	117,190	123,765	128,748	135,024	143,271	150,411	5.0%	4.3%	4.2%	2.3%
Mexico	41,456	52,355	54,828	57,539	58,112	59,416	61,603	61,343	64,092	61,808	65,877	66,608	69,275	4.0%	3.1%	1.7%	1%
Asia	933,941	1,225,871	1,360,554	1,502,042	1,609,858	1,709,471	1,834,334	1,971,350	2,105,663	2,258,818	2,421,911	2,636,655	2,822,565	7.1%	6.7%	6.4%	42.3%
China	336,120	530,590	645,261	758,195	840,279	917,825	1,012,026	1,107,871	1,195,176	1,297,693	1,405,028	1,564,067	1,687,461	7.9%	10.0%	7.6%	25.3%
South Korea	48,869	63,490	67,061	70,085	74,448	74,901	76,962	80,551	82,999	87,720	92,750	96,149	104,365	8.5%	4.6%	4.4%	1.6%
India	114,814	143,479	152,119	167,573	177,245	188,341	202,216	219,714	247,089	271,230	294,758	321,686	350,555	9.0%	6.8%	8.2%	5.3%
Japan	258,487	273,105	274,112	274,888	277,147	281,179	283,295	288,056	291,492	298,653	311,197	319,525	330,247	3.4%	1.5%	2.2%	4.9%
Middle East	119,584	149,927	157,640	165,918	181,361	196,993	216,203	235,807	255,259	269,977	282,182	294,500	299,858	1.8%	5.6%	4.8%	4.5%
Saudi Arabia	31,078	39,058	41,736	43,440	47,222	53,886	59,851	60,850	64,428	69,781	76,839	81,603	83,503	2.3%	6.0%	4.9%	1.3%
Iran	33,338	44,033	45,350	49,416	52,966	56,284	61,220	64,208	68,785	70,315	72,464	73,183	73,197	0.0%	4.7%	2.6%	1.1%
CIS	329,355	336,544	341,085	344,095	347,089	351,990	357,096	361,067	369,955	376,937	385,242	389,827	391,633	0.5%	1.0%	1.3%	5.9%
Russia	210,888	215,941	219,410	221,979	223,978	227,459	230,927	234,290	239,910	244,579	250,507	253,343	254,660	0.5%	1.1%	1.4%	3.8%
Africa	101,278	116,191	118,883	122,682	126,327	136,127	141,382	149,373	156,062	186,362	174,160	184,253	193,345	4.9%	3.9%	4.6%	2.9%
South Africa	41,308	42,069	42,079	42,687	43,112	44,270	44,255	44,299	44,412	45,030	46,054	47,560	50,556	6.3%	1.2%	1.9%	0.8%
Egypt	14,830	19,637	20,937	21,772	22,641	24,906	26,490	28,600	30,548	31,001	32,944	35,629	35,643	0.0%	5.3%	4.3%	0.5%
Pacific	55,018	59,999	60,554	63,940	64,850	67,600	71,018	73,308	74,916	75,557	77,826	78,780	79,107	0.4%	2.2%	1.6%	1.2%
Australia	46,204	50,142	50,653	53,437	54,349	57,058	60,395	62,299	63,992	64,702	66,723	67,947	68,256	0.5%	2.3%	1.8%	1%
World	**3,544,816**	**4,208,626**	**4,402,214**	**4,608,682**	**4,793,641**	**4,987,988**	**5,220,351**	**5,462,807**	**5,706,952**	**5,930,132**	**6,157,496**	**6,427,055**	**6,674,907**	**3.9%**	**3.8%**	**3.6%**	**100%**

Source: Enerdata Global Energy & CO2 Data (2017)

Electricity: forecast of electricty generating capacity

GENERATING CAPACITY FORECAST BY SOURCE (GW)

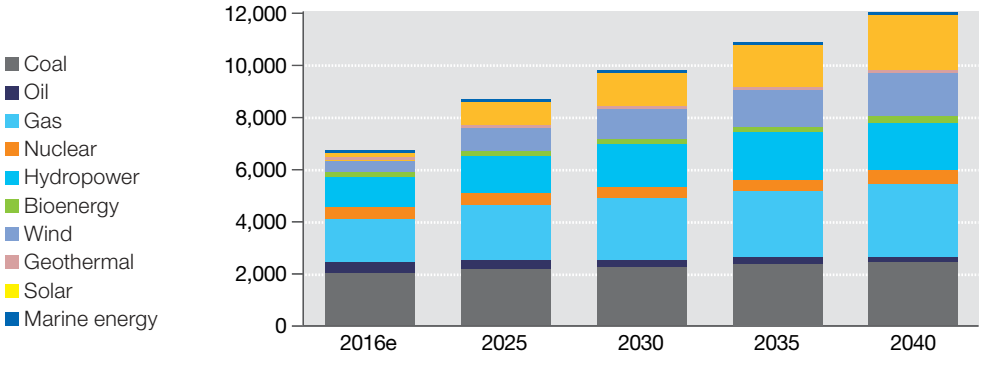
		New Policies Scenario			
	2016	2025	2040	AAGR 2016-2025	AAGR 2016-2040
Coal	2,020	2,228	2,434	1%	1%
Oil	443	334	233	-3%	-3%
Gas	1,650	2,087	2,800	2%	2%
Nuclear	413	448	516	1%	1%
Renewables	2,151	3,550	5,978	5%	4%
o/w hydropower	1,241	1,460	1,830	2%	2%
o/w bioenergy	127	180	273	4%	3%
o/w wind power	466	932	1,664	7%	5%
o/w geothermal	13	21	51	5%	6%
o/w solar PV	299	939	2,067	12%	8%
o/w CSP	5	16	72	13%	11%
o/w marine energy	1	2	21	12%	16%
Total capacity	**6,677**	**8,647**	**11,960**	**3%**	**2%**

GENERATING CAPACITY FORECAST BY REGION (GW)

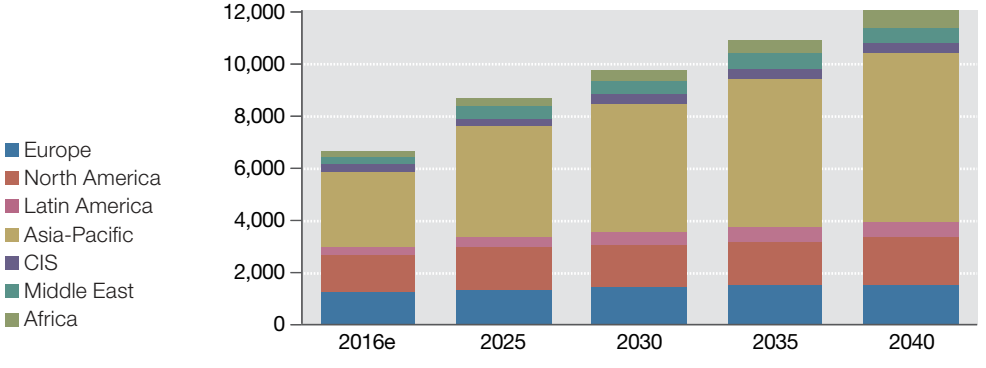
		New Policies Scenario			
	2016	2025	2040	AAGR 2016-2025	AAGR 2016-2040
Europe	1,262	1,392	1,576	1%	1%
North America	1,390	1,545	1,799	1%	1%
Latin America	333	419	590	2%	2%
Asia-Pacific	2,852	4,221	6,378	4%	3%
CIS	323	339	389	0,5%	1%
Middle East	310	405	597	3%	3%
Africa	207	327	632	5%	5%
OECD	**3,056**	**3,413**	**3,942**	**1%**	**1%**
non-OECD	**3,621**	**5,234**	**8,018**	**4%**	**3%**
Total capacity	**6,677**	**8,647**	**11,960**	**3%**	**2%**

Source: World Energy Outlook 2017 © OECD/IEA 2017

GENERATION CAPACITY FORECAST IN THE IEA NEW POLICY SCENARIO (GW)



GENERATION CAPACITY FORECAST IN THE IEA NEW POLICY SCENARIO (GW)



Source: World Energy Outlook 2017 © OECD/IEA 2017

Electricity: production

The moderate rise in electricity generation has not prevented continuing decarbonisation

World electricity production has rising by a steady 2% per year over recent years. It increased 2.2% in 2016, and early estimates for 2017 suggest a continuation of this trend. The rise can be attributed largely to renewables (up 6.6% in 2016), as production from fossil fuels stagnated (up 0.7%). Detailed analysis shows a mixed picture in terms of both energy sources and regions, however.

Production from coal-fired plants has decreased over the last two years, falling 0.4% in 2016 after a marked 1.8% decline in 2015. This reflects coal's loss of competitiveness in a context of very low gas prices and tougher environmental constraints. The exit from coal-fired energy is well established in the EU and in the USA (-12% and -8% respectively in 2016), but much less so in Asia (up 3% in 2016), where two thirds of coal power is produced. Trends within Asia diverge, however: China has put a sharp brake on coal in electricity generation over the last four years (up 2% in 2016) in favour of renewable sources, while India has accelerated its growth with production booming 5% in 2016. The share of coal in the world production mix has slipped from 41% to 38% over the past decade, and from 80% to 70% in China. It also dropped below the 60% level in 2016 for the whole of Asia. A high degree of price sensitivity is liable to undermine this trend: coal-fired production rebounded in the USA in 2017, for example, supported by higher gas prices at the beginning of the year and Donald Trump's policies (source: IEA).

Power generation from natural gas has picked up strongly on the back of competitive prices and its environmental advantage over coal. After rebounding 6% in 2015, it expanded another 4% in 2016. Europe is the main driver of this growth (up 18% in 2016 and +7% in 2017), along with Asia (up 4%) and the Middle East (up 7%). The share of natural gas in the world mix has been rising steadily over the last ten years (up 3 percentage points) and topped 23% in 2016.

Nuclear power generation is slowly regaining lost ground after the severe dip caused by the Fukushima disaster in 2011. It expanded 1.3% in 2016, yet it still remains 5,5% below its 2010 level. This was not enough to reverse a constant decline in market share from 17% in 2000 to 11% in 2016, however. The drop in nuclear production recorded in Europe (-2%) stemmed mainly from outages in France related to anomalies discovered in some steam generators' steel, and from the gradual exit from nuclear power in Germany.

Electricity: production

RES now accounts for a quarter of world electricity generation and 30% in Europe

Production from renewable sources has increased by an annual average 6% since 2010 (6.5% in 2016) and its share in the electricity mix has jumped from 20% to 26% in just ten years. This momentum is currently derived from Asia-Pacific (up 9% in 2016), where RES account for 22% of the production mix. In Europe, renewable power generation stalled in 2016 (up 2%) after a decade of very strong growth during which its share rose from 21% to 37%. It was at the time the only expanding power source, and total production was continuously falling (-0.4% average annual growth between 2006 and 2016). Latin America is the region where RES have developed the most: they represent 56% of the mix, thanks to especially to hydro power (46%).

RES power generation growth depends heavily on wind and solar production, and to a lesser extent on biomass. Excluding hydro power, renewable power rose 12% in 2016 and, according to early indicators, 18% in 2017 (ENGIE estimates).

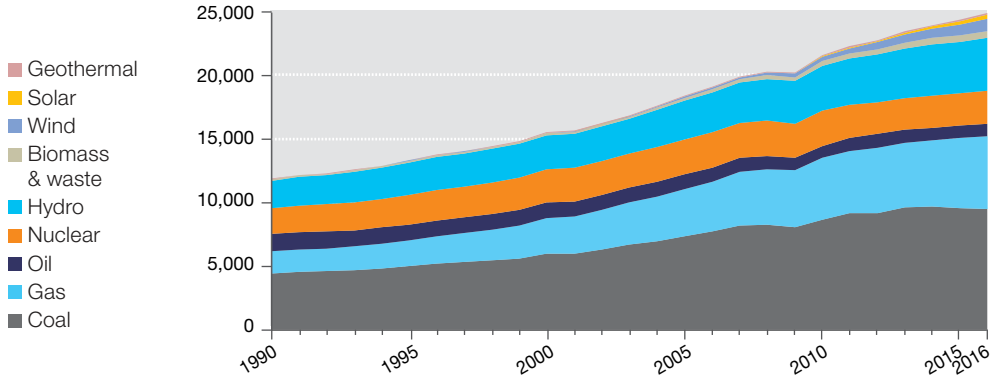
Wind power has rocketed since the beginning of the century, expanding by an annual average 25% overall. Despite some loss of momentum in 2016 (up 15%), the boom has lifted its share of the mix to the same level as oil (4%).

Still in a start-up phase (1.4% share), solar power is suffering the consequences of reduced and/or uncertain support for investors in many countries, especially in the residential sector. World solar production growth was still a rapid 30% in 2016, although this was not quite as forceful as the average 49% per year recorded over the previous ten years. Production has slowed markedly in Europe since 2013. It rose just 4% in 2016,compared with annual average growth of 60% between 2005 and 2015.

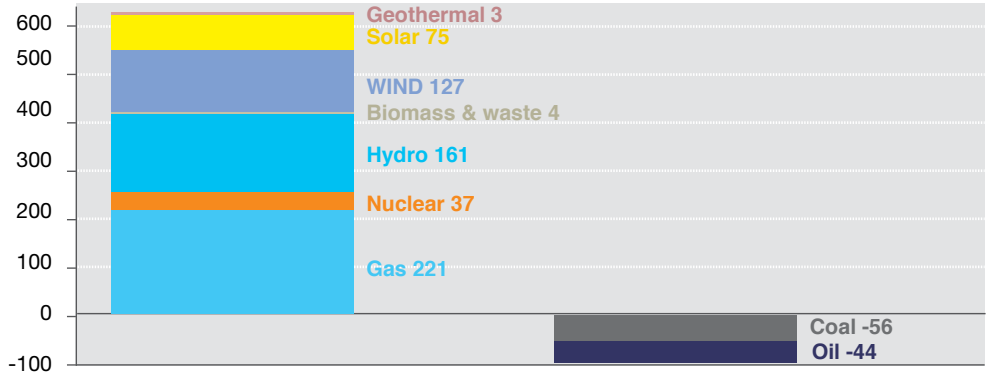
We should bear in mind that 80% of the planet's wind and solar power is produced in Europe, China and the USA. This underlines the need to improve financing tools and regulations to allow their take-off worldwide, and particularly in electricity-deprived regions.

Electricity: production

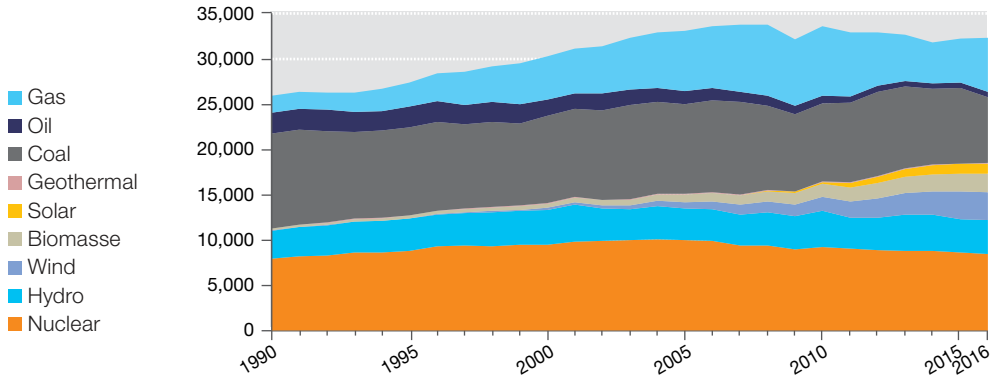
WORLD ELECTRICITY PRODUCTION BY SOURCE BETWEEN 1990 AND 2016 IN TWH



CHANGE IN WORLD ELECTRICITY PROCUCTION IN 2016 (VS. 2015)

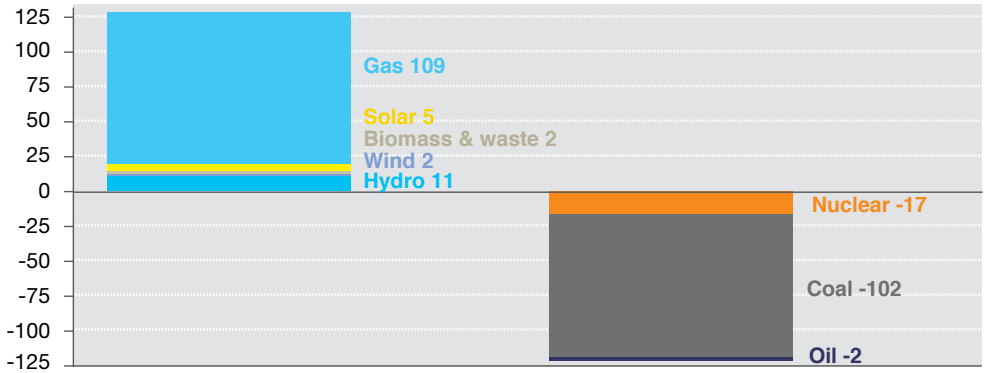


EUROPEAN ELECTRICITY PRODUCTION BY SOURCE BETWEEN 1990 AND 2016 IN TWH



Source: Enerdata Global Energy & CO2 Data (2017)

CHANGE IN EUROPEAN ELECTRICITY PROCUCTION IN 2016 (VS. 2015)



Source: Enerdata Global Energy & CO2 Data (2017)

Electricity: production by power station type

Electricity production in TWh	Total production			Hydro production			Nuclear production			Thermal production			Wind production			Solar production			Geothermal production			Others		
	2015	2016	Change 2015-2016	2015	2016	Change 2015-2016	2015	2016	Change 2015-2016	2015	2016	Change 2015-2016	2015	2016	Change 2015-2016	2015	2016	Change 2015-2016	2015	2016	Change 2015-2016	2015	2016	Change 2015-2016
Europe	3,803	3,831	1%	656	677	3%	880	862	-2%	1,819	1,837	1.0%	318	322	1%	109	113	4%	15	16	10%	5	5	2%
European Union	3,236	3,251	0%	371	382	3%	857	840	-2%	1,585	1,600	0.9%	304	305	0%	108	112	4%	7	7	1%	4	4	1%
Germany	652	653	0%	25	28	11%	92	85	-8%	415	424	2.0%	79	77	-2%	38	38	-1%	0.1	0.2	13%	2	2	0%
France	568	553	-3%	60	65	8%	437	403	-8%	41	54	31.7%	21	21	-1%	7	8	14%	0	0	-	1	1	1%
North America	4,976	4,963	0%	649	675	4%	932	943	1%	3,108	2,999	-3.5%	223	261	17%	37	58	54%	19	19	3%	8	8	-1%
Canada	659	643	-2%	378	385	2%	102	104	2%	145	118	-18.5%	30	32	4%	2	2	12%	0	0	-	2	2	0%
USA	4,317	4,320	0%	271	290	7%	830	840	1%	2,963	2,880	-2.8%	193	229	19%	36	56	56%	19	19	3%	6	5	-2%
Latin America	1,602	1,590	-1%	719	724	1%	36	38	5%	795	759	-4.5%	39	53	38%	3	5	83%	10	10	-4%	0	0	-
Brazil	582	579	0%	360	381	6%	15	16	8%	185	149	-19.8%	22	33	55%	0.06	0.09	44%	0	0	-	-	-	-
Asia	10,220	10,650	4%	1,546	1,618	5%	425	469	10%	7,892	8,091	2.5%	239	306	28%	93	140	51%	24	24	1%	2	2	7%
China	5,860	6,165	5%	1,130	1,194	6%	171	213	25%	4,328	4,439	2.6%	186	242	30%	45	78	72%	0.1	0.1	0%	0.01	0.01	0%
South Korea	549	549	0%	6	7	14%	165	162	-2%	373	375	0.6%	1	1	8%	3	3	1%	0	0	-	2	2	8%
India	1,383	1,463	6%	138	139	1%	37	38	1%	1,159	1,226	5.8%	43	50	17%	6	10	82%	0	0	-	-	-	-
Japan	1,041	1,025	-2%	91	86	-6%	9	18	91%	897	870	-3.0%	5	5	1%	36	44	22%	3	2	-14%	0	0	-
Pacific	302	306	1%	39	46	18%	0	0	-	235	229	-2.3%	14	16	16%	6	7	12%	8	8	0%	0.1	0.1	2%
CIS	1,525	1,555	2%	238	261	10%	286	280	-2%	999	1,012	1.3%	1	1	2%	0.7	0.8	11%	0.5	0.4	-9%	-	-	-
Russia	1,068	1,090	2%	170	189	11%	195	197	1%	701	703	0.3%	0.1	0.147	-1%	0.3	0.4	33%	0.5	0.4	-9%	-	-	-
Middle East	1,089	1,131	4%	20	23	13%	3	5	85%	1,065	1,100	3.3%	0.5	2	344%	1	1	5%	0	0	-	0	0	-
Saudi Arabia	325	327	1%	0	0	-	0	0	-	325	327	0.7%	0	0	-	0.001	0.001	0%	0	0	-	-	-	-
Iran	282	290	3%	17	19	15%	3	5	85%	263	264	0.7%	0.4	2	351%	0	0	-	0	0	-	-	-	-
Africa	792	805	2%	125	125	0%	12	15	23%	640	646	1.0%	7	10	36%	3	3	24%	5	5	0%	-	-	-
World	**24,309**	**24,830**	**2%**	**3,992**	**4,150**	**4%**	**2574**	**2611**	**1%**	**16,554**	**16,673**	**0.7%**	**842**	**971**	**15%**	**253**	**328**	**30%**	**81**	**83**	**2%**	**14**	**14**	**1%**

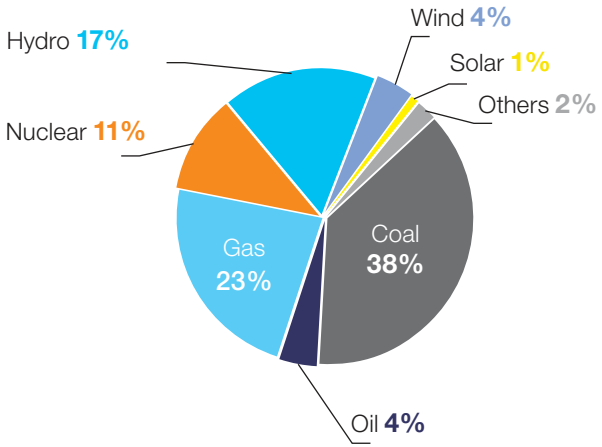
Source: Enerdata Global Energy & CO2 Data (2017)

Electricity: detail of thermal electricity production

Detail of thermal electricity production in TWh	Thermal production Oil			Thermal production Natural gas			Thermal production Coal & lignite			Thermal production Biomass & waste		
	2015	2016	Change 2015-2016	2015	2016	Change 2015-2016	2015	2016	Change 2015-2016	2015	2016	Change 2015-2016
Europe	64	69	7%	596	702	18%	950	856	-10%	204	206	1%
European Union	62	61	-1%	493	598	21%	828	734	-11%	199	203	2%
Germany	6	6	-5%	63	82	30%	286	274	-4%	60	61	2%
France	2	2	-13%	690	702	2%	12	10	-15%	7	8	6%
North America	47	41	-13%	1,439	1,470	2%	1,536	1,403	-9%	87	85	-2%
Canada	8	7	-19%	66	51	-23%	65	53	-19%	7	8	24%
USA	39	34	-12%	1,373	1,419	3%	1,471	1,350	-8%	80	77	-4%
Latin America	177	145	-18%	442	429	-3%	107	109	2%	69	76	10%
Brazil	29	14	-53%	79	55	-31%	27	26	-6%	49	54	11%
Asia	263	223	-15%	1,289	1,338	4%	6,189	6,382	3%	151	147	-3%
China	10	10	4%	145	164	13%	4,109	4,202	2%	64	64	0%
South Korea	16	20	19%	118	125	5%	236	229	-3%	2	2	1%
India	23	30	32%	68	75	10%	1,042	1,093	5%	27	28	6%
Japan	103	73	-28%	410	413	1%	343	347	1%	41	36	-13%
Pacific	9	11	16%	60	53	-12%	160	160	0%	4	5	15%
CIS	14	15	6%	20	35	75%	292	292	0%	3	4	2%
Russia	10	10	4%	530	535	1%	159	155	-2%	3	3	2%
Middle East	328	321	-2%	707	754	7%	30	24	-17%	0.1	0.1	0%
Saudi Arabia	162	161	0%	163	166	2%	0	0	-	0	0	-
Iran	56	54	-4%	206	210	2%	1	1	0%	0	0	0%
Africa	91	93	2%	294	300	2%	254	252	-1%	1	2	2%
World	**992**	**917**	**-8%**	**5,518**	**5,747**	**4%**	**9,518**	**9,479**	**0%**	**521**	**525**	**1%**

Source: Enerdata Global Energy & CO2 Data (2017)

WORLD ELECTRICITY PRODUCTION BY ENERGY
TOTAL: 24,830 TWH



Source: Enerdata Global Energy & CO2 Data (2017)

Electricity: production – long series

In TWh	2000	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	Change 2015-2016	AAGR 2000-2016	AAGR 2010-2016	Market share 2016
Europe	3,438	3,763	3,813	3,857	3,883	3,708	3,866	3,810	3,843	3,814	3,744	3,802	3,831	0.8%	0.6%	-0.1%	15.4%
European Union	3,036	3,325	3,371	3,383	3,387	3,222	3,366	3,298	3,298	3,271	3,191	3,235	3,242	0.2%	0.4%	-0.5%	13%
Germany	577	623	639	641	640	596	633	613	630	639	628	652	653	0.2%	0.7%	0.5%	2.6%
Spain	224	294	299	305	314	295	302	294	298	286	279	280	275	-1.9%	1.2%	-1.3%	1.1%
France	540	576	575	569	574	536	569	561	566	572	563	568	553	-2.7%	0.1%	-0.4%	2.2%
Italy	277	304	314	314	319	293	302	303	299	290	280	285	288	1.2%	0.2%	-0.7%	1.2%
United Kingdom	377	398	397	397	389	377	382	367	364	359	339	340	339	-0.2%	-0.6%	-1.7%	1.4%
North America	4,658	4,916	4,908	4,976	4,998	4,795	4,974	4,979	4,924	4,967	4,995	4,976	4,963	-0.3%	0.4%	0.0%	20%
Canada	606	622	607	627	629	606	596	630	633	661	656	659	643	-2.5%	0.4%	1.1%	2.6%
USA	4,053	4,294	4,301	4,350	4,368	4,188	4,378	4,349	4,291	4,306	4,339	4,317	4,320	0.1%	0.4%	-0.2%	17.4%
Latin America	982	1,156	1,201	1,255	1,305	1,310	1,375	1,445	1,495	1,528	1,563	1,616	1,603	-0.8%	2.9%	2.2%	6.4%
Brazil	349	403	419	445	463	466	516	532	553	571	591	582	579	-0.4%	3.0%	1.7%	2.3%
Mexico	206	251	258	265	269	268	276	303	307	297	301	307	310	0.8%	2.4%	1.7%	1.2%
Asia	4,024	5,679	6,162	6,716	6,907	7,234	7,983	8,581	8,958	9,538	9,936	10,228	10,658	4.2%	5.9%	4.2%	42.9%
China	1,356	2,500	2,866	3,282	3,467	3,715	4,208	4,716	4,994	5,447	5,679	5,860	6,165	5.2%	9.3%	5.6%	24.8%
South Korea	290	389	404	427	446	455	500	523	535	542	551	549	549	0.1%	3.8%	1.4%	2.2%
India	570	716	774	824	848	917	979	1,075	1,123	1,191	1,294	1,383	1,463	5.8%	5.7%	5.9%	5.9%
Japan	1,100	1,139	1,140	1,164	1,108	1,075	1,149	1,083	1,065	1,066	1,059	1,041	1,025	-1.5%	-0.4%	-1.6%	4.1%
Middle East	472	646	690	732	786	818	892	916	957	988	1,051	1,089	1,132	3.9%	5.3%	3.5%	4.6%
Saudi Arabia	126	176	181	191	204	217	240	250	272	284	312	325	327	0.7%	5.8%	4.5%	1.3%
Iran	121	178	193	204	215	221	233	240	254	262	275	282	290	2.8%	5.3%	3.2%	1.2%
CIS	1,250	1,374	1,433	1,458	1,483	1,407	1,482	1,513	1,542	1,538	1,542	1,523	1,553	2.0%	1.3%	0.7%	6.3%
Russia	878	953	996	1,015	1,040	992	1,038	1,055	1,071	1,059	1,064	1,066	1,088	2.1%	1.3%	0.7%	4.4%
Africa	445	564	590	615	624	629	675	699	728	748	770	791	804	1.7%	3.5%	2.5%	3.2%
South Africa	211	245	254	263	258	250	260	263	258	256	253	248	250	0.9%	1.0%	-0.5%	1%
Egypt	78	109	115	125	131	139	147	157	164	168	172	183	190	4.2%	5.4%	3.8%	0.8%
Pacific	253	276	281	291	291	297	302	303	300	298	297	302	306	1.4%	1.1%	0.2%	1.2%
Australia	210	229	233	243	243	249	253	254	251	250	248	252	257	1.9%	1.2%	0.2%	1%
World	**15,523**	**18,374**	**19,078**	**19,901**	**20,276**	**20,198**	**21,549**	**22,247**	**22,747**	**23,420**	**23,897**	**24,327**	**24,854**	**2.2%**	**2.8%**	**2.1%**	**100%**

Source: Enerdata Global Energy & CO2 Data (2017)

Electricity: production forecasts

ELECTRICITY PRODUCTION FORECAST BY SOURCE (TWH)

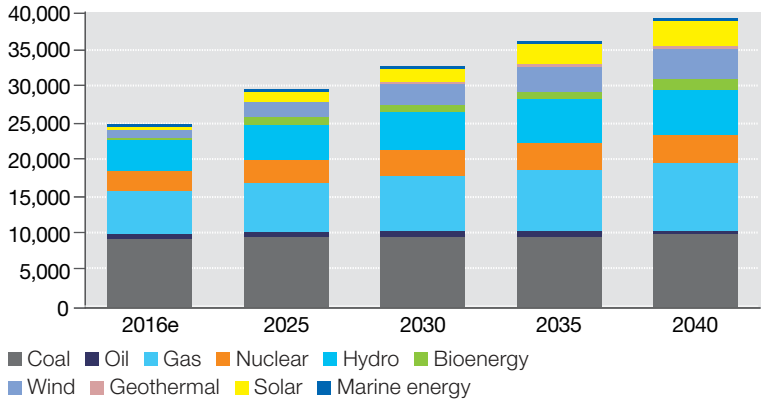
	2016	New Policies Scenario				SDS Scenario			
		2025	2040	AAGR 2016-2025	AAGR 2016-2040	2025	2040	AAGR 2016-2025	AAGR 2016-2040
Coal	9,282	9,675	10,086	0%	0%	6,575	2,195	-3.4%	-6%
Oil	1,006	719	491	-3%	-3%	593	192	-5%	-6%
Gas	5,850	6,730	9,181	1%	2%	6,903	5,585	2%	0%
Nuclear	2,611	3,217	3,844	2%	2%	3,531	5,345	3%	3%
Renouvelables	6,021	9,316	15,688	4%	4%	10,625	22,664	6%	5%
o/w hydro	4,070	4,804	6,193	2%	2%	4,986	6,928	2%	2%
o/w bioenergy	570	867	1,424	4%	4%	952	1,807	5%	5%
o/w wind	981	2,192	4,270	8%	6%	2,785	6,950	11%	8%
o/w geothermal	86	140	349	5%	6%	170	563	7%	8%
o/w solar PV	303	1,264	3,162	15%	10%	1,629	5,265	18%	12%
o/w CSP	11	44	237	15%	13%	99	1,066	25%	20%
o/w marine energy	1	4	53	13%	16%	5	85	15%	19%
Total capacity	**24,770**	**29,657**	**39,290**	**2%**	**2%**	**28,226**	**35,981**	**1%**	**2%**

ELECTRICITY PRODUCTION FORECAST BY REGION (TWH)

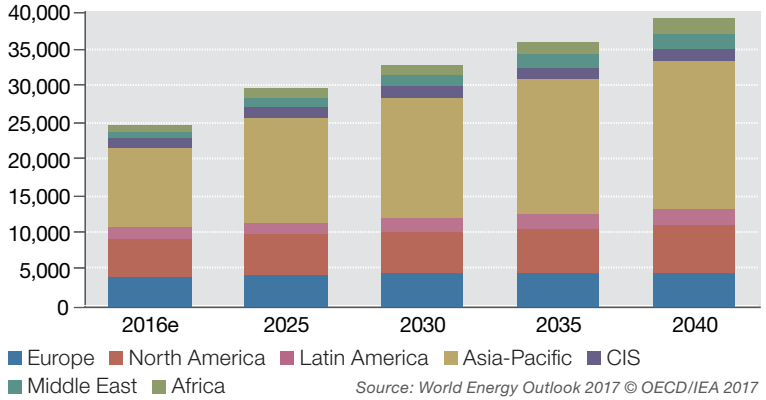
	2016	New Policies Scenario				SDS Scenario			
		2025	2040	AAGR 2016-2025	AAGR 2016-2040	2025	2040	AAGR 2016-2025	AAGR 2016-2040
Europe	5,295	5,621	6,285	1%	1%	5,399	6,040	0.2%	1%
North America	1,299	1,581	2,229	2%	2%	1,501	2,071	1.5%	2%
South America	4,080	4,303	4,693	1%	1%	4,150	4,458	0.2%	0%
Asia-Pacific	814	1,094	2,069	3%	4%	1,064	2,070	2.7%	4%
CIS	1,091	1,338	2,138	2.1%	3%	1,275	1,903	1.6%	2%
Middle East	1,340	1,443	1,677	1%	1%	1,370	1,463	0%	0%
Africa	10,852	14,277	20,200	3%	3%	13,467	17,976	2%	2%
OECD	**10,935**	**11,558**	**12,746**	**1%**	**1%**	**11,088**	**12,087**	**0%**	**0%**
non-OECD	**13,835**	**18,100**	**26,543**	**3%**	**3%**	**17,138**	**23,894**	**2%**	**2%**
Total capacity	**24,770**	**29,657**	**39,290**	**2%**	**2%**	**28,226**	**35,981**	**1%**	**2%**

Source: World Energy Outlook 2017 © OECD/IEA 2017

FORECAST OF ELECTRICTY PRODUCTION BY SOURCE IN THE IEA NEW POLICY SCENARIO (TWH)



FORECAST OF ELECTRICTY PRODUCTION BY REGION IN THE IEA NEW POLICY SCENARIO (TWH)



Source: World Energy Outlook 2017 © OECD/IEA 2017

Electricity: consumption Economic growth and electrification in emerging countries, coupled with substitution to other energy sources, support the demand for electricity

World electricity consumption has been growing by an annual 2% for the past three years. Asia's economic vitality and electrification have been the main factors behind this rise. While China accounts for over half of the increase, India, Indonesia, Malaysia and Thailand also played their part. In contrast, economic weakness and improved energy efficiency allowed OECD countries to curtail their consumption over the past few years. That trend continued in 2016, with electricity demand falling in the USA (-1% in 2016 and 2017) and increasing slightly in the EU (+0.7% in 2017 after +0.4% in 2016).

Although still robust, and up 6% in 2017 after +5% in 2016, Chinese electricity demand has slowed sharply as a result of a shift towards a service economy (10% average annual growth between 2000 and 2016). The industrial sector weighs slightly less than it used to in final electricity consumption, at 64% in 2016 against 69% in 2006, while the service sector now accounts for 13%, up from 11% in 2006.

A contraction in demand for electricity in the USA was confirmed with a 0.8% drop in 2016, in line with a fifth successive year of reduced industrial consumption. This trend reflects improved energy efficiency and the push towards the new digital economy.

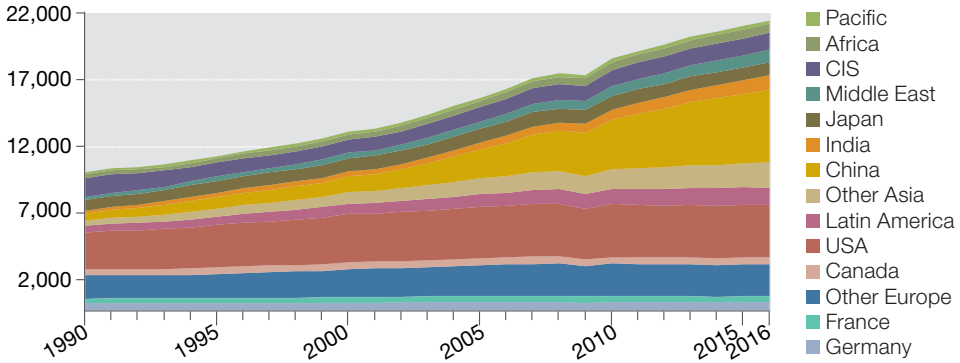
In Brazil, the continuing political and economic crisis (GDP down 3.6% in 2016) is hampering electricity demand (up 0.6% in 2016, compared with 3% per year previously). The service and industrial sectors are the hardest hit (-0.6% and -1.2%). The residential sector is proving more resilient (up 1.2% in 2016).

CIS electricity demand resumed with growth in 2016, climbing 1.5%, after three years of decline related to the Ukrainian crisis. The trend reversal was particularly marked in Russia, where the industrial sector benefited in 2016 from favourable export conditions (weak rouble, higher oil prices).

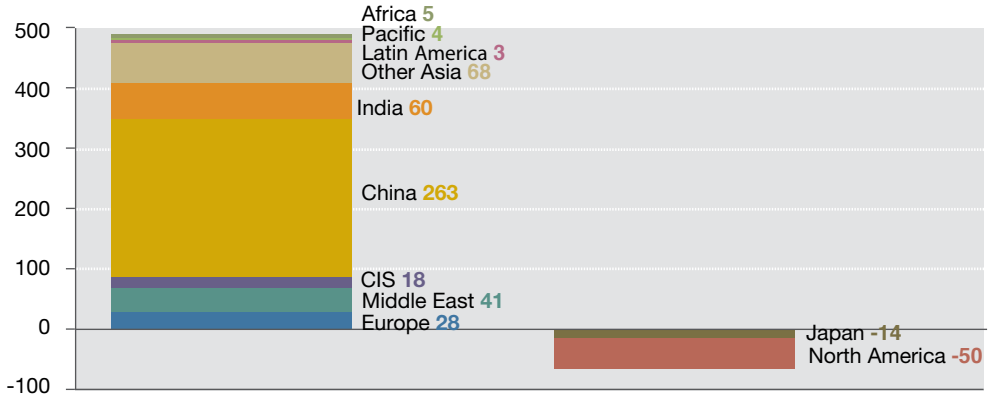
Electricity demand growth remains robust in the Middle East (up 4.5% in 2016), driven mainly by substantial increases in services sector consumption.

Electricity: consumption

WORLD ELECTRICITY CONSUMPTION BETWEEN 1990 AND 2016 (TWH)

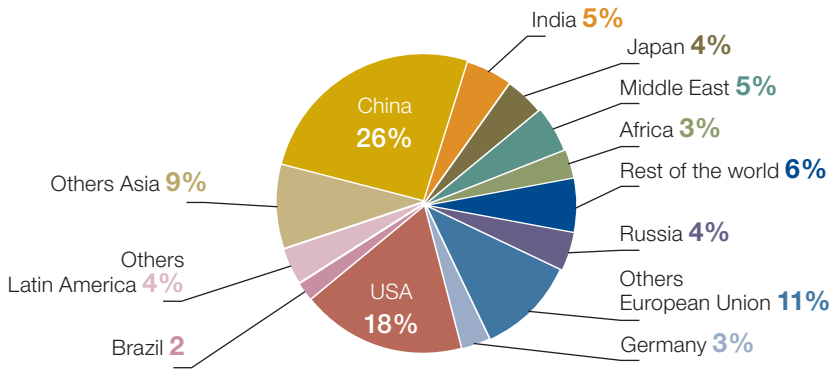


CHANGE IN WORLD CONSUMPTION 2015 VS. 2016 – BREAKDOWN BY ENERGY SOURCES



Source: Enerdata Global Energy & CO2 Data (2017)

ELECTRICITY CONSUMPTION IN THE WORLD IN 2016
TOTAL: 21,392 TWH



Source: Enerdata Global Energy & CO2 Data (2017)

Electricity: consumption – long series

TWh	2000	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	Change 2000-2016	AAGR 2010-2016	AAGR 2015-2016	Share of world total in 2016
Europe	2,952	3,264	3,317	3,356	3,388	3,229	3,380	3,335	3,343	3,321	3,258	3,314	3,342	0.9%	0.7%	-0.2%	15.6%
European Union	2,638	2,901	2,943	2,964	2,977	2,829	2,952	2,898	2,892	2,866	2,800	2,840	2,851	0.4%	0.5%	-0.5%	13.3%
Germany	501	539	544	545	543	514	547	541	540	537	526	533	533	0%	0.4%	-0.4%	2.5%
France	410	451	446	448	461	448	472	443	454	457	432	440	448	1.7%	0.5%	-0.7%	2.1%
United Kingdom	340	357	354	351	350	330	337	326	325	325	311	311	307	-1.3%	-0.6%	-1.4%	1.4%
North America	4,093	4,345	4,342	4,466	4,457	4,228	4,400	4,401	4,355	4,400	4,413	4,412	4,362	-1.1%	0.4%	-0.1%	20.4%
Canada	503	533	524	544	549	503	506	516	524	527	519	516	498	-3.5%	-0.1%	-0.2%	2.3%
USA	3,590	3,811	3,818	3,922	3,907	3,725	3,894	3,885	3,831	3,873	3,894	3,895	3,864	-0.8%	0.4%	-0.1%	18.1%
Latin America	788	938	979	1,023	1,064	1,066	1,130	1,183	1,234	1,265	1,283	1,307	1,310	0.2%	3%	2.1%	6.1%
Brazil	329	371	386	406	423	421	459	476	492	509	522	514	518	0.6%	2.7%	1.7%	2.4%
Asia	3,369	4,800	5,250	5,743	5,937	6,230	6,869	7,368	7,748	8,253	8,600	8,871	9,248	4.2%	6.1%	4.3%	43.2%
China	1,138	2,126	2,446	2,817	2,989	3,223	3,626	4,052	4,326	4,718	4,939	5,104	5,367	5.2%	9.5%	5.8%	25.1%
South Korea	263	358	371	393	408	415	458	481	493	498	499	505	512	1.3%	4.0%	1.6%	2.4%
India	376	489	543	588	619	669	727	803	839	890	963	1,032	1,092	5.8%	6.5%	6%	5.1%
Japan	982	1,016	1,036	1,051	1,008	983	1,037	979	978	983	976	964	950	-1.4%	-0.2%	-1.2%	4.4%
Pacific	218	241	246	256	256	260	265	268	266	266	266	270	274	1.3%	1.4%	0.5%	1.3%
Middle East	400	528	571	597	638	670	742	760	795	831	885	923	965	4.5%	5.3%	3.8%	4.5%
Saudi Arabia	114	153	163	170	181	193	212	220	241	257	283	294	296	0.5%	5.8%	4.9%	1.4%
Iran	96	137	149	157	166	174	188	191	202	207	224	236	250	5.9%	5.8%	4.1%	1.2%
CIS	984	1,086	1,138	1,165	1,192	1,135	1,203	1,223	1,247	1,243	1,242	1,234	1,252	1.5%	1.4%	0.6%	5.9%
Russia	693	760	798	821	843	808	851	856	875	872	877	872	887	1.7%	1.5%	0.6%	4.1%
Africa	378	472	494	521	522	521	555	584	595	609	624	632	638	0.8%	3.1%	2%	3%
World	**13,182**	**15,674**	**16,336**	**17,126**	**17,454**	**17,339**	**18,543**	**19,122**	**19,582**	**20,187**	**20,572**	**20,964**	**21,392**	**2%**	**2.9%**	**2.1%**	**100%**

Source: Enerdata Global Energy & CO2 Data (2017)

Electricity: consumption forecasts

WORLD ELECTRICITY CONSUMPTION FORECAST BY SECTOR (TWH)

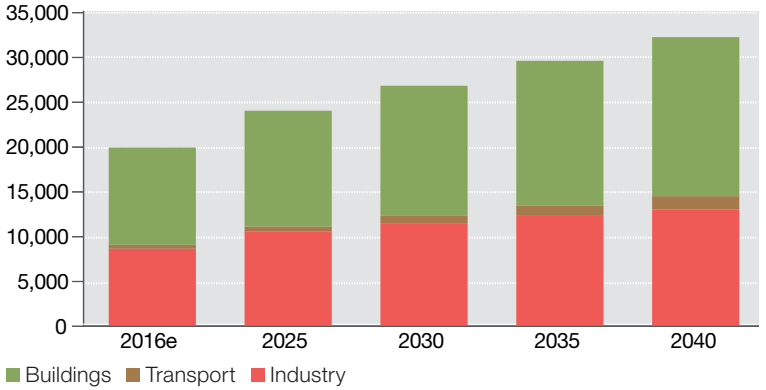
	2016	New Policies Scenario				SDS Scenario			
		2025	2040	AAGR 2016-2025	AAGR 2016-2040	2025	2040	AAGR 2016-2025	AAGR 2016-2040
Industry	8,664	10,497	13,107	2%	4%	9,966	10,323	1%	2%
Share in total industry energy consumption	26%	28%	29%			27%	28%		
Transports	427	673	1,417	5%	13%	66	293	-17%	-4%
Share in total transports energy consumption	1%	2%	3%			2%	11%		
Buildings	10,898	13,072	18,046	2%	5%	12,457	13,666	1%	2%
Share in total building consumption	31%	35%	41%			38%	42%		
Electricity final consumption	**20,670**	**25,110**	**33,664**	**2%**	**5%**	**24,025**	**31,384**	**2%**	**4%**
Share in total final consumption	**19%**	**20%**	**23%**			**21%**	**27%**		

WORLD ELECTRICITY CONSUMPTION FORECAST BY REGION IN TWH

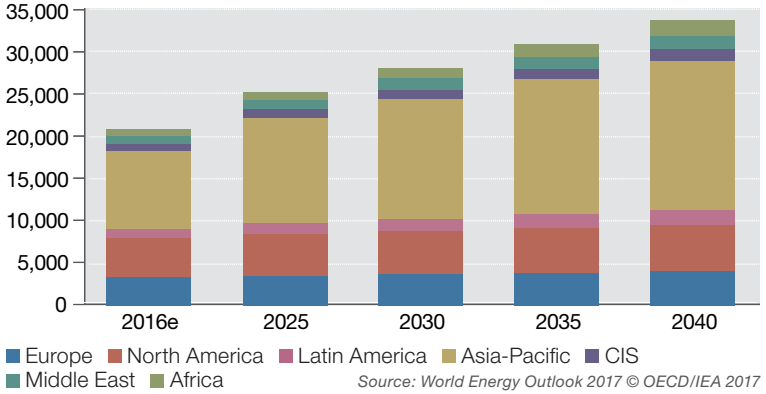
	2016	New Policies Scenario				SD Scenario			
		2025	2040	AAGR 2016-2025	AAGR 2016-2040	2025	2040	AAGR 2016-2025	AAGR 2016-2040
Europe	3,452	3,691	4,103	1%	2%	3,571	3,929	0%	1%
North America	4,562	4,871	5,499	1%	2%	4,706	5,401	0%	2%
Latin America	1,044	1,284	1,825	2%	6%	1,222	1,713	2%	5%
Asia-Pacific	9,159	12,251	17,491	3%	7%	11,633	15,868	2%	6%
CIS	920	1,054	1,297	1%	3%	993	1,138	1%	2%
Middle East	888	1,086	1,757	2%	7%	1,042	1,596	2%	6%
Africa	645	874	1,692	3%	10%	857	1,739	3%	10%
OECD	**9,475**	**10,089**	**11,250**	**1%**	**2%**	**9,716**	**10,821**	**0%**	**1%**
Non-OECD	**11,194**	**15,021**	**22,415**	**3%**	**7%**	**14,309**	**20,563**	**2%**	**6%**
World	**20,670**	**25,110**	**33,664**	**2%**	**5%**	**24,025**	**31,384**	**2%**	**4%**

Source: World Energy Outlook 2017 © OECD/IEA 2017

FORECASTS OF THE WORLD'S ELECTRICITY CONSUMPTION BY SECTOR, ACCORDING TO THE IEA *NEW POLICIES* SCENARIO (TWH)



FINAL ELECTRICITY CONSUMPTION FORECAST BY REGION, ACCORDING TO THE IEA *NEW POLICIES* SCENARIO (TWH)



Source: World Energy Outlook 2017 © OECD/IEA 2017

Electricity: consumption in Europe

Electricity consumption TWh	Total consumption								Residential		Services		Industry		Transport	
	2000	2010	2015		2016		AAGR 2000-2016	Change 2015-2016	2016		2016		2016		2016	
				EU market share ▼		EU market share ▼				Share in country total ←		Share in country total ←		Share in country total ←		Share in country total ←
Germany	501	547	533	19%	533	19%	0%	0%	132	25%	142	27%	229	43%	12	2%
Austria	53	63	63	2%	65	2%	1%	3%	17	26%	13	20%	28	43%	3	4%
Belgium	79	86	83	3%	83	3%	0%	0%	19	23%	22	26%	39	47%	1	2%
Bulgary	25	28	30	1%	30	1%	1%	1%	11	36%	8	28%	9	30%	0	1%
Cyprus	3	5	4	0%	4	0%	2%	8%	2	36%	2	48%	1	12%	0	0%
Croatia	12	16	16	1%	13	0%	0%	-17%	5	38%	4	33%	3	21%	0	1%
Denmark	33	33	31	1%	32	1%	0%	1%	10	32%	10	32%	8	26%	0	1%
Spain	195	250	239	8%	240	8%	1%	1%	71	29%	75	31%	77	32%	6	3%
Estonia	5	7	7	0%	8	0%	2%	3%	2	25%	3	39%	2	32%	0	1%
Finland	77	85	80	3%	83	3%	0%	3%	21	26%	19	23%	38	46%	1	1%
France	410	472	440	15%	448	16%	1%	2%	161	36%	135	30%	112	25%	13	3%
Greece	45	55	49	2%	50	2%	1%	1%	17	34%	16	33%	12	25%	0	1%
Hungary	31	36	37	1%	37	1%	1%	1%	11	30%	8	21%	15	41%	1	3%
Irland	20	26	25	1%	26	1%	1%	4%	8	31%	7	27%	10	39%	0	0%
Italy	279	310	299	11%	293	10%	0%	-2%	64	22%	90	31%	110	38%	10	3%
Latvia	4	6	6	0%	6	0%	2%	0%	2	28%	3	42%	2	26%	0	1%
Lithuania	7	9	10	0%	11	0%	3%	5%	3	26%	3	31%	3	32%	0	0%
Luxembourg	6	7	6	0%	6	0%	1%	2%	1	14%	2	32%	3	51%	0	2%
Malta	2	2	2	0%	2	0%	2%	-1%	1	31%	1	48%	0	20%	0	0%
Netherlands	99	113	108	4%	107	4%	0%	-1%	23	21%	36	33%	35	32%	2	2%
Poland	109	129	138	5%	141	5%	2%	2%	29	20%	46	33%	51	36%	3	2%
Portugal	39	51	46	2%	47	2%	1%	1%	12	26%	17	36%	16	33%	0	1%
Czech Republic	52	59	60	2%	61	2%	1%	2%	15	24%	18	29%	24	40%	2	3%
Roumania	41	46	49	2%	51	2%	1%	4%	12	24%	9	18%	23	45%	1	2%
United Kingdom	340	337	311	11%	307	11%	-1%	-1%	108	35%	94	31%	93	30%	4	1%
Slovakia	23	25	25	1%	25	1%	1%	-2%	5	20%	7	27%	11	46%	1	2%
Slovenia	11	12	13	0%	13	0%	1%	1%	3	25%	3	25%	6	48%	0	1%
Sweden	135	137	127	4%	131	5%	0%	3%	38	29%	32	24%	52	40%	3	2%
European Union	**2,638**	**2,952**	**2,840**	**100%**	**2,854**	**100%**	**0%**	**1%**	**802**	**28%**	**825**	**29%**	**1,015**	**36%**	**64**	**2%**
Norway	111	121	119		121		1%	2%	38	32%	24	20%	47	39%	1	1%
Turkey	98	172	217		229		5%	6%	53	23%	64	28%	103	45%	1	0%
Europe	**2,952**	**3,380**	**3,314**		**3,342**		**1%**	**1%**	**944**	**28%**	**943**	**28%**	**1,214**	**36%**	**69**	**2%**

NB: Total electricity consumption : Final consumption (Residential, Services, Industry, Transort and Agriculture not shown here) plus energy sector's own consumption (not shown here)

Source: Enerdata Global Energy & CO2 Data (2017)

RES electricity Renewable sources produced a quarter of the world's electricity output in 2016 and have become the preferred option for new capacity

RES electricity sets new records every year. In terms of new installed capacity, renewables overtook non-renewables in 2012, and all other sources taken together – nuclear included – in 2015. Their share in total new installed capacity was was closed to 60% in 2016 and 2017.

Although hydro power accounts for 60% of RES capacity (1,243 GW out of 2,121 GW), **wind and solar power are gaining ground.** They have accounted for more incremental capacity than hydro and have attracted the majority of RES investment since 2015. According to the IEA, solar PV capacity will be the fastest-growing sector out to 2040 (seven times over in the New Policies scenario, a third of additional capacity over the period), followed by wind power, with especially rapid growth in offshore wind farms (three times over in the New Policies scenario). Solar power production is set to overtake hydro power to become the prevailing renewable source of electricity production in 2040 (17% and 15%, respectively, with wind power at 14%). The decentralisation and flexibility permitted by storage solutions will also play a major role between now and 2040.

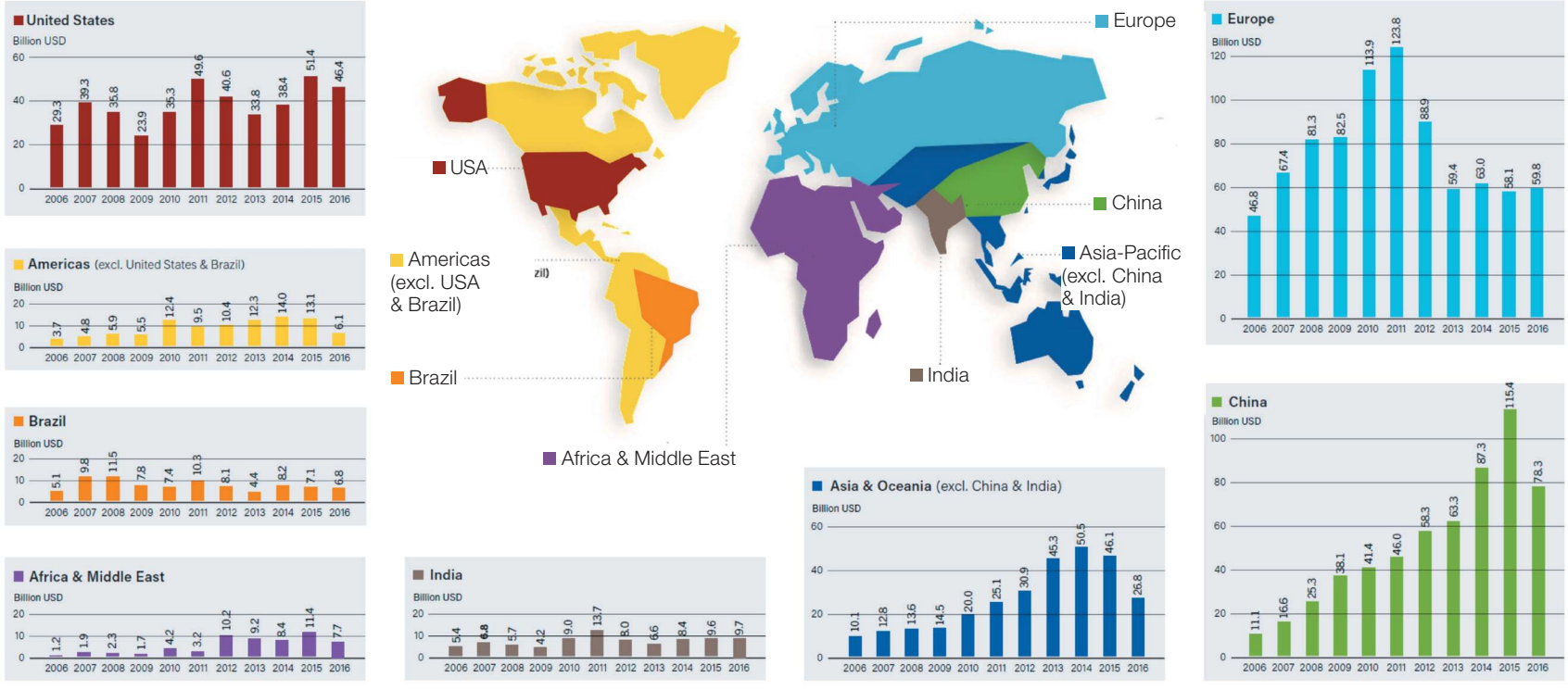
Europe remains the world's top producer of RES electricity (451 TWh excluding hydro in 2016), but the sector's real leader is China. This is especially true of onshore wind and solar PV. China accounts for 60% of all RES jobs, with most solar technologies (thermal and PV) manufactured there.

RES are no longer unique to developed countries. RES investment are currently split equally between the North and the South. According to Bloomberg, two thirds of new RES capacity will be built outside Europe and North America by 2040.

RES investment has oscillated around $250 bn per year since 2012. It decreased slightly in 2016 (to $241.6 bn) as a result of significant cost reduction in solar and wind production. The competitiveness of decentralised RES production and pollution levels in major cities are making RES more attractive to investors. 2016 saw record price falls in wind production in Morocco and in solar production in Dubai, to $28/MWh and $30/MWh, respectively.

RES electricity

NEW INVESTMENTS IN POWER RES AND BIOFULS BETWEEN 2006 AND 2016 (IN BLS $)

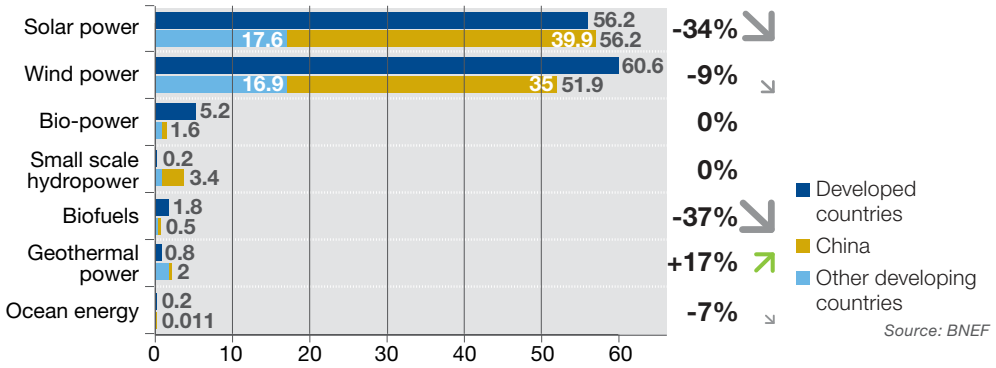


Source: REN 21 Renewable 2017 Global Status Report (2017)

RES electricity

New investments in renewable energy by region in 2016 in $ bn

GLOBAL NEW INVESTMENT IN RENEWABLE ENERGY BY TECHNOLOGY, DEVELOPED AND DEVELOPING COUNTRIES, 2016

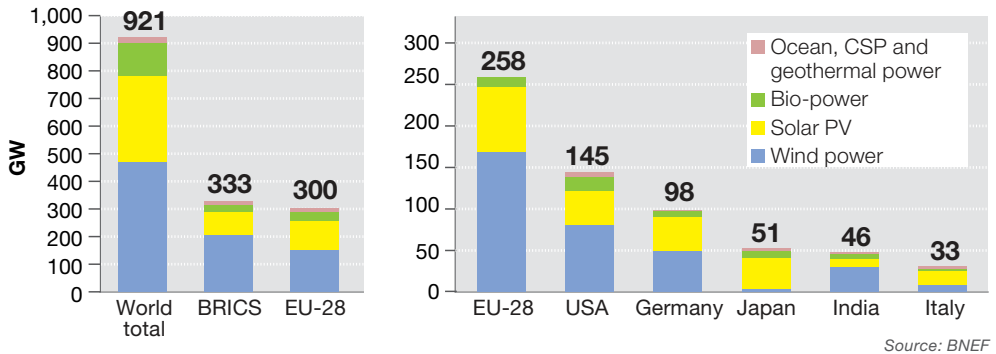


Source: BNEF

GLOBAL RENEWABLE ENERGY CAPACITY AND BIOFUEL PRODUCTION, 2016

Power generation (GW)	Added during 2016	Existing at end 2016
Bio-power	5.9	112
Geothermal power	0.4	13.5
Hydropower	25	1.096
Ocean power	0	0.5
Solar PV	75	303
Concentrated solar thermal power (CSP)	0.1	4.8
Wind power	55	487
Heating / Hot water(GW_{th})		
Modern bio-heat	5	311
Geothermal direct use	1.3	23
Solar collectors for water heating	37	456
Transport fuels (Billion litres per year)		
Ethanol production	0.04	98.6
Biodiesel production	2.17	30.8
Hydrotreated vegetable oil (HVO)	0.9	4.9

RENEWABLE POWER CAPACITIES IN WORLD, BRICS, EU-28 AND TOP 6 COUNTRIES, 2016



Source: BNEF

RENEWABLE ELECTRIC POWER GLOBAL CAPACITY, TOP REGIONS/ COUNTRIES, 2016

Technology	Global	BRICS'	UE-28'	China	USA	Germany	Japan	India	Itlay
	GW			GW					
Bio-power	112	35	37	12	16.8	7.6	4.1	8.3	4.1
Geothermal power	13.5	0.1	0.9	0	3.6	0	0.5	0	0.8
Hydropower	1,096	499	127	305	80	5.6	23	47	18.5
Ocean power	0.5	0	0.3	0	0	0	0	0	0
Solar PV	303	88	106	77	41	41	43	9.1	19.3
Concentrated solar thermal power (CSP)	4.8	0.4	2.3	0	1.7	0	0	0.2	0
Wind power	487	210	154	169	82	50	3.2	29	9.3
Total renewable power capacity (including hydropower)	2,017	832	428	564	225	104	73	94	52
Total renewable power capacity (not including hydropower)	921	333	300	258	145	98	51	46	33

Source: REN 21 Renewable 2017 Global Status Report (2017)

Electricity: prices Electricity prices on the European market remain moderate thanks to low commodity prices, persistent surplus on the carbon market and prevalent overcapacity

Forward electricity prices remained relatively low over the first half of 2017 (around €30/MWh for the German contract – Cal 18), **before rising vigorously as a consequence of a strong increase in coal prices from May onwards and higher CO2 prices from July,** as measures restoring equilibrium on the EU-ETS market were announced. By the end of November, French prices were up to €43/MWh and German prices €37/MWh.

In August 2017, the ASN initiated a new enquiry that required EDF to check all the parts of its nuclear plants that had been manufactured by AREVA on its Creusot site. The enquiry will last until end-2018. Even if it has not directly lead to plant stoppages, it has contributed – in conjunction with low plant availability this year – to heightened tension on prices. Lastly, the appointment of Nicolas Hulot to the French government has raised fears of nuclear plant shutdowns in the medium term and additional taxation of CO_2 emissions. Both measures would push prices up.

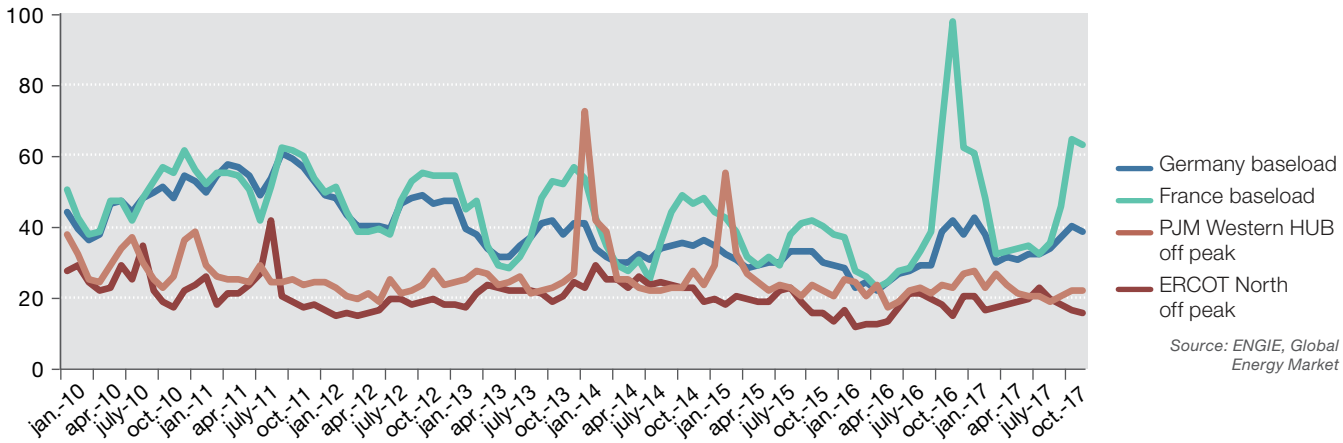
2018 forecasts are for slightly lower or stable prices relative to 2017. More specifically, prices should remain high over the first quarter of 2018, especially if there is a cold winter, before heading down below end-2017 levels as the winter ends. Over the second half of the year, prices are expected to rebound in line with an expected rise in CO_2 prices towards the €10 mark by the end of 2018. The major uncertainties lie in the ASN's conclusions (the Creusot enquiry poses a slight upside risk to French prices and, to a lesser extent, to the rest of Continental European prices until end-2018) and in Chinese policy on coal. In the short run, ARENH's wholesale price (Regulated Access to Incumbent Nuclear Electricity) is likely to act as a cap to calendar electricity prices in France. ENGIE internal analysis.

Lastly, in the longer run, it seems that Europe will move towards the shutdown of power generation overcapacity, especially coal and nuclear plants. That ought to tighten the markets and lift prices. **Electricity prices were particularly low in Europe in 2016, thanks to the collapse of most energy commodity prices** (an average €32.6/MWh in France and €26.3/MWh in Germany in 2016 for year-ahead contracts – Cal 17). Rising RES capacity and ample French nuclear plant availability in 2015 and in early 2016 also weighed on prices.

2016 retrospective: Having hit record lows in early 2016 (less than €21/MWh for the February German year-ahead contract), **electricity prices appreciated over the rest of the year,** spiking to nearly €50/MWh (Cal 17) in France: at the end of 2016 the French regulator ASN forced a third of the country's reactors to shut down for security reasons regarding their tanks. The rally boosted German prices as well (NB: after several months of enquiry, no serious security problem has been detected).

Electricity: prices

ELECTRICITY PRICES IN FRANCE, GERLMANY AND USA (IN $/MWH)



Source: ENGIE, Global Energy Market

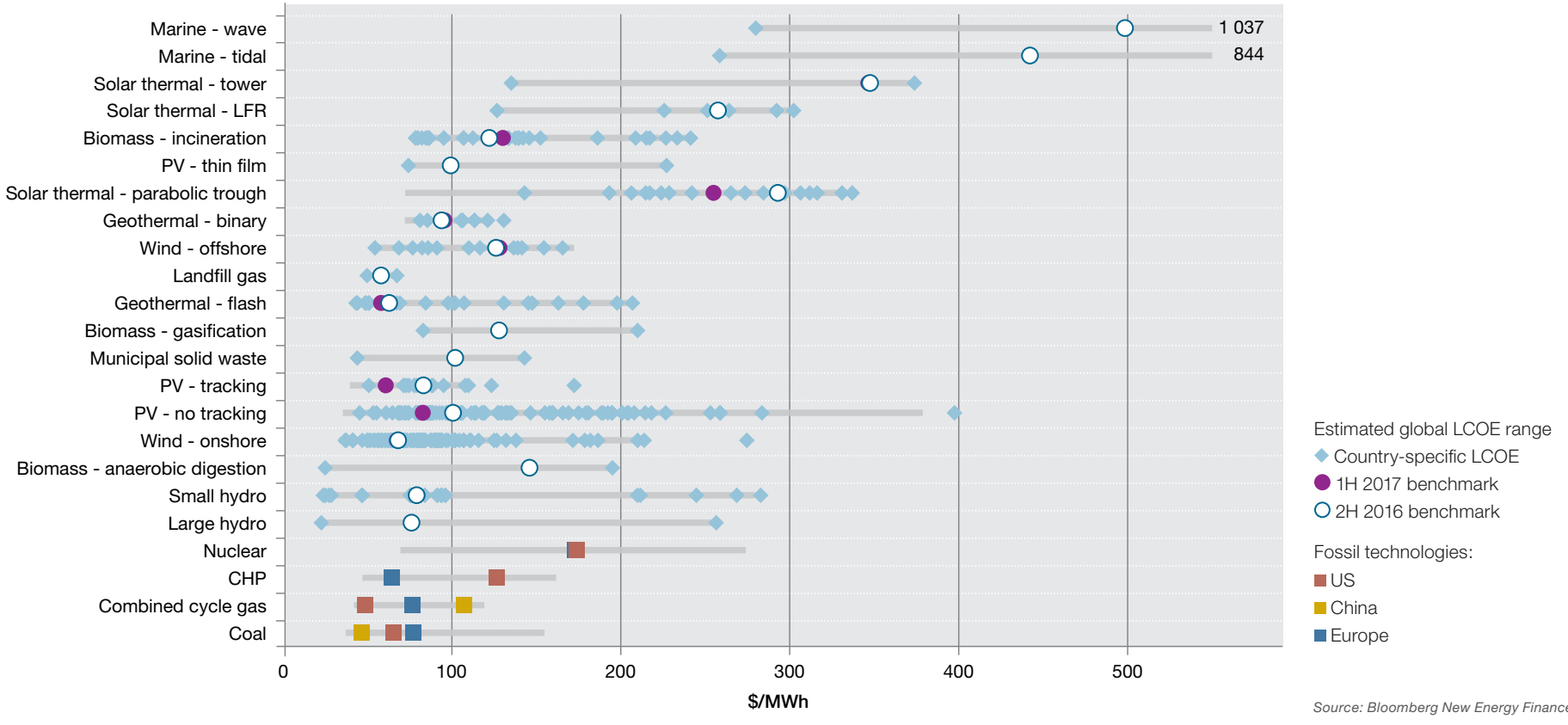
ELECTRICITY PRICES FOR CUSTOMER IN EUROPE

Electricity prices in €/MWh	Residential prices in € 05/MWh					Electricity prices in € 05/MWh				
	2000	2010	2015	2016	AAGR 2010-2016	2000	2010	2015	2016	AAGR 2010-2016
UE 28	128	158	176			61	94	100		
Germany	141	222	255	256	3.6%	47	95	113	111	5.1%
Belgium	159	158	168	197	1.3%	57	85	80	78	1.8%
Spain	149	159	160	201	1.8%	54	89	95	88	2.9%
France	121	115	140	143	1%	61	69	87	83	1.8%
Italy	166	182	209	213	1.5%	109	138	144	141	1.5%
United Kingdom	111	152	176	174	2.7%	57	100	108	104	3.5%
USA $/MWh	89	99	100	98	0.6%	50	58	55	53	0.3%
USA€/MWh	75	83	84	82	0.6%	42	49	46	44	0.3%
Japan	165	157	193	171	0.2%	110	104	139	122	0.6%

Source: Enerdata Global Energy & CO2 Data (2017)

Electricity

AVERAGE DISCOUNTED COST OF PRODUCING ELECTRIICTY USING VARIOUS TECHNOLOGIES



Source: Bloomberg New Energy Finance

Natural gas

PRODUCTION

In the USA, cost cuts in unconventional gas production may have reached their limit

CONSUMPTION

Record natural gas consumption in Europe in 2017: a +10% increase in a context of competitive prices for electricity production and the abandonment of coal

Natural gas: production

After a modest +0.7% increase in 2016, world natural gas output is expected to have jumped +1.4% in 2017.

> **The decline in natural gas production recorded in the USA in 2016 (-2.3%) continued in 2017 (-1.6%),** even though the number of rigs increased over the year (170 against 94, over the first 9 months) and Henry Hub prices rose (over $3/MMBtu in 2017). This disconnect raises the question of whether, after remarkable cost reductions, the American unconventional gas industry can improve its profitability from here without an increase in oil prices. Thanks to shale gas, representing 55% of total production, the USA has been the world's top gas producer since 2012, far ahead of Russia (750 bcm and 643 bcm, respectively, in 2016, or 21% and 18% of world output).

> **Russian production expanded moderately in 2016 (up 0.9%) then surged to a 25-year high in 2017 (up 9% to 701 bcm).** This rise is attributable to strong demand on the domestic market as well as robust exports to Europe, estimated at 190 bcm in 2017. Mothballed Russian gas capacity remains substantial, however, at 150-200 bcm/year.

> **European gas production is structurally depleting but expanded in 2017 (+1.4%),** thanks to Norway's contribution. Dutch production is increasingly constrained, with earthquakes in the Groningen field forcing the government to slash production from 88 bcm in 2010 to 50.4 bcm in 2016 and 42 bcm in 2017. Conversely, Norwegian production proved relatively resilient thanks to technological progress, rising 8.5% to 131 bcm in 2017. In the UK, with several small fields discovered in 2014-15 coming on stream, gas production increased from 39 bcm in 2014 to 41 bcm in 2016, and an expected 42 bcm in 2017, but it is unlikely to progress further.

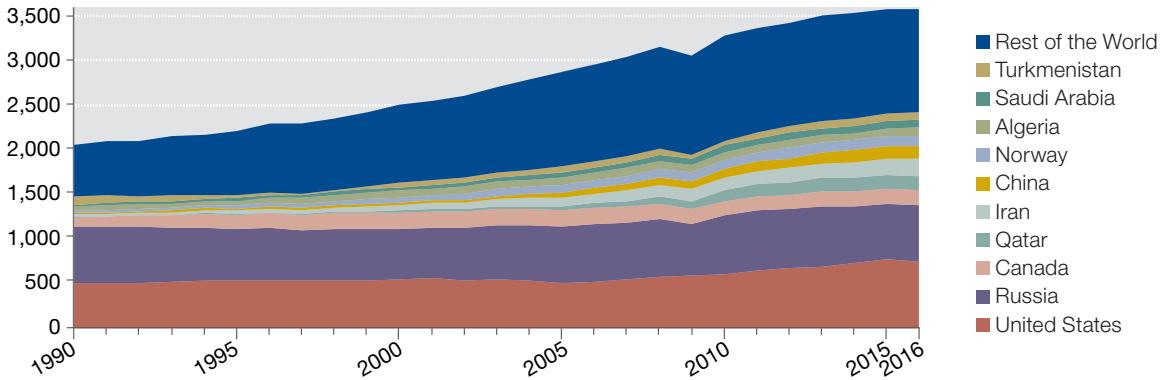
> **Iranian production is on the rise** (190 bcm in 2016), as new development phases of the world's largest gas field of South Pars (shared with Qatar) started operation. With very strong demand on its domestic market, Iran plans to post output of 500 bcm by 2021; part of that is destined for export.

> **In China, natural gas production increased rapidly over the last decade.** It reached 148 bcm in 2017 (+9%), which is more than EU production.

The exploitation of shale gas has become an integral part of the world gas market, yet it still has not really developed outside North America. The UK hopes to replicate the American experience, and the first round of drilling was planned for North Yorkshire in late 2017. **Chinese recoverable shale gas reserves were revised down in 2016** (from 130 bcm to 122 bcm) and the country's production is expected to have fallen short of 10 bcm in 2017. The government confirmed its intention to produce 30 bcm of shale gas in 2020.

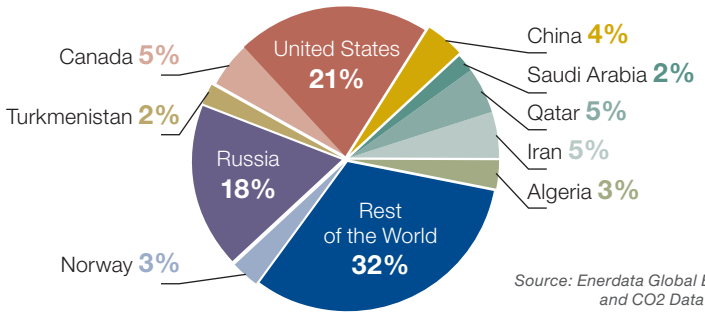
Natural gas: production

NATURAL GAS PRODUCTION BY REGION IN BCM



Source: Enerdata Global Energy and CO2 Data (2017)

NATURAL GAS PRODUCTION IN THE WORLD IN 2016 (TOTAL: 3,577 BCM)

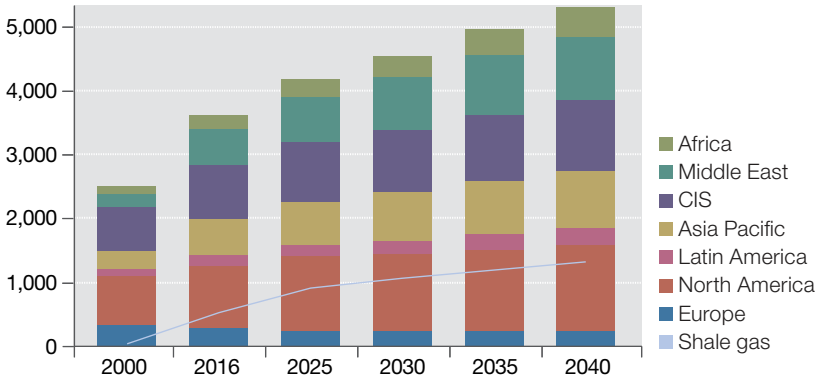


Source: Enerdata Global Energy and CO2 Data (2017)

FORECASTS OF NATURAL GAS PRODUCTION IN NEW POLICIES AND SDS SCENARIOS FROM IEA

IEA production forecast in Bcm	2016	New Policy Scenario				Sustainable Development Scenario			
		2025	2040	AAGR 2016-2025	AAGR 2016-2040	2025	2040	AAGR 2016-2025	AAGR 2016-2040
Europe	285	244	236	-2%	-1%	241	228	-2%	-1%
North America	960	1,166	1,338	2%	1%	1159	972	2%	0.1%
Latin America	175	178	279	0.1%	2%	175	186	-0.02%	0.2%
Asia Pacific	568	675	894	2%	2%	679	875	2%	2%
CIS	842	935	1,095	1%	1%	920	892	1%	0.2%
Middle-East	585	703	1,003	2%	2%	689	730	2%	1%
Africa	205	273	460	3%	3%	264	334	3%	2%
OECD	**1,310**	**1,539**	**1,738**	**2%**	**1%**	**1,535**	**1,348**	**2%**	**0.1%**
Non OECD	**2,310**	**2,634**	**3,566**	**1%**	**2%**	**2,592**	**2,868**	**1%**	**1%**
World	**3,621**	**4,174**	**5,304**	**1%**	**2%**	**4,127**	**4,216**	**1%**	**1%**
Shale gas	**462**	**820**	**1,188**	**6%**	**4%**	**735**	**901**	**5%**	**3%**

WORLD NATURAL GAS PRODUCTION FORECASTS UNDER THE IEA'S NEW POLICIES SCENARIO



Source: World Energy Outlook 2017 © OECD/IEA 2017

Natural gas: production

	Natural gas production													Change 2015-2016	AAGR 2000-2016	AAGR 2010-2016
Bcm	2000	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016			
Europe	319	329	322	311	326	311	318	291	294	287	266	258	251	-3%	-1%	-3%
European Union	264	241	231	218	220	201	206	184	174	173	153	136	130	-5%	-4%	-6%
Norway	53	87	89	92	105	109	112	105	119	113	113	121	120	-0.4%	5%	1%
North America	726	699	713	729	748	748	764	808	837	842	898	931	915	-2%	1%	3%
Canada	182	187	188	183	177	164	160	160	156	156	164	165	165	0.3%	-1%	0.5%
United States	544	511	524	546	571	584	604	649	681	686	733	767	749	-2%	2%	3%
Latin America	138	178	192	198	200	199	211	214	218	219	222	224	218	-3%	3%	0.4%
Argentina	41	48	48	46	47	44	42	42	41	39	39	41	43	5%	0.2%	0.1%
Mexico	37	43	48	50	50	51	51	49	47	46	45	44	40	-10%	0.5%	-4%
Asia	251	334	345	360	379	396	426	425	425	440	451	455	456	0.2%	4%	1%
China	27	49	59	69	80	85	96	105	111	121	130	135	136	1%	10%	5%
Indonesia	70	75	74	72	74	77	86	81	77	76	75	76	75	-1%	0%	-2%
Malaysia	50	66	65	64	68	62	60	62	61	69	70	66	67	2%	2%	1%
Pacific	39	40	47	50	52	54	58	61	59	67	73	81	87	7%	5%	6%
Australia	33	36	43	45	47	49	53	56	54	62	63	66	71	7%	5%	4%
Middle East	709	797	814	824	851	747	828	867	859	896	845	842	840	-0.3%	1%	0.2%
Saudi Arabia	573	628	640	635	651	583	657	673	658	685	630	624	628	1%	1%	-1%
United Arab Emirates	196	302	328	355	385	404	467	497	521	551	566	582	599	3%	7%	4%
Iran	38	56	59	61	67	64	73	75	81	82	85	87	90	4%	5%	3%
Qatar	37	48	49	49	49	47	51	52	54	55	54	59	59	1%	3%	2%
CIS	59	99	109	123	128	137	144	150	156	157	175	183	190	4%	7%	4%
Russia	24	45	52	62	78	89	121	134	144	163	160	164	167	2%	12%	5%
Africa	124	187	197	211	217	202	210	203	212	206	213	207	212	2%	3%	0%
Algeria	82	89	87	87	87	83	85	82	85	81	83	84	97	16%	1%	2%
World	**2,503**	**2,868**	**2,959**	**3,037**	**3,158**	**3,060**	**3,281**	**3,367**	**3,423**	**3,508**	**3,533**	**3,581**	**3,577**	**-0.1%**	**2.1%**	**1.2%**

Source: Enerdata Global Energy and CO2 Data (2017)

Natural gas: consumption

After inching higher in 2015 and 2016 (by +1.2% and +1.0%, respectively), natural gas consumption is expected to have accelerated in 2017, driven by Europe and Asia. A stronger world economy in 2017 and environmental policies have favoured natural gas, but particularly high temperatures over the last three years have weakened demand.

In Europe, after a strong rise in 2016 (+6%), natural gas consumption progressed even faster in 2017 (+10%, or +49 bcm), despite unusually mild weather. This call for natural gas is related to electricity production and stems from its complementarity with renewable energies in a context of low prices and the move away from coal.

In the USA, in contrast, natural gas demand increased just +0.9% in 2016 and is expected to have contracted +3% in 2017 against a backdrop of slightly higher Henry Hub prices, greater use of coal and, to a lesser extent, an increase in electricity production from renewable sources.

Asia-Pacific renewed with its rapid expansion of natural gas consumption in 2016 and 2017 (+5% in 2016 and +14% over the first 9 months of 2017). In China, which is the world's third largest consumer of natural gas in 2016 behind the USA and Russia, gas demand increased 14% over the first 9 months of 2017, driven by the authorities' new environmental focus and efforts, albeit painstaking, to curb the country's overwhelming use of coal. In India, after a 10% rise in 2016 to 57 bcm, natural gas consumption continued to flourish with a 5% rise in 2017. Electricity production and pro-gas policies should maintain high pressure in the coming years and accelerate the development of the gas infrastructure. In Japan, the world's largest importer of LNG, natural gas demand declined 2.2% in 2016, and is expected to have flatlined at 125 bcm in 2017.

IEA 2017 forecasts (published in the 2017 World Energy Outlook) confirm the prominence of natural gas: it is the only fossil energy whose share in the energy mix is set to increase to 2040, reaching 25% in both the New Policies and the Sustainable Development scenarios. In the latter, natural gas would actually take the leading share of the overall mix. These scenarios assume an average rise in natural gas demand at 1.6% and 0.6% per year, respectively (against 2.3% per year over 1990-2016).

Given increasingly proactive moves on energy transition, natural gas offers the most attractions among fossil fuels, notably its complementarity with RES and its low carbon content.

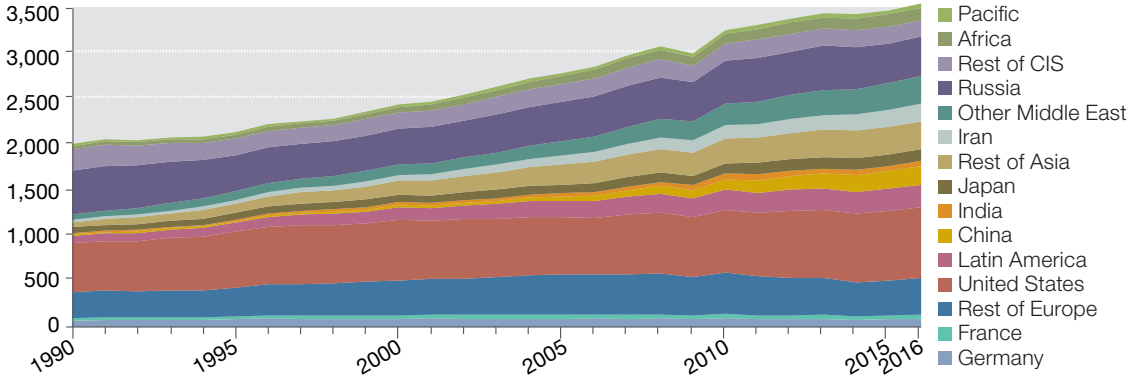
Non-OECD Asia, the Middle East and Latin America will be the three main areas of growth in natural gas demand. Consumption will be greater than in Europe, where stagnation is expected.

The industrial sector will be the indisputable engine growth until 2025, while in the electricity sector, natural gas will feel the combined pressure from cheap coal and enhanced support to RES. Electricity production should again be a growth engine after 2025.

LNG allows the emergence of truly global market. It will represent 75% of incremental trade flows over the period. Its flexibility will permit market integration and more competitive pricing.

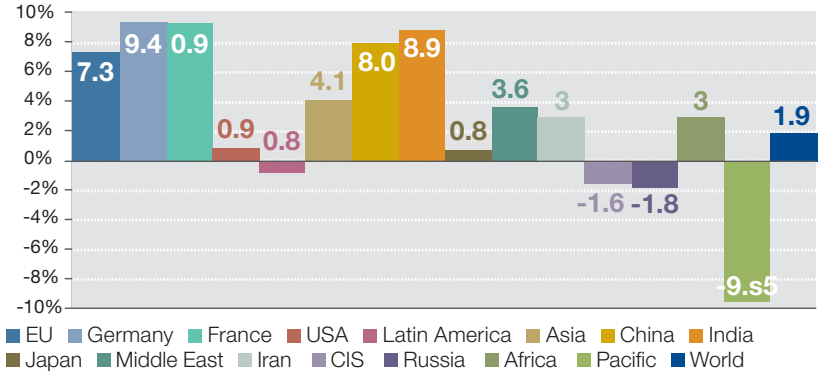
Natural gas: consumption

PRIMARY NATURAL GAS CONSUMPTION IN THE WORLD IN BCM



Source: Enerdata Global Energy and CO2 Data (2017)

CHANGE IN PRIMARY CONSUMPTION OF NATURAL GAS IN 2016 (%)

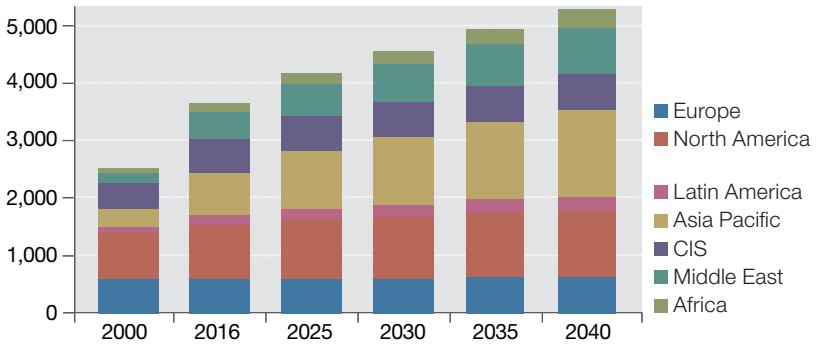


Source: Enerdata, Global Energy & CO2 Data (Juillet 2016)

FORECASTS OF NATURAL GAS CONSUMPTION IN NEW POLICIES AND SDS SCENARIOS FROM IEA

IEA consumption forecast in Bcm	2016	New Policies Scenario				Sustainable Development Scenario			
		2025	2040	AAGR 2016-2025	AAGR 2016-2040	2025	2040	AAGR 2016-2025	AAGR 2016-2040
Europe	590	604	631	0%	0%	593	471	0%	-1%
North America	961	1,045	1,143	1%	1%	1,061	822	1%	-1%
Latin America	166	183	271	0.0%	2%	166	182	0.04%	0%
Asia Pacific	732	998	1,472	3%	3%	1,019	1,441	3%	3%
CIS	575	583	636	0%	0%	560	508	0%	0%
Middle East	477	568	795	1%	2%	537	547	1%	1%
Africa	134	177	306	2%	3%	157	188	2%	1%
OECD	**1,694**	**1,774**	**1,924**	**0%**	**1%**	**1,769**	**1,374**	**0%**	**-1%**
non OECD	**1,941**	**2,383**	**3,329**	**2%**	**2%**	**2,324**	**2,786**	**2%**	**1%**
World	**3,635**	**4,174**	**5,304**	**1%**	**2%**	**4,127**	**4,217**	**1%**	**1%**
Bunkers	**0**	**16**	**51**	**-**	**-**	**33**	**57**	**-**	**-**

WORLD NATURAL GAS CONSUMPTION FORECASTS UNDER THE IEA'S NEW POLICIES SCENARIO



World Energy Outlook 2017 © OECD/IEA (2017)

Natural gas: primary consumption

	Primary gas consumption													Change 2015-2016	AAGR 2000-2016	AAGR 2010-2016
Bcm	**2000**	**2005**	**2006**	**2007**	**2008**	**2009**	**2010**	**2011**	**2012**	**2013**	**2014**	**2015**	**2016**			
Europe	507	574	571	571	585	547	595	550	536	529	481	500	531	6%	0.3%	-2%
European Union	483	535	528	523	537	501	545	494	479	471	420	440	472	7%	-0.1%	-2%
Germany	88	91	93	89	92	86	94	86	86	88	79	83	91	9%	0.2%	-1%
North America	753	722	712	753	759	743	779	797	832	851	867	881	885	0%	1%	2%
Canada	92	99	98	99	100	97	97	106	105	112	117	114	111	-3%	1%	2%
United States	661	623	614	654	659	647	682	691	726	739	750	767	774	1%	1%	2%
Latin America	135	177	186	192	207	201	221	221	231	233	240	241	239	-1%	3%	1%
Argentina	37	41	43	46	47	46	46	48	50	50	52	53	56	6%	2%	3%
Mexico	40	53	58	63	68	66	70	71	74	70	72	70	70	0.4%	3%	0.2%
Asia	287	392	424	455	478	498	552	595	620	648	666	668	696	4%	5%	3%
China	25	47	57	70	81	89	106	131	147	167	184	192	207	8%	13%	10%
India	28	38	40	42	43	58	64	64	57	52	50	50	55	9%	4%	-2%
Indonesia	31	33	36	30	33	39	44	41	41	45	46	47	47	-1%	2%	1%
Japan	84	89	98	107	105	104	110	128	133	128	130	124	125	1%	2%	2%
Pacific	29	31	33	37	37	38	40	40	41	43	44	44	40	-10%	2%	0%
Middle East	174	256	279	303	334	345	376	396	411	426	452	478	495	4%	6%	4%
Saudi Arabia	38	56	59	61	67	64	73	75	81	82	85	87	90	4%	5%	3%
United Arab Emirates	30	42	43	48	58	58	61	63	66	67	66	72	74	2%	5%	3%
Iran	62	99	109	123	130	136	144	153	152	153	172	183	188	3%	7%	4%
CIS	567	622	631	644	649	599	655	674	666	669	635	612	602	-2%	0.4%	-1%
Russia	391	425	436	445	446	426	466	476	471	483	454	431	423	-2%	0.5%	-1%
Africa	57	89	95	102	103	101	106	115	121	124	129	133	137	3%	5%	4%
Algeria	20	24	25	26	26	28	27	29	33	34	38	40	42	4%	5%	6%
World	**2,510**	**2,864**	**2,931**	**3,058**	**3,153**	**3,073**	**3,324**	**3,387**	**3,458**	**3,523**	**3,515**	**3,557**	**3,625**	**1.9%**	**2.2%**	**1.2%**

Source: Enerdata Global Energy and CO2 Data (2017)

Natural gas: final consumption

	Final consumption of natural gas													Change 2015-2016	AAGR 2000-2016	AAGR 2010-2016
Bcm	**2000**	**2005**	**2006**	**2007**	**2008**	**2009**	**2010**	**2011**	**2012**	**2013**	**2014**	**2015**	**2016**			
Europe	345	364	356	345	351	325	360	331	342	350	313	328	336	2%	-0.2%	-1%
European Union	334	347	335	322	328	307	338	304	315	322	284	296	304	3%	-1%	-2%
Germany	70	66	68	65	66	62	68	61	63	67	60	62	66	5%	-0.4%	-1%
North America	480	410	394	416	423	404	421	427	409	443	462	437	431	-1%	-1%	0%
Canada	60	52	49	52	51	49	48	52	50	53	56	55	54	-3%	-1%	2%
United States	420	359	344	364	372	355	373	374	359	389	406	382	377	-1%	-1%	0%
Latin America	61	79	81	81	89	83	93	92	92	93	90	92	93	1%	3%	0%
Argentina	18	21	22	23	23	22	23	24	24	25	25	25	26	4%	2%	2%
Mexico	14	13	14	14	16	14	16	16	17	17	17	16	16	-4%	1%	0.1%
Asia	107	158	178	189	207	216	234	264	280	297	304	302	318	5%	7%	4%
China	15	33	41	50	58	60	69	88	99	112	126	126	136	8%	14%	10%
India	12	16	17	17	24	29	32	33	33	35	34	33	36	9%	7%	2%
Indonesia	13	16	18	13	14	18	18	19	20	20	20	19	19	-5%	2%	0%
Japan	26	32	35	37	35	33	36	37	37	36	35	35	35	1%	2%	0%
Pacific	17	15	16	16	17	16	17	17	17	18	20	19	19	-2%	1%	1%
Australia	13	14	14	15	15	14	15	15	15	16	16	16	15	-4%	1%	0.4%
Middle East	78	106	120	138	148	159	176	197	201	203	208	220	222	1%	6%	3%
Saudi Arabia	14	20	22	24	29	28	33	35	37	33	34	35	36	4%	6%	1%
United Arab Emirates	15	16	15	20	24	28	30	32	32	33	29	33	29	-10%	4%	0%
Iran	34	55	63	75	75	82	89	104	100	105	111	117	121	3%	8%	4%
CIS	189	201	207	212	217	199	216	218	211	214	207	206	-	-	-	-
Russia	110	115	118	117	120	123	134	130	123	135	132	130	128	-2%	1%	-1%
Africa	16	28	31	35	34	32	33	37	37	39	40	43	45	4%	6%	5%
Algeria	5	8	8	9	9	10	10	11	12	13	15	17	17	4%	7%	8%
World	**1,291**	**1,361**	**1,382**	**1,432**	**1,486**	**1,433**	**1,549**	**1,583**	**1,588**	**1,657**	**1,643**	**1,646**	**1,664**	**1.1%**	**1.5%**	**1.0%**

Source: Enerdata Global Energy and CO2 Data (2017)

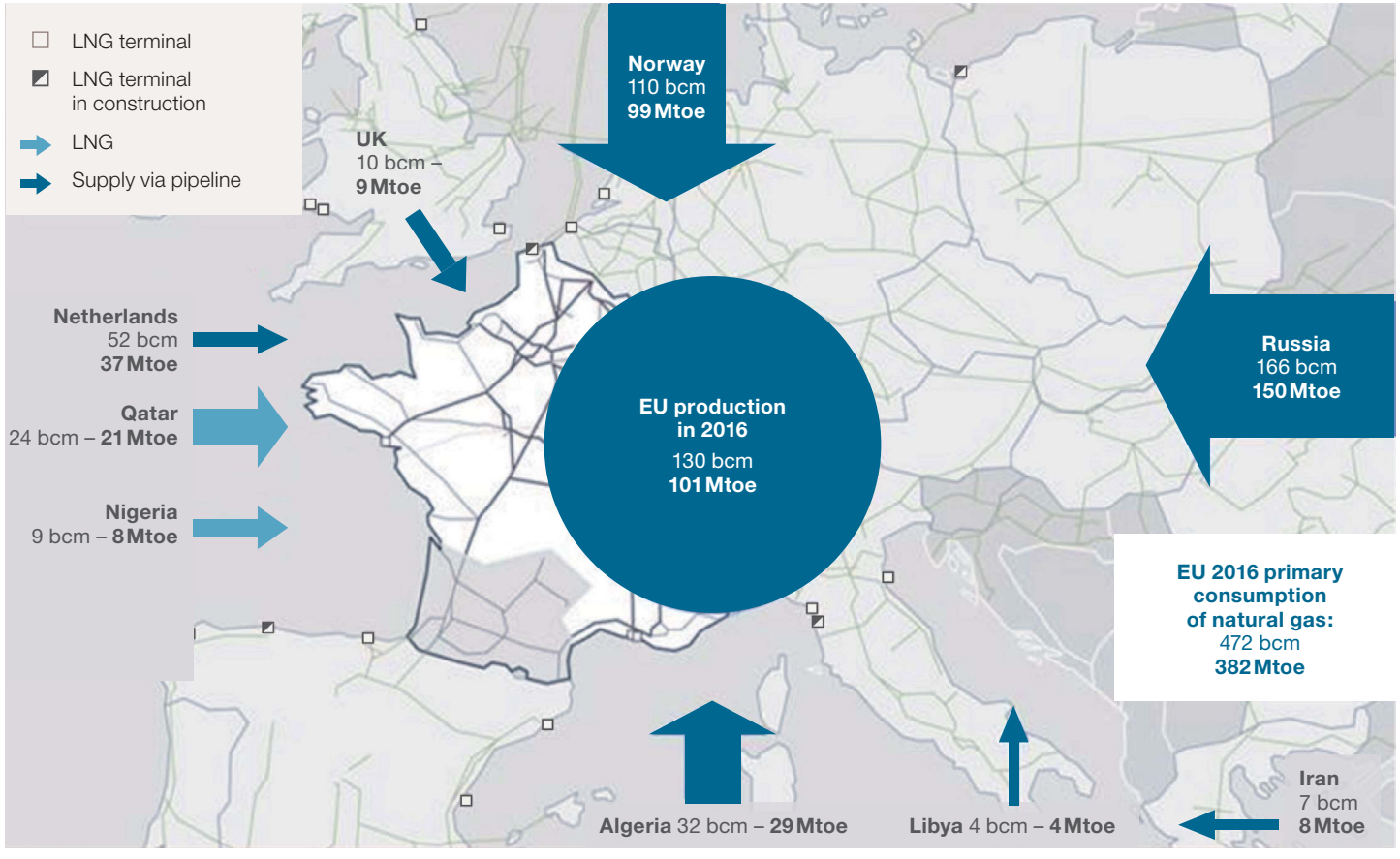
Natural gas: consumption by sector

Total Consumption 2016	Power stations		Residential		Services		Agriculture		Industry		Transports		Non-energy uses		Total final consumption		Primary consumption (for reference)	
	bcm	Change 2015/2016	bcm	Change 2015/2016	bcm	Change 2015/2016	bcm	Change 2015/2016	bcm	Change 2015/2016	bcm	Change 2015/2016	bcm	Change 2015/2016	bcm	Change 2015/2016	bcm	Change 2015/2016
Europe	152	17%	136	3%	62	3%	4.8	3%	109	0%	2	1%	20	3%	335	2%	531	6%
European Union	131	21%	124	4%	58	4%	4.6	2%	96	1%	2	1%	19	2%	304	3%	471	7%
Germany	18	30%	25	8%	14	8%	0.0	-	23	1%	0	0%	3	5%	66	5%	91	9%
North America	313	2%	143	-4%	98	-4%	2.6	-4%	164	1%	1	1%	22	1%	431	-1%	885	0%
United States	301	3%	126	-4%	85	-4%	1.7	-4%	144	2%	1	1%	19	2%	377	-1%	774	1%
Latin America	104	-2%	15	3%	3	3%	0.0	3%	52	0%	7	2%	15	2%	93	1%	239	-1%
Argentina	22	8%	11	4%	1	4%	-	-	9	4%	3	4%	2	4%	26	4%	56	6%
Asia	296	3%	73	5%	32	4%	0.3	7%	119	4%	33	6%	57	6%	315	5%	693	4%
China	35	13%	39	8%	13	8%	0.1	8%	50	8%	21	8%	13	8%	136	8%	207	8%
India	17	10%	1	9%	1	9%	0.2	9%	6	9%	2	9%	26	9%	36	9%	55	9%
Japan	88	1%	10	0%	11	0%	0.0	0%	14	4%	0	1%	0	1%	35	1%	125	1%
Pacific	14	-12%	4	-1%	2	-2%	0.1	-6%	10	-4%	0	0%	2	5%	19	-2%	40	-10%
Middle East	210	7%	50	3%	7	3%	1.5	3%	129	0%	8	3%	27	3%	222	1%	496	4%
Iran	54	2%	49	3%	7	3%	1.5	3%	42	3%	8	3%	13	3%	121	3%	188	3%
CIS	260	2%	80	-6%	19	-6%	1.7	-6%	57	-5%	1	-4%	44	-6%	203	-5%	616	-2%
Russia	200	1%	48	-6%	2	-6%	1.3	-6%	41	-6%	0	-6%	38	-6%	131	-6%	437	-2%
Africa	70	2%	10	4%	0	4%	0.1	4%	18	1%	0	6%	11	3%	41	3%	133	2%
Algeria	17	3%	8	4%	0	-	0.1	4%	4	4%	0	-	4	4%	17	4%	42	4%
World	**1,419**	**4%**	**512**	**0.05%**	**223**	**0.5%**	**11.1**	**0.2%**	**660**	**0.5%**	**53**	**4%**	**198**	**1.5%**	**1,659**	**0.4%**	**3,632**	**1.9%**

Source: Enerdata, Global Energy and CO2 Data, 2017

Natural gas: focus on Europe

NATURAL GAS SUPPLY OF EUROPE IN 2016

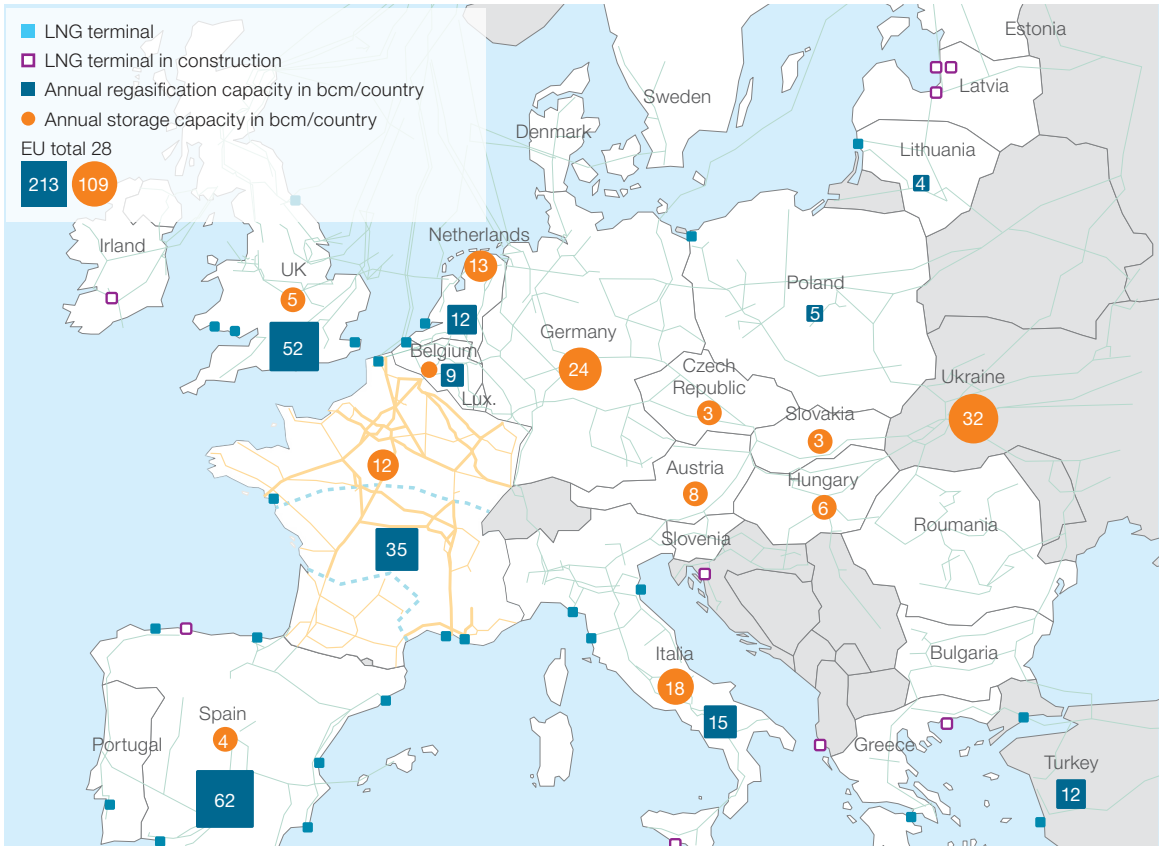


NB: BP conversion: 1 bcm = 0.9 Mtoe.

Source: Enerdata, Global Energy and CO2 Data, 2017

Natural gas: focus on Europe

STORAGE AND REGASIFICATION CAPACITY IN EUROPE IN 2015



Source: GRT gaz: " Plan décennal de développement du réseau de transport de GRTgaz 2016-2024 " (2016)

Natural gas: focus on Europe

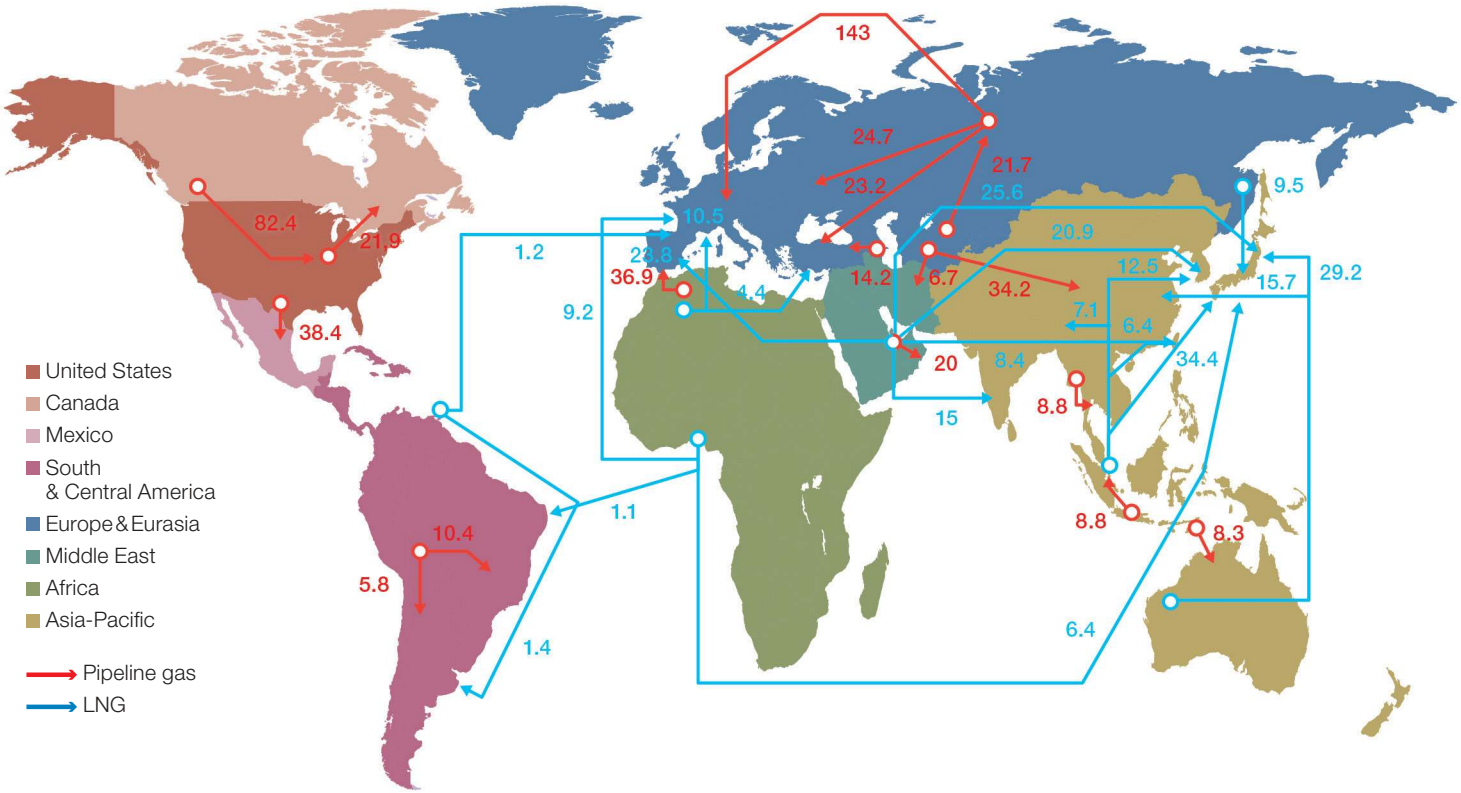
Natural gas consumption, bcm	Natural gas total domestic consumption*						Power station consumption		Final consumption**		R&C consumption***		Industrial consumption****	
	2000	2015	2016		AAGR 2000-2015	Change 2000-2015	2016		2016		2016		20165	
	Volume	Volume	Volume	Share in Eu total			Volume	Change 2014-2015	Volume	Change 2014-2015	Volume	Change 2014-2015	Volume	Change 2014-2015
Germany	88	83	91	19%	9%	0.2%	18	30%	66	5%	39	8%	23	1%
Austria	8	8	9	2%	4%	0.4%	2	4%	6	6%	2	3%	3	8%
Belgium	16	17	18	4%	2%	0.7%	4	0%	12	3%	7	6%	4	-3%
Denmark	5	3	3	1%	2%	-2.4%	1	3%	2	2%	1	2%	1	2%
Spain	18	28	29	6%	2%	3.0%	9	-3%	17	3%	6	3%	10	3%
Finland	4	3	2	0%	-8%	-3.3%	1	-9%	1	-8%	0	-9%	1	-8%
France	41	40	44	9%	9%	0.3%	8	75%	34	1%	22	1%	11	1%
Greece	2	3	4	1%	29%	4.2%	2	54%	2	9%	0	9%	1	9%
Hungary	12	9	10	2%	7%	-1.1%	2	17%	8	7%	5	7%	2	7%
Irlande	4	4	5	1%	12%	1.3%	3	23%	2	1%	1	1%	1	1%
Italia	71	68	71	15%	5%	0.0%	28	13%	41	0%	28	0%	10	0.3%
Netherlands	49	40	42	9%	5%	-0.9%	13	16%	27	1%	18	1%	7	1%
Poland	13	18	19	4%	5%	2.2%	2	23%	14	5%	7	5%	4	5%
Portugal	2	5	5	1%	10%	5.0%	3	18%	2	-2%	1	-2%	1	-2%
Czech Republic	9	8	8	2%	8%	-0.5%	1	21%	7	8%	4	8%	3	8%
Roumania	17	11	11	2%	-1%	-2.4%	2	-1%	8	-1%	4	-1%	3	-1%
United Kingdom	103	72	82	17%	13%	-1.4%	27	39%	46	3%	37	5%	8	-3%
Slovakia	7	5	5	1%	2%	-2.3%	1	2%	3	2%	2	2%	1	2%
Sweden	1	1	1	0%	11%	1.3%	0	36%	1	4%	0	-1%	0.4	5%
UE	**483**	**440**	**472**	**100%**	**7%**	**-0.1%**	**132**	**22%**	**304**	**3%**	**186**	**4%**	**98**	**1%**
Turkey	15	48	47		-3%	7.0%	19	-3%	26	-3%	14	-3%	12	-3%
Europe	**507**	**500**	**531**		**6%**	**0.3%**	**152**	**17%**	**336**	**2%**	**202**	**3%**	**112**	**0.4%**

*** Total domestic demand: final demand, power station consumption as well as own final consumption and urban heating consumption, which do not appear in the table.**
**** Final consumption: R&S, Industry and Transport, as well as Non-energy uses (which are not shown in the table).**
***** R&C: including farm consumption.**
****** Industry: excluding gas used as raw material (non-energy uses).**

Source: Enerdata, Global Energy and CO2 Data, 2017

Natural gas: world trade flows

MAIN NATURAL GAS TRADE FLOWS IN 2016 (BCM)



Source: BP Statistical Review, 2017

Natural gas: world trade flows

GLOBAL TRADE IN "GASEOUS" AND LNG GAS

Natural gas world trade is expected to have expanded in 2017, by 25% for LNG, boosted by demand from all regions except Latin America, and by 10% for pipeline gas in Europe. A recovery in international trade flows started in 2016 (+4.8%), driven by regional imbalances in Europe and shortages in Asia. With a 19% market share, Russia is the world's largest exporter of natural gas, followed by Qatar (11%). The EU remains the number one importer with a 43% share, way ahead of Asia at 29%. In 2016, 32% of natural gas market production was traded across national borders.

Pipeline gas still represents 68% of trade flows, even if its share decreased by a third since 2000, while LNG dominates long distance flows. LNG trade (32% of flows) accelerated in 2016 (+6.5%), supported by Asian demand and continuing increases in liquefaction capacity.

China was the engine of growth for LNG imports over 2016 and 2017. In coastal regions and nationally, and following measures fostering the switch from coal to natural gas, LNG enjoys a competitive advantage relative to pipeline gas. In India, subsidies boosted natural gas demand until they stopped in 2017 and LNG imports have slowed substantially ever since. In South Korea, the new government is stepping up efforts to favour natural gas over coal. In Taiwan, limited nuclear capacity in conjunction with a particularly hot summer bolstered LNG imports.

LNG : LIQUEFACTION AND REGASIFICATION CAPACITY IN THE WORLD

Once again, Australia recorded the largest increase in liquefaction capacity between 2015 and 2016 (+24 Mtpa). The country's LNG exports increased accordingly (+49%). In the USA, the opening of the Sabine Pass terminal in 2016 allowed the country to become an LNG exporter, supplying the Atlantic basin for 50%, Asia for 30% and the Middle East for the rest. The US LNG boom expected in 2017-2018 has been set back to 2018-2019 because of construction delays.

Regasification capacity continued to expand in 2016-2017, notably in Asia, where vigorous economic growth is boosting development. In India, capacity at the Dahej terminal increased by 4 Mtpa; in Thailand, the Map Ta Phut terminal doubled capacity (+5 Mtpa) early 2017; in South Korea, the Samcheok terminal expanded by 3 Mtpa and the Boryeong terminal started operations early 2017. In Europe, a Polish terminal opened at end-2015 allowed the import of 0.8 Mt in 2016. In France, the Dunkirk terminal, with a capacity of 10 Mtpa,started operating early 2017.

Floating Storage and Regasification Units (FSRUs) have opened new LNG markets, such as in Jamaica and Columbia. Worldwide, LNG imported via FSRUs increased 32% between 2015 and 2016. The introduction of new FSRUs in Pakistan in 2017 also boosted LNG import growth. Finally, Turkey increased its regasification capacity by 4 Mtpa with the FSRU Eztki to meet winter peak load demand.

Natural gas: natural gas trade flows (Pipeline gas and LNG)

Trade flows, bcm	Via pipeline						Via tanker						Total						Trade balance*		
	Exports			Imports			Exports			Imports			Exports			Imports					
	2015	2016	Change	2015	2016	Change	2015	2016	Change	2015	2016	Change	2015	2016	Change	2015	2016	Change	2015	2016	Change
Europe	215	208	-3%	404	416	3%	10	11	5%	56	56	-0.1%	225	218	-3%	459	471	3%	-235	-253	8%
Germany	0.2	19	-	102	99	-3%	0	0	-	0	0	-	0.2	19	-	102	99	-3%	-102	-80	-22%
Netherlands	47	52	11%	34	38	13%	1.3	0.7	-46%	2.1	1.5	-29%	48	53	10%	36	40	11%	13	14	6%
Norway	110	110	0%	0	0.0	-	6	6	7%	0	0	-	116	116	0.5%	0	0	-	116	116	0.5%
North America	124	143	15%	124	143	15%	0.8	4	487%	10	9	-10%	125	147	18%	134	152	13%	-8.9	-4.3	-51%
United States	49	60	23%	74	83	11%	0.7	4	529%	2.6	2.5	-4%	50	65	30%	77	85	10%	-27	-20	-25%
Canada	74	82	11%	19	22	14%	0	0	-	0.6	0.3	-50%	74	82	-	20	22	12%	55	60	10%
Latin America	19	17	-9%	19	17	-9%	21	20	-2%	18	16	-14%	39	37	-5%	36	32	-11%	3	5	76%
Argentina	0	0	-	6	6	6%	0	0	-	5	5	6%	0	0	-	11	11	6%	-11	-11	6%
Brazil	0	0	-	12	10	-16%	0	0.6	-	7	3	-55%	0	0.6	-	19	13	-29%	-19	-13	-33%
Trinidad and Tobago	0	0	-	0	0	-	17	14	-15%	0	0	-	17	14	-15%	0	0	-	17	14	-15%
Asia-Pacific	32	31	-3%	62	8	-87%	112	129	15%	231	242	4%	144	161	11%	293	250	-15%	-149	-89	-40%
Australia	0	0	-	6	8	30%	38	57	49%	0.1	0.1	0%	38	57	49%	7	8	29%	32	48	53%
China	0	0	-	34	38	13%	0.0	0	-	26	34	33%	34	0	-100%	59	72	22%	-26	-72	180%
Japan	0	0	-	0	0	-	0	0	-	111	109	-2%	0	0	-	111	109	-2%	-111	-109	-2%
Indonesia	9	9	-5%	0	0	-	21	21	2%	0	0	-	30	30	0%	0	0	-	30	30	0%
South Korea	0	0	-	0	0	-	0.2	0.1	-50%	44	44	0.2%	0.2	0.1	-50%	44	44	0.2%	-44	-44	0.5%
CIS	251	265	6%	63	61	-3%	14	14	-2%	0	0	-	265	279	5%	63	61	-3%	202	218	8%
Russia	179	191	7%	22	22	-0.5%	14	14	0%	0	0	-	193	205	6%	22	22	-0.5%	171	183	7%
Turkmenistan	40	37	-7%	0	0	-	0	0	-	0	0	-	40	37	-7%	0	0	-	40	37	-7%
Middle East	33	28	-15%	35	27	-22%	124	123	-0.9%	10	14	45%	157	151	-4%	44	41	-7%	113	110	-3%
Abu-Dhabi	4	4	0%	9	9	1%	7	8	1%	0	0	-	11	11	1%	9	9	1%	2	2	-0.6%
Iran	8	8	0.2%	10	7	-28%	0	0	-	0	0	-	8	8	0.2%	10	7	-28%	-1	2	-228%
Qatar	20	20	-0.1%	0	0	-	102	104	3%	0	0	-	122	124	2%	0	0	-	122	124	2%
Africa	40	46	14%	8	8	0.1%	47	46	-2%	4	10	183%	87	91	5%	12	19	55%	75	73	-3%
Algeria	29	37	30%	0	0	-	17	16	-4%	0	0	-	45	53.0	17%	0	0	-	45	53	17%
Nigeria	0.6	0.1	-83%	0	0	-	26	24	-8%	0	0	-	26	23.8	-10%	0	0	-	26	24	-10%
World	**709**	**738**	**4%**	**709**	**738**	**4.0%**	**326**	**347**	**6.5%**	**326**	**347**	**6.5%**	**1,035**	**1,084**	**4.8%**	**1,035**	**1,084**	**4.8%**	**0%**	**0%**	

*The trade balance is the difference between exports and imports. A positive balance means a net exporting country while a negative balance (trade deficit) means a net importing country.

Source: Cedigaz (2017)

Natural gas: liquefaction and regasification capacity worldwide

Regasification capacities (Mt/yr)	2015	2016-2017
Belgium	6.7	6.7
Spain	44.6	50.4
France	15.7	25.0
Greece	3.9	3.3
Italia	11.3	11.0
Netherlands	8.9	8.8
Portugal	5.9	5.8
United Kingdom	36.0	35.0
Turkey	9.2	15.6
Poland	0.0	3.6
Other countries	3.6	4.3
Total Europe	145.7	169.5
Canada	7.6	7.5
United States	128.8	128.8
Mexico	5.4	5.4
Argentina	7.6	7.6
Colombie	0	3.9
Brazil	11.0	11.7
Other countries	1.5	1.6
Total America	162.0	166.5
Egypt	9.5	15.6
Total Africa	9.5	15.6
Total Atlantic basin	317.2	351.6

Regasification capacities (Mt/yr)	2015	2016-2017
Chile	5.5	5.5
Mexico	11.3	11.3
Total America	16.8	16.8
China	40.6	51.5
South Korea	97.0	127.4
India	25.0	27.0
Indonesia	8	8.9
Japan	196.7	188.4
Pakistan	3.5	3.8
Taiwan	14.0	14.0
Thailand	5.0	10.0
Other countries	9.8	9.8
Total Asia	399.5	440.8
Total Asia-Pacific basin	416.4	457.6
United Arab Emirates	3.6	9.9
Koweit	5.9	5.9
Israel	3.8	3.8
Jordan	3.8	3.8
Total Middle East basin	30.1	23.4
World	**763.7**	**832.6**

Sources: Enerdata, Gloabal Energy and CO2 Data, 2017 (IHS 2017)

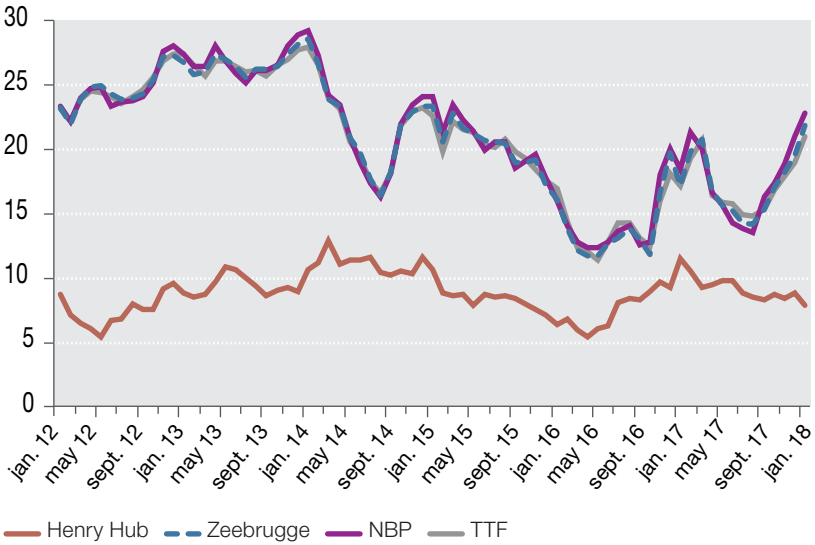
Liquefaction capacities (Mt/yr)	2015	2016-2017
Atlantic-Mediterean basin	88.1	106.8
Algeria	25.4	25.4
Angola	5.2	5.2
Egypt	12.2	12.2
Equatorial Guinea	3.7	3.7
Libya	0.6	0.6
Nigeria	21.9	21.9
Total Africa	69.0	69.0
Norway	4.3	4.5
Total Europe	4.3	4.5
Trinidad & Tobago	14.8	15.3
United States	-	18
Total America	14.8	33.3
Total Middle East basin	100	100.9
United Arab Emirates	5.8	5.8
Oman	10.4	10.8
Qatar	77.1	77.1
Yemen	6.7	7.2

Liquefaction capacities (Mt/yr)	2015	2016-2017
Pacific basin	124.3	152.7
Peru	4.4	4.5
United States	1.5	1.3
Total America	5.9	5.8
Australia	36.7	66.2
Brunei	7.2	7.2
Indonesia	31.8	26.5
Malaysia	26.2	29.3
Papua New-Guinea	6.9	6.9
Russia	9.6	10.8
Total Asia-Pacific	118.4	146.9
World	**312.4**	**360.3**
OPEC	136.0	136.0
Non Opec	176.4	224.4

Sources: Enerdata, Gloabal Energy and CO2 Data, 2017 (IHS 2017)

Natural gas: prices

NATURAL GAS MARKET PRICES IN €/MWH



Source: ENGIE Global Markets; Prix Month Ahead

Gas prices €05/toe PCI	Residential Constant prices incl. tax					Industry Constant prices incl. tax					Power station Constant prices incl. tax				
	2000	2014	2015	2016	AAGR 2000-2016	2000	2014	2015	2016	AAGR 2000-2016	2000	2014	2015	2016	AAGR 2000-2016
France	236	448	431	376	2.8%	236	448	431	376	2.8%	n.d.	n.d.	n.d.	n.d.	
Germany	244	376	344	295	1.2%	244	376	344	295	1.1%	200	307	281	241	1.1%
Spain	248	360	323	259	0.3%	248	360	323	259	0.3%	233	n.d.	n.d.	n.d.	
Italia	202	420	412	394	4.3%	202	420	412	394	4.0%	155	321	315	301	4.0%
United Kingdom	121	359	321	270	5.2%	121	359	321	270	4.9%	120	279	234	175	2.2%
Belgium	254	328	311	271	0.4%	254	328	311	271	0.4%	153	197	187	163	0.4%
United States	173	157	108	99	-3.4%	173	157	108	99	-3.2%	175	146	94	85	-4.2%
Japan	387	704	527	n.d.		387	704	527	n.d.		218	727	534	n.d.	
Russia	30	68	62	n.d.		30	68	62	n.d.		n.d.	62	56	n.d.	

Source: Enerdata, Global Energy and CO2 Data, 2017

Gas prices €05/MWh PCI	Residential Constant prices incl. tax					Industry Constant prices incl. tax					Power station Constant prices incl. tax				
	2000	2014	2015	2016	AAGR 2000-2016	2000	2014	2015	2016	AAGR 2000-2016	2000	2014	2015	2016	AAGR 2000-2016
France	36	67	66	60	3.1%	18	35	33	29	2.8%	n.d.	n.d.	n.d.	n.d.	-
Germany	38	62	61	59	2.7%	19	29	27	23	1.1%	15	24	22	19	1.1%
Spain	54	74	74	67	1.3%	19	28	25	20	0.3%	18	n.d.	n.d.	n.d.	
Italia	61	73	70	63	0.3%	16	32	32	30	4.0%	12	25	24	23	4.0%
United Kingdom	26	59	55	52	4.1%	9	28	25	21	4.9%	9	22	18	14	2.2%
Belgium	42	55	50	44	0.3%	20	25	24	21	0.4%	12	15	14	13	0.4%
United States	25	24	23	26	0.1%	13	12	8	8	-3.2%	14	11	7	7	-4.2%
Japan	86	108	97	n.d.		30	54	41	n.d.		17	56	41	n.d.	
Russia	1	4	4	n.d.		2	5	5	n.d.		n.d.	5	4	n.d.	

Source: Enerdata, Global Energy and CO2 Data, 2017

Natural gas: prices

Natural gas index prices picked up slightly in 2017 on the three main regional markets

Natural gas prices on the three main regional markets – USA, Europe and Asia – in 2016 and 2017

> **In the USA,** the long downtrend in spot prices that started in January 2014 (Henry Hub was then at $4/MMBtu, or €11/MWh) drove the market to the extremely low level of $2/MMBtu (€6/MWh) in early 2016. Weaker shale gas output in 2016 and 2017 has pushed prices up since mid-2016. Henry Hub averaged $2.4/MMBtu (€7.5/MWh) in 2016 and $3.1/MMBtu (€9.3/MWh) in 2017.

> **In Europe,** the downtrend lasted until the first quarter of 2016 in a context of abundant supply and a mild winter. As natural gas demand recovered in 2016 and even more in 2017, natural gas index prices rebounded markedly. The TTF averaged €17/MWh in 2017, against €14/MWh in 2016.

> **In Asia,** the Japanese index Japan-Korea Marker, JKM, followed a similar pattern, picking up from mid-2016 to average $6.5/MMBtu over the year, and settling on a nearly $8/MMBtu average in 2017, coinciding with higher oil prices.

LNG price convergence between the different regions continues. This reflects a more fluid market against a backdrop of low oil prices. More abundant supply in 2017-2018 will strengthen this trend: the new Yamal LNG terminal opened at end-2017 and others are to follow in 2018 in Asia and probably in the USA. Moreover, **the price differential between long term contracts and spot prices has become much less of an issue.** Oil-indexed prices have become so competitive that in 2017 new long-term contracts were signed for a total volume of 11 Mt.

Oil

PRODUCTION

The slowdown in oil production started in 2016 continued in 2017

CONSUMPTION

The transport and petrochemical sectors are clearly the main drivers of stronger demand for oil. In geographical terms, Asia accounts for 60%

PRICES

Although 2017 is ending with higher oil prices, the markets are wary of any signs of overproduction

Oil: production

In a move that had become unavoidable after three years of extremely low prices, oil production adjusted to demand in 2016

WORLD

The world oil production experienced in 2016 and 2017 a very strong slowdown with +0.3% in 2017 (+0.6% in 2016), a marked reduction compared to the 2015 abundance (+3%).

In 2016, the increase in production was mainly driven by OPEC members, particularly Iran (+19.6%), Iraq (+7%), Saudi Arabia, until the agreement on quotas at the end of the year, then that the United States, Latin America, China recorded a sharp decline in production.

In 2017, the OPEC-non OPEC reduction agreement is bearing fruit; the growth is mainly driven by the recovery in north american production.

USA

Production in the United States remains stable in 2017 (+ 0.2% estimate) after a decrease by -4% in 2016. In 2016, the number of wells drilled was reduced by price low, ending exceptionally fast growth since 2010 (an annual average 10% between 2009 and 2015). But the situation did not fundamentally alter the resilience of US production, especially as operating costs were drastically cut in unconventional oils. Productivity gains have optimised output from the most productive US fields, especially with respect to the service industry's costs.

OPEC

Until end-2016, OPEC maintained its market share policy with continuing sharp increases in production (up 6% in 2016). It was not until November 2016 that OPEC members and their non-OPEC allies (Russia in particular) moved to rebalance of the oil market and speed up the depletion of stocks. OPEC had not reduced its output since 2008, contributing to sustained low prices. But budgetary pressures in several oil producers since 2014 worsened to critical levels, leading the cartel back towards market management.

PRICES

Despite less vigorous production, and with demand still relatively strong, high inventories meant that prices stayed low throughout 2016 and up until October 2017. Excess supply over three years has severely undermined prices (an average $52/bbl in 2015 and $44/bbl in 2016). In the first part of 2017, the market swung between OPEC's desire to cut output, the recovery in American drilling and persistently high inventories. The price trend switched in the summer to pick up significantly to the last quarter, surpassing $ 60/bbl in November (2017 average: $54). The extension of the OPEC deal confirmed the move.

See price movement details on our Prices page 100.

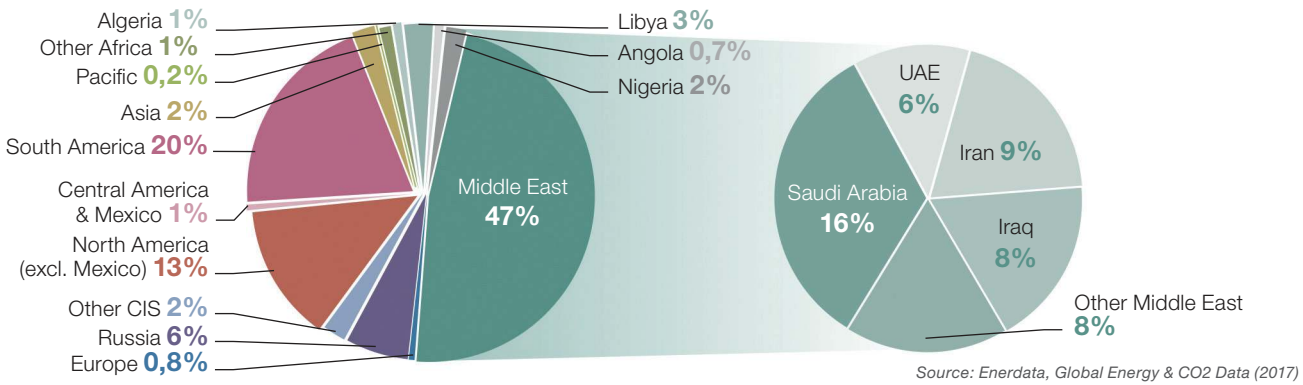
WORLD OIL RESERVES

Reserves are sufficient to meet the highest production scenarios even without unconventional oil resources, for which estimates are unreliable.

Oil: production

A persistent threat of oversupply kept the oil markets watchful throughout 2017

BREAKDOWN OF WORLD OIL RESERVES – TOTAL: 1,698 BILLION OF BARRILS



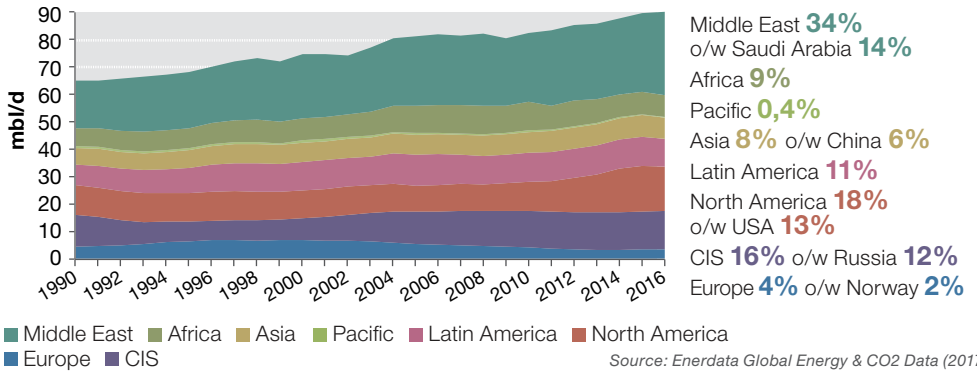
Source: Enerdata, Global Energy & CO2 Data (2017)

Total proven reserves

- OPEP 71.5%
- Ex-USSR 8.7%
- Rest of the world 19.5%

Source: BP Statistical Review (2016)

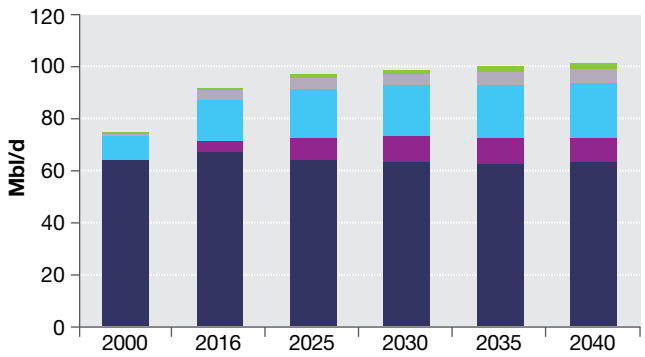
OIL PRODUCTION IN 1990-2016 AND BREAKDOWN BY REGION IN 2016



Middle East **34%**
o/w Saudi Arabia **14%**
Africa **9%**
Pacific **0,4%**
Asia **8%** o/w China **6%**
Latin America **11%**
North America **18%**
o/w USA **13%**
CIS **16%** o/w Russia **12%**
Europe **4%** o/w Norway **2%**

Source: Enerdata Global Energy & CO2 Data (2017)

OIL PRODUCTION IN NEW POLICIES SCENARIO FROM IEA



Source: World Energy Outlook 2017
© OECD/IEA (2017)

Oil: production

Crude oil, NGL production in mbl/d	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	Change 2015-2016	AAGR 2000-21016	AAGR 2010-2016
European Union	3.5	3.3	3.4	3.2	3.0	2.7	2.5	2.5	2.3	2.2	2.0	1.8	1.6	1.5	1.5	1.6	1.6	0.7%	-4.7%	-3.6%
Germany	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	16.5%	0.3%	2.9%
United Kingdom	2.6	2.4	2.4	2.2	2.0	1.8	1.6	1.6	1.5	1.4	1.3	1.1	0.9	0.8	0.8	0.9	1.0	5.1%	-5.6%	-4.0%
North America	10.3	10.3	10.4	10.3	10.1	9.7	9.7	9.8	9.8	10.2	10.6	11.1	12.5	14.0	16.0	16.8	16.3	-3.0%	2.7%	6.3%
Canada	2.7	2.7	2.8	3.0	3.1	3.0	3.1	3.2	3.3	3.3	3.4	3.6	3.9	4.1	4.4	4.5	4.6	2.8%	3.3%	4.5%
USA	7.6	7.5	7.5	7.3	7.0	6.7	6.6	6.6	6.5	6.9	7.2	7.5	8.7	9.9	11.5	12.2	11.6	-5.1%	2.5%	7.1%
Latin America	10.5	10.6	10.6	10.4	11.2	11.4	11.5	10.7	10.6	10.6	10.7	10.9	10.8	10.7	10.8	10.7	10.2	-4.7%	-0.1%	-0.6%
Brazil	1.3	1.3	1.5	1.6	1.5	1.7	1.8	1.8	1.9	2.0	2.1	2.2	2.2	2.2	2.4	2.6	2.7	2.6%	4.5%	3.3%
Mexico	3.5	3.6	3.7	3.9	4.0	3.9	3.8	3.6	3.3	3.0	3.0	3.0	3.0	2.9	2.8	2.6	2.5	-5.0%	-2.0%	-2.6%
Venezuela	3.4	3.4	3.2	2.7	3.4	3.5	3.6	3.1	3.1	3.2	3.1	3.1	3.0	3.0	2.9	2.8	2.6	-8.6%	-1.6%	-2.6%
Asia	7.0	7.0	7.1	7.1	7.2	7.3	7.3	7.3	7.4	7.4	7.7	7.6	7.8	7.7	7.8	7.9	7.6	-3.1%	0.5%	-0.2%
China	3.3	3.3	3.4	3.4	3.5	3.6	3.7	3.7	3.8	3.8	4.1	4.1	4.2	4.2	4.3	4.4	4.1	-6.7%	1.3%	-0.1%
India	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.9	0.9	0.9	0.9	0.9	0.9	0.8	-2.1%	0.5%	-0.8%
Indonesia	1.5	1.4	1.3	1.2	1.1	1.1	1.0	1.0	1.0	1.0	1.0	0.9	0.9	0.9	0.8	0.8	0.9	6.9%	-2.8%	-1.5%
Pacific	0.8	0.8	0.7	0.7	0.6	0.6	0.5	0.6	0.6	0.6	0.6	0.5	0.5	0.5	0.4	0.4	0.4	-9.9%	-4.7%	-6.1%
CIS	8.0	8.6	9.5	10.4	11.4	11.7	12.2	12.7	12.8	13.0	13.4	13.5	13.6	13.7	13.8	13.9	14.1	1.5%	3.4%	0.7%
Russia	6.6	7.1	7.7	8.6	9.3	9.6	9.8	10.0	10.0	10.0	10.3	10.5	10.6	10.7	10.8	11.0	11.2	2.6%	3.2%	1.2%
Kazakhstan	0.7	0.8	1.0	1.0	1.2	1.3	1.3	1.4	1.4	1.6	1.6	1.6	1.6	1.7	1.7	1.6	1.6	-1.8%	4.9%	-0.3%
Middle East	23.5	23.1	21.7	23.5	24.9	25.7	25.9	25.5	26.5	24.8	25.5	27.7	27.8	27.6	27.8	28.8	30.7	6.8%	1.6%	2.7%
Saudi Arabia	9.1	8.9	8.2	9.6	10.3	10.8	10.7	10.3	10.7	9.7	9.9	11.1	11.7	11.4	11.5	12.1	12.8	5.7%	2.0%	3.7%
United Arab Emirates	2.6	2.6	2.4	2.7	2.8	2.9	3.1	3.1	3.1	2.8	2.8	3.1	3.2	3.4	3.3	3.5	3.6	3.7%	1.9%	3.5%
Iraq	2.6	2.6	2.3	1.6	2.1	1.9	2.0	2.1	2.3	2.4	2.4	2.7	3.0	3.0	3.1	3.6	3.9	10.1%	2.4%	7.3%
Iran	4.1	3.9	3.9	4.3	4.4	4.4	4.5	4.5	4.5	4.4	4.5	4.4	3.4	3.4	3.5	3.3	4.0	19.2%	-0.1%	-1.6%
Koweït	2.1	2.1	1.9	2.2	2.4	2.7	2.8	2.7	2.8	2.4	2.5	2.8	3.2	3.1	3.1	3.2	3.3	2.9%	2.7%	4.2%
Africa	8.2	8.2	8.2	8.8	9.6	10.0	10.2	10.5	10.5	10.1	10.4	8.8	9.5	8.8	8.3	8.3	8.0	-4.1%	-0.1%	-3.7%
Nigeria	2.4	2.5	2.2	2.5	2.7	2.7	2.6	2.4	2.3	2.3	2.7	2.6	2.6	2.4	2.4	2.4	2.2	-6.6%	-0.5%	-2.7%
World	**75.2**	**75.3**	**74.8**	**77.6**	**81.1**	**81.9**	**82.5**	**82.1**	**82.8**	**81.2**	**83.1**	**84.0**	**86.0**	**86.4**	**88.3**	**90.3**	**90.9**	**0.7%**	**1.1%**	**1.3%**

Source: Enerdata Global Energy & CO2 Data (2017)

Oil: consumption

Oil consumption continued to grow in 2016, bolstered by low prices and robust demand from non-OECD countries

WORLD

Oil consumption increased 1.7% (ENGIE estimation) **in 2017, boosted by low prices and economic growth.** It had grown 1,5% in 2016.

REGIONS

China and India remain the main sources of this growth (demand up 3.7% and 4.9% respectively in 2016). Together they accounted for nearly half of additional demand. In China, a burgeoning middle class and greater road and air transport needs have buoyed consumption of gasoline, kerosene and fuel oil. In India, the need for mobility and the robust health of sectors such as mining and construction played a fundamental role in boosting local consumption of gasoline, diesel and LPG.

The USA are the world's leading consumer and reported a 0.7% increase in oil demand in 2016. For the first time since 2010, the country had to increase oil imports to match domestic needs against a backdrop of shrinking domestic production.

Oil demand is increasingly from non-OECD countries, which taken together have been consuming more of it than their OECD counterparts since 2013. Medium to long term demand growth prospects depend largely on non-OECD countries (Asia, Middle East, Africa); OECD countries' consumption is expected to stagnate or even contract.

CONSUMPTION BY SECTOR

Oil demand is driven by petrochemicals and transport. The share of transport in oil primary consumption was just over 40% in the 1980s, about 52% in the early 2000s and is now 57%.

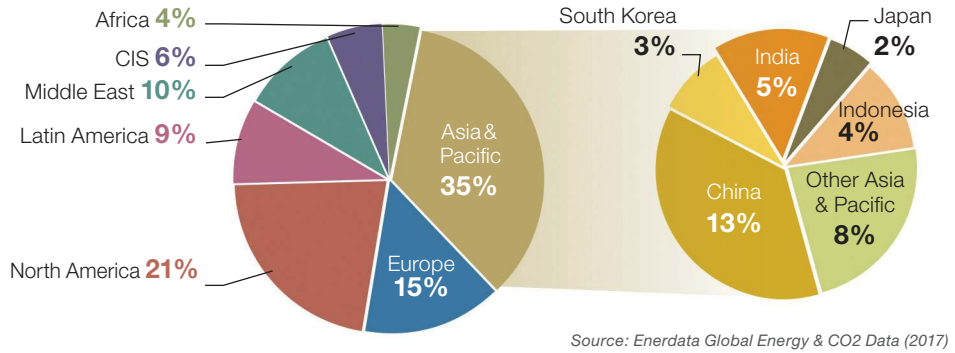
Although losing ground both as a source of fuel in electricity generation and as a source of heating in the residential and services sector, oil is benefiting from growing demand from the petrochemical sector (13% of total demand). The products most used are naphtha (50%) and LPGs (propane, butane and ethane, 40%). The USA and the Middle East are the world leaders in the petrochemicals industry.

CONSUMPTION BY SECTOR: FORECASTS

By 2040, and according to the EIA, passenger transport will reduce its oil consumption as a result of higher efficiency and the development of both electrical vehicles and biofuels, even though the world car fleet is expected to double over the period (see graph opposite). It is however generally accepted that oil demand in the transport sector will stagnate from about 2025. The exact date – especially in relation to the automotive sector – is a subject of considerable research on the *"peak demand"* theme.

Oil: Consumption The transport sector is the main driver of oil demand growth and will remain so over the coming decades, notably in non-OECD countries where car ownership is expanding rapidly

BREAKDOWN OF PRIMARY OIL CONSUMPTION IN 2016
TOTAL: 91.7 MBL/D



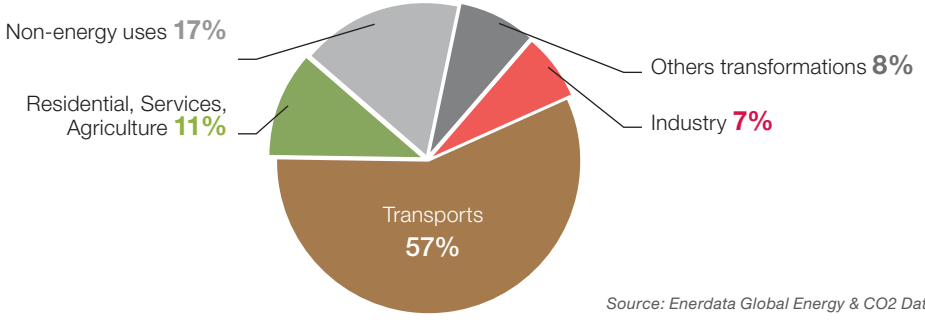
Source: Enerdata Global Energy & CO2 Data (2017)

OIL CONSUMPTION FORECAST IN NEW POLICIES SCENARIO FROM IEA

Oil consumption in Mb/d		New Policies			
	2016	2025	2040	AAGR 2016-2025	AAGR 2016-2025
Europe	13.0	11.3	8.7	-1.5%	-1.6%
North America	22.3	21.8	18.0	-0.2%	-0.9%
Latin America	5.9	6.2	6.7	0.4%	0.5%
Asia Pacific	29.6	34.8	39.2	1.6%	1.1%
CIS	3.9	4.3	4.4	1.0%	0.5%
Middle East	7.6	8.6	10.7	1.3%	1.4%
Africa	3.9	4.6	6.2	1.8%	1.9%
Soute	7.7	8.8	11.1	1.4%	1.5%
World	**93.9**	**100.3**	**104.9**	**0.7%**	**0.4%**

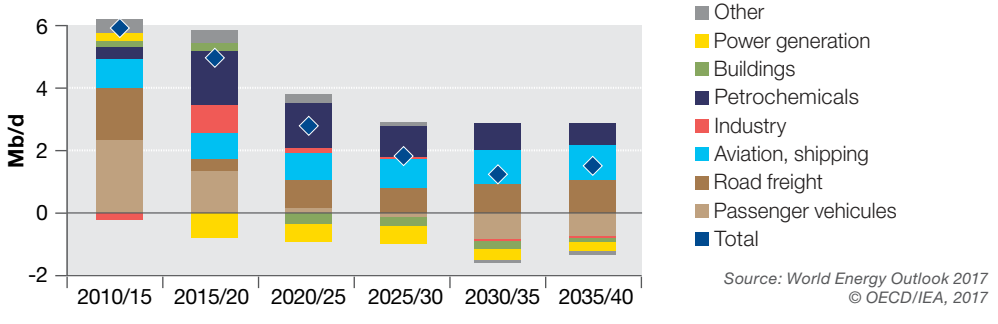
Source: World Energy Outlook 2017 © OECD/IEA, 2017

BREAKDOWN OF WORLD PRIMARY OIL CONSUMPTION BY SECTOR IN 2016
TOTAL: 91.7 MBL/JD



Source: Enerdata Global Energy & CO2 Data (2017)

OIL CONSUMPTION EVOLUTION BY USAGE BETWEEN 2010 AND 2040
IEA, *NEW POLICIES* 2017



Source: World Energy Outlook 2017 © OECD/IEA, 2017

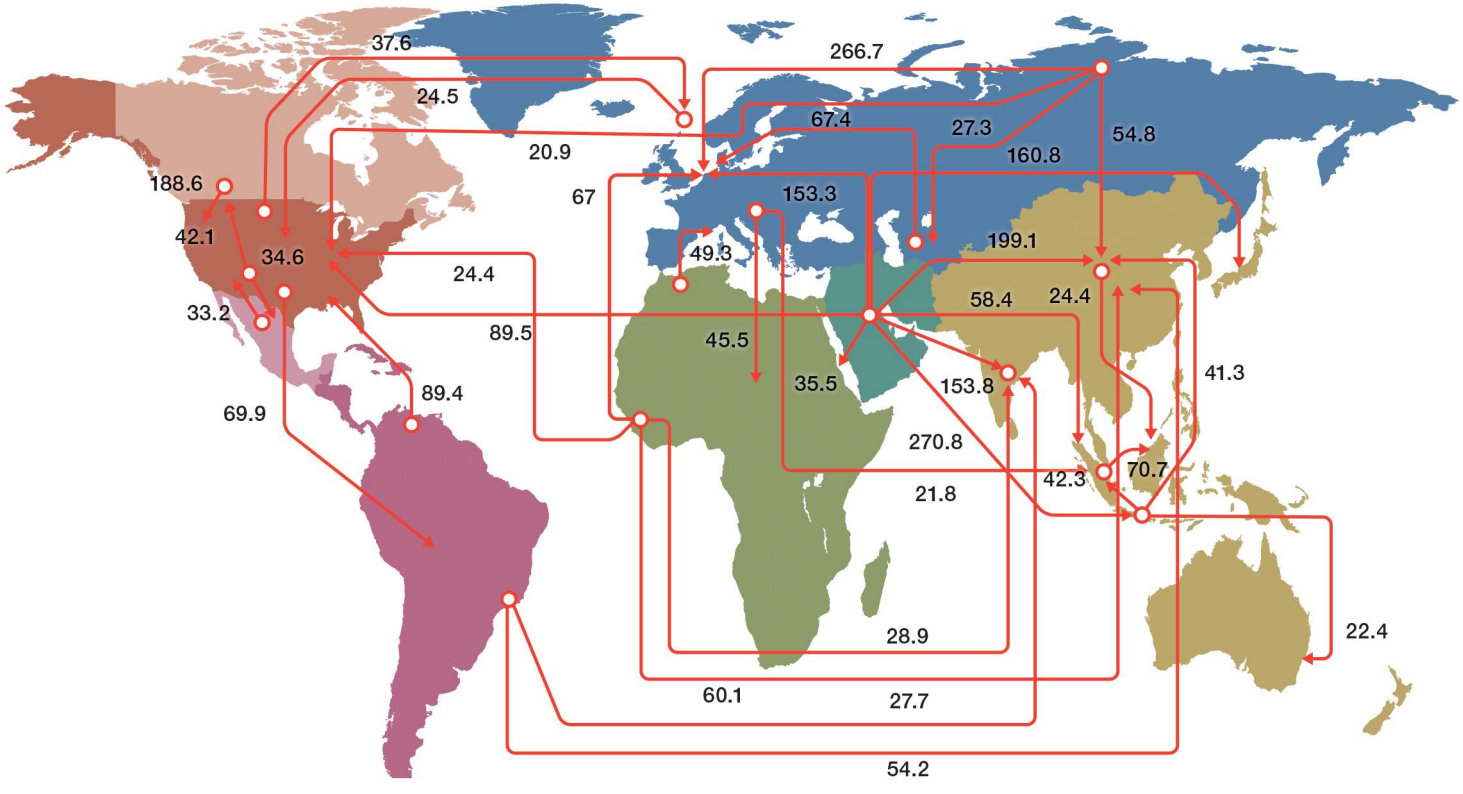
Oil: consumption

Primary oil consumption mbl/d	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	Change 2015-2016	AAGR 2000-2016	AAGR 2010-2016
European Union	12.8	13.0	12.9	13.0	13.0	13.0	13.0	12.6	12.4	11.6	11.6	11.1	10.7	10.4	10.4	10.4	10.6	1.7%	-1.1%	-1.3%
Germany	2.5	2.6	2.5	2.4	2.4	2.3	2.3	2.1	2.2	2.1	2.1	2.0	2.0	2.1	2.0	2.0	2.1	2.2%	-1.2%	-0.4%
United Kingdom	1.5	1.4	1.4	1.4	1.4	1.5	1.4	1.4	1.3	1.3	1.3	1.2	1.2	1.1	1.2	1.1	1.2	3.3%	-1.2%	-0.8%
North America	19.8	20.0	19.9	20.3	20.9	20.9	20.7	20.5	19.2	18.4	18.6	18.3	18.5	18.5	18.8	18.9	18.9	-0.3%	-0.3%	0.2%
Canada	1.9	1.9	1.9	2.0	2.1	2.1	2.2	2.2	2.2	2.1	2.2	2.2	2.3	2.3	2.3	2.3	2.4	4.6%	1.3%	1.2%
USA	17.9	18.1	18.0	18.3	18.8	18.8	18.5	18.3	17.0	16.3	16.4	16.1	16.2	16.2	16.5	16.6	16.5	-1.0%	-0.5%	0.1%
Latin America	6.3	6.2	6.1	6.0	6.3	6.5	6.7	6.8	7.1	7.0	7.4	7.5	7.8	7.8	8.0	7.8	7.5	-3.6%	1.1%	0.3%
Brazil	1.8	1.8	1.7	1.7	1.7	1.8	1.8	1.8	1.9	1.9	2.1	2.2	2.4	2.4	2.5	2.4	2.3	-5.1%	1.5%	1.4%
Mexico	2.0	2.0	1.9	1.9	2.0	2.0	2.0	2.1	2.1	2.0	2.0	2.0	2.0	2.0	2.0	2.0	1.9	-3.7%	-0.5%	-0.8%
Venezuela	0.4	0.5	0.5	0.5	0.5	0.6	0.6	0.6	0.7	0.7	0.8	0.7	0.8	0.8	0.7	0.7	0.6	-4.8%	2.3%	-3.1%
Asia	18.2	18.1	18.8	19.4	20.6	20.6	20.9	21.7	21.3	21.7	23.3	24.1	25.0	25.6	26.0	27.1	27.9	3.1%	2.6%	2.6%
China	4.4	4.5	4.9	5.4	6.3	6.3	6.8	7.1	7.2	7.5	8.6	8.9	9.3	9.8	10.2	10.9	11.3	4.1%	5.7%	4.1%
South Korea	1.9	1.9	1.9	1.9	1.9	1.9	1.9	1.9	1.8	1.9	1.9	1.9	2.0	2.0	2.0	2.0	2.2	8.5%	0.8%	2.1%
India	2.2	2.2	2.3	2.3	2.4	2.5	2.6	2.8	3.0	3.0	3.1	3.3	3.5	3.5	3.6	4.0	4.2	4.7%	3.7%	4.1%
Japan	1.1	1.2	1.2	1.2	1.3	1.3	1.3	1.3	1.3	1.4	1.5	1.6	1.6	1.6	1.6	1.6	1.6	0.8%	1.9%	0.7%
Indonesia	5.0	4.9	5.0	4.9	4.9	4.8	4.6	4.6	4.2	4.0	4.0	4.1	4.2	4.2	3.8	3.7	3.6	-3.4%	-2.0%	-1.5%
Pacific	0.9	0.9	0.9	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.1	1.1	1.1	1.2	1.2	1.2	-0.3%	1.6%	1.6%
CIS	3.7	3.7	3.7	3.8	3.8	3.8	4.0	3.9	4.1	4.0	4.0	4.4	4.7	4.6	4.7	4.6	4.7	2.2%	1.5%	2.4%
Russia	2.7	2.7	2.7	2.8	2.7	2.8	2.9	2.9	3.0	2.9	3.0	3.4	3.6	3.5	3.7	3.6	3.6	2.4%	1.8%	2.9%
Middle East	4.6	4.8	4.9	5.0	5.3	5.7	5.9	6.1	6.5	6.9	7.1	7.1	7.6	7.7	8.0	8.2	8.3	1.2%	3.5%	2.3%
Saudi Arabia	1.5	1.6	1.6	1.6	1.8	1.9	2.0	2.1	2.2	2.4	2.7	2.8	3.0	2.9	3.1	3.4	3.5	3.2%	5.0%	4.1%
United Arab Emirates	0.1	0.2	0.2	0.2	0.2	0.3	0.3	0.3	0.3	0.3	0.3	0.4	0.4	0.4	0.4	0.4	0.5	6.6%	7.0%	4.8%
Iraq	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.4	0.5	0.6	0.7	0.7	0.8	0.9	0.9	0.9	0.9	0.1%	3.6%	3.3%
Iran	1.4	1.5	1.5	1.5	1.5	1.7	1.8	1.8	1.9	2.0	1.8	1.7	1.8	2.0	2.0	1.9	1.9	-1.5%	1.7%	1.0%
Koweït	0.2	0.2	0.2	0.2	0.3	0.3	0.3	0.3	0.4	0.4	0.4	0.4	0.5	0.4	0.4	0.4	0.4	-2.4%	4.5%	-0.4%
Africa	2.4	2.4	2.5	2.5	2.7	2.8	2.8	2.9	3.1	3.2	3.4	3.3	3.6	3.6	3.6	3.5	3.6	1.2%	2.3%	0.9%
Nigeria	0.2	0.3	0.3	0.3	0.3	0.3	0.2	0.2	0.3	0.2	0.3	0.3	0.3	0.3	0.2	0.2	0.3	8.3%	1.0%	-1.1%
World	**75.2**	**75.5**	**76.3**	**77.7**	**80.9**	**81.7**	**82.8**	**83.7**	**82.9**	**81.8**	**84.6**	**85.3**	**87.1**	**87.7**	**88.8**	**90.4**	**91.7**	**1.4%**	**1.2%**	**1.2%**

Source: Enerdata Global Energy & CO2 Data (2017)

Oil: international trade

MAIN OIL TRADE FLOWS IN 2016 (MILLIONS OF TONNES)



- USA
- Canada
- Mexico
- South & Central America
- Europe & Eurasia
- Middle East
- Africa
- Asia Pacific

Source: BP Statistical Review, 2017

Oil: international trade in 2016

OIL EXPORTS

Oil exports in volume mbl/d)	2000	2015		2016		Change 2015-2016	AAGR 2000-2016
	mbl/ day	mbl/ day	Share in world total	mbl/ day	Share in world total		
Europe	5.4	2.5	6%	2.7	5.8%	7.4%	-4.0%
European Union	2.4	1.1	2%	1.1	2.4%	4.8%	-4.5%
North America	1.8	4.2	9%	4.4	9.4%	4.5%	5.4%
Canada	1.6	3.2	7%	3.3	7.2%	3.7%	4.3%
USA	0.2	1.0	2%	1.0	2.2%	7.0%	11.9%
Latin America	5.0	4.9	11%	4.7	10.1%	-4.0%	-0.4%
Mexico	1.9	1.2	3%	1.3	2.7%	1.9%	-2.2%
Venezuela	2.2	1.8	4%	1.6	3.4%	-11.0%	-1.8%
Asia	1.7	1.1	2%	1.6	3.4%	42.0%	-0.5%
Pacific	0.5	0.3	1%	0.2	0.5%	-11.8%	-3.8%
CIS	3.7	7.1	16%	7.3	15.7%	2.7%	4.1%
Russia	2.9	4.9	11%	5.2	11.2%	5.1%	3.5%
Middle East	16.1	17.9	40%	19.3	41.7%	8.1%	1.1%
Saudi Arabia	6.3	7.1	16%	7.2	15.5%	0.9%	0.8%
United Arab Emirates	1.9	2.6	6%	2.7	5.7%	2.3%	1.9%
Iraq	2.1	3.0	7%	3.5	7.5%	14.9%	3.1%
Iran	2.4	1.3	3%	1.9	4.1%	48.1%	-1.2%
Koweït	1.2	2.1	5%	2.3	4.9%	9.3%	3.7%
Africa	6.2	6.5	15%	6.2	13.4%	-4.0%	0.0%
Angola	0.8	1.7	4%	1.7	3.6%	-4.1%	4.7%
Nigeria	2.3	2.3	5%	2.2	4.7%	-7.0%	-0.4%
OPEP	**21.9**	**24.3**	**55%**	**n.d.**	**-**	**-**	
Non-OPEP	**18.4**	**20.1**	**45%**		**-**	**-**	
World in Mt	**40.3**	**44.4**	**100%**	**46.4**	**100%**	**4.5%**	**0.8%**

Source: Enerdata Global Energy & CO2 Data (2017)

OIL IMPORTS

Oil imports in volume (mbl/d)	2000	2015		2016		Change 2015-2016	AAGR 2000-2016
	mbl/ day	mbl/ day	Share in world total	mbl/ day	Share in world total		
Europe	13.3	12.7	28%	12.4	26%	-2%	-0.4%
European Union	12.7	12.0	26%	11.8	25%	-2%	-0.5%
Germany	2.1	1.8	4%	1.8	4%	0%	-1%
Netherlands	1.3	1.2	3%	1.3	3%	2%	0%
North America	11.4	8.9	19%	9.6	20%	7%	-1%
Canada	0.9	1.0	2%	1.1	2%	10%	1%
USA	10.4	7.9	17%	8.5	18%	7%	-1%
Latin America	1.2	1.0	2%	0.8	2%	-19%	-2%
Asia	13.1	20.9	45%	22.2	47%	6%	3%
China	1.4	6.7	15%	7.6	16%	14%	10%
South Korea	2.5	2.8	6%	3.0	6%	5%	1%
India	1.5	4.1	9%	4.4	9%	5%	6%
Japan	4.4	3.4	7%	3.3	7%	-2%	-2%
Pacific	0.5	0.5	1%	0.5	1%	5%	0%
CIS	0.5	0.6	1%	0.4	1%	-25%	-1%
Middle East	0.4	0.5	1%	0.5	1%	0%	2%
Africa	0.8	0.8	2%	0.8	2%	4%	-0.2%
World	**41.3**	**46.0**	**100%**	**47.4**	**100.0%**	**3.2%**	**0.8%**

Source: Enerdata Global Energy & CO2 Data (2017)

Oil: prices

Following a period of extreme weakness, oil prices bounced back to $60 per barrel in late 2017

2016 OVERVIEW

Oil prices were exceptionally weak in 2016. Brent opened the year at $27/bbl, its lowest level in 17 years. This marked the bottom of a downtrend that began in mid-2015 and that stemmed from a number of factors, notably OPEC's inability to reduce its supply, uncertainty over demand, notably from China, and Iran's return to the market on 1 January 2016 after a deal was agreed on its nuclear programme. The trend reversed when OPEC expressed its firm intention to cut output: Brent surged to around $50/bbl in a climate of uncertainty and high volatility. When the cartel announced on 30 November 2016 that it had finally reached an agreement with non-OPEC countries, notably Russia, to cut production by 1.8m bbl for six months starting 1 January 2017, oil prices jumped another 10%.

2017

Crude prices began 2017 at a relatively high level (around $55/bbl for Brent). They fell back between March and June against a backdrop of excess supply, however. Despite output cuts, the fundamentals remained far from balanced: several years of stock building and the strong recovery of world production, from the USA in particular, meant reaching market equilibrium was far longer than expected. Prices slipped to about $45/bbl for Brent by mid-year, despite an extension of OPEC/non-OPEC deal to March 2018.

Prices started to recover in the second half of 2017. Compliance with the OPEC/non-OPEC deal (another extension is expected at end-November), together with the impact of successive hurricanes hitting the USA, the latest developments in the Middle East (Donald Trump disavowing the nuclear deal, events in Syria and Iraq) and depletion of inventories led to a significant rally in oil markets to above $60/bbl in late 2017.

2018 OUTLOOK

After a year of pain for producer countries, the effects of cuts in output will finally impact the physical market. Shale production in the USA may stabilise or even decline because of low prices in 2016. **The outlook is for an upward trend in prices, nuanced by the Americans' new role as "swing producer".**

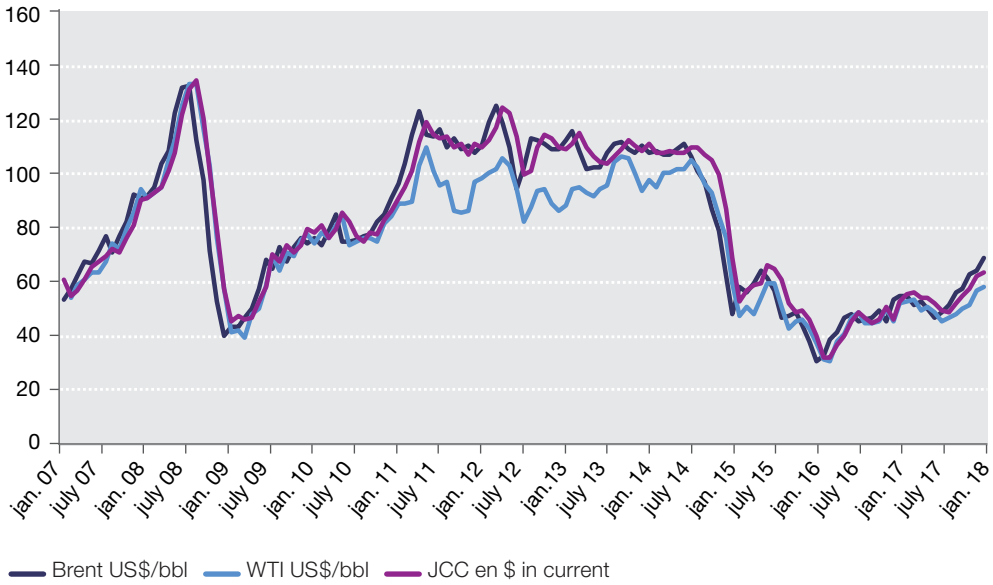
Oil: prices

OPEC's efforts to deal with long-term excess supply have finally materialised, thanks partly to renewed tension over Iran

Brent	1970	1975	1980	1985	1990	1995	2000	2005	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017
Brent Dated in $/bl (nominal)	2	12	37	28	24	17	28	55	97	62	79	111	112	109	99	52	44	54
Brent Dated in €/bl (nominal)	2	8	24	37	20	13	31	44	66	44	60	78	87	82	74	48	40	48

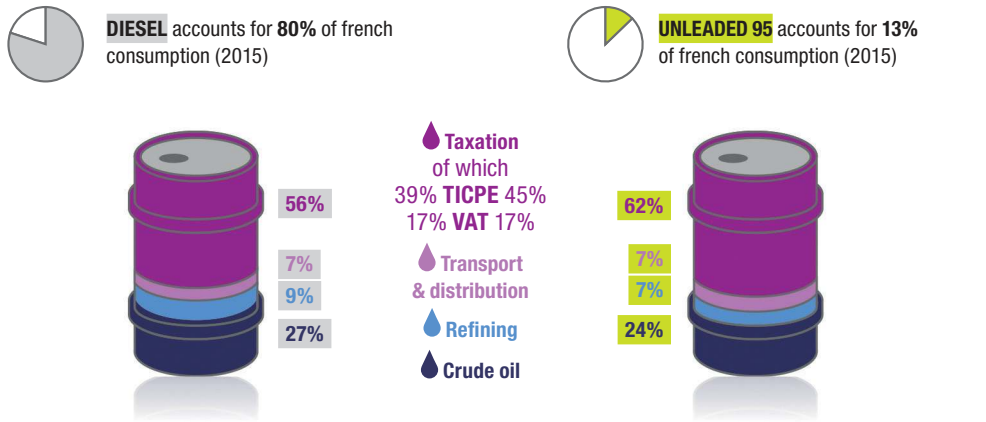
Source: Enerdata Global Energy & CO2 Data (2017)

BRENT, WTI AND JCC PRICES IN $/BARIL



Sources: ENGIE Global Markets (2017)

FUEL PRICING - DIESEL AND UNLEADED 95



Percentages based on the March 2015 average price (1.21 for diesel – 1.39 for unleaded 95).

Source: French economy and finance ministry – 2015

Coal

PRODUCTION

China is positioning itself as the world's regulator of coal production and prices

Its 2016 intervention put the market on a healthier footing and boosted prices

CONSUMPTION

The drop in coal consumption for the third consecutive year (-3% in 2016) highlights a marked trend among many countries to disengage from this source of energy

Rapidly expanding economies such as India are unable to do without coal for the time being, however

Coal: production Affected by two years of overproduction, coal output finally contracted in 2016

China, with its 45% share of world production, took on a market regulator role in order to keep prices above USD70 per tonne

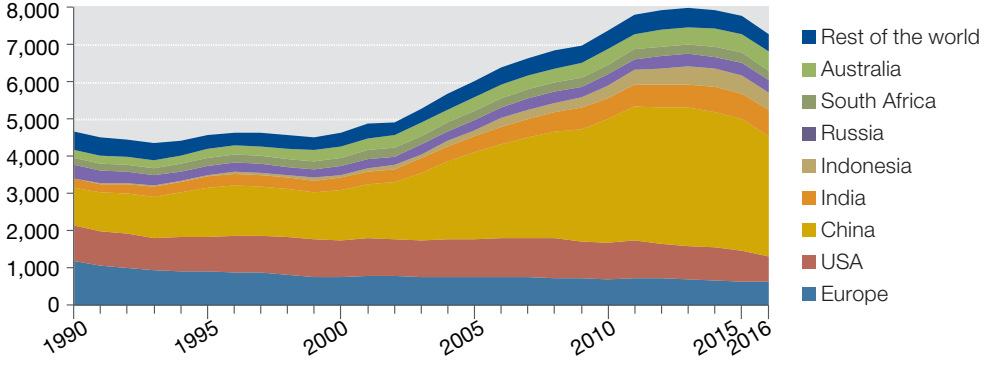
World coal output contracted by an extraordinary 6 % in 2016, with most producer countries reporting declines. India, Russia and Columbia were conspicuous exceptions to the rule. China, the world's leading producer, reduced its output by 9% following a series of measures aimed at putting the industry on a healthier footing and at better control over prices (mine closures, fewer working days. The US is the world's third producer, behind India and China. Its output dropped 17% in 2016

This put the market on a healthier footing and loosened constraints in 2017. Production gradually rebounded and is expected to post a small 1% increase worldwide for the year. China cancelled or suspended some of its restrictions in 2017, while the US mining industry benefitted from the new Trump administration's support (production expected up 8% in 2017).

The Chinese government intends to use domestic output control as a means of regulating international coal prices, with a clear objective of keeping them between CNY 450 and CNY 525 per tonne (approx. USD 65-75) over the medium term. It plans to close hundreds of coal mines in 2018 to bring their total number down from to 7,000 (against 10,800 in 2015).

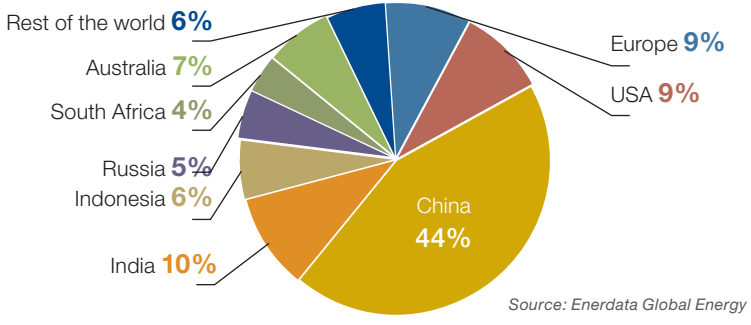
Prices picked up strongly in 2016 and held at around USD 85/tonne in 2017. Having bottomed out below USD 44/tonne CIF ARA in February 2016, coal rallied to USD 90/tonne by the end of the year and fluctuated between USD 70 and USD 90/tonne in 2017. Prices averaged around USD 85/tonne over the year as a whole. This trend is likely to continue in 2018.

WORLD COAL PRODUCTION FROM 1990 TO 2016 IN VOLUME (MT)



Source: Enerdata Global Energy & CO2 Data (June 2016)

WORLD COAL CONSUMPTION IN 2016 (TOTAL 7,309 MT)



Source: Enerdata Global Energy & CO2 Data (2017)

Coal: production

	Coal and lignite production													AAGR 2000-2016	AAGR 2010-2016	Change 2015-2016	Market share 2016
Mt	2000	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016				
Europe	778	758	759	761	749	723	705	740	732	690	664	653	640	-1%	-1%	-2%	9%
European Union	657	639	630	620	599	574	564	591	592	559	540	527	500	-2%	-2%	-5%	7%
Germany	205	206	200	205	194	185	184	189	197	191	187	184	177	-1%	-1%	-4%	2%
Poland	163	160	156	146	144	135	133	139	144	143	137	136	131	-1%	-0.2%	-3%	2%
Turkey	63	58	64	75	79	79	73	76	71	60	65	58	71	1%	-1%	21%	1%
North America	1,041	1,109	1,138	1,127	1,144	1,050	1,064	1,073	999	973	987	876	734	-2%	-5%	-16%	10%
USA	972	1,039	1,068	1,053	1,076	988	996	1,006	932	904	918	814	672	-2%	-5%	-17%	9%
Latin America	65	87	94	99	100	96	99	114	114	114	118	113	119	4%	3%	5%	2%
Colombia	38	59	66	70	74	73	74	86	89	85	89	86	94	5%	3%	10%	1%
Asia	1,851	3,035	3,328	3,576	3,732	4,024	4,349	4,741	4,862	4,981	4,914	4,865	4,533	5%	1%	-7%	62%
China	1,355	2,317	2,520	2,722	2,844	3,043	3,316	3,608	3,678	3,749	3,640	3,563	3,242	5%	-0.3%	-9%	44%
India	336	437	462	491	525	566	570	582	603	610	657	683	708	4%	3%	4%	10%
Indonesia	79	171	233	249	249	291	325	405	446	490	485	488	459	11%	5%	-6%	6%
Pacific	310	376	380	396	397	412	441	420	440	463	493	516	512	3%	2%	-1%	7%
Australia	307	371	375	391	392	408	436	415	435	458	489	512	509	3%	2%	-1%	7%
CIS	388	439	451	459	488	445	476	492	528	525	513	498	506	2%	1%	2%	7%
Kazakhstan	77	87	97	98	111	101	111	116	121	120	114	107	102	2%	-1%	-5%	1%
Russia	242	285	286	290	306	277	300	297	331	328	334	348	359	2%	3%	3%	5%
Middle East	2	2	2	2	2	2	2	2	1	2	1	1	1	-0.2%	-0.4%	-0.3%	0.0%
Africa	231	250	250	252	256	253	259	258	268	267	275	265	264	1%	0.3%	-0.3%	3.6%
South Africa	224	245	245	248	252	249	255	253	259	256	261	251	250	1%	-0.2%	-0.3%	3.4%
World	**4,665**	**6,055**	**6,402**	**6,672**	**6,869**	**7,006**	**7,394**	**7,839**	**7,943**	**8,014**	**7,965**	**7,788**	**7,309**	**3%**	**0%**	**-6%**	**100%**

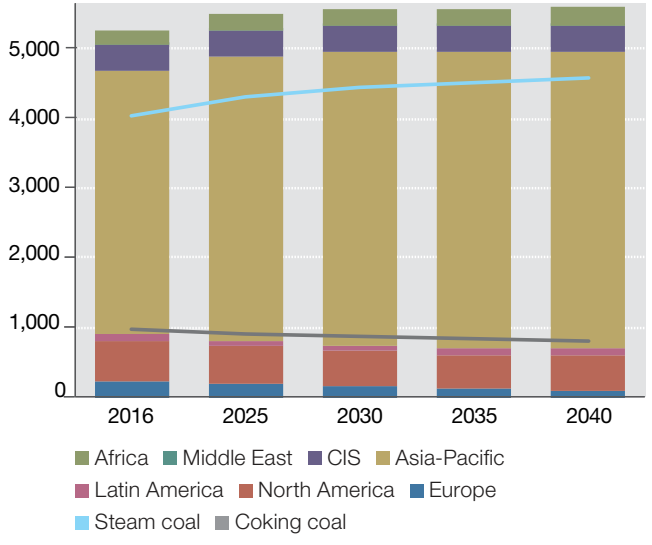
Source: Enerdata Global Energy & CO2 Data (2017)

Coal: production forecasts

COAL PRODUCTION FORECASTS IN NEW POLICIES AND SDS SCENARIOS FROM IEA (WEO 2017) IN MILLION TONS

Mt	2016	New Policies Scenario				Sustainable Development Scenario			
		2025	2040	AAGR 2016-2025	AAGR 2016-2040	2025	2040	AAGR 2016-2025	AAGR 2016-2040
Europe	242	187	106	-3%	-3%	136	43	-6%	-7%
North America	566	537	489	-1%	-1%	262	102	-7%	-7%
Latin America	91	91	95	0%	0%	77	27	-2%	-5%
Asia Pacific	3,793	4,072	4,269	1%	0%	3,370	2,014	-1%	-3%
CIS	362	367	378	0%	0%	282	225	-2%	-2%
Middle East	1	1	0	-5%	-5%	1	0	-5%	-5%
Africa	216	234	276	1%	1%	191	127	-1%	-2%
OECD	**1,173**	**1,090**	**1,026**	**-1%**	**-1%**	**676**	**384**	**-5%**	**-4%**
Non-OECD	**4,098**	**4,398**	**4,587**	**1%**	**0%**	**3,643**	**2,155**	**-1%**	**-3%**
World	**5,271**	**5,488**	**5,613**	**0%**	**0%**	**4,318**	**2,539**	**-2%**	**-3%**
Steam coal	**4,049**	**4,319**	**4,574**	**1%**	**0%**	**3,300**	**1,834**	**-2%**	**-3%**
Coking coal	**967**	**900**	**806**	**-1%**	**-1%**	**826**	**595**	**-2%**	**-2%**

COAL PRODUCTION FORECAST IN THE IEA NEW POLICIES SCENARIO (MT)



Source: World Energy Outlook 2017 © OECD/IEA 2017

Coal: consumption

Lower coal consumption over the past three years clearly relates to environmental policies

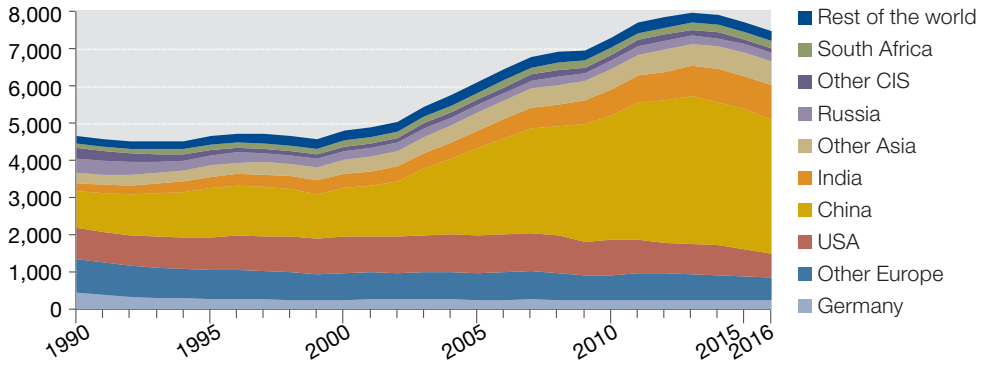
The fall in world coal consumption continued in 2016, accelerating to a 3% decline after a 2% drop in 2015 and a 1% fall in 2014.

The trend is particularly marked in the EU and North America (both down 8% in 2016) but mixed in Asia, where a substantial 5% drop in Chinese demand only partially offset stable growth in India and Indonesia (up 4% and up 10%, respectively).

- **In the USA, coal consumption declined 20% between 2014 and 2016,** mainly because of a loss of competitiveness in electricity production compared with unconventional gas. The Trump administration's pro-coal agenda is unlikely to succeed to turn back the tide in the coming years.
- **To varying degrees, all European countries are reporting lower coal consumption** (-4% in Germany, -11% in Belgium, -8% in the Netherlands, -3% in Poland, -18% in Spain). The EU's Large Combustion Plant Directive is gradually forcing the most polluting power stations to shut down. **The UK is the best example of disaffection with coal in Europe:** total coal consumption shrunk 52% in 2016, and 60% in the power generation sector, in the wake of the increase in the carbon floor price. Despite its historical importance, UK coal consumption is back to nineteenth-century levels.
- **Asian coal demand remains vigorous, largely because of increases in its share of the energy mix in India and Indonesia** (75% in India, an 8-point rise in 5 years; and 56% in Indonesia, a 12-point rise in 5 years). Conversely, China's decision to reduce its dependency on coal is bearing fruit: this fuel has lost 11 points in the country's mix over the last five years, to 68% in 2016.

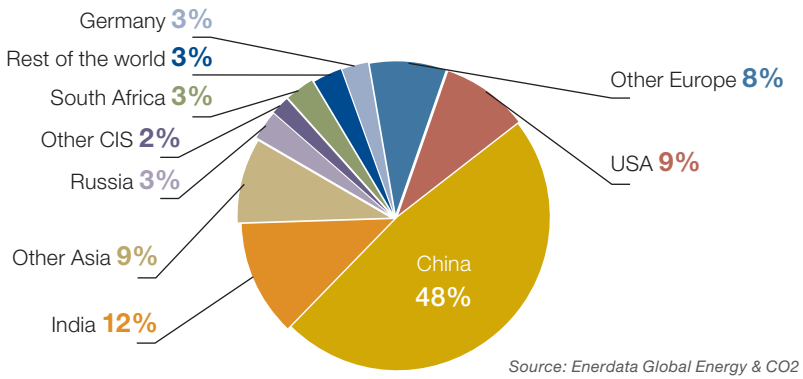
In the light of coal import figures, **demand appears to have picked up in 2017.** The outlook for the medium to long term is however for flatlining or decreasing consumption as a result of environmental constraints.

WORLDS COAL CONSUMPTION FROM 1990 TO 2016 IN VOLUME (MT)



Source: Enerdata Global Energy & CO2 Data (June 2016)

WORLD COAL CONSUMPTION IN 2016 (TOTAL: 7,477 MT)



Source: Enerdata Global Energy & CO2 Data (2017)

Coal: consumption

	Primary consumption of coal & lignite													AAGR 2000-2016	AAGR 2010-2016	Change 2015-2016	Market share 2016
Mt	2000	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016				
Europe	973	972	992	1,019	971	902	915	959	968	921	889	877	835	-0.9%	-1.3%	-4.8%	11%
European Union	832	833	844	854	803	734	749	781	796	765	731	715	658	-1.4%	-1.8%	-7.9%	9%
Germany	244	244	245	254	240	226	232	236	247	247	239	236	226	-0.5%	-0.4%	-4.0%	3%
Poland	141	137	140	137	135	128	134	137	135	137	130	127	124	-0.8%	-1.0%	-2.5%	2%
Turkey	81	77	84	99	99	99	96	101	101	85	97	93	106	1.6%	1.5%	14.1%	1%
North America	1,046	1,078	1,069	1,086	1,077	954	1,005	959	851	880	873	764	700	-2.3%	-5.0%	-8.4%	9%
USA	983	1,018	1,009	1,021	1,018	904	954	910	807	837	831	722	660	-2.3%	-5.1%	-8.6%	9%
Latin America	47	56	59	58	57	53	65	71	70	75	75	77	70	2.3%	1.1%	-8.7%	1%
Colombia	5	4	4	4	4	5	4	5	4	5	5	6	3	-3.2%	-5.8%	-50.3%	0%
Asia	2,062	3,300	3,612	3,901	4,039	4,343	4,602	4,982	5,198	5,383	5,361	5,307	5,180	5.6%	1.7%	-2.4%	69%
China	1,304	2,345	2,609	2,821	2,920	3,158	3,350	3,695	3,832	3,969	3,837	3,770	3,593	6.1%	1.0%	-4.7%	48%
South Korea	72	83	86	93	104	108	120	130	128	126	131	131	126	3.4%	0.7%	-4.1%	2%
India	375	466	498	542	581	652	684	715	777	808	892	892	931	5.5%	4.5%	4.3%	12%
Indonesia	25	41	50	62	54	54	51	51	61	66	79	89	100	8.5%	10.0%	11.5%	1%
Japan	151	180	179	186	175	166	178	172	179	191	190	189	191	1.4%	1.0%	1.5%	3%
Pacific	130	142	145	144	144	148	136	131	130	119	114	117	116	-0.7%	-2.2%	-0.6%	2%
Australia	128	138	140	141	140	144	133	128	127	116	111	114	114	-0.7%	-2.2%	-0.2%	2%
CIS	356	350	366	364	392	350	369	390	404	378	355	346	351	-0.1%	-0.7%	1.3%	5%
Kazakhstan	50	65	69	74	85	77	83	90	91	90	84	77	75	2.4%	-1.5%	-2.7%	1%
Russia	232	213	219	210	227	203	212	221	232	207	199	207	210	-0.6%	-0.2%	1.1%	3%
Middle East	13	16	16	17	16	16	16	18	20	17	17	16	14	0.7%	-1.8%	-11.6%	0%
Africa	170	192	194	200	213	198	203	194	199	205	216	207	211	1.3%	0.6%	2.1%	3%
South Africa	157	179	181	187	202	187	193	182	187	193	201	190	194	1.2%	0.1%	2.1%	3%
World	**4,798**	**6,106**	**6,452**	**6,788**	**6,910**	**6,963**	**7,310**	**7,704**	**7,841**	**7,978**	**7,901**	**7,711**	**7,477**	**2.6%**	**0.3%**	**-3.0%**	**100%**

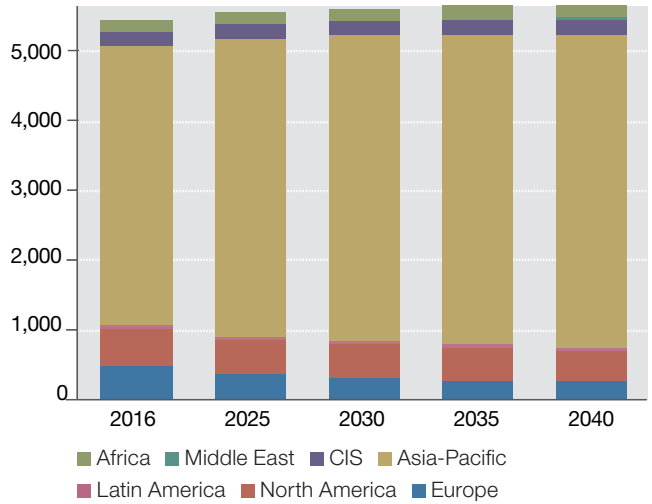
Source: Enerdata Global Energy & CO2 Data (2017)

Coal: consumption forecasts

COAL CONSUMPTION FORECASTS IN NEW POLICIES AND SDS SCENARIOS FROM IEA (WEO 2017)
IN MILLION TONS

Mt	2016	New Policies Scenario				Sustainable Development Scenario			
		North America	2040	AAGR 2016-2025	AAGR 2016-2040	2025	2040	AAGR 2016-2025	AAGR 2016-2040
Europe	242	187	106	-3%	-3%	136	43	-6%	-7%
North America	566	537	489	-1%	-1%	262	102	-7%	-7%
Latin America	91	91	95	0%	0%	77	27	-2%	-5%
Asia Pacific	3,793	4,072	4,269	1%	0%	3,370	2,014	-1%	-3%
CIS	362	367	378	0%	0%	282	225	-2%	-2%
Middle East	1	1	0	-5%	-5%	1	0	-5%	-5%
Africa	216	234	276	1%	1%	191	127	-1%	-2%
OECD	**1,173**	**1,090**	**1,026**	**-1%**	**-1%**	**676**	**384**	**-5%**	**-4%**
Non-OECD	**4,098**	**4,398**	**4,587**	**1%**	**0%**	**3,643**	**2,155**	**-1%**	**-3%**
World	**5,271**	**5,488**	**5,613**	**0%**	**0%**	**4,318**	**2,539**	**-2%**	**-3%**
Steam coal	**4,049**	**4,319**	**4,574**	**1%**	**0%**	**3,300**	**1,834**	**-2%**	**-3%**
Coking coal	**967**	**900**	**806**	**-1%**	**-1%**	**826**	**595**	**-2%**	**-2%**

COAL CONSUMPTION FORECAST
IN THE IEA NEW POLICIES SCENARIO (MT)

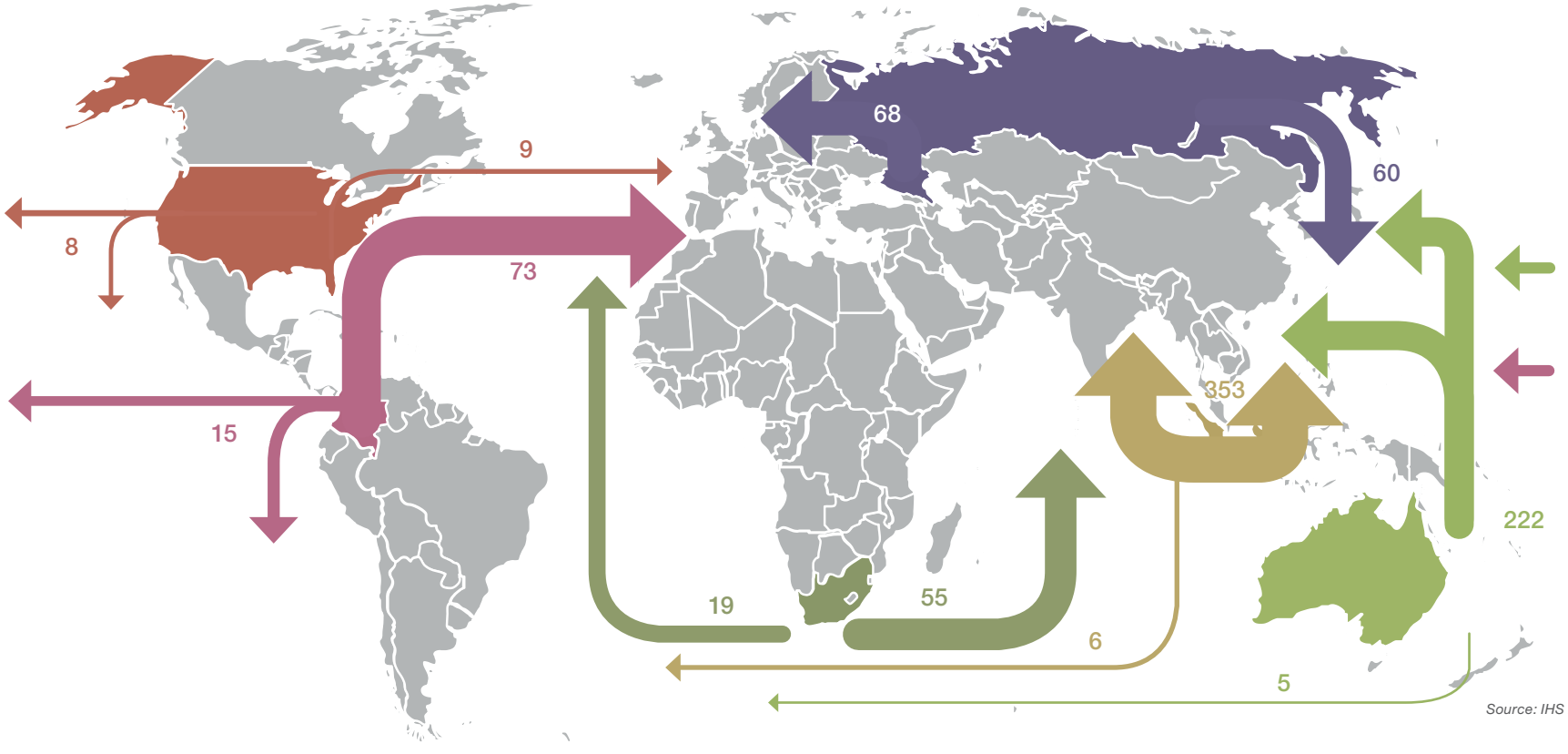


Source: World Energy Outlook 2017 © OECD/IEA 2017

Coal: world trade flows

Coal trade flows pick up in 2017, driven by the demand recovery in Asia, the destination of 71% of the world's exports (+3% growth extimated in 2017). In the medium term, environmental policies in China, India and South Korea (the world's leading importers) might slow down world trade flows

MAIN STEAM COAL AND LIGNITE TRADE FLOWS IN 2016 (MILLIONS OF TONNES)



Source: IHS Energy (Juillet 2017)

Coal: world trade flows

Coal and lignite exports Mt	2000	2015	2016	Share in the world total 2016	Change 2015-2016	AAGR 2000-2016
	Mt	Mt	Mt			
Europe	54	61	58	4.3%	-3.6%	0.4%
European Union	53	58	56	4.2%	-3.1%	0.3%
Poland	27	16	17	1.2%	2.6%	-2.8%
North America	86	95	82	6%	-13.8%	-0.3%
Canada	32	27	27	2%	-2.2%	-1.1%
USA	54	68	55	4.1%	-18.5%	0.1%
Latin America	44	82	92	6.8%	12.3%	4.5%
Colombia	36	80	91	6.7%	13.9%	5.7%
Asia	135	459	426	31.4%	-7.1%	7%
China	70	15	24	1.8%	64.6%	-6.1%
Indonesia	57	402	363	26.7%	-9.8%	11.5%
Pacific	189	394	397	29.2%	0.7%	4.5%
Australia	187	393	396	29.1%	0.7%	4.5%
CIS	78	192	204	15.0%	6.1%	5.8%
Russia	40	159	173	12.7%	8.7%	9%
Kazakhstan	34	27	27	2%	-0.5%	-1.3%
Middle East	0.1	0	0.2	0%	0%	6.7%
Africa	71	76	74	5.4%	-3.2%	0.2%
South Africa	70	71	69	5.1%	-3.4%	-0.1%
World	**657**	**1,359**	**1,359**	**100%**	**0%**	**4.4%**

Source: Enerdata Global Energy & CO2 Data (2017)

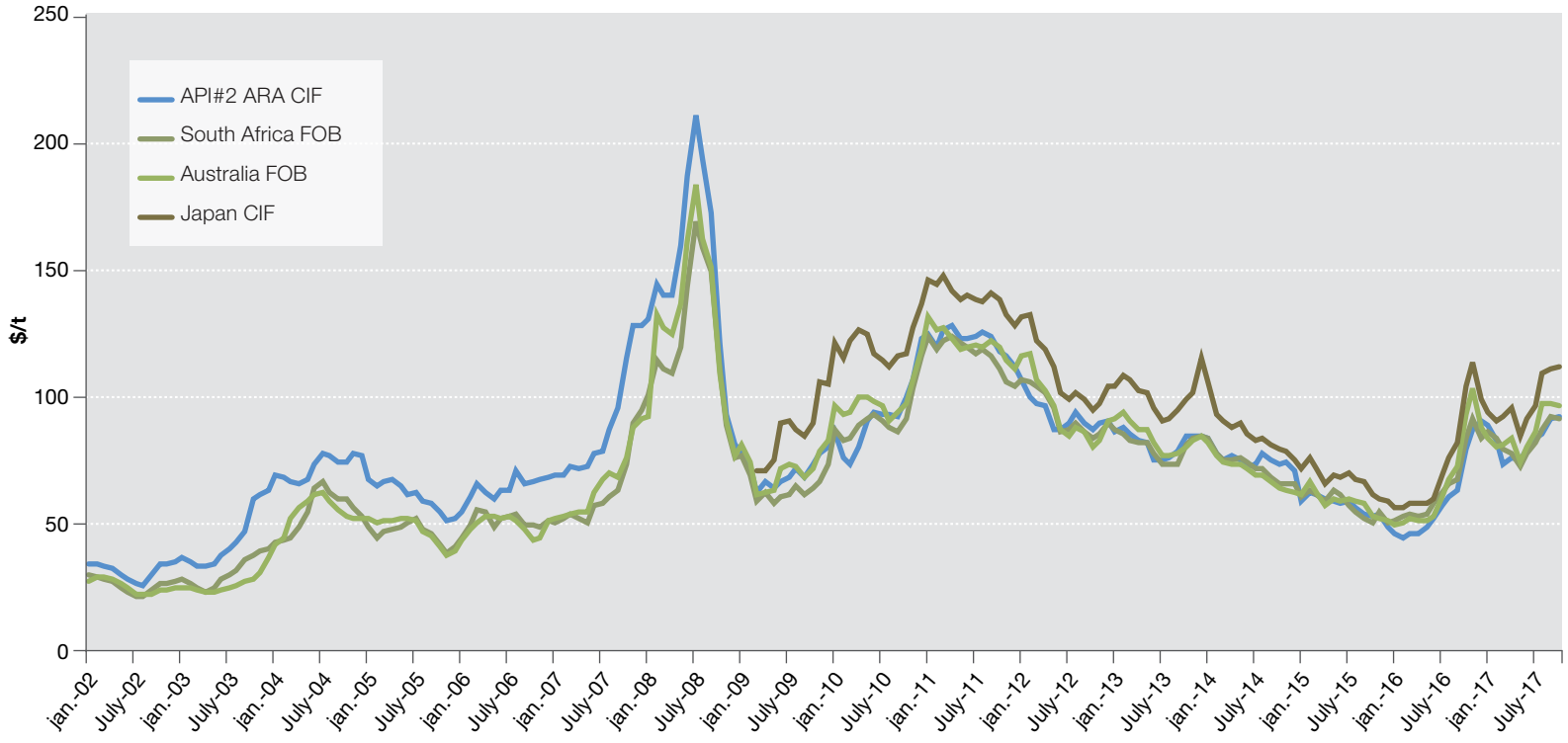
Coal and lignite imports Mt	2000	2015	2016	Share in the world total 2016	Change 2015-2016	AAGR 2000-2016
	Mt	Mt	Mt			
Europe	225	275	254	18.7%	-7.8%	1%
European Union	209	236	210	15.5%	-10.9%	0%
Germany	36	57	57	4.2%	1.3%	3%
Netherlands	23	50	49	3.6%	-0.8%	5%
North America	39	19	16	1.1%	-17.1%	-5%
USA	15	10	9	0.7%	-13%	-3%
Latin America	25	46	44	3.2%	-4.9%	3%
Brazil	15	22	20	1.5%	-9.6%	2%
Asia	313	914	969	71.4%	6.1%	7%
China	3	204	256	18.9%	25.2%	31%
South Korea	65	134	133	9.8%	-0.3%	4%
India	23	221	220	16.2%	-0.6%	14%
Japan	153	192	191	14.1%	-0.5%	1%
Taïwan	46	65	65	4.8%	-0.3%	2%
Pacific	0.02	1	1	0.1%	1.2%	25%
CIS	36	48	47	3.4%	-3.6%	2%
Russia	26	27	24	1.8%	-12%	0%
Middle East	11	14	14	1.0%	0%	1%
Africa	8	13	13	1.0%	0%	3%
World	**657**	**1,330**	**1,357**	**100%**	**2.0%**	**4%**

Source: Enerdata Global Energy & CO2 Data (2017)

Coal: prices Output restriction measures drove coal prices back up in 2016

The international market's modest recovery kept prices at around USD85/ton in 2017

BITUMINOUS COAL – SPOT PRICE – NOMINAL $/TONNE



NB: Bituminous coal = coal destined for electricity generation.
ARA: Amsterdam, Rotterdam, Anvers.

Source: ENGIE, Global Market (November 2017)

France

The Hulot plan and new temperature records kept climate issues in the headlines in 2017

Confirmation of economic recovery in 2017 resulted in stable energy consumption, despite lower heating requirements

France: energy mix

French GDP growth has increased by +2% in 2017, "a level not seen since 2011", after +1.2% in 2016 and +1.1% in 2015. Temperatures were milder than normal in 2016, not exceptionally warm as in 2015 and 2014, but 2017 set new temperature records. Rainfall patterns were unusual in 2016: the first half of the year posted a substantial excess, while August and December had not been so dry since 1956.

Primary energy production dropped 6% in 2016 to 126 Mtoe. This phenomenon was mainly attributable to the nuclear sector (-8% in 2016) where numerous control and maintenance operations were conducted over the year. Renewable production rose 7% in 2016, led by hydro power (up 8%) and solar (up 14%) energy; wind power slipped 1% because of adverse wind conditions. The steady expansion of the biogas sector over the last ten years was hampered in 2016 by delays in the publishing of structuring laws, but is expected to resume in 2017.

In 2016, primary energy consumption contracted 1% in real terms and 2% in temperature-adjusted terms, reflecting a relatively warm year. Natural gas consumption rose again strongly in 2016 (up 9% after an 8% gain in 2015), while oil and coal continued their steady decline (-0.3% and -1% respectively).

In 2017, encouraged by the improved economic situation, energy consumption was almost stable (-0.5% in real terms), while temperatures were very hot; in corrected data, the energy demand increases by +0.9%. The demand for gas slows in 2017 in real terms (+0.4%) but remains dynamic in corrected data (+4%).

The energy mix deteriorated in 2016 (+2% relative to 2015) for the first time in ten years. Because of weaker nuclear output, the country exported less electricity (-17%) and imported more natural gas for combined-cycle power plants to offset the nuclear shortfall. Despite this, the country's energy independence ratio remains high, at 53%, and the energy bill trended lower for the fourth consecutive year (-21% in 2016 to €31.3 bn), thanks to lower oil imports, in both volume and value terms.

France: energy mix

Mtoe	1990	2000	2005	2010	2015	2016	Change	
							2015-2016	2010-2016 (AAGR)
PRIMARY ENERGY PRODUCTION								
PRIMARY ELECTRICITY	87	114	122	118	121	113	-7%	-1%
o/w nuclear	82	108	118	112	114	105	-8%	-1%
o/w hydro, wind, PV	5	6	5	6	7	8	7%	3%
Renewable thermal energy and waste	11	11	12	15	15	15	-1%	0%
Oil	3,5	1,8	1,4	1,1	0,9	0,9	-5%	-3%
Natural gas	2,5	1,5	0,9	0,6	0,02	0,03	30%	-42%
Coal	8,3	2,5	0,4	0,2	0,01	0,01	0%	-36%
Energy Indiapendance ratio	50%	51%	51%	52%	56%	53%	-5%	0%
Total	112	131	137	135	138	129	-6%	-1%
TRADE BALANCE								
Imports	140	166	178	161	148	149	1%	-1%
o/w crude oil	70	85	84	64	57	55	-4%	-3%
o/w refined petroleum products	26	30	37	41	41	39	-4%	-1%
o/w natural gas	33	45	53	54	44	49	10%	-2%
o/w coal	14	14	14	12	9	8	-6%	-6%
Exports	20	30	35	30	33	32	-4%	1%
o/w electricity	4	6	6	4	6	5	-17%	3%
o/w refined petroleum products	14	21	28	23	21	20	-3%	-2%
Imports balance	120	136	143	131	115	118	2%	-2%
PRIMARY ENERGY CONSUMPTION								
Primary electricity (nuclear, hydro, wind, PV)	83	108	117	115	116	109	-6%	-1%
Renewable thermal energy and waste	11	11	12	16	16	16	-1%	0%
Oil	85	85	86	76	71	70	-0,3%	-1%
Gas (natural and industrial)	26	36	41	43	35	38	9%	-2%
Coal	20	15	14	12	9	9	-1%	-5%
Total	225	255	271	261	246	243	-1%	-1%
Seasonally adjusted total	229	258	269	255	250	244	-2%	-1%
FINAL ENERGY CONSUMPTION								
Primary electricity	26	33	36	38	36	37	2%	-1%
RES	10	12	13	15	14	14	-1%	-2%
Oil	75	81	80	71	67	66	-1%	-1%
Natural gas	24	33	34	34	30	30	1%	-2%
Coal	10	7	6	5	5	5	-1%	-2%
Total Energy	132	150	154	150	139	139	0%	-1%
Total non-energy	13	17	17	14	13	12	-6%	-2%
Total	146	167	171	164	152	152	0%	-1%
Seasonally adjusted total	150	170	169	158	155	153	-2%	-1%

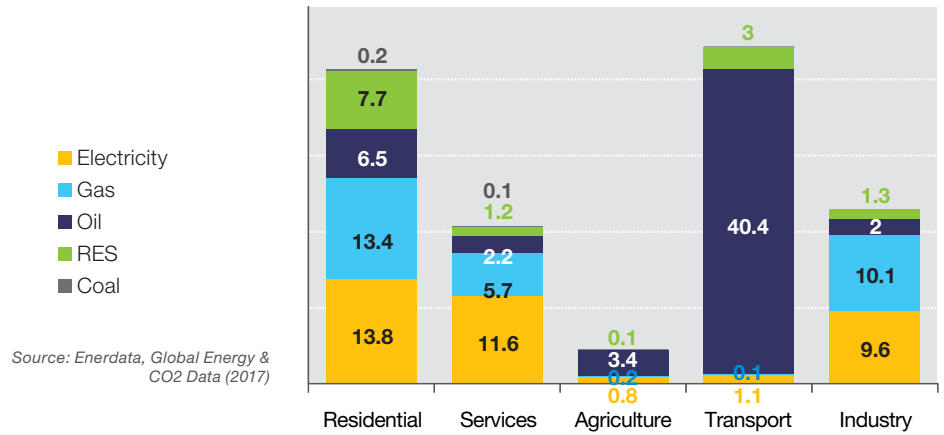
Source: Enerdata, Global Energy & CO2 Data (2017)

France: final energy consumption by sector

Mtoe	1990	2000	2005	2010	2015	2016	Change 2015-2016	Change 1990-2016 (AAGR)
RESIDENTIAL	39.2	41.5	44.6	46.0	41.2	41.6	1.1%	0.2%
Electricity	8.3	11.1	11.9	13.9	13.4	13.8	2.9%	1.9%
Natural gas	10.0	13.4	16.1	16.8	13.2	13.4	1.4%	1.1%
Oil	11.0	9.6	9.6	7.8	6.5	6.5	-0.4%	-1.9%
RES	8.2	6.8	6.6	7.3	7.8	7.7	-1.3%	-0.2%
Coal	1.6	0.6	0.4	0.2	0.2	0.2	2.6%	-8.0%
SERVICES	14.6	18.4	21.7	23.1	20.7	20.8	0.3%	1.3%
Electricity	6.9	9.2	10.8	12.5	11.6	11.6	0%	2%
Natural gas	2.6	4.5	6.5	6.6	5.6	5.7	1.4%	2.9%
Oil	5.1	4.3	4.0	3.5	2.2	2.2	-0.3%	-3.1%
RES	0.0	0.4	0.3	0.4	1.2	1.2	-0.6%	12.6%
Coal	0.0	0.0	0.0	0.1	0.1	0.1	2.6%	
AGRICULTURE	3.9	4.3	4.7	4.5	4.5	4.5	-0.1%	0.5%
Electricity	0.2	0.2	0.6	0.7	0.7	0.8	1.5%	5.4%
Natural gas	0.1	0.3	0.3	0.2	0.2	0.2	1.4%	0.7%
Oil	3.5	3.7	3.6	3.5	3.4	3.4	-0.5%	-0.2%
RES	0.0	0.0	0.1	0.1	0.1	0.1	-1.5%	4.5%
Coal	0.0	0.0	0.0	0.0	0.0	n.d.		
TRANSPORTS	38.6	45.6	45.1	44.3	44.5	44.6	0.2%	0.5%
Electricity	0.8	1.0	1.1	1.1	1.1	1.1	1.5%	1.4%
Natural gas	0.0	0.0	0.0	0.0	0.1	0.1	1.4%	25.6%
Oil	37.8	44.3	43.4	40.7	40.4	40.4	0.2%	0.2%
RES	0.0	0.3	0.6	2.4	2.9	3.0	0.2%	
Coal	0.0	0.0	0.0	0.0	0.0	0.0		
INDUSTRY	35.6	36.8	33.6	28.6	27.4	27.5	0.3%	-1.0%
Electricity	9.9	11.6	12.0	10.1	9.5	9.6	1.5%	-0.1%
Natural gas	9.2	12.3	9.7	9.1	10.0	10.1	1.4%	0.4%
Oil	6.6	4.9	4.4	2.9	2.1	2.0	-6.3%	-4.3%
RES	1.5	1.6	1.6	1.5	1.3	1.3	-1.1%	-0.6%
Coal	0.0	0.0	0.0	0.0	0.0	0.0		
TOTAL ENERGY	132.4	149.8	153.9	150.0	138.7	139.3	0.5%	0.2%
Electricity	26.0	33.1	36.4	38.2	36.4	36.9	1.5%	1.3%
Natural gas	23.9	32.9	34.4	34.1	30.0	30.4	1.4%	0.9%
Oil	75.2	81.2	79.9	71.3	66.8	65.9	-1.4%	-0.5%
RES	10.3	12.4	13.4	15.2	13.7	13.6	-0.9%	1.1%
Coal	10.4	7.1	6.4	5.5	5.0	4.9	-1.2%	-2.8%
Non-energy uses	13.4	16.8	16.7	14.3	13.2	12.4	-5.9%	-0.3%
Total	145.8	166.7	170.6	164.2	151.9	151.8	-0.1%	0.1%

Source: Enerdata, Global Energy & CO2 Data (2017)

FINAL CONSUMPTION BY SECTOR IN FRANCE, 2016 (MTOE)



Source: Enerdata, Global Energy & CO2 Data (2017)

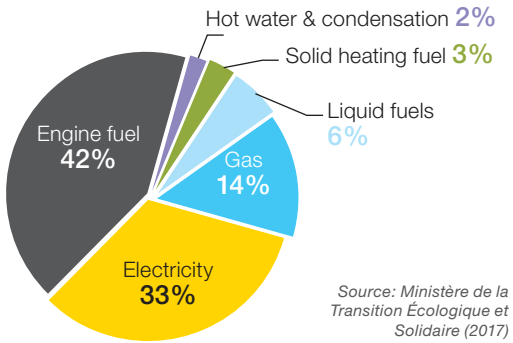
Final energy consumption has been contracting since 2010.

This downward trend affects almost every sector and reflects France's deindustrialisation, energy efficiency measures and economic sluggishness. In 2016, final energy demand slipped 1.5% in the residential and service sector, 0.3% in the industry and 0.1% in agriculture. Although generally trending down since the 2000s, demand from the transport sector picked up in 2015 and again, slightly, in 2016 (+0.2%), thanks to low fuel prices. The share of biofuels in this sector is 7%. Electric and natural gas vehicles are developing, but still represent a minimal share of the sector's consumption (0.2% for gas). Declining 6%, energy used as a raw material to produce petrochemicals and fertilisers continued the downward move initiated in 2015.

France: household energy bills

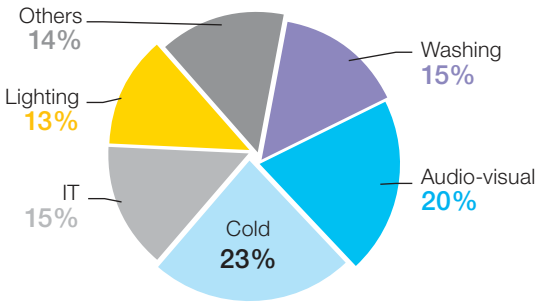
- The share of energy (transport and housing) in the French household budget is a fairly stable 8% or so (approx. €3,000).
- The French government has set the energy poverty threshold at 10% of the household budget. This only takes account of energy consumed within the home and concerns 3.8 million households (14% of all households).

BREAKDOWN OF THE AVERAGE FRENCH HOUSEHOLD ENERGY BILL IN 2016



Source: Ministère de la Transition Écologique et Solidaire (2017)

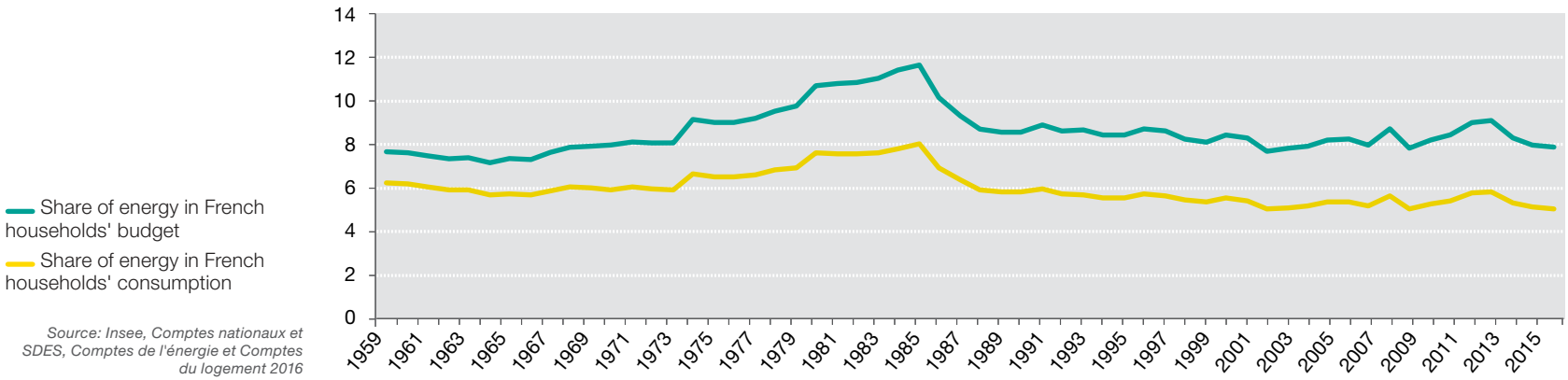
ELECTRICITY CONSUMPTION BY ITEM (%)



A french household uses on average 2,700 kWh of electricity per year (excl. heating & hot water)

Source: ADEME

SHARE OF ENERGY IN HOUSEHOLD BUDGETS FROM 1959 TO 2016 (%)



Source: Insee, Comptes nationaux et SDES, Comptes de l'énergie et Comptes du logement 2016

France: Nicolas Hulot's Climate Plan

Last summer Nicolas Hulot unveiled his Climate Plan, giving precise guidelines to the energy transition policy. More a backbone than an fixed framework, the plan is to be supplemented in time with new initiatives. It is a continuation of the Energy Transition for Green Growth Act, though altogether more ambitious.

Energy transition lies at the heart of the government's programme: the Great Investment Plan includes €20 billion for this purpose over five years, and the environment ministry's budget has been revised up 3.9% in 2018, despite a significant cut in headcount (-1,274 staff).

The Plan provides for the country's future energy mix and aims at carbon neutrality by 2050. Production of oil on French territory will end by 2040, and the last coal-fired plants will shut by 2022. The objective of reducing the nuclear power's share remains, but no deadline is set. The Hulot Plan maintains the renewable energy objectives laid in the 2015 Transition Act, i.e. by 2030, 32% of the country's electricity consumption shall come from renewable sources. The development of renewable energies is central to the project: it represents over half of the ministry's budget, plus €7 billion as part of the Great Investment Plan over the government's five-year mandate.

The government will use all means at its disposal to foster energy transition, such as public procurement to promote bio-sourced products, fiscal leverage to penalise hydrofluorocarbons (HFCs) and a €20 billion increase in the carbon tax over five years to reflect carbon's true price. The government will encourage similar measures at European level. The public investment bank BPI France has been called upon to participate in energy transition financing in the form of loans for thermal rehabilitation and biogas plant purchase, and via support for investment funds specialising in eco-technologies and green infrastructures.

One of the Climate Plan's objectives is the end of sales of petrol cars by 2040. Various measures to reduce emissions from transport have already been announced, such as a conversion premium to help households replacing polluting cars (those built before 2001 for diesel and before 1997 for petrol) with new or second hand cars with a carbon dioxide emission rate of less than 130g/km. Taxes on diesel and on petrol are also to converge over the government's mandate.

Another large project relates to the renovation of all badly insulated homes within ten years. The investment plan will earmark €9 billion for thermal renovation, with an objective of 75,000 homes per year. The tax credit for energy transition (Crédit d'Impôt pour la Transition Énergétique, CITE) will be replaced in 2019 by a grant for wall, loft or boiler insulation works. In addition, households replacing an oil-fired boiler with a wood-fired system or a heat pump will be entitled to a grant of up to €3,000. Energy cheques will replace social tariffs for natural gas, a measure that will benefit 4 million households.

France: thermal regulations

In anticipation of the future Thermal Regulations 2018 (announced in November 2016), the French State is launching an experiment for the construction of a new type of green building . This experiment is accompanied by a new label “E + C” – “Buildings with Positive Energy & Carbon Reduction” which will be put in place by 2018 with the aim of becoming the environmental standard for new homes.

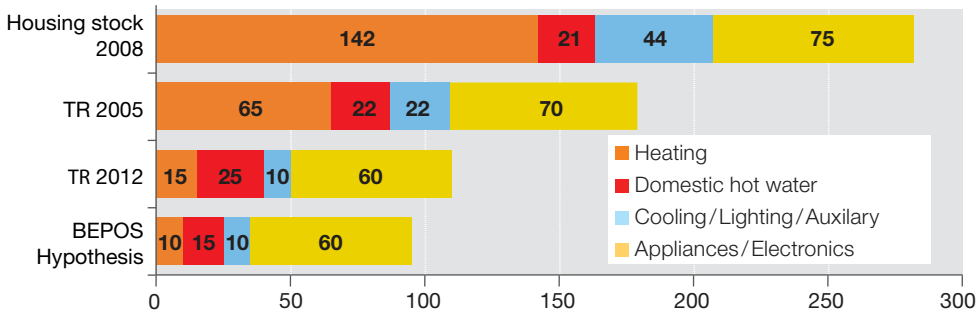
The Thermal Regulation 2012 already included three requirements, which can vary according to the type of building, use, geographical location and GHG emissions: the “Cepmax” coefficient (primary energy consumption not to be exceeded), the coefficient “Bbio (maximum limit for conventional bioclimatic requirements for heating, cooling and lighting) and “summer comfort” (active cooling system). These allow the energy consumption of new buildings to be divided by three. The building sector accounts for 25% of CO_2 emissions and 44% of energy consumption (compared to 31% for transport).

The new E + C – label aims to promote buildings with low consumption and low CO_2 emissions, capable of reinjecting energy into the networks. The Label is only issued by one of the 5 certification bodies that have concluded an agreement with the State (Céquami, Cerqual, Certivéa, Prestaterre and Promotelec Services).

The aim of the Positive Energy & Carbon Reduction experiment is to encourage the construction of buildings with better energy efficiency, reduce their dependence on carbon-based energies, generate energy and integrate a calculation of energy consumption and an indicator of performance throughout the life cycle.

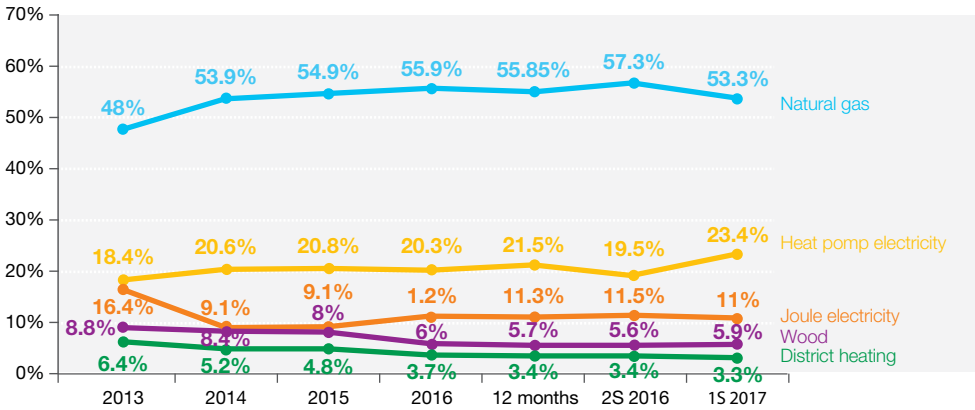
This new type of sustainable building must be generalized by 2018, the date of the launch of the new Thermal Regulation, and the requirements that it will have to meet will be grouped under the indicator BEPOS “Buildings with Positive Energy”. This indicator will be characterized by 4 performance levels from “Energy 1” to “Energy 4”, which corresponds to the level of equilibrium between non-renewable consumption and renewable energy production.

EVOLUTION OF HOUSEHOLD ENERGY NEEDS (kWhep/m²/year)



Source: Ceren, CTSB, ADEME

BREAKDOWN OF HEATING TYPE CHOSEN FOR NEW HOMES (ALL HOUSINGS, ALL AREAS,% NUMBER OF HOMES)

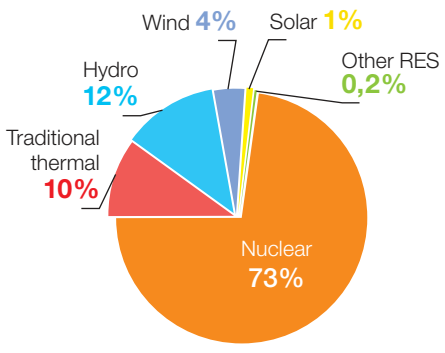


Source: Batim Etude – New Building Observatory (2017)

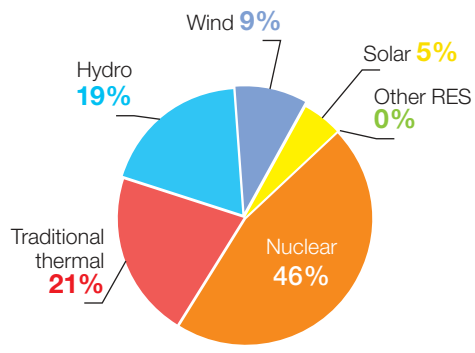
France: electricity production

Electricity generation & generating capacity	Gross electricity generation				Generating capacity			
	TWh		% total production	Change 2014/2015	MW		% Total capacities	Change 2015/2016
	2015	2016			2015	2016		
Nuclear	437	403	73%	-8%	63,130	63,130	46%	0%
traditional thermal	41	54	10%	32%	30,290	28,778	21%	-5%
o/w oil	2	2	0%	-13%	13,511	10,983	8%	-19%
o/w natural gas	20	35	6%	75%	10,528	11,339	8%	8%
o/w coal	12	10	2%	-15%	4,672	4,662	3%	0%
o/w biomass	7	8	1%	6%	1,579	1,794	1%	14%
Hydro	60	65	12%	8%	25,380	26,331	19%	4%
Wind	21	21	4%	-1%	10,358	12,065	9%	16%
Solar	7	8	2%	14%	6,579	7,138	5%	8%
Other RES	1	1	0.2%	1%	2	2	0%	0%
Total	**568**	**553**	**100%**	**-3%**	**135,979**	**137,684**	**100%**	**1%**

ELECTRICITY PRODUCTION IN FRANCE IN 2016 – TOTAL: 553 TWH



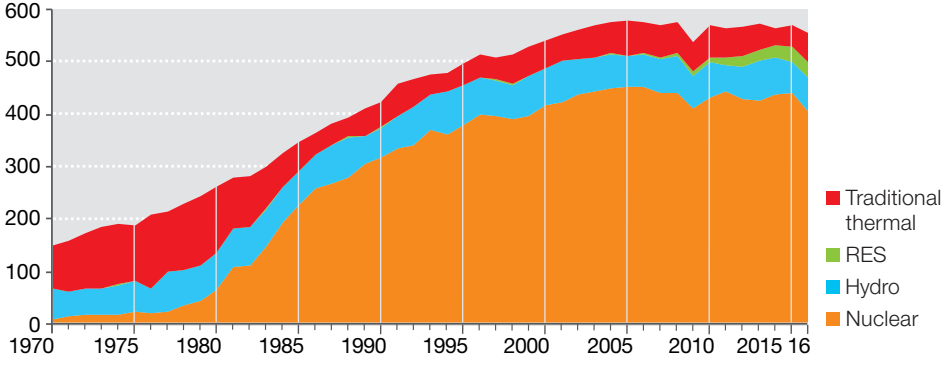
GENERATING CAPACITY IN FRANCE IN 2016 TOTAL: 137,684 MW



Electricity Production TWh	1970	1980	1990	2000	2005	2010	2011	2012	2013	2014	2015	2016
Nuclear	6	61	314	415	452	429	442	425	424	436	437	403
Traditional thermal	84	126	49	53	67	62	55	57	51	33	41	54
Hydro	57	70	57	71	56	68	50	64	76	69	60	65
Wind	0	0	0	0	1	10	12	15	16	17	21	21
Solar	0	0	0	0	0	1	2	4	5	6	7	8
Others	0	0	1	1	0	0	0	1	1	1	1	1
Total	**147**	**258**	**421**	**540**	**576**	**569**	**561**	**566**	**572**	**563**	**568**	**553**

Source: Enerdata, Global Energy & CO2 Data (2017)

GROSS ELECTRICITY PRODUCTION, 1970 -2016, TWH



Source: Enerdata, Global Energy & CO2 Data (2017)

France: electricity consumption and market share by sector

ELECTRICITY CONSUMPTION

TWh	2015	2016	Share in total consumption	Change 2015-2016
Total consumption	440	448	100%	2%
Energy sector consumption	17	18	4%	5%
Final consumption	423	429	96%	2%
Industry	111	112	25%	2%
Transport	13	13	3%	2%
Residential, services, agriculture	300	304	68%	2%
o/w residential	156	161	36%	3%
o/w services	135	135	30%	0%
o/w agriculture	9	9	2%	2%

FINAL ELECTRICITY CONSUMPTION AND ELECTRICITY MARKET SHARE

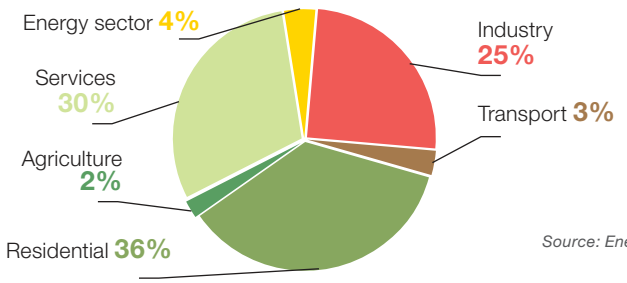
2015 – Mtoe	Electricity	Energy Total	PDM Electricity
Final consumption	37	152	24%
Industry	10	28	35%
Transport	1	45	2%
Residential, services, agriculture	26	67	39%
o/w residential	14	42	33%
o/w services	12	21	56%
o/w agriculture	1	4	17%
Non-energy		12	-

FINAL ELECTRICITY CONSUMPTION BETWEEN 1990 AND 2016

TWh	1990	2000	2005	2010	2011	2012	2013	2015	2016
Industry	115	135	140	117	118	114	111	111	112
Residential	97	129	138	162	140	158	168	156	161
Services	80	107	125	145	139	141	140	135	135
Agriculture	2	3	7	8	8	8	9	9	9
Transport	9	12	12	13	12	12	13	13	13
Total	**302**	**385**	**423**	**444**	**418**	**434**	**441**	**423**	**429**

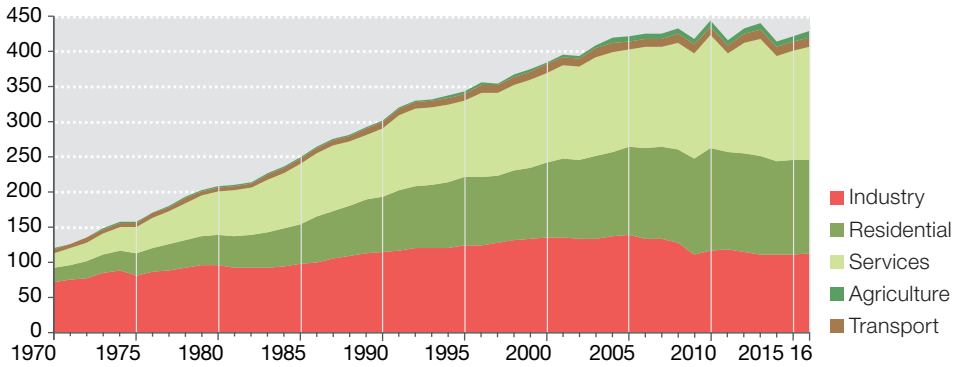
Source: Enerdata, Global Energy & CO2 Data (2017)

ENERGY CONSUMPTION IN FRANCE IN 2016 – TOTAL: 448 TWH



Source: Enerdata, Global Energy & CO2 Data (2017)

FINAL ELECTRICITY CONSUMPTION BY SECTOR, 1970 -2016, TWH



Source: Enerdata, Global Energy & CO2 Data (2017)

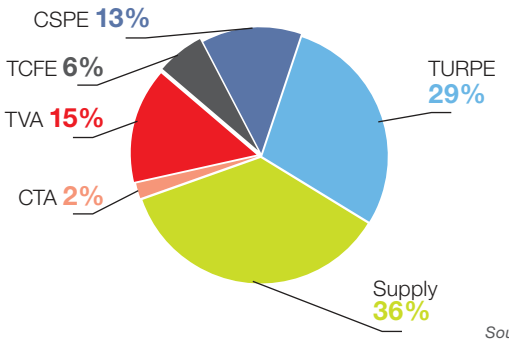
France: electricity consumption

In 2017, gross electricity consumption was nearly 482 TWh, or -0.3% compared to the previous year. This very slight decrease is explained by higher temperatures than last year (+0.6°C), as well as a calendar effect, the year 2016 being leap year. After reaching a low point in 2014, total electricity consumption in real terms rose by +1.9% in 2015, then by +1.8% in 2016 (448 TWh) due to lower temperatures than the year previous year 2014 exceptionally sweet.

In "average climate", electricity consumption has been almost stable for several years; better control over consumption and tertiarisation of the economy more than offset increases in GDP, home areas and electricity usage (replacing other energy sources or otherwise). Constant temperature consumption data show a slight 0.5% increase in the residential sector, against a 0.9 contraction in services. Over the long run, demand from these two sectors depends on heated area, the share of electricity in the heating mix and buildings' thermal efficiency. Demand from industry has been diminishing for several years as a result of improved energy efficiency within processes and the sector's declining weight in the French economy. Power demand from the agriculture and transport sectors has been fairly stable since 2012.

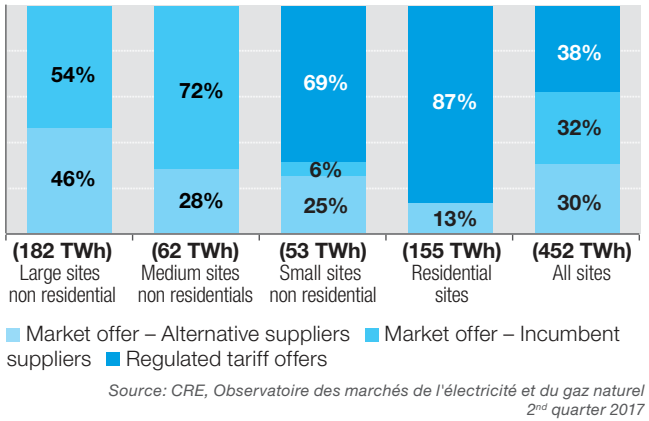
France: electricity regulated tariffs

DETAILED BREAKDOWN OF AN ELECTRICITY BILL, ALL TAXES INCLUDE, WITH REGULATED TARIFF "BLEU RESIDENTIEL" – AS OF 31 ARCH 2017 (2,500 to 5,000 KWh consumption)



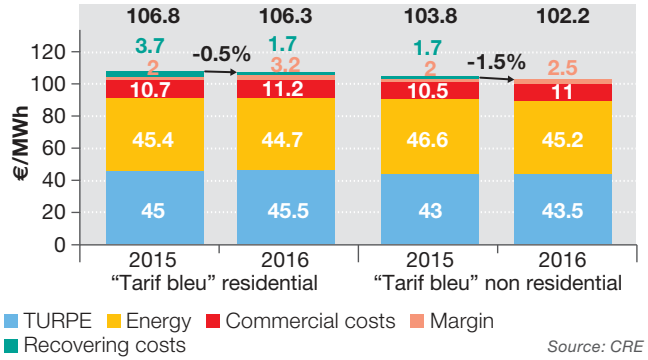
Source: CRE

BREAKDOWN OD ANNUALISED CONSUMPTION BY CONTRACT TYPE AS OF MARCH 31, 2017



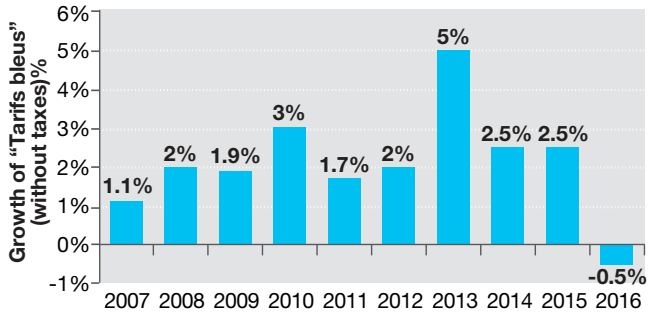
Source: CRE, Observatoire des marchés de l'électricité et du gaz naturel 2nd quarter 2017

AVERAGE EVOLUTION OF REGLEMENTED RETAIL TARIFFS (IN €/MWH) BASED ON THE 2015 CLIENTS DATABASE



Source: CRE

CHANGE IN REGULATED "TARIF BLEU" TO INDIVIDUALS (%) FROM 2007 TO 2016



Source: CRE, Observatoire des marchés de l'électricité et du gaz naturel 2nd quarter 2017

Since the liberalisation of the electricity market, two types of contracts co-exist: market offers, freely proposed and priced by all suppliers, and regulated tariff offers, proposed by the incumbents (EDF and local suppliers) and subject to prices set by the government.

Since 1 July 2016, sites from 36 kVA are not entitled to regulated tariffs anymore. Only residential sites (Tarif Bleu) remains so. The NOME Act (« Nouvelle Organisation du Marché de l'électricité ») governing this liberalisation does not provide for the end of regulated tariffs for small consumers.

The decree of 28 October 2014 defined new pricing terms as follows: regulated electricity tariffs must cover the costs of regulated access to incumbent nuclear electricity, the supply supplement (including the capacity guarantee), procurement and marketing, plus the regular remuneration from supplying electricity.

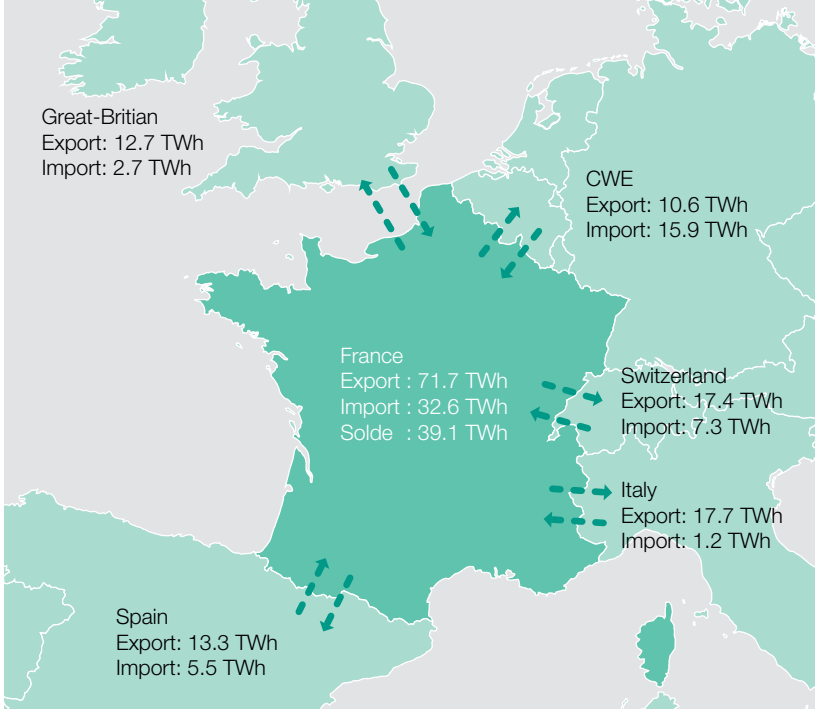
France: infrastructure and exchanges

2016 key figures:

- 477 TWh d'electricity injectés sur le réseau
- 96% of the new 90 kV and 63 kV lines in service since 2014-2016 are underground
- 105,660 km of power lines
- 2,718 substations
- 50 cross-border connections
- 938 km of new or replaced lines

RTE invests on average €1.5 bn per year (€1,519bn in 2016) to prepare the French energy mix change. The closure of coal-fired plants, the decommissioning plan and the development of solar and wind power have lead to a reconfiguration of electricity flows and greater production variability. Enhanced interconnections between European countries should therefore allow cheaper electricity thanks to complementary production mixes. RTE also looks to improve transits fluidity between regions in order to secure electricity supply in each of the French region.

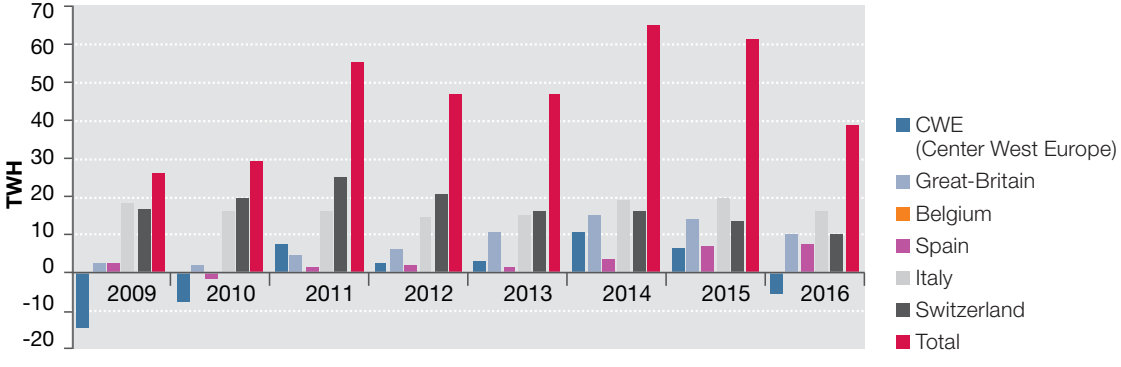
CONTRACTUAL EXCHANGES IN 2016



TWh	France	Great-Britain	Spain	Italy	Switzerland	CWE
Export	71.7	12.7	13.3	17.7	17.4	10.6
Import	32.6	2.7	5.5	1.2	7.3	15.9
Balance	**39.1**	**10.0**	**7.8**	**16.5**	**10.1**	**-5.3**

Source: RTE bilan électrique 2016

EXPORT-IMPORT BALANCE OF FRENCH ELECTRICITY INTERCONNEXIONS 2009-2016 (TWH)



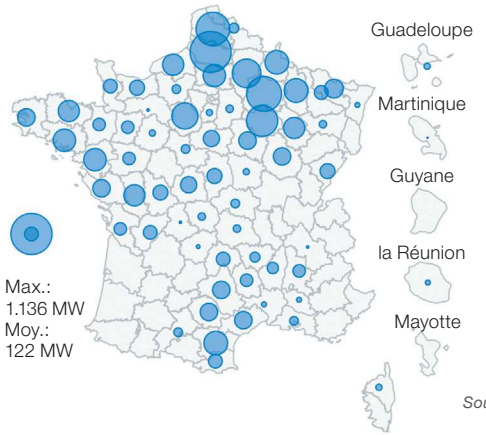
France: renewable energies

PRIMARY RENEWABLE ENERGY PRODUCTION BY SECTOR

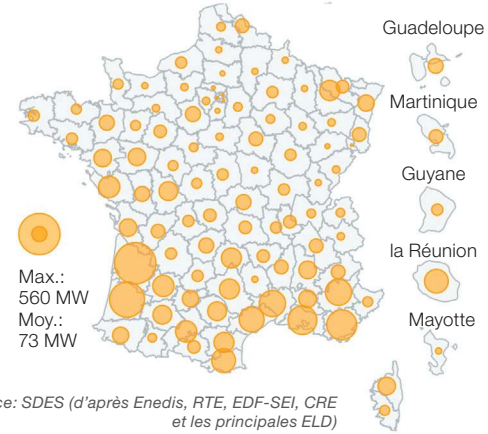
RES objectives monitoring by sector	Actual		Pathway	Traget	Target reached
	2005	2016p	2016	2020	in %
Total electricity (A)	6,125	8,491	10,008	12,729	85%
Normalized renewable hydro	5,686	5,171	5,523	5,541	94%
Normalized wind	96	1,936	3,051	4,979	63%
o/w onshore	96	1,936	2,191	3,431	88%
o/w offshore	0	0	860	1,548	0%
Solar PV & CSP	2	744	313	592	238%
o/w PV	2	744	272	509	274%
o/w CSP	0	0	42	84	0%
Marine energies	41	43	74	99	58%
Geothermal electricity	9	8	30	41	27%
Solid biomass and renewable urban waste	250	420	807	1,158	52%
Biogas	41	169	210	318	80%
Total heating and cooling (B)	8,663	12,471	15,980	19,732	78%
Solar thermal	49	164	555	927	30%
Geothermal heat	106	125	350	500	36%
Heat pomps	203	2,178	1,575	1,850	138%
o/w geothermal	77	279	455	570	61%
Solid biomass and renewable urban waste	8,256	9,828	13,180	15,900	75%
o/w household wood consumption	6,627	6,902	7,175	7,400	96%
Biogas	49	177	320	555	55%
Total fuel (C)	591	3,115	3,100	3,660	100%
Bioethanol	103	474	550	650	86%
Biodiesel	488	2641	2,500	2,850	106%
Others (biogas, vegetable oil)	-	-	50	160	-
Gross final RES consumption accounting for the overall objective (A) + (B) + (C)	15,379	24,077	29,088	36,121	83%
Gross final consumption in the transportation sector (C) +(D) + (E)	896	3872	3,387	4062	114%
Renewable fuel (C)	591	3115	3,100	3,660	100%
Renewable electricity for transportation (D)	122	241	287	402	84%
o/w railroad	122	237	246	292	96%
o/w road	-	4	41	110	10%
Bonifications (E)	183	516	-	-	-

Source: Ministère de la Transition Ecologique et Solidaire, 2017

WIND

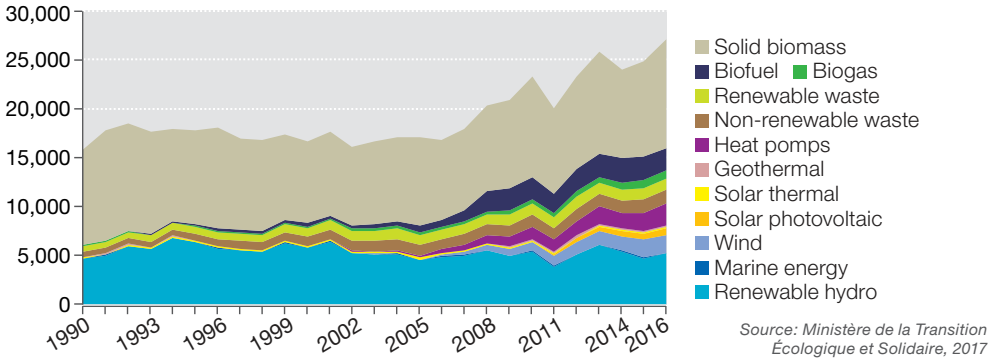


SOLAR PHOTOVOLTAIC



Source: SDES (d'après Enedis, RTE, EDF-SEI, CRE et les principales ELD)

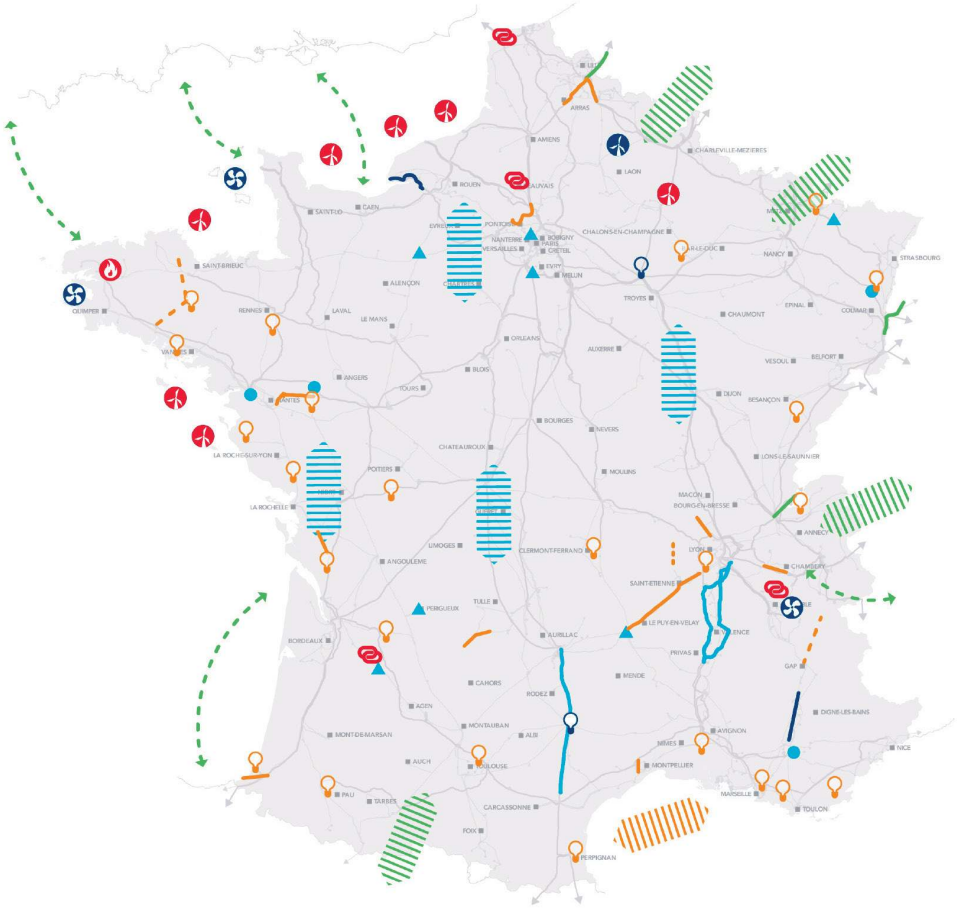
RENEWABLE ENERGY PRODUCTION 1990-2016, KTOE



Source: Ministère de la Transition Écologique et Solidaire, 2017

France: renewable energies

INFRASTRUCTURES: KEY INVESTMENT FOR THE ENERGY TRANSITION



Type of construction works:

- Reinforcement of existing power line
- New power line
- Reinforcement under review (need, nature and localisation tbd)
- Reinforcement of existing stations

Particular stations:

- Combinedgas cycle
- Wind, photovoltaic
- Hydro, tidal energy
- Client station

Main aim of the projects:

- Interconnexions
- Customer connexion
- Safety og electricity supply
- Grid entry point

Aim: grid safety

- Low voltage management
- High voltage management
- Control of short circuit current
- Grid stability

Source: RTE bilan électrique 2016

France: biomethane as part of the energy transition

France has considerable biogas potential and the new Energy Transition Act for green growth encourages the upgrading of biogas into biomethane for injection in the natural gas grid.

Over 500 sites produce biogas in France and over 300 of them use it in cogeneration to produce electricity and heat, notably in the agricultural sector. The regulatory framework setting purchase tariffs for electricity generated from biogas dates back to 2006, so the use of biogas in cogeneration is relatively recent.

Since 2011, the practice of injecting biomethane into the natural gas grid has created a new opportunity for biogas and is a first step towards greener gas supply. The biogas has to be purified to obtain what is then called biomethane* which is of similar quality to that of natural gas before injecting it in the natural gas networks. **End October 2017, 43 biomethane production sites were connected to the distribution and transport grid,** supplying the equivalent of about 52,417 homes** or 2,457 buses using bioNGV.

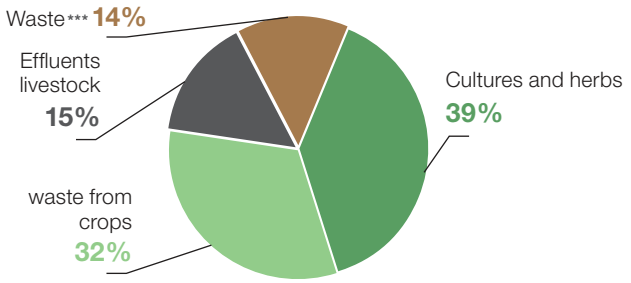
A traceability system allows customers to use green gas for heating, cooking, hot water or fuel. The use of biomethane as a fuel (bioGNV) is considered the most virtuous by ADEME (the French environmental agency), as it substitutes for oil and therefore offers the greatest for cutting GHG emissions.

ADEME is promoting this sector and is planning a 39 TWh injection into transport and gas supply networks from 1,800 sites by 2035. **Renewable gas could represent up to 30% of gas consumption in France by 2030.** For the time being, the Energy Transition Act provides for an objective of a 10% share of renewable gas in final natural gas consumption by 2030 and the multiannual energy plan (PPE) includes intermediary production objectives of 1.7 TWh by 2018 and 8 TWh by 2023.

Together biométhane and new renewable gas alternatives (power-to-gas, hydrogen, biomass gasification, micro-algae) **could cover 100% of French gas needs by 2050.** Results of the Ademe-GRDF-GRTgaz study to be published in 2018 will outline the sources and costs associated with this 100% objective of renewable gas.

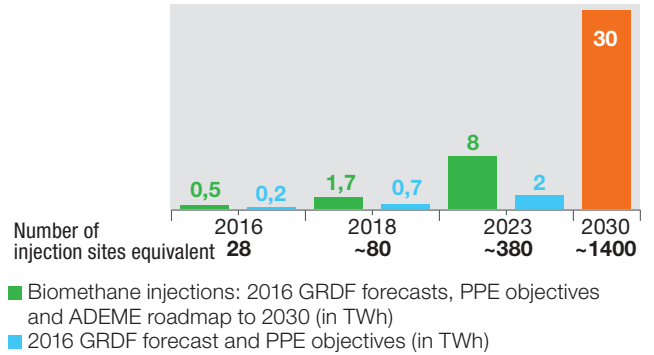
*** See glossary in appendix for biogas and biomethane definitions**
**** Assumptions: average consumption of a natural gas client = 12 MWh/year**
average consumption of a bus = 256 MWh/year
8,200 hours in operation in a full year

ADEME ESTIMATES OF FRENCH METHANISATION POTENTIAL: 76 TWH FROM 2035



***Household waste, vegetable waste and sludge from wastewater treatment plants
Source: " Actualisation du scénario énergie-climat ADEME 2035-50 ", ADEME, Octobre 2017

FRENCH MULTIANNUAL PLAN FOR ENERGY (PPE) SETS AMBITIOUS OBJECTIVE FOR THE DEVELOPMENT OF BIOMETHANE AND BIOGNV TO 2018 AND 2023



Source: Ministère de la Transition écologique et solidaire – PPE

France: natural gas consumption and market share by sector

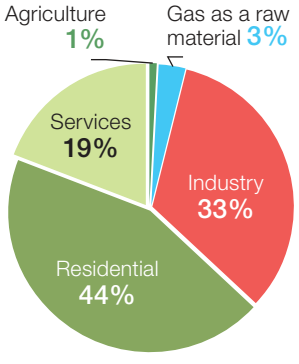
Natural gas resources and use Mtoe	1980	1990	2000	2005	2010	2015	2016	Change 2015-2016	AAGR 2000-2016
Total primary energy consumption	21,6	26,0	35,8	41,0	42,5	35,0	38,3	9%	0%
Energy sector consumption	2,4	0,9	4,1	7,3	10,1	6,3	9,6	52%	5%
Thermal energy production	1,3	0,4	3,0	5,5	7,5	4,4	7,2	66%	5%
Internal energy sector use	0,4	0,3	0,3	0,2	0,8	n.d.	n.d.	-	-
Losses and adjustments	0,1	0,0	0,3	0,7	0,4	0,4	0,4	9%	2%
Final energy consumption	**19,2**	**23,9**	**32,9**	**34,4**	**34,1**	**30,0**	**30,4**	**1%**	**0%**
Industry	7,2	9,2	12,3	9,7	9,1	10,0	10,1	1%	-1%
Residential	8,1	10,0	13,4	16,1	16,8	13,2	13,4	1%	0%
Services	1,6	2,6	4,5	6,5	6,6	5,6	5,7	1%	1%
Agriculture	0,17	0,2	0,3	0,3	0,2	0,2	0,2	1%	-3%
Transport	0,01	0,0002	0,002	0,05	0,05	0,1	0,1	1%	26%
Final non-energy consumption	2,2	1,9	2,3	1,8	1,3	0,9	0,9	1%	-5%

Source: Enerdata, Global Energy & CO2 Data (2017)

Gas consumption by sector Mtoe	2000			2016		
	Gas	Energies total	Market share gas	Gas	Energies total	Market share gas
Primary consumption	36	255	14%	38	243	16%
Final consumption	33	167	20%	30	152	20%
o/w industry	12	37	34%	10	28	37%
o/w residentiel	13	42	32%	13	42	31%
o/w services	5	18	11%	6	21	31%
o/w agriculture	0	4	7%	0	4	4%
o/w transports	0	46	0,0%	0	45	0,2%
o/w non-energy consumption	2	17	14%	1	12	7%

Source: Enerdata, Global Energy & CO2 Data (2017)

FINAL GAS CONSUMPTION BY SECTORS IN FRANCE IN 2016



Source: Enerdata, Global Energy & CO2 Data (2017)

Primary gas consumption rose 9% in 2016 on an unadjusted basis. This substantial increase is due to the extensive use of combined cycle gas turbine (CCGT) plants and, to a lesser extent, lower temperatures than in 2015 (although still 0.5°C higher than normal). **Natural gas demand for CCGT nearly doubled in 2016** (up 66%), as a consequence of exceptionally low nuclear power output and more competitive gas prices. **In temperature-adjusted terms,** the increase in natural gas consumption was a more moderate 3.4%.

In 2017, the demand for gas stabilizes at +0.4% in real terms, again, CCGT operations played a significant role in this gain as nuclear and hydro output was low. Demand from the residential and service sectors shrunk because of milder weather than in 2016. **Thus, at average climate, gas consumption increased by +4% in 2017.**

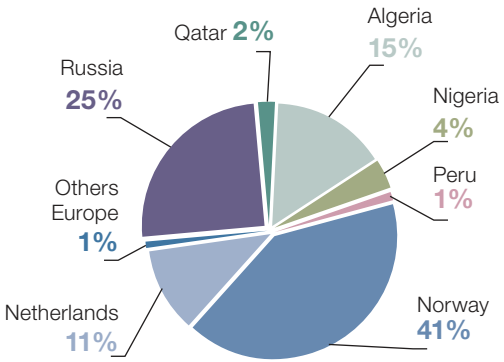
Since 2000, final gas consumption has been on a downward trend in the order of -0.5% per year on average (in 2016 final demand rose by +1% with a real climate, but fell by -1.2% average climate.

The use of natural gas in transport increased 2.9% in 2016, to nearly 1 TWh, extending an uptrend initiated in the early 2000s. Vehicles in captive fleets are the main users, notably buses, refuse collectors and commercial vehicles.

Finally, domestic production of natural gas has virtually disappeared but **the supply of biomethane into transport and distribution networks is rising sharply** (215 GWh in 2016 against 82 GWh in 2015, a 162% rise).

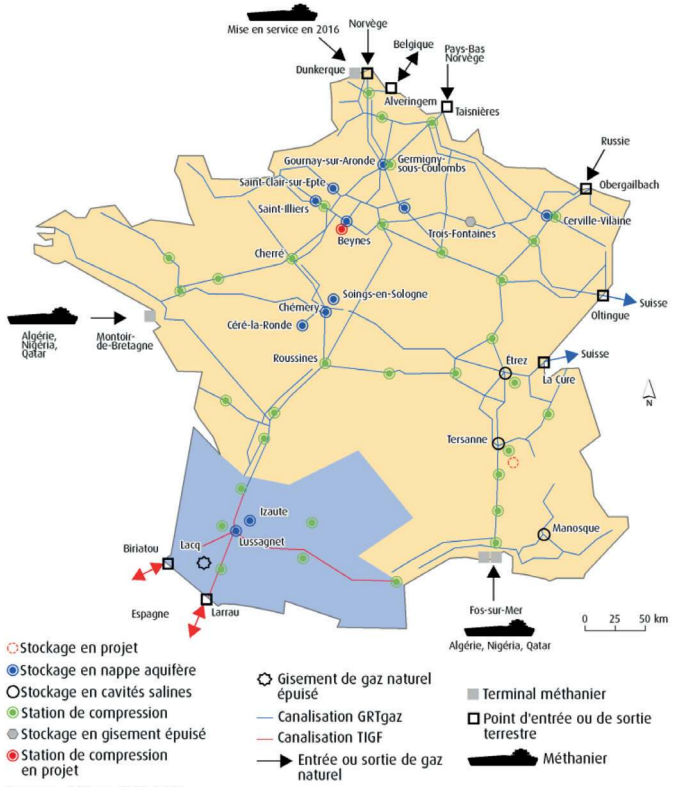
France: natural gas supply and infrastructures

FRENCH NATURAL GAS SUPPLY BY ORIGIN IN 2016



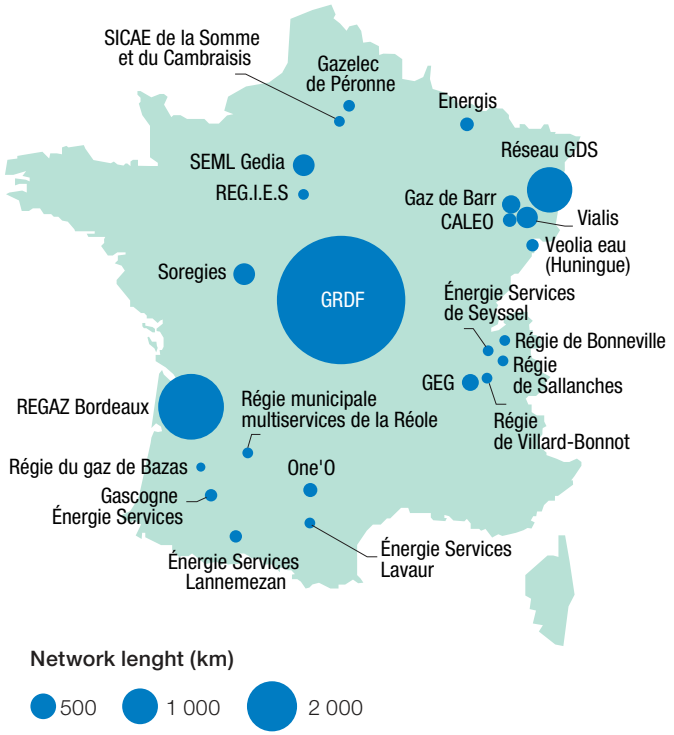
Source: BP statistical Review (2017)

MAJOR GAS INFRASTRUCTURES



Source: GRT gas, TIGF, DGEC

DISTRIBUTION NETWORKS FOR NATURAL GAS



Source: SPEGNN, gtg2007 (2016)

France: natural gas regulated tariffs

Pricing rules for natural gas supply are laid down in a decree dated 16th May 2013. These so-called regulated tariffs cover all costs borne by ENGIE (ex GDF SUEZ):

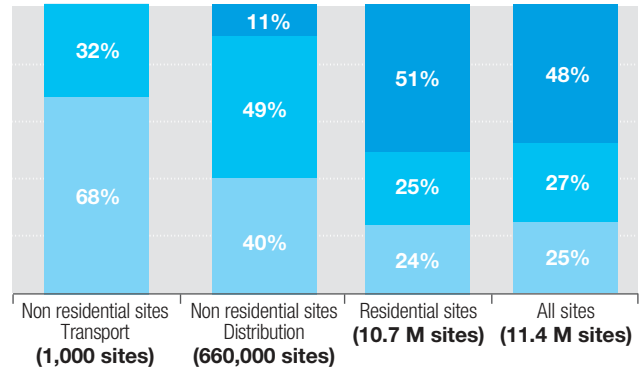
- Procurement costs
- Non-procurement costs:
  - > Infrastructure (transport, distribution, storage)
  - > Marketing

The historical pricing terms that have prevailed since December 2010 have changed with the introduction of indexation on the natural gas market. Since July 2016, this indexation has been 77.6%.
This gradual introduction of market indexation has limited the impact of oil prices on natural gas supply prices. Before this amendment, imported natural gas supply prices were entirely indexed on oil prices. Since July 2016, only the Brent oil index remains in the pricing formula.

On 1st July 2016 the authorities set a new pricing formula and a new methodology for non-procurement cost changes. Procurement costs are calculated every month on the basis of a formula reflecting the costs of imported natural gas within ENGIE's portfolio of long term supply contracts. The CRE (Energy Research Council) checks that the formula is applied properly.

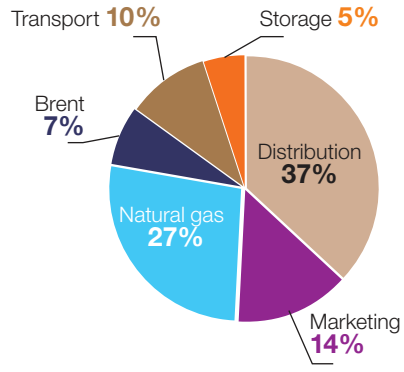
Prices remained stable over 2017. The major change in tax included prices stems from the rise in the TICGN (domestic tax on natural gas consumption), from €4.34 /MWh to €5.88 €/MWh on 1st January 2017.

BREAKDOWN OF ANNUALISED CONSUMPTION BY SITE TYPE AS OF MARCH 31, 2017



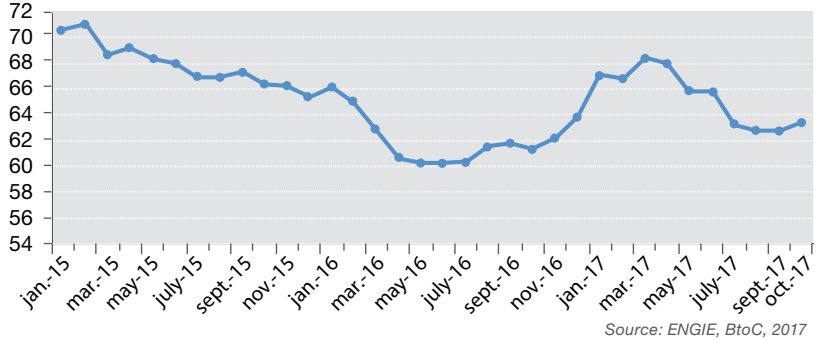
Source: CRE, Observatoire des marchés de l'electricity et du Natural gas 2nd quarter 2017

BREAKDOWN OF NATURAL GAS SUPPLY COSTS FOR CUSTOMER ON PUBLIC NETWORK (WITHOUT TAX)



Source: ENGIE, BU BtoC, 2017

REGULATED TARIFF OF NATURAL GAS FOR RESIDENTIALS IN €/MWH TTC (TARIFF B1)



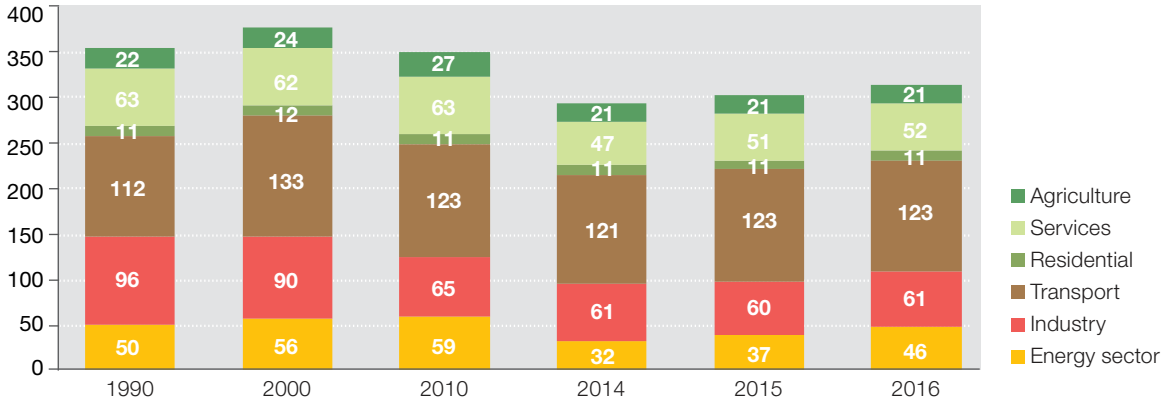
Source: ENGIE, BtoC, 2017

France: CO_2 emissions

Emissions related to fossil fuel combustion $MtCO_2$	1990	2000	2005	2010	2015	2016	Change 2015-2016	Change 1990-2016
Energy sector	50	56	55	59	37	46	24%	-7%
Industry	96	90	85	65	60	61	1%	-37%
Transport	112	133	131	123	123	123	0%	9%
Residential, services, agriculture	96	99	108	102	83	83	1%	-13%
o/w residential	11	12	12	11	11	11	0%	-3%
o/w services	63	62	68	63	51	52	1%	-18%
o/w agriculture	22	24	28	27	21	21	1%	-4%
TOTAL	351	376	348	326	303	313	3%	-11%

Source: Enerdata, Global Energy & CO2 Data (2017)

CO2 FOSSIL-FUEL COMBUSTION RELATED EMISSIONS IN FRANCE, BY SECTOR ($MTCO_2$)



Source: Enerdata, Global Energy & CO2 Data (2017)

CO_2 emissions related to the combustion of energy in France increased in 2016 (+3.4%) and in 2017, a deterioration compared to 2015 (+1%). The main reason is a higher demand for gas power plants (+75%) after shutdowns of nuclear units for review, **pushing emissions from the electricity sector by +24% in 2016 and +20% in 2017.** French CO_2 emissions have declined 11% from their 1990 level.

The largest emitter remains the transport sector, with 39% of total emissions, well ahead of the residential and services sector (20%), industry (19%), the energy sector –refineries and power production (15%) and agriculture (7%).

Emissions from the transport sector declined gradually from 2000 onwards, but this trend stopped in 2016 (up 0.2% that year) in a context of lower fuel prices. It is the only sector posting higher CO_2 emissions compared to 1990 (up 9%).

The residential and services sector shows a slight increase in CO_2 emissions (up 0.6%), as a result of cooler temperatures than in 2015. Temperature-adjusted data continue to trend lower, however (-13% since 1990).

Also breaking a downtrend, CO_2 emissions of the industrial sector grew 1% in 2016 as a result of the economic recovery (-37% since 1990).

France: CO_2 emissions 2000-2030 by sector

$MtCO_2$	2000	Share of total emissions	2010	Share of total emissions	2020	Share of total emissions	2030	Share of total emissions	Change 2010-2020	Change 2010-2030
Total Co_2 emissions (incl. Industrial processes)	397	100%	369	100%	302	100%	275	100%	-18%	-26%
Total fuel combustion	374	94%	350	95%	285	94%	260	95%	-19%	-26%
Heat and electricity generation	41	10%	48	13%	29	9%	24	9%	-40%	-49%
Industry (incl. self-produced)	98	25%	74	20%	76	25%	84	31%	2%	14%
Residential, services, agriculture	101	25%	104	28%	77	25%	66	24%	-26%	-36%
Transport	133	34%	128	35%	108	36%	87	32%	-16%	-32%
Coal	52	13%	40	11%	36	12%	33	12%	-9%	-19%
Heat and electricity generation	30	8%	23	6%	18	6%	8	3%	-23%	-66%
Manufacturing	17	4%	14	4%	16	5%	22	8%	16%	59%
Residential, services, agriculture	2	0,6%	2	0,4%	0	0,1%	0	0%	-86%	-92%
Transport	0	0%	0	0,0%	0	0%	0	0%		
Natural gas	84	21%	99	27%	80	26%	83	30%	-19%	-16%
Heat and electricity generation	7	2%	18	5%	7	2%	12	4%	-58%	-33%
Manufacturing	32	8%	23	6%	26	9%	30	11%	12%	27%
Residential, services, agriculture	43	11%	55	15%	42	14%	38	14%	-23%	-32%
Transport	0	0%	0	0%	0	0%	0	0%		
Oil	238	60%	211	57%	169	56%	144	53%	-20%	-32%
Heat and electricity generation	4	1%	7	2%	4	1%	5	2%	-48%	-32%
Manufacturing	25	6%	17	5%	16	5%	18	6%	-9%	2%
Residential, services, agriculture	56	14%	47	13%	34	11%	28	10%	-27%	-40%
Transport	133	34%	128	35%	108	36%	87	32%	-16%	-32%

Source: Enerdata Global Energy & CO2 Database, POLES Global energy forecasting model (2017)

France: 2016 combustion CO_2 and 2015 GHG profiles

BILAN CO_2 (COMBUSTION) – FRANCE – 2016

$MtCO_2$	2015	2016	Evolution 2015-2016
Reference approach	298.7	305.5	2%
Coal	28.5	28.2	-1%
Oil	181.8	181.4	0%
Natural gas	82.4	90.1	9%
Sectoral approach	302.6	312.7	3%
Energy Industrys, o/w	37.4	46.3	24%
Electricity generation	19.3	22.1	15%
Refineries	9.3	12.2	31%
Manufacturing and construction, o/w	59.9	60.5	1%
Self-generation	10.6	12.1	14%
Other sectors, o/w	82.6	83.1	1%
Residential	51.2	51.6	1%
Services	20.6	20.8	1%
Agriculture	10.7	10.6	0%
Transport, o/w	122.7	122.9	0%
Road	116.3	116.6	0%
Rail	0.5	0.5	0%
Domestic civil aviation	4.5	4.4	-2%
Fluvial	1.4	1.4	1%
International bunkers, o/w	22.0	21.1	-4%
Maritimes	5.2	4.7	-11%
Aviation	16.7	16.5	-2%

Source: Enerdata. Global Energy & CO2 Data (2017)

GES EMISSIONS IN FRANCE REPORTED TO THE UNITED NATIONS FRAMEWORK CONVENTION ON CLIMATE CHANGE

Emissions $ktCO_{2eq}$	2015						
	CO_2	CH_4	N_2O	HFC	PFC	SF_6	NF_3
Energy	315,701	117	13	-	-	-	-
Industrial processes	23,226	2	4	19,324	540	522	11
Agriculture	2,006	1,646	119	-	-	-	-
LULUCF	-39,087	44	7	-	-	-	-
Waste disposal	1,526	609	3	-	-	-	-
Total excluding LULUCF*	342,459	2,374	139	19,324	540	522	11
TOTAL	**303,372**	**2,418**	**146**	**19,324**	**540**	**522**	**11**

***LULUCF: Land use, land use change and forestry.**

Source: Greenhouse gas inventory data – United Nations Framework Convention on Climate Change

Appendix 1: energy scenarios and sources

World scenarios' positioning

	Business as usual	Central	Environmental
IEA (WEO 2017) Horizon 2040	**Current Policies:** This scenario takes into account only those energy policies in effect by mid-2016. As it assumes that commitments will not be translated into action, it allows us to estimate the consequences of inaction. The results of COP21 commitments are therefore very minimal.	**New Policies:** This IEA central scenario takes into account energy policies in effect and commitments made by mid-2016, depending on their credibility. National commitments (INDCs) submitted for COP21 are also included, but with varying degrees of implementation depending on the countries.	**Sustainable Development Scenario:** This scenario replaces the 450 scenario. It is a "dream scenario" consistent with the realisation of the Paris agreement's objectives. It also includes the realisation of the UN's Sustainable Growth Objectives in relation to energy. This scenario is intended as a tool to compare progress with what still has to be done.
Carbon prices ($\$_{2014}$/tonne)	European Union: $20 in 2020, $30 in 2030, $40 in 2040	European Union: $22 in 2020, $37 in 2030, $50 in 2040 Chine: 6$ en 2020, 12$ en 2030, 20$ en 2040	n/a
Macroeconomic assumptions	Economic growth: an average +3.4% per year in 2014-2040 (OECD: +1.9%; non OECD: +4.4%) World population: from 7.3 billion in 2014 to 9.2 billion people in 2040		
Global Energy Forcasting 2017 Horizon 2040	**Ener-Brown:** This scenario assumes increased fossil fuel consumption in the wake of the shale oil and gas revolution and geopolitical changes impacting some countries' energy independence.	**Ener-Blue:** This scenario takes into account current trends and policies but also assumes that commitments regarding energy will translate into action. Energy demand and prices rise, as well as GHG emissions.	**Ener-Green:** This scenario assumes strict application of climate policies (greater energy efficiency, priority to RES, etc.). A worldwide agreement is reached to reduce GHG emissions by half across the globe by 2050.
Rise in temperature	From +5° to +6°C	From +3° to +4°C	From +1,5° to +2°C
Environmental objectives (INDC)	Not met	Met in 2030	Regularly enhanced
CO_2 emissions	Sharp increase	Modest increase	Decrease
Macroeconomic assumptions	Economic growth: an average 3.6% per year in 2017-2040 World population: from 8.5 billion in 2030 to 9.1 billion in 2040		

Sources

ECONOMY & ENERGY CONTEXT
Enerdata
IEA – WEO 2017

CO_2 & CLIMAT
Enerdata
UNFCCC
ADEME

ELECTRICITY
Enerdata
IEA – WEO 2017
BNEF
UNEP
BP statistical review 2016
REN21: Renewables 2017
GIEC
World Energy Council
Greenpeace (R)evolution scenario
ENGIE Global Market

NATURAL GAS
Enerdata
IEA – WEO 2017
Cedigas
BP statistical review 2017
IHS
GRT gas
ENGIE Global Markets

OIL
Enerdata
IEA – WEO 2017
BP statistical review 2017
Ministère de l'économie et des finances
ENGIE Global Markets

COAL
Enerdata
IHS

FRANCE
Enerdata
UNFCCC
BP statistical review 2017
Ministère de la transition écologique et solidaire
ADEME
RTE
CRE
GRT Gas

Enerdata methodology

Primary energy data comes from the International Energy Agency (IEA). It is completed with data from regional organizations (EUROSTAT, OLADE, ADB, OPEC) or specialized institutions (Cedigaz), as well as by data from national sources (national statistics or data specially prepared by local correspondents with more than 100 partners in around 60 countries). This complementary data is used for the assessment and correction of primary data, and for the quick update of our own data.

The methodology and definitions used by Enerdata are the same as that of IEA and Eurostat.

Energy statistics in physical units are converted into energy units (ktoe or Mtoe) on the basis of the following coefficients:

- Crude oil: fixed coefficient for most countries: 1.02 toe/ton
- Oil products: fixed coefficient for all countries - same as EUROSTAT or IEA
- Natural gas: national coefficients for key countries and fixed coefficients for the other countries (0.82 toe/1000 m^3); the national coefficients are indicated in the database
- Coal, Lignite: fixed coefficient for coke; national coefficient for production, imports and exports for key producers or importers; the national coefficients are indicated in the database.
- Electricity:
  - nuclear: 1 TWh = 0.26 Mtoe
  - hydroelectricity: 1 TWh = 0.086 Mtoe
  - geothermal: 1 TWh = 0.86 Mtoe
  - total production: 1 TWh = 0.086 Mtoe
  - imports, exports: 1 TWh = 0.086 Mtoe
  - consumption: 1 TWh = 0.086 Mtoe

Geographic scope of the sources

Enerdata	
Europe region	
Europe	European Union (28), Albania, Bosnia-Herzegovina, Croatia, Iceland, Macedonia, Norway, Serbia and Montenegro, Switzerland, Turkey.
UE-28	European Union (25), Bulgaria, Romania, Croatia.
America region	
America	North America, Mexico, Central America, South America, Caribbeanv
Latin America	Central America, Mexico, South America, Caribbean.
North America	Canada, USA.
Central America and Mexico	Belize, Costa Rica, El Salvador, Guatemala, Honduras, Nicaragua, Panama.
South America	Argentina, Bolivia, Brazil, Chile, Colombia, Ecuador, Guyana, Paraguay, Peru, Suriname, Uruguay, Venezuela.
Caribbean	Bahamas, Barbados, Bermuda, Cuba, Dominica, Dominican Republic, Grenada, Haiti, Jamaica, Netherlands Antilles and Aruba, Saint Vincent and the Grenadines, Saint Lucia, Trinidad and Tobago.
Asia region	
Asia	ASEAN, Afghanistan, China, Hong Kong, Japan, Macao, Mongolia, North Korea, South Asia (Bangladesh, Bhutan, India, Maldives, Nepal, Pakistan, Sri Lanka), Soth Korea, Taiwan.
ASEAN	Association of Southeast Asian Nations (Brunei, Cambodia, Indonesia, Laos, Malaysia, Myanmar, Philippines, Singapore, Thailand, Vietnam).
Pacific region	
Pacific	Australia, Pacific Islands, New Zealand.

Enerdata	
Africa region	
Africa	North Africa, Sub-Saharan Africa.
North Africa	Algeria, Egype, Libya, Morocco, Tunisia.
Sub-Saharan Africa	Angola, Benin, Botswana, Burkina Faso, Burundi, Cameroon, Cape Verde, Central African Republic, Chad, Comoros, Congo, DR Congo, Ivory Coast, Djibouti, Eritrea, Ethiopia, Gabon, Gambia, Ghana, Guinea, Equatorial Guinea, Guinea-Bissau, Kenya, Lesotho, Liberia, Madagascar, Malawi, Mali, Mauritania, Mauritius, Mozambique, Namibia, Niger, Nigeria, Rwanda, Sao Tome and Principe, Senegal, Seychelles, Sierra Leone, Somalia, South Africa, Sudan, Swaziland, Tanzania, Togo, Uganda, Zambia, Zimbabwe.
Middle East region	
GCC	Gulf Cooperation Council (Bahrain, Kuwait, Oman, Qatar, Saudi Arabia, United Arab Emirates).
OPEC Middle East	Iran, Iraq, Kuwait, Qatar, Saudi Arabia, UAE.
OAPEC	Organization of Arab Petroleum Exporting Countries (Algeria, Bahrain, Egypt, Iraq, Kuwait, Libya, Qatar, Saudi Arabia, Syria, Tunisia, UAE).
CIS region	
CIS	Commonwealth of Indiapendent States (former USSR, excluding Baltic countries).
Soviet Union (former)	Armenia, Azerbaijan, Belarus, Estonia, Georgia, Kazakhstan, Kyrgyzstan, Latvia, Lithuania, Moldova, Russia, Tajikistan, Turkmenistan, Ukraine, Uzbekistan.

Source: Enerdata

Geographic scope of the sources

International Energy Agency	
Europe region	
European Union	UE 28
Eastern Europe/Eurasia	Albania, Armenia, Azerbaijan, Belarus, Bosnia and Herzegovina, Bulgaria, Croatia, Estonia, Georgia, Kazakhstan, Kyrgyzstan, Latvia, Lithuania, the former Yugoslav, Republic of Macedonia, the Republic of Moldova, Romania, Russian Federation, Serbia (incl Montenegro until 2004 and Kosovo until 1999, Slovenia, Tajikistan, Turkmenistan, Ukraine, and Uzbekistan. For statistical reasons, this region also includes Cyprus, Gibraltar and Malta.
OECD Europe	Austria, Belgium, the Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Israel, Italy, Luxembourg, the Netherlands, Norway, Poland, Portugal, the Slovak Republic, Slovenia, Spain, Sweden, Switzerland, Turkey and the United Kingdom.
America region	
OECD North America	Canada, Mexico and the United States.
OECD Latin America	Chile.
Latin America	Antigua and Barbuda, Aruba, Argentina, Bahamas, Barbados, Belize, Bermuda, Bolivia, Brazil, the British Virgin Islands, the Cayman Islands, Chile, Colombia, Costa Rica, Cuba, Dominica, the Dominican Republic, Ecuador, El Salvador, the Falkland Islands, French Guyana, Grenada, Guadeloupe, Guatemala, Guyana, Haiti, Honduras, Jamaica, Martinique, Montserrat, Netherlands Antilles, Nicaragua, Panama, Paraguay, Peru, St. Kitts and Nevis, Saint Lucia, Saint Pierre et Miquelon, St. Vincent and the Grenadines, Suriname, Trinidad and Tobago, the Turks and Caicos Islands, Uruguay and Venezuela.
Asia-Pacific region	
China	Refers to the People's Republic of China, including Hong Kong.
ASEAN	Brunei Darussalam, Cambodia, Indonesia, Laos, Malaysia, Myanmar, Philippines, Singapore, Thailand and Vietnam.
OECD Asia	Japan and Korea.
Non-OECD Asia	Afghanistan, Bangladesh, Bhutan, Brunei Darussalam, Cambodia, China, Chinase Taipei, the Cook Islands, East Timor, Fiji, French Polynesia, India, Indonesia, Kiribati, the Democratic People's Republic of Korea, Laos, Macau, Malaysia, Maldives, Mongolia, Myanmar, Nepal, New Caledonia, Pakistan, Papua New Guinea, the Philippines, Samoa, Singapore, Solomon Islands, Sri Lanka, Thailand, Tonga, Vietnam and Vanuatu.
Other Asia	Non-OECD Asia regional grouping excluding China and India.

International Energy Agency	
OECD Oceania	Australia and New Zealand.
OECD Pacific	Includes OECD Asia and Oceania.
Africa region	
Africa	Algeria, Angola, Benin, Botswana, Burkina Faso, Burundi, Cameroon, Cape Verde, Central African Republic, Chad, Comoros, Congo, Democratic Republic of Congo, Côte d'Ivoire, Djibouti, Egypt, Equatorial Guinea, Eritrea, Ethiopia, Gabon, Gambia, Ghana, Guinea, Guinea-Bissau, Kenya, Lesotho, Liberia, Libya, Madagascar, Malawi, Mali, Mauritania, Mauritius, Morocco, Mozambique, Namibia, Niger, Nigeria, Reunion, Rwanda, Sao Tome and Principe, Senegal, Seychelles, Sierra Leone, Somalia, South Africa, Sudan, Swaziland, United Republic of Tanzania, Togo, Tunisia, Uganda, Zambia and Zimbabwe.
North Africa	Algeria, Egypt, Libyan Arab Jamahiriya, Morocco and Tunisia.
Sub-Saharan Africa	Africa regional grouping excluding South Africa and North Africa regional grouping.
Middle East region	
Middle East	Bahrain, the Islamic Republic of Iran, Iraq, Israel, Jordan, Kuwait, Lebanon, Oman, Qatar, Saudi Arabia, Syrian Arab Republic, the United Arab Emirates and Yemen. It includes the neutral zone between Saudi Arabia and Iraq.
CIS region	
OECD	Includes OECD Europe, OECD Latin and North America and OECD Pacific regional groupings.
OECD+	OECD regional grouping and those countries that are members of the European Union but not of the OECD.
Other Major Economies	Brazil, China, Russia, South Africa and the countries of the Middle East.
Other Countries	Comprises all countries not included in OECD+ and Other Major Economies regional groupings, including India, Indonesia, the African countries (excluding South Africa), the countries of Latin America (excluding Brazil), and the countries of non-OECD Asia, (excluding China) and the countries of Eastern Europe/Eurasia (excluding Russia).
Organization of the Petroleum Exporting Countries	Algeria, Angola, Ecuador, the Islamic Republic of Iran, Iraq, Kuwait, Libya, Nigeria, Qatar, Saudi Arabia, the United Arab Emirates and Venezuela.

Geographic scope of the sources

BP Statistical Review	
North America	US (excluding Puerto Rico), Canada, Mexico.
South and Central America	Caribbean (including Puerto Rico), Central and South America
Europe	European members of the OECD plus Albania, Bosnia-Herzegovina, Bulgaria, Croatia, Cyprus, Former Yugoslav Republic of Macedonia, Gibraltar, Malta, Romania, Serbia and Montenegro, Slovenia.
Former Soviet Union	Armenia, Azerbaijan, Belarus, Estonia, Georgia, Kazakhstan, Kyrgyzstan, Latvia, Lithuania, Moldova, Russian Federation, Tajikistan, Turkmenistan, Ukraine, Uzbekistan.
Europe and Eurasia	All countries listed above under the headings Europe and Former Soviet Union.
Middle East	Arabian Peninsula, Iran, Iraq, Israel, Jordan, Lebanon, Syria.
North Africa	Territories on the north coast of Africa from Egypt to western Sahara.
West Africa	Territories on the west coast of Africa from Mauritania to Angola, including Cape Verde, Chad.
East and Southern Africa	Territories on the east coast of Africa from Sudan to Republic of South Africa. Also Botswana, Madagascar, Malawi, Namibia, Uganda, Zambia, Zimbabwe.
Asia Pacific	Brunei, Cambodia, China, China Hong Kong SAR*, Indonesia, Japan, Laos, Malaysia, Mongolia, North Korea, Philippines, Singapore, South Asia (Afghanistan, Bangladesh, India, Myanmar, Nepal, Pakistan, Sri Lanka), South Korea, Taiwan, Thailand, Vietnam, Australia, New Zealand, Papua New Guinea, Oceania. * Special Administrative Region.
Australasia	Australia, New Zealand.
OECD members	Europe: Austria, Belgium, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Iceland, Republic of Ireland, Italy, Luxembourg, Netherlands, Norway, Poland, Portugal, Slovakia, Slovenia, Spain, Sweden, Switzerland, Turkey, UK. Other member countries: Australia, Canada, Israel, Japan, Mexico, New Zealand, South Korea, US.
OPEC members	Middle East: Iran, Iraq, Kuwait, Qatar, Saudi Arabia, United Arab Emirates. North Africa: Algeria, Libya. West Africa: Angola, Nigeria. South America: Ecuador, Venezuela.

BP Statistical Review	
European Union members	Austria, Belgium, Bulgaria, Cyprus, Croatia, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Republic of Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Poland, Portugal, Romania, Slovakia, Slovenia, Spain, Sweden, UK.
Other EMEs (Emerging Market Economies)	South and Central America, Africa, Middle East, non-OECD Asia, non-OECD Europe.
Methodology	The primary energy values of both nuclear and hydroelectric power generation have been derived by calculating the equivalent amount of fossil fuel required to generate the same volume of electricity in a thermal power station, assuming a conversion efficiency of 38% (the average for OECD thermal power generation).
Percentages	Calculated before rounding of actuals. All annual changes and shares of totals are on a weight basis except on pages 6, 14, 18, 20 and 22.
Rounding differences	Because of rounding, some totals may not agree exactly with the sum of their component parts.
Tonnes	Metric equivalent of tons.
Disclosure	Statistics published in this Review are taken from government sources and published data. No use is made of confidential information obtained by BP in the course of its business.

Country groupings are made purely for statistical purposes and are not intended to imply any judgement about political or economic standings.

Appendix 2: conversions & Glossary

Conversions

Weight	kilograms
1 pound	0.453
1 American ton (short ton)	907
1 British ton (long ton)	1,016

Denominations in the American system	
10^{0}	unit
10^{1}	tens
10^{2}	hundreds
10^{3}	thousands
10^{6}	millions
10^{9}	billions
10^{12}	trillions
The French billion is 10^{12}	

Multiples and decimal sub-multiples of the units of measurement			
Abbreviation	Name	Value	Power
P	panda	1,000,000,000,000,000	10^{15}
T	tera	1,000,000,000,000	10^{12}
G	giga	1,000,000,000	10^{9}
M	mega	1,000,000	10^{6}
k	kilo	1,000	10^{3}
h	hecto	100	10^{2}
da	deca	10	10^{1}
unité	unit	1	10^{0}
da	deci	0.1	10^{-1}
c	centi	0.01	10^{-2}
m	milli	0.001	10^{-3}
µ	micro	0.000 001	10^{-6}

Other energies						
	Heavy fuel	Super fuel	Dry wood	Household waste	Paper waste	Natural uranium
Physical unit	1 ton	1 000 liters	1 ton	1 ton	1 ton	1 ton
Tons of oil equivalent	0.95	0.79	0.33	0.18	0.33	12,000
MWh	11	9.1	3.9	2.1	3.9	140,280
GJ	40	33	14	7.6	14	505,000

Source: Joint report by the OECD Nuclear Energy Agency and the International Atomic Energy Agency – Uranium 2005: Resources, Production and Demand

Volume unit					
From	To				
	m^3	liters	ft^3	US gallon	barrel
	multiply by				
m^3	1	1 000	35.32	264	6.28
liters	0.001	1	0.0353	0.264	0.00629
ft^3	0.0283	28.3	1	7.47	0.178
US gallon	0.00379	3.79	0.134	1	0.0238
Barrel	0.159	159	5.62	42	1

Energy unit					
From	To				
	MWh	toe	GJ	MMBtu	Therm
	multiply by				
MWh	1	0.0860	3.6	3.412	34.12
toe	11.63	1	41.9	39.68	396.8
GJ	0.2778	0.0239	1	0.948	9.48
MMBtu	0.293	0.0252	1.055	1	10
Therm	0.0293	0.00252	0.105	0.1	1

Conversions

Crude oil						
From	To					
	Tonnes	1,000 liters	Barrels	US Gallons	MWh	GJ
	Multiply by					
Tons (Metric)	1	1.212	7.6	320	12.1	43.5
1,000 liters	0.825	1	6.290	264.17	10.0	35.9
Barrel	0.132	0.159	1	42	1.587	5.710
US Gallons	0.00313	0.0038	0.0238	1	0.0378	0.136
MWh	0.0827	0.100	0.630	0.630	1	3.60
GJ	0.0230	0.028	0.028	7.35	0.278	1

Coal					
From	To				
	Short ton	Metric ton	Ton of oil equivalent	MWh	GJ
	Multiply by				
Short ton	1	0.9071847	0.6248	7.560	27.22
Metric ton	1.102	1	0.6887	8.333	30
Ton of oil equivalent	1.601	1.452	1	12.1	43.5
MWh	0.1323	0.1200	0.08264	1	3.6
GJ	0.03674	0.03333	0.02299	0.278	1

Natural gas (GN) & liquefied natural gas (LNG)									
From	To								
	Bcm	Gft³	Mtoe	Million tons of LNG	Millions of m³ of LNG	TBtu	Million barrels of oil equivalent	TWh	PJ
	Multiply by								
1 billion cubic meter NG (1 Bcm)	1	**35.3**	0.93	0.739	1.63	37.0	6.37	10.8	**39.0**
1 billion cubic feet NG	0.0283	1	0.026	0.0209	0.0460	1.05	0.18	0.307	1.10
1 million tons of oil equivalent	1.07	37.9	1	0.794	1.74	39.69	6.84	**11.6**	41.9
1 million tons of LNG	1.35	47.7	1.26	1	2.20	50.0	8.62	14.7	**52.7**
1 million cubic meter of LNG	0.615	21.7	0.573	**0.455**	1	22.8	3.92	6.67	24.0
1 trillion British thermal units	0.0270	0.955	0.0252	0.0200	0.0440	1	0.17	**0.293**	1.05
1 million barils of oil equivalent	0.157	5.54	0.146	0.116	0.255	**5.8**	1	1.70	6.12
TWh	0.0923	3.258	0.0860	0.0683	0.150	3.41	0.588	1	**3.6**
PJ	0.0256	0.905	0.0239	0.0190	0.0417	0.948	0.163	0.278	1

1 m³ NG: 0.9 of crude oil – 1 m³ NG: 10,000 kcal – 1 m³ NG: 41.860 kJ
NB: These conversions are based on eight assumptions identified by the figures in bold.

The change from cubic meters to kWh and more generally from volume units to energy units depends on the quality of the gas. We speak of HHV and LHV depending on whether we use the lower or higher estimate of the heating value of the gas. The HHV estimate includes heat recoverable from steam (including energy recoverable from condensation). In a gas context, we generally speak of HHV. We speak of LHV in domestic inter-energy reports, for example.

1 kWh LHV . . . . . = 0.9 kWh HHV
1,000 m³ of HHV Natural Gas = 0,9 toe
1,000 m³ of LHV Natural Gas. = 0,81 toe
1 toe (HHV context) . . . . . = 1,111 m³ of Natural Gas
1 toe (LHV context) . . . . . = 1,234 m³ of Natural Gas
1 m³ of HHV Natural Gas . . . = standard of 42 MJ (HHV) (between 38 and 42 MJ)
. . . . . standard of 11.7 kWh (HHV) (between 9 and 12 kWh)
. . . . . European conversion: 39 MJ (HHV)
. . . . . European conversion: 10.8 kWh (HHV)
. . . . . conversion in France: 11.5 kWh (HHV)
1 Tcf PCS. . . . . = 25,48 Mtoe
1 tonne of LNG. . . . . = 1,320 – 1,380 m³ of gas

Glossary

Added value: Usual method for measuring the net production of a branch or a sector in monetary units; added value is equal to the difference between the gross production and intermediate consumption; added value can be measured at the cost of the factor or at the market price. Added value of agriculture measures the activity of farming, fishing and forestry. Added value of industry measures mining, manufacturing and construction activities, and electricity, gas and water. Added value of services or of the tertiary sector measures the activity of all services, both public and private: retail and wholesale commerce, banking, and public administration.

Annex I: UN Convention on Climate Change Annex I countries: Germany, Australia, Austria, Belarus, Belgium, Bulgaria, Canada, Croatia, Denmark, Spain, Estonia, United States of America, Finland, France, Greece, Hungary, Iceland, Ireland, Italy, Japan, Latvia, Liechtenstein, Lithuania, Luxembourg, Malta, Monaco, New Zealand, Norway, Netherlands, Poland, Portugal, Romania, Russia, Slovakia, Slovenia, Switzerland, Czech Republic, Turkey, Ukraine, United Kingdom.

ATEE: Association Technique Energie Environnement, a French association of energy and environmental operators (institutional, private, etc…).

Aviation and marine bunker oils: Marine bunker oils are the duty-free fuels for ocean vessels and aviation bunker oils are the aircraft fuels consumed for international transport. At country level, they are excluded from primary consumption and are considered to be exports. At global level, they are included in primary consumption.

Biogas: a gas resulting from the fermentation, also called methanisation, of organic matter (animal or plant) in the absence of oxygen. It consists primarily of methane (from 50% to 70%), but usually also carbon dioxide, water vapour, hydrogen sulphide, etc. The energy produced by biogas solely comes from methane.

Biomethane: a biogas whose undesired components have been removed (carbon dioxide, water vapour, hydrogen sulphide, etc.), so that methane only remains. Methane's properties are similar to those of natural gas. Biomethane can be handled in natural gas distribution and transport networks.

Bituminous coal: Type of coal transformed into coke.

CAPEX-OPEX: Operating expense (often abbreviated as OPEX) is the ongoing cost for running a product, business, or system. Its counterpart, capital expenditure (CAPEX), is the cost of developing or providing non-consumable parts for the product or system.

CEA: Commissariat à l'énergie anomique (French Atomic Energy Commission)

Cedigaz: International association of manufacturers for gas (GDF SUEZ is a member).

CERA: Cambridge Energy Research Associates.

CH_4: Methane, a hydrocarbon with a global warming potential 25 times greater than that of CO_2.

Change in inventories: In principle, these are the changes in inventory levels between two identical dates one year apart. The inventories are those of the energy producers and generally exclude consumer inventories. However, depending on the measurement methods adopted by each country, these changes in inventories represent real data or may include statistical deviations or non-metering between the primary supply and the inputs transformed or consumed. The + sign indicates a decrease in inventories during the year; the - sign indicates an increase in inventories during the year. Changes in inventories that systematically have the same sign are an indication of accounting distortions or poor allocation.

CI: Cost Insurance Freight. CIF price, in contrast to FOB price, includes shipping costs, and the various taxes and insurance; the seller is responsible for the merchandise up to the port of arrival.

CIS: Community of Indiapendent States, composed of 11 of the 15 former Soviet Republics: Armenia, Azerbaijan, Belarus, Georgia, Kyrgyzstan, Kazakhstan, Moldavia, Russia, Federation of Tajikistan, Turkmenistan (Associate State), Ukraine, Uzbekistan - Mongolia as an observer.

Coke: Transformed coal used primarily in making steel.

Coking plants and blast furnaces: The inputs of coking plants are the coking coal consumed by coking plants. The inputs of blast furnaces are the coke consumed.

Coking plants, briquette plants: The inputs of coking plants are the coking coal consumed by coking plants. The inputs of blast furnaces are the coke consumed. The outputs of coking plants are coke and coking gas. The outputs of the blast furnaces are the blast furnace gases.

DEP: Department of Exploration Production.

DGEMP: Department of Energy and Raw Materials (Direction Générale de l'Energie et des Matières Premières).

DFO: Domestic fuel oil (home heating oil).

Domestic consumption: Domestic consumption, for each energy product, is the balance of the total production, foreign trade, air and marine bunker oils (for oil) and changes in inventories.

EIA-DOE: Energy Information Agency - Department of Energy (USA).

Electric power plants: The inputs of electric power plants correspond (for thermal plants) to the consumption of fuels by the power plants. The production of the electric power plants corresponds to the gross production.

Glossaire

Electric power plants (thermal): The inputs of electricity power plants are the fuels consumed by public plants and by self-producers (including co-generation).

Electricity production: Gross electricity production including public production (private and public power companies) and the self-producers, by any type of power plant (including co-generation).

Electricity production from co-generation: Gross production of electricity by power plants that produce electricity and heat (power companies and self-producers).

Energy sector self-consumption: Consumption to run energy transformation units (power plants, refineries).

ENTSO-E: European Network of Transmission System Operators for Electricity.

EU: The European Union has since 1 July 2013 28 Member States: Austria, Belgium, Bulgaria, Cyprus, Denmark, Estonia, Finland, France, Greece, Hungary, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Poland, Portugal, Czech Republic, Romania, United Kingdom, Slovakia, Slovenia, Sweden. The accession of Croatia is effective July 1, 2013 and confirms the prospects of enlargement in the Balkans started nine years earlier. The EU has a total of over 500 million people and covers an area of 3,930,000 km^2.

Exploration and development cost: The average cost of exploration and development represents the dollar cost per barrel equivalent of additional reserves of a country coming from exploration activities, discoveries, improved recovery or update assessments. This cost does not include the licensing of proven reserves

Exports: Exports are the volumes of energy product exported from the national territory to another country, minus simple transit volumes and volumes “custom” processed on behalf of a third party country. In the case of geographic or geopolitical regions, exports are the aggregates of national exports, including those that are part of flows within the region. For accounting consistency, exports appear with a negative sign.

Final consumption: Final consumption is the balance between the interior consumption and consumption from the energy transformations and various losses. It measures the needs of the end consumers in the country. They are broken down by category as follows: industry, transport, residential, services, agriculture and non-energy uses. Final consumption of industry is broken down by business line or sector: steel, chemical, non metallic minerals (construction materials), and so on.

Final consumption for non-energy uses: This is the consumption of the products intended for petrochemicals (naphtha), the fabrication of ammonia (natural gas), use in electrode (carbon) form and the use of all products used for their physical-chemical properties (bitumen, paraffins, motor oils, etc.). They are divided into chemicals and other.

FOB: Free On Board. FOB price, in contrast to CIF price, does not include any transport cost, tax or insurance.

Forward price: Forward = forward price - given for different expirations.

Fugitive emissions: Intentional and non-intentional greenhouse gas emissions, from the extraction of a fossil fuel up to the point of use.

GDP: Gross Domestic Product: Measurement of the economic activity of a country; it is currently measured at market prices. GDP at market price is the sum of the value added to the cost of factors, plus indirect taxes, minus subsidies.

GHG: Greenhouse Gases.

Henry Hub: Point of determination of the prices of the gas traded on the NYMEX (New York Mercantile Exchange).

HFC: Hydrofluorocarbon (a category of fluorinated gases that actively contribute to the deterioration of the ozone layer, with a global warming potential 3,000 times greater than that of CO_2).

IEA: International Energy Agency.

IIASA: International Institute for Applied Systems Analysis.

Imports: Imports are the volumes of energy product imported from another country into the national territory, minus the volumes that are transiting to a third party country and the quantities intended to be “custom” processed on behalf of a third party country. In the case of geographic or geopolitical regions, imports are the aggregates of the national imports, including those that are flows within the region.

Industry final consumption: Industry final consumption includes the consumption of the mining, manufacturing and construction sectors. They exclude the consumption of fuel for transport activities, even when the means of transport belong to the industrial companies, and the consumption of fuels for the self-production of electricity. The energy products used as raw materials or maintenance products are in general separate, or at least identified under the name “non-energy uses.”

LNG: Liquefied Natural Gas.

Light Tight Oil (Tight Oil): Light tight oil or tight oil is a type of oil present in relatively impermeable, non-porous layers and requires extraction techniques similar to those of shale gas. Tight oil primarily differs from shale oil in its degree of viscosity and is found in particular in the Niobrara and Eagle Ford formations in the United States.

Glossaire

Lignite: A type of low-carbon coal with a low calorific value.

Liquefaction (of gas): The inputs of gas liquefaction plants are natural gas consumptions. The production of liquid gas is the output.

LPG: Liquefied Petroleum Gas.

ULUCF: Land Use, Land Use Change and Forestry, with implications for CO_2, CH_4 and N_2O emissions and capture. The notion covers tree felling and planting, woodland conversion (clearing) and prairies as well as soils whose carbon content is sensitive to the use to which it is put (forest, prairie, cultivated).

Marginality: In the production of electricity, the duration of marginality represents the time when the production method used is the one with the lowest marginal cost (cost of an additional unit).

Mbl: Million barrels.

MMBtu: 1,000,000 Btu (1 million Btus).

NBP: National Balancing Point is a virtual trading location for the sale and purchase and exchange of UK. It serves as a reference for forward contracts.

Net production (electricity): The net production of electricity is the balance between gross production and the auto-consumption of electric power plants.

Nitrogen oxide: NO, nitrogen oxide.

NO_2: Nitrogen dioxide.

N_2O: Nitrogen protoxide (also known as nitrous oxide) with the chemical formula N_2O is a powerful greenhouse gas that remains in the atmosphere for a long time (about 120 years). It is partially responsible for the destruction of the ozone. The soil and oceans are the principal natural sources of this gas, but it is also produced by the use of nitrogen fertilizers, the combustion of organic matter and fossil fuels, the production of nylon, etc. In France, farming contributes to the 3/4 of N_2O emissions that essentially come from the transformation of nitrogen products (fertilizer, manure, liquid manure, crop residues) in farm land. N_2O is a colorless and non-flammable gas, stable in the lower levels of the atmosphere, but it decomposes in the higher levels (stratosphere) through chemical reactions involving sunlight.

Non-conventional gases: Like the gas known as "conventional", "non-conventional gases" are essentially composed of methane, but are trapped in relatively impermeable rock, which until recently had limited their development. In fact, extraction requires production technologies that are much more complex than for traditional reservoirs.

Non-conventional oils: Oil extracted by methods other than from a well (in oil sands, for example).

OECD: Organization of Economic Cooperation and Development. Member countries: Australia, Austria, Belgium, Canada, Chile, Czech Republic, Denmark, Germany, Finland, France, Greece, Hungary, Ireland, Iceland, Israel, Italy, Japan, Luxembourg, Mexico, Netherlands, New Zealand, Norway, Poland, Portugal, Slovak Republic, Slovenia, South Korea,,Spain, Sweden, Switzerland, Turkey, United Kingdom, United States.

Particulate Matter: Particles in suspension (PM 2.5 corresponds to the fine particles that can enter the pulmonary alveoli).

PFC: Perfluorocarbon (category of fluorinated gases, with a global warming power on average 7500 times greater than that of CO_2).

Primary consumption: Primary consumption is the balance from primary production, foreign trade, bunker oils, and changes in inventories. Primary consumption aggregated over all products measures the country's total energy consumption, including all losses and self-consumption during transformations. For primary energies, primary consumption = domestic consumption.

Primary production: Primary production measures the quantity of natural energy resource extracted and produced for the purpose of consumption as is, on the production site or elsewhere, or for subsequent transformations. It excludes the quantities not use for energy or transformation purposes, particularly for natural gas, the quantities flared, reinjected into wells or discharged as is. On the other hand, it includes auto-consumption on the production sites (electricity generation, auxiliary motors, for example). The production of hydraulic, geothermal, wind and nuclear electricity is considered to be primary production.

Private consumption: Total consumption of goods and services in monetary units by households.

Production: Energy production corresponds to gross domestic production. It measures the volume of energy product produced directly or resulting from a transformation process, including the volume reused in the transformation process itself (hence the concept of gross production).

Production cost: The average production cost is the average lifting cost of oil and gas from the reservoir to the shipping interface towards the processing center.

Power generation from cogeneration: Gross production of electricity by power plants that produce electricity and heat (power companies and self-producers).

Public production (electricity): The public production of electricity is the gross production of electricity production companies, whatever their status (public or private).

Pumping: Pumping station inputs are their electricity consumption. The output is the gross production of hydroelectricity.

RES: Renewable energy sources.

Glossaire

Residential-services-agriculture consumption: This includes all the final consumptions from energy products used for energy purposes, excluding the consumption of industry and transport. They are divided into three categories: residential, services, agriculture (including fishing).

Reserves: oil reserves are termed possible, probable or proven, according to the degree of certainty of their existence in the light of geological and technical data and interpretations for each location. Oil reserves derive primarily from a measure of geological risk, i.e. the probability of oil being present and of its exploitation in current economic and technical conditions.

Proven reserves: gas and oil resources whose extraction is "reasonably certain" using existing techniques, at current prices and under current trade and government agreements. In the industry they are known as 1P. Some specialists refer to them as P90, as they have a 90% probability of being put into production.

Probable reserves: gas and oil resources whose extraction is "reasonably probable" using existing techniques, at current prices and under current trade and government agreements. In the industry they are known as 2P. Some specialists refer to them as P50, as they have a 50% probability of being put into production.

Possible reserves: gas and oil resources with a chance of extraction in favourable circumstances. In the industry they are known as 3P. Some specialists refer to them as P10, as they have a 10% probability of being put into production.

Self-production (electricity): Self-production of electricity is the gross production of businesses whose main activity is not electricity production.

SF_6: Sulfur hexafloride (greenhouse gas with a global warming potential 22,800 times greater than that of CO_2). SF_6 is used in metallurgy for the production of aluminum and magnesium, in the fabrication of semi-conductors (because of its inert character and its density, which maintain the purity of the medium against dust and oxidizing elements), in electric construction (electric stations (Gas Insulated Substation) and high-voltage electrical equipment because of its high dielectric rigidity and its good stability in electric arc), in particle accelerators, and in medical applications (for example, for disinfecting respiratory equipment against aerobic microbes).

SO_2: Sulfur dioxide. Sulfur dioxide is used as a disinfectant, antiseptic and antibacterial as well as a coolant gas, a whitening agent and food preservative (particularly for dry fruits), in the production of alcoholic beverages and, more specifically, in oenology and wine making.

Spot price: Spot prices are prices negotiated the day before for delivery the following day. They reflect the short-term balance between supply and demand.

Sulfur dioxide: In industry, sulfur dioxide is used particularly for the production of sulfuric acid. Sulfuric acid has numerous applications and is the most-used chemical product. Atmospheric pollution by sulfur dioxide from industry is mainly the result of fossil fuel combustion.

Sulphur dioxide: Sulfur dioxide.

Trade balance: Marine bunker oils are the duty-free fuels for ocean vessels and aviation bunker oils are the aircraft fuels consumed for international transport. At country level, they are excluded from primary consumption and are considered to be exports. At global level, they are included in primary consumption.

Transport/Distribution losses: Quantity of energy lost during transport and distribution.

Toe: Ton of oil equivalent.

Transport final consumption: Transport final consumption is the consumption by all transport methods, whatever the ownership status or type of use. However, it excludes "air and marine bunker oils." Generally, transport consumption includes the consumption of infrastructures (railway stations, airports, etc.), pleasure boats and consumption by port maChinary. They are divided into the four main infrastructures: road transport, rail transport, inland waterways, air transport.

Refineries: Refinery inputs are crude oil, natural gas liquids, and various products to be refined. The outputs are the refined products. The production from refineries is the gross production (including the uses made by the refineries).

Troll-Zeebrugge: LNG terminal and the connection point for European gas infrastructures where a spot price for the gas is set.

WEO: World Energy Outlook, a forward-looking report on energy in the world; annual publication of the IEA.

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