Opening the EU Black Box

Energy metabolism, dependence and geopolitics

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Contents

1. Aims

The European Union is one of the principal actors on the world energy stage and plays a leading role in determining the composition and operation of international policies. Developments in the energy field in recent years have affected the EU, both within its territory and externally, but the global effects of this have yet to be defined in detail.

The objective of the current study is to analyse the existing relationship between the ways member states and the European Union as a whole organise their energy needs (social metabolism), and the external geopolitics which derive from this. In other words, we want to uncover the external dimension of Europe's energy metabolism. To this end we need to know the metabolic profile of the EU and its member states (its structure and levels of energy and material use, and how these affect the various economic sectors), and also how this is changing. This will help explain the workings of the internal structures of the EU as they relate to the internal extraction of materials and energy resources, their internal consumption, imports and exports. We also require an understanding of energy material flows and how these are changing in order to detect interdependencies between the EU (as a whole and by country) and the countries which export the fuels arriving in Europe.

In circumstances in which the external dimension of European metabolism has proven to be significant, we will look deeper into whether this entails energy grabbing from other territories, and if so, how that comes about. To this end it will be necessary to explore the interdependencies established between the EU and the countries which produce the energy materials it imports.

Insofar as we know that social metabolism is not only restricted to the physical dimension, but also depends on socio-political organisation, we must also tackle an analysis of governance as it is established in the EU. It would be interesting to discover the correlation of forces between the energy policies of individual Member States, and the EU energy strategy led by the European Commission, which includes energy security (security of energy provision) and economic competitiveness amongst its pillars. Also, as the financial sphere is a growing source of capital with which to develop European energy policies, what conditions does this impose on the metabolism, whether within European borders or in other countries?High levels of complexity and uncertainty in the current geopolitical arena compel us to try and look more deeply at its different constituent elements, and in this way obtain a more faithful picture of the effects of European metabolism around the world.

During the course of this study we will attempt to address the following questions in order to aid comprehension:

What is the relationship between social metabolism and Europe's external action?

If energy security (and competitiveness) are the drivers of European energy strategy, what are the implications of this?

How has the increasing prominent role of finance in the European energy universe come about?

What is the influence of finance on Europe's social metabolism?

What role will the EU play in global geopolitics?

2. The EU Metabolic profile

With the term social metabolism we refer to the way in which human societies organise their growing exchange of energy and materials with the environment (Martinez-Alier, J., et al., 2010). Studying social metabolism allows us to analyse the relationship between resource use and a society's economic activity both within its borders and externally. It is possible to analyse the extent to which economies "ingest" raw materials, which are "metabolised" to produce goods and services, and then "excrete" residues of waste materials and pollution. This also allows the identification, not only of which economic activities are capturing other social and environmental spaces, whether transnational or inter-generational, but also of where these resource grabs are generated (Llistar et al., 2013). What's more, metabolism is a social and political process, and for this reason energy and material flows are accompanied by flows of power. This means that through its analysis we can gain a deeper understanding of socio-economic conflicts (Heynen et al., 2006).

It must be borne in mind that the extraction of essential resources (oil, gas, coal, other minerals and biomass) for the metabolism of traditionally importing countries or regions usually entails very high social and environmental costs. This becomes very important for the importing countries' social relations and commercial economies. A basic premise of economic exchanges is that in general they will tend to benefit one party to the detriment of other parties, whether these already exist or are yet to exist (Martinez-Alier, J., et al., 2010).

2.1 How benefits and impacts are distributed in North-South trade. Biophysical focus

The series of impacts starts with a demand localised inside a territorial framework, which is passed on to exporting countries by means of a chain of commercial and financial operators who are seeking to maximise profits in the minimum possible time, and when added to similar contributions from consumption in other economies, the result is a kind of pressure exerted by the extraction of raw materials on regions with conditions more favourable for capital. In times of so-called neoliberal globalisation, in states with a business-orientated approach, under pressure from capital and multilateral entities, agricultural, oil and mineral frontiers have been advancing at breakneck speed, to the detriment of human communities and ecosystems. Delocalised models, such as that of energy, which are found in internationalised economies, have in practice become systems of "delocalised plunder" where the purchaser can comfortably avoid exploitative conditions at the point of origin (Llistar et al., 2013).

The free trade paradigm neither assumes not explains the emergence of unequal distribution patterns in the environmental costs and benefits of world trade. Nevertheless, studies of physical accounting suggest that an increase in global commerce tends to cause a redistribution between the North and the South, with respect to the consumption of natural resources on one hand, and the negative environmental impacts of resource extraction and production processes on the other. This is an ecologically unequal exchange, since the consumption of these resources, corporate and financial capital hubs, and the capital gains derived from these exchanges are all concentrated in the main centres of the Global North,

meanwhile the areas of extraction and exploitation are located in peripheral spaces in the Global South, accumulating the greatest social and ecological costs (Honborg, 2012).

An analysis of an economic system varies substantially depending on which measure is used for the analysis: monetary or physical. This means, in the case of international commerce, any interpretations which detach the monetary and biophysical analyses are quasi antagonistic. This is due to the fact that mechanisms of monetary valuation do not give adequate information about the accompanying biophysical dimension, indeed it is more the complete opposite (Naredo, 2010).

Therefore from the physical point of view it appears that Northern countries are substantial net importers. For Southern countries, patterns of specialisation of economic activities are particularly concentrated in primary resource-intensive sectors, which cause serious environmental problems and a significant loss of natural capital, whilst at the same time creating limited jobs and contributing little to the development of a diversified economy (Giljum et al., 2004).

EU countries: EU-28, EU-27, EU-15, EU-13 and Candidates, are mentioned throughout the text. This will correspond to the following classification:

2.2 The EU metabolic profile: a voracious appetite for materials and a high dependence on external energy sources.

The European Union was constituted as a regional bloc after the Second World War to coordinate both the geoeconomic and geopolitical roles it would have to play in the New Global Order. In a context marked by North American hegemony, expansion of the oil industry as a central vector of Fordist capitalism, and the end of the colonial era, European countries had to prepare themselves for some new rules in the global capitalist game. In the post-war context, the regional European bloc was inaugurated under the name of the European Coal and Steel Community (ECSC), an allusion to the two principle resources upon which European industry had been built, and which had also been a motivating factor in the confrontations between states. Nevertheless, the low price of crude meant its use was completely overtaking that of coal and the EU would later go on to become highly dependent on oil (Fernández-Durán y González-Reyes, 2014).

Throughout the second half of the twentieth century and moving into the twenty-first, the EU has consolidated its position as one of global capitalism's principal actors, and it has a socio-economic metabolism typical of advanced capitalist economies.

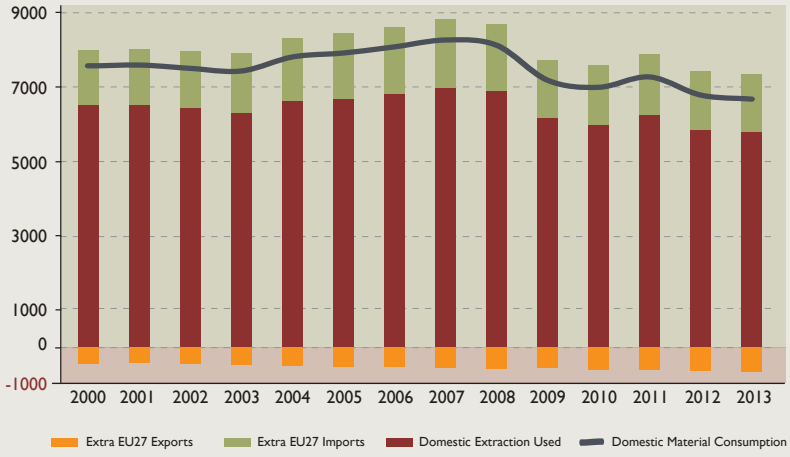
a. Materials: an economy based on extraction of materials from the earth's crust

The EU-27's Domestic Material Consumption (DMC)[8] during the years of robust expansion in the financial and property sectors, when the Union was also expanding due to the incorporation of the new Eastern European

8 DMC (Domestic Material Consumption = (Domestic Extraction + Imports) – Exports.

states, increased from 7,526 million tonnes in the year 2000 to a maximum of 8,233 million tonnes in 2007, but then decreased to 6,648 million tonnes in 2012. This decrease in the EU's material needs corresponds strictly to the effects of the economic crisis, and should in no way be interpreted as having resulted from policies aimed at reducing the burden on the earth's crust. Despite having decreased by about 19.25% (DMC) between 2008 and 2013, the consumption of materials has proven to be fairly inelastic due to the fact that the physical needs of advanced capitalism's spatial and economic complexes show a high degree of inertia (e.g. a city would require practically identical energy provision over the course of a year).

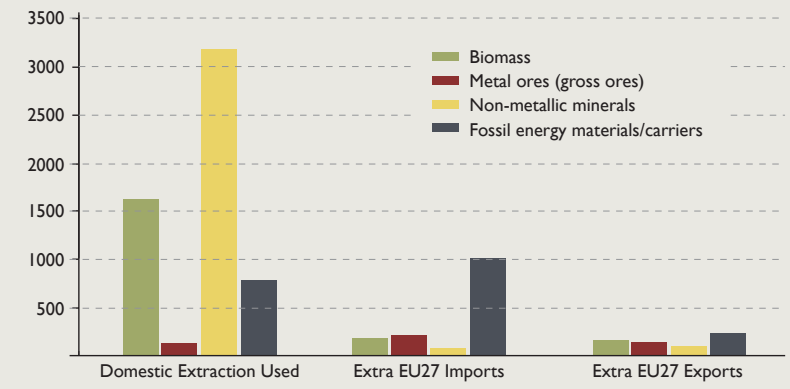
Figure 1. Material flows for the EU-27, 2000-2013 [millions of tonnes].



Source: calculation based on Eurostat (online data code: env_ac_mfa, demo_gind)
http://ec.europa.eu/eurostat/statistics-explained/index.php/Material_flow_accounts

Looking at the composition of domestic consumption according to the materials' origin, it can be seen that 85.41% came from domestic extraction over the 2000-2013 period, while the level of imports came to an average of 21.7%. If these material flows, both those arising from domestic extraction and those linked to external trade, are now broken down by typology, the following patterns can be identified (figure 2). Firstly, the type of materials with the greatest share extracted domestically is the non-metallic minerals, a component which is closely connected to the construction sector, and this is followed by biotic products, which can be related to mechanisms to protect agroindustry within the EU. Secondly, it is worth pointing out the leading role energy materials play in the EU-27's imports. Imports of energy materials were 33% greater than domestic extraction and the level of imports has seen practically no change over the period, fluctuating between 925 million tonnes in 2000 and 1,158 million tonnes in 2006.

Figure 2. Material flows in the EU-27 according to flow typology, 2013 [millions of tonnes]

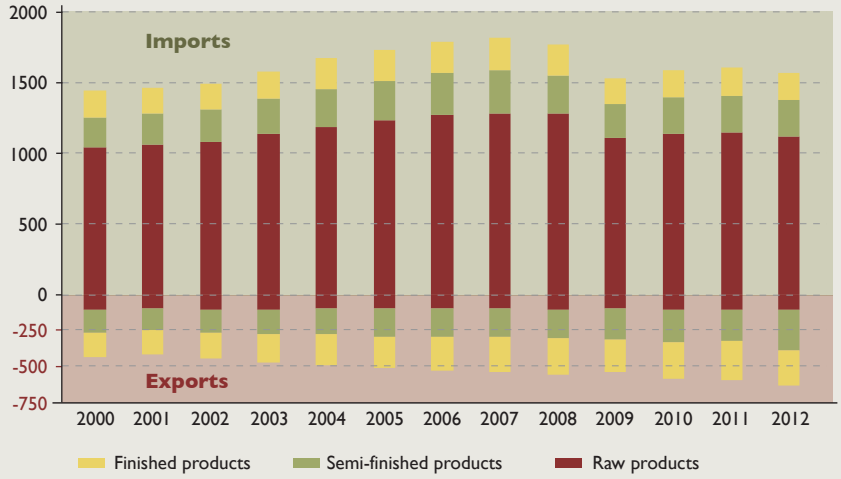


Source: http://ec.europa.eu/eurostat/web/environment/material-flows-and-resource-productivity/database

On the other hand, an analysis of externally-traded material flows by degree of processing can reveal a constant pattern throughout the years analysed, characterised (especially given the fact that levels of imports amount to practically three times that of exports) by a predominance of unprocessed raw materials in the case of imports, and a greater importance of semi-finished (38%) and finished products (43%) in the case of exports. In this way, the EU is a clear exam-

ple of a region in an advanced state of capitalism, specialising in exports of higher unitary value due to having been processed, while imports from the rest of the world, being essentially raw materials, attract a lower monetary return. This seems to corroborate what has been called the Rule of the Notary , formulated by José Manuel Naredo (2010), according to which the international division of labour defines an economic geography consisting of some zones based on resource extraction for which they receive a low monetary return, and other areas of accumulation and consumption where the value added by economic activity is concentrated.

Figure 3. Commercial material flows by degree of processing, 2000-2012 [millions of tonnes].



Source: http://appsso.eurostat.ec.europa.eu/nui/show.do

The maximum DMC (Direct Material Consumption) in per capita terms was reached in 2007, some 16.6 tonnes, which then reduced by 3.38 tonnes by 2013 due to the economic crisis, leaving the DMC per capita at around 13.23 tonnes. Looking at the composition of these flows, it may be observed that for energy materials and metals, import flows exceeded domestic extraction.

Table 1. Direct Material Inputs (DMI) and Direct Material Consumption (DMC), 2007-2013 [tonnes per capita]

	2007					2013				
	Direct Material Input	Domestic Extraction Used	Extra EU27 Imports	Domestic Material Consumption	Extra EU27 Exports	Direct Material Input	Domestic Extraction Used	Extra EU27 Imports	Domestic Material Consumption	Extra EU27 Exports
Biomass	3,79	3,35	0,44	3,55	0,24	3,74	3,36	0,38	3,43	0,31
Non-metallic minerals	8,84	8,61	0,24	8,7	0,14	6,42	6,27	0,15	6,24	0,18
Metallic Minerals	0,84	0,26	0,58	0,61	0,23	0,76	0,34	0,42	0,5	0,26
Fossil Energy Materials	4,13	1,82	2,31	3,74	0,39	3,53	1,49	2,04	3,07	0,46
Total	17,6	14,03	3,57	16,6	1	14,44	11,47	2,98	13,23	1,22

Source: http://appsso.eurostat.ec.europa.eu/nui/show.do?dataset=env_ac_mfa&lang=en

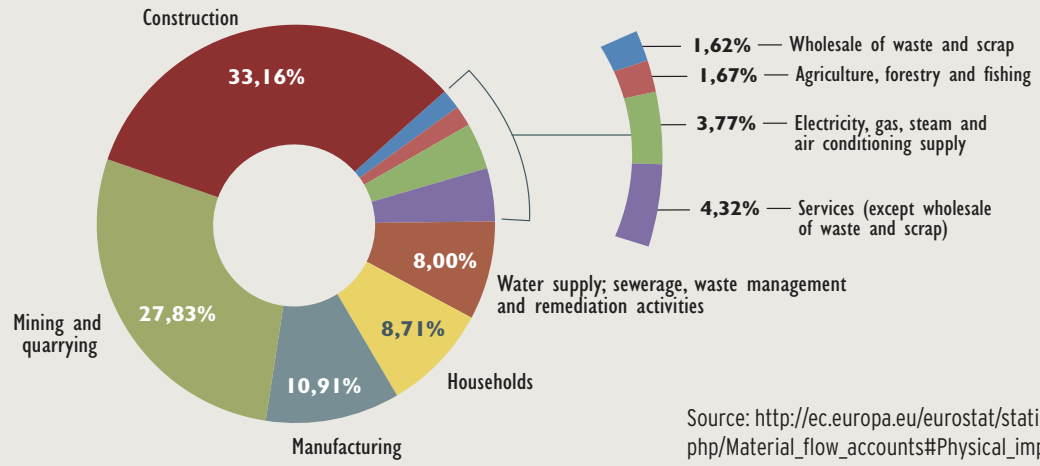
The "ingestion" of all these materials by the European economy is accompanied by the generation of waste. By failing to close the materials' cycles, waste has become one of the EU's main environmental problems, as well as becoming a key niche for business. With the crisis, corporate and financial capital has undertaken an aggressive strategy to consolidate the roles of market mechanisms and private enterprise as ideal vehicles for managing waste. Ultimately, capital has found in waste management a new terrain for expansion, accumulation by dispossession, and financialisation.

Between 2004 and 2012 the EU-28's **solid waste** went from 2,625 million tonnes (5,317 kg *per capita*) to 2,472 million tonnes (4,895 kg *per capita*), consisting of 95% non-hazardous waste. In Figure 4 it can be seen how the majority of wastes are produced by the construction industry and mining, two sectors closely interrelated with the secondary circuit of accumulation, i.e. "production" by the property and infrastructure sectors. In

the EU-28 as a whole, despite the financial and property bubble having burst, these sectors continue to be central to the European model of accumulation, which contradicts the rhetoric of the "knowledge economy" and illusions of "dematerialisation".

Incineration has taken its place as one of the main options for the treatment of solid urban waste, supported by the rhetoric of "energy recovery". The incinerator lobby, which is linked to those of the construction and electricity industries, has managed to construct a large number of incineration plants over a large portion of the EU. The arrival of the crisis has highlighted an overcapacity for incineration and has let loose a battle between member states to burn what have become euphemistically called WDF (Waste Derived Fuels). This has significantly increased trade in waste now that waste generated in-country is proving insufficient to keep power stations fed with WDF (Jofra, 2013).

Figure 4. Solid waste generated by activity, 2012 [percentage]



Source: http://ec.europa.eu/eurostat/statistics-explained/index.php/Material_flow_accounts#Physical_imports_and_exports

b. Energy

From an energy metabolism point of view, the EU displays the following characteristics: on the one hand a sparse endowment of fossil fuel deposits, principally oil and gas, and on the other, an energy deficit arising from high energy needs and high import dependence. Nevertheless, within the EU there are notable differences between member states: in some cases hydrocarbons are practically non-existent (e.g. France and Spain), but other countries possess significant reserves (e.g. the United Kingdom and the Netherlands). In any case, North Sea reserves reached their peak towards the end of the 1990s and the early 2000s. Despite this, these North Sea reserves have seen a momentary revival as new extractive technologies have come online (Amiel et al., 2013).

European **energy flows** are above the global average (approximately 50% more) and are also a quarter more than the average of the other countries usually described as industrialised. Furthermore, the proportion of these flows which pertains to biomass is considerably lower in European countries than in countries on the periphery of the global economy. On the other hand, the countries of the EU use a much larger amount of fossil energy than the global average.

From a sustainability point of view, these EU **biomass flows** are nevertheless important. In human beings' food supply, biomass is irreplaceable. EU countries use about 70-90% of their surface area for the production of biomass. Corine Land Cover data, which analyses changes in land cover in the EU, shows that the majority of its surface area corresponds to agricultural lands, forests, pasture, wetlands etc. That is to

say, to land cover assigned to biomass production. Nevertheless, one of the principle features of the process of transformation of European territory has been the expansion of artificial surfaces, which in turn causes a permanent fragmentation of agro-ecosystems (EEA, 2010). The use of biomass for human purposes results in a reduction in the amount of biomass available to ecosystems.

The consumption of products derived from biomass in the EU-15 increased by 21%, between 1970 and 2000. This increase owes as much to demographic increases as to increase in demand for biotics in per capita terms. It is worth noting that biomass represents approximately a third of energy consumption in the EU-15, and is a forgotten issue in the debates on energy. This becomes more relevant if we take into account that the consumption of biotic materials amounted to approximately 30% of Net Primary Production (NPP) in the EU-15 in the year 2000. This Human Appropriation of Net Primary Production (HANPP) is distributed thus: 26% is domestic extraction; 2,1% imports from the rest of the world. Definitively, this means that the extraction of biomass in the European Union was already reaching its limits at the start of the 21st century (Haberl et al., 2006). It is therefore not surprising that, with the launch of energy policies that provided incentives for agrofuels, opted, fundamentally, for them to be supplied through imports. There simply was not enough agricultural land to feed all the cars in the EU. European cars therefore are not only eating up the land , but they are eating up the land of the Global South (Riechmann, 2007; Estevan, 2008; Vargas, 2009).

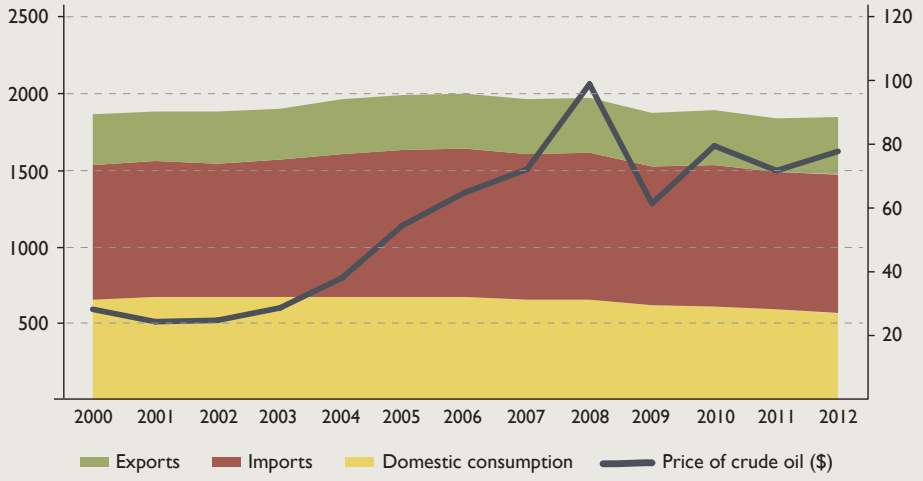
Over the period 2000-2012, the **gross inland consumption** of energy decreased slightly due to the crisis, from 1,726 Mtoe (million tonnes of oil equivalent) to 1,683 Mtoe. Nevertheless, it should be noted that in broad terms this figure has remained relatively stable since the nineties, with a peak coinciding with the economic boom just before the property bubble burst. In parallel this has produced a result which to many people goes unnoticed: the energy consumption of goods manufactured outside the borders of the EU has increased in recent years, to the point which the region with the highest level of energy imports (measured in amount of greenhouse gases) is now the EU, much higher than, for example, the US (Davis et al., 2010). Increased outsourcing of the European economy is causing a delocalisation of the production of goods to outside its borders, which does not remove its responsibility for this production.

Another feature of metabolisms such as that of Europe is the **price inelasticity of demand** in the face of variations in the price of oil (Figure 5). In fact the demand for oil in the European metabolism follows the behaviour expected of that of a basic necessity (such as bread); it does not experience noticeable fluctuations despite the large price variations (increases of up to four times the minimum price: from $24.86 to $98.95 /barrel). This happens because of the EU's great dependence on oil use, combined with its low level of self-sufficiency[9], as oil still (2011) comprises 35% of European energy consumption[10] and transportation is enormously dependent on oil, in particular road transport (which accounts for a majority 82% of energy used in transportation). The result is a metabolic structure which doesn't decide about what it ingests (whether price, conditions or quantities), and this determines the rest of the economic structure (consumption which is unresponsive to price increases, for example, leaves less resources for other investments, promotes indebtedness, and provides the temptation to reduce environmental, social and labour standards both within European borders and outside, amongst other extremely serious consequences).

9 The primary energy extracted from European territory persistently declined between 2001 and 2009, falling by 13%, went on to rise slightly (2%) between 2009 and 2010, and ended up falling once again between 2010 and 2011 (4%). The decrease over the whole period 2001-2011 was 15%.

10 Gas comprised 23%, coal and solid fuels 17%, nuclear 14% and renewables 11%. The latter were the only ones for which generation increased during the period 2001-2011 (+69%)

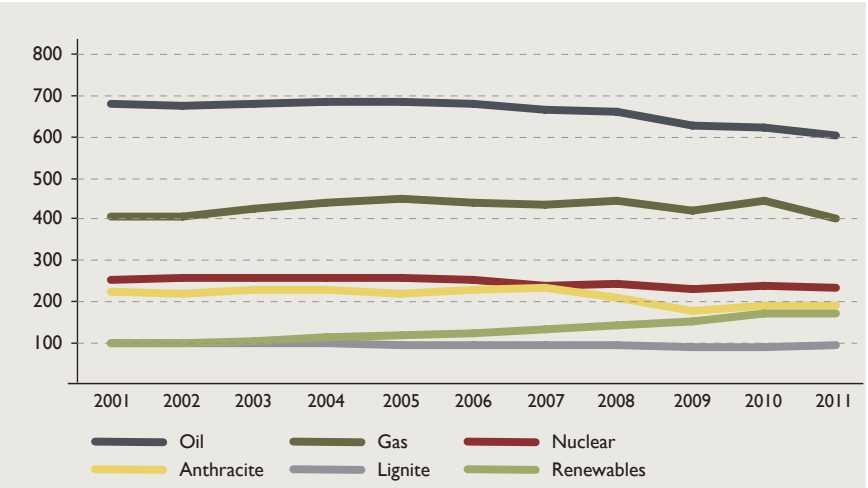
Figure 5. Price inelasticity of energy consumption, imports and exports [Mtoe], with variations in the oil price ($) UE-28.



Source: Eurostat and the Spanish Industry, Energy and Tourism Ministry

The fact that European energy consumption has maintained its level, combined with the reduction in the extraction of oil (48%), gas (32%), coal and other solid fuels (21%) and nuclear power generation (7%)[11] (Figure 6), means that special attention must be paid to the external actions of the EU in relation to energy materials (Eurostat, 2013).

Figure 6. Gross inland consumption, by source [Mtoe]



Source: Eurostat (online data codes: nrg_100a, nrg_101a, nrg_102a, nrg_103a, nrg_104a and nrg_1071a)

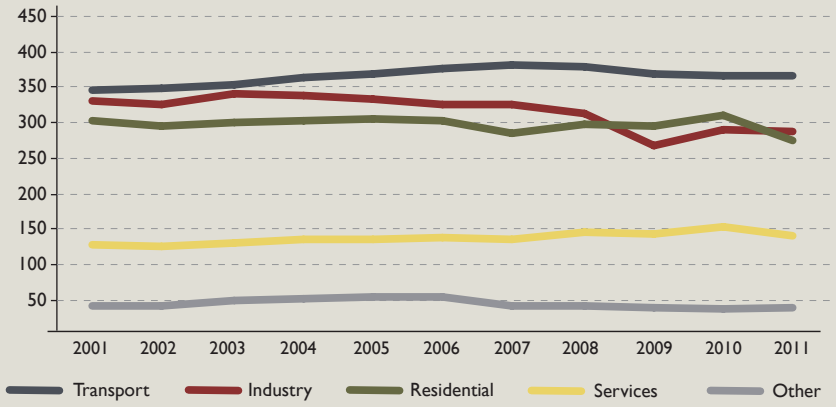
Before moving on, let's pause to consider the new **extractive activities** occurring within European borders. While the domestic extraction of energy materials has reduced in the EU as a whole in recent years, some member states have seen a certain degree of growth in their domestic extraction. Such is the case in Poland and Germany with coal (basically lignite in the German case), Estonia with shale oil and tar sands, Lithuania with peat, Romania with a slight tendency towards growth in coal extraction, and Turkey and Serbia, both candidates for entry in the EU, with lignite. Therefore it is solid fossil fuels which at the moment are starting to timidly make an appearance once more in the European energy mix (although actually they never went away). On the other hand, the wave of requests to explore unconventional gas sources was not yet reflected in the 2012 data on domestic extraction (Eurostat, 2014).

The development of neoliberal policies which have led to an abandonment of the railways and industrial delocalisation has meant that the distribution of **energy use between different economic sectors** has become highly uneven, which is also shown in its evolution between 2011 and 2011. Transportation uses 33% of

11 Despite the generation of energy considered to be renewable having increased by 63% over the whole period.

Europe's energy, industry 26%, the residential sector almost 25% and the service sector approaches 13%. Two of the sectors most favoured by policy-makers, transportation and services, have seen an increase in economic activity and their total energy consumption has increased by of 6% and 10% respectively. On the contrary, industrial consumption has declined by 13%, in a period of major delocalisation of production to countries of the periphery. Parallel to this, the impact of individual responsibility in the face of climate and energy challenges has brought about a 9% reduction in residential energy use.

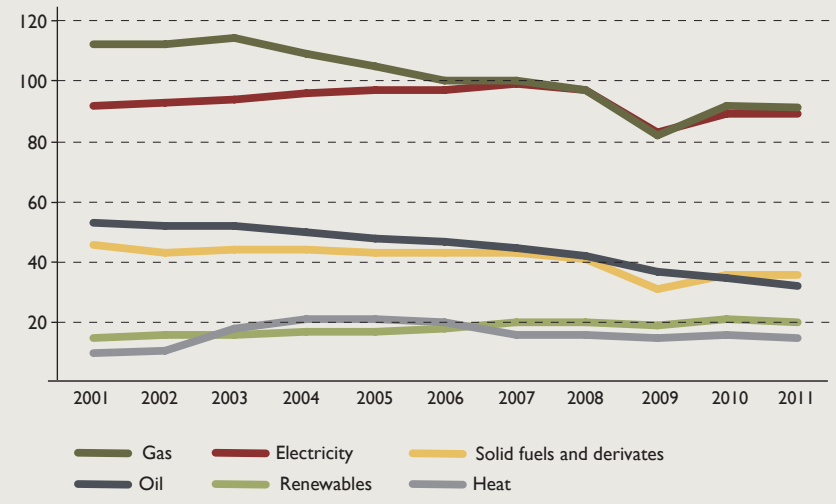
Figure 7. Final energy consumption by sector [Mtoe], EU-28



Source: Eurostat (online data code: nrg_100a)

Amongst the **industrial sectors**, metals (18%) and chemicals and petrochemicals (19%) are still those which use the most energy. The types of energy most used by the industrial sector are gases (32%) and electricity (31%) (Figure 8).

Figure 8. Final energy consumption in the industrial sector, by source [Mtoe], EU-28



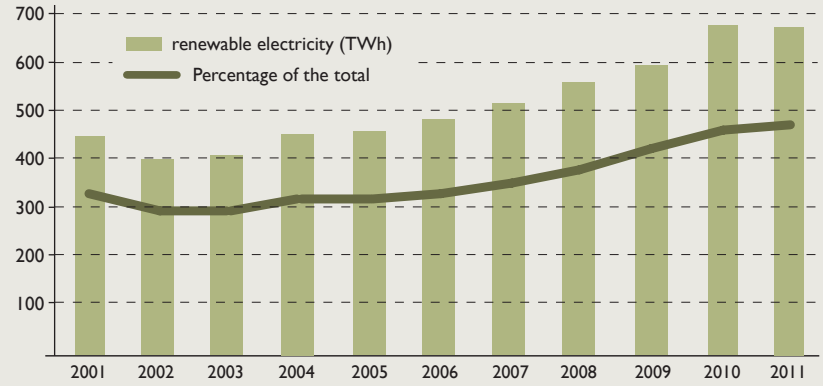
Source: Eurostat (online data codes: nrg_100a, nrg_101a, nrg_102a, nrg_103a, nrg_105a, nrg_106a and nrg_1071a)

European **homes** continue to mostly use natural gas (36%) and electricity (25%). Despite the use of products derived from oil and gas having declined by 39% and 12% respectively, and renewable energy playing an increased role (+31%) in meeting domestic needs, the European Commission is placing a decisive bet in favour of gas, based on arguments such as the need to heat homes.

Another of the economic sectors where European power is concentrated is **electricity generation**, which is characterised by centralised systems where the majority are non-nuclear thermal power stations (52%), supported by nuclear power stations (28%), hydroelectric (9%) and other renewables (11%). It can also be observed that as surplus capital deserted the property bubble, it discovered healthy returns in several European countries' renewable energy sectors (Spain being a prime example), causing a more than fivefold increase in their share

(2001-2011). At the same time, nuclear and hydroelectric decreased by 8%, and thermal generation barely increased by 1%. The percentage of renewables in terms of total electrical energy used in the EU-28 has also seen an increase, rising from 14% to 20%, although the majority of this increase occurred since 2006, when the property bubble was showing signs of likely collapse (Figure 9).

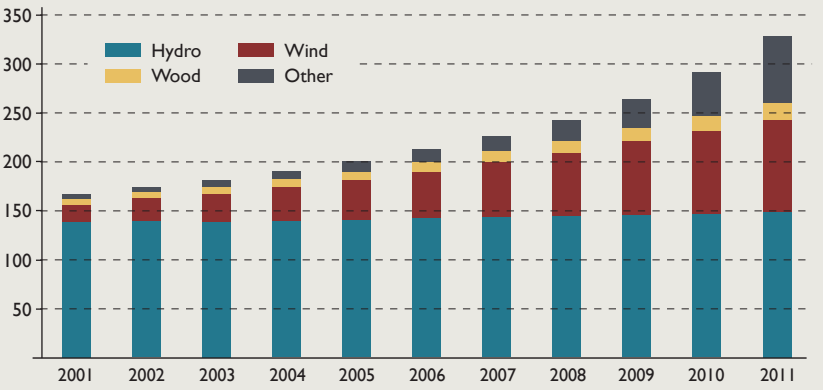
Figure 9. Renewable energy as a percentage of total energy consumption, EU-28



Source: Eurostat (online data codes: nrg_105a, nrg_1071a and nrg_1072a)

The huge increase in renewable generating capacity: 445% in the case of wind power and 1,298% for other renewable technologies (principally photovoltaic and thermoelectric), can be explained, amongst other reasons, by the returns offered by these technologies.

Figure 10. Installed electrical capacity of renewable origin [GW], EU-28

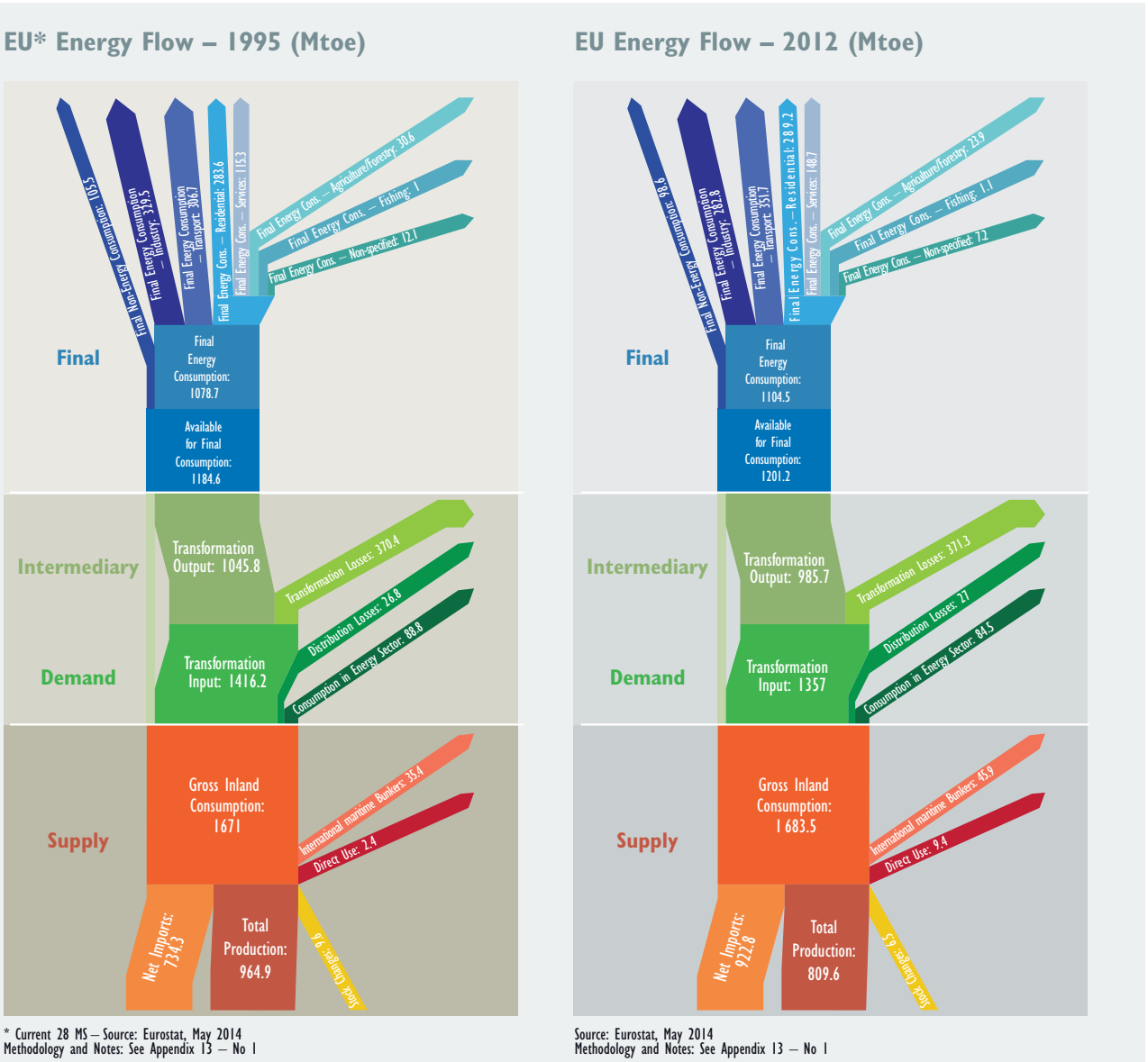


Source: Eurostat (online data code: nrg_113a)

With respect to indicators concerned with the sustainable use of energy (2001-2011): the **efficiency**[12] of power generation facilities has improved slightly (2%) to 49.3%, which is a response to changes in the electricity generation mix. Meanwhile, the EU's **gross inland energy consumption per capita** declined by 7% and its electricity consumption increased by 3% over the same period, reaching its peak in 2007 (+7.3%), responding to industrial delocalisation and the boom in the service sector. In a similar vein of favouring activities with higher added value, the **energy intensity**, which measures the energy efficiency of economic processes by calculating the energy used by each unit of GDP generated, has decreased by almost 8%, an almost continuous decline (Eurostat, 2013).
The **development of energy flows** over a longer period (1995-2012) is shown in Figure 11. It clearly indicates how a decrease in internal energy extraction has caused an increase in imports from outside the EU.

12 Thermal efficiency of power stations is calculated as the ratio between the output of electricity and heat from electricity and combined heat and power (CHP) power plants and the input of fuels to these plants.

Figure 11 Changes in energy flows 1995-2012 [Mtoe]



Source: European Commission. Energy in figures 2014 Statistical Pocketbook. (pp. 20-21)

A review of EU **net energy imports**, alongside enduring levels of consumption, price elasticity of demand for oil and sparse domestic extraction, all suggest the need for a deeper analysis of Europe's external relations in the field of energy. They all indicate that the external dimension of the EU energy metabolism should not be left out of a more general energy analysis.

For example, it is no mere anecdote that of EU energy consumption, the majority (53.8% in 2011) currently comes from outside European borders[13]. For **coal**, 62.3% of EU consumption was extracted outside EU territory[14]. In the case of oil, growth in internal sourcing has followed the general trend, reaching a maximum of 84.9% in 2011.

13 The peak of which coincided with the start of the economic crisis, in 2008 (54.6%)

14 The maximum level of external sourcing was also in 2008 (64.8%)

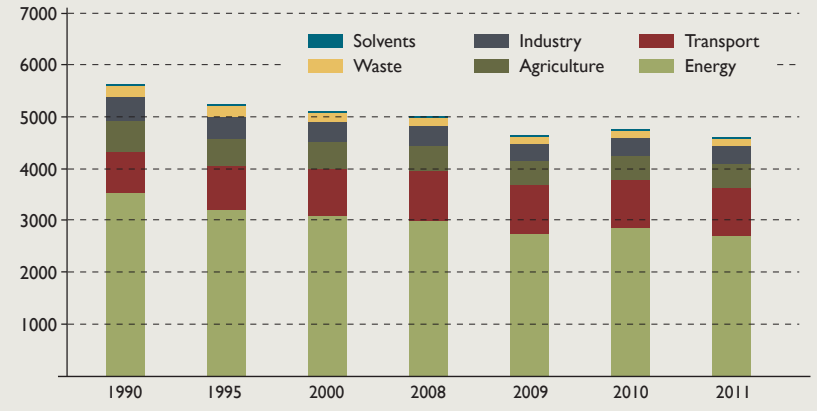
Net imports of coal and other solid fuels has increased irregularly during the period 2001-2011 by almost 10%. Meanwhile in the case of oil there has been a small, 2% decrease in imports. The situation for gas is somewhat similar to that for oil, in that 66.7% of this fossil fuel is sourced outside the EU (2011). Nevertheless, in the case of gas the level of imports has undergone a very significant increase (39%).

Electricity, being governed by different rules, experienced serious fluctuations in the levels of imports (or exports). Although the values at the beginning (7,667 TWh in 2001) and the end of the period (7,836 Twh in 2011) were similar, we find that in 2004 the EU was a net exporter of 3,660 Twh and in 2008 electricity imports reached their maximum level of 23,641 Twh (Eurostat, 2013).

As stated in the section on materials involved in metabolism, in energy terms the "ingestion" of certain fuels (fossil and nuclear) generates various kinds of **waste**: predominantly **gaseous and radioactive**. Among the waste which ends up in the atmosphere are the greenhouse gases produced by the combustion of fossil fuels, which produce what has become known as climate change. The EU is one of the main responsible parties for both the historical and current emissions of this type of gases, the consequences of which are having impacts globally.

According to the standard method of accounting, these emissions have been gradually decreasing in Europe in recent years (Figure 12). Despite this, levels of **greenhouse gases** imported through the purchase of goods have largely been increasing. Imports by the five largest European importers of carbon alone (United Kingdom, Germany, France, Italy and Spain) far exceed those of the United States (the largest importer globally at 699 M t $CO_{2\text{-eq}}$) (Davis et al., 2010). If the imported emissions of these five countries alone were counted towards achieving the EU's commitments under the Kyoto Protocol (alongside measures taken within the EU, naturally), then the EU would not have met its target to reduce emissions by 8% by the period 2008-2012. Using data from the European Environment Agency, the sum of the mean emissions within EU territory between 2008 and 2012 plus these five European leaders' carbon imports (5,548.5 M t $CO_{2\text{-eq}}$) exceeds the target for the EU agreed in Kyoto (5,176.16 M t $CO_{2\text{-eq}}$).

Figure 12. Greenhouse gas emissions by sector (M t $CO_{2\text{-eq}}$), EU-28.



Source: European Environment Agency, also available at Eurostat (online data code: env_air_gge)

This informal mechanism to address climate change can be added to existing formal mechanisms: those considered in the Kyoto Protocol and the tools which the EU promotes to reduce or compensate for the emissions generated by its social metabolism, whether directly or indirectly, and inside or outside its territory. The carbon market stands out in particular, combining as it does the expansion of capital (by financialising spaces previously beyond the reach of any market), with an apparent achievement of sustainability goals (Gilberston et al., 2009). With the development of this kind of market, the EU has become a main leader globally in the process of financialisation of the atmosphere as a way out of the critical juncture the expansion of capital finds itself in due to the environmental crisis.

It can be deduced from the 7% reduction in nuclear power generation that the radioactive waste it produces will have undergone a similar decline. Extrapolating to the EU level based on data from Spain, each

year the EU-28 produces around 14,500 m^3 of high-level nuclear waste and 200,000 m^3 of medium and low-level nuclear waste (Red Eléctrica de España, 2013). Taking into account the extremely long lifetime of the former (tens of thousands of years) and the lack of a definitive solution for its disposal, it can be confirmed that the waste generated by Europe's metabolism exceeds its capacity to manage it, whether due to its global dimension (climate change), or the dangers presented by, and the extended lifespan of, the wastes themselves (in the case of nuclear).

The EU metabolic profile

Despite having declined in recent years as a result of the economic crisis, levels of consumption of materials in the EU prove to be fairly inelastic due to the fact that the physical needs of advanced capitalism's spatial and economic complexes exhibit a high level of inertia.

The type of **materials** with the greatest share extracted domestically is non-metallic minerals, a component which is closely connected to the construction sector, and this is followed by biotic products, which can be related to mechanisms to protect agroindustry within the EU. It is also worth pointing out the leading role energy materials play in imports.

Raw unprocessed materials are predominant amongst imports, but semi-processed and finished products make up the majority of exports. The EU specialises in exports with a higher unitary value due to having been processed, meanwhile imports from the rest of the world, being essentially raw materials, attract a lower monetary return.

The majority of waste materials are produced by the construction industry and mining, two sectors closely interrelated with the secondary circuit of accumulation, i.e. "production" by the property and infrastructure sectors.

The EU has a limited amount of fossil fuel reserves, especially oil and gas, as well as an **energy** deficit arising from high energy demand and high import dependence. Despite this fact, notable differences exist between member states. Gross inland consumption has remained constant over recent decades, a trend only disturbed in the years of the property boom. Other points to highlight are that biomass comprises approximately one third of the EU-15's energy consumption, that European demand is extremely inelastic in the face of oil price fluctuations, that the principal uses of energy are for transportation (the majority by road), industry and the residential sector, and that the source of the majority of energy materials used in the EU is external.

The delocalisation of production has allowed indicators of efficiency to show an increase over recent years, and the returns on investment offered by renewable energies have resulted in a spectacular growth in the share of electricity generated in this way.

The sum of waste from energy produced by fossil fuels (i.e. gases which contribute to climate change) burnt within the EU, plus the imported waste associated with products manufactured outside its borders, exceeds the limits established by the EU's international commitments (Kyoto).

All of this means that Europe's metabolism has a external dimension that it is hard to avoid, whether from the point of view of material imports or because of the waste generated which has global impacts, and this is due to the promotion of a financialised model typical of advanced capital.

3. Interdependencies between the EU and energy exporting countries

The external dimension of Europe's energy metabolism involves other actors on the world stage. An analysis of the dependences this external dimension creates has been a key issue for growth-oriented economies, because of the need to secure their current and future energy flows. In the case of the EU, the Commission's Green Paper "*Towards a European strategy for the security of energy supply*"[8] published in November 2000 had already cited dependence on gas sourced externally as a concern. At the time it was 40% and projected to rise to 70% by 2020. The implications of this dependence became starkly evident when the Russian Federation cut off the supply in early 2006[9]. The dispute between Russia and Ukraine over gas prices arose after a drastic measure taken by Gazprom, which decided to close the shut-off valves for the pipelines which cross Ukraine on their way to the EU. This action pushed energy security way up the EU policy agenda, and diversification, or in other words, freeing the EU from its dependence on Russia, became the principle of preference.

3.1 Analysis of energy dependence

Energy dependence is defined as the net imports (imports minus exports) divided by the gross consumption ("inland" consumption + international marine bunkers)[10].

$$\frac{\text{Imports} - \text{Exports}}{\text{Gross inland consumption} + \text{International marine bunkers}}$$

Gross inland consumption is defined as the quantity of energy required to meet the needs of a defined geographical area[11]. International marine bunkers are the quantities of fuels delivered to ships of all flags that are engaged in international navigation[12].

The importance of the dependence indicator lies in the way the official discourse links it directly to vulnerability, or in other words, a high dependence is equated with a high vulnerability, since it will always be

8 Green Paper on the security of energy supply (http://europa.eu/legislation_summaries/energy/external_dimension_enlargement/l27037_en.htm)

9 Russia turns off supplies to Ukraine in payment row, and EU feels the chill. http://www.theguardian.com/world/2006/jan/02/russia.ukraine

10 Eurostat, Dataset Details http://ec.europa.eu/eurostat/web/products-datasets/-/tsdcc310

11 RAMON - Reference And Management Of Nomenclatures http://ec.europa.eu/eurostat/ramon/nomenclatures/index.cfm?TargetUrl=DSP_GLOSSARY_NOM_DTL_VIEW&StrNom=CODED2&StrLanguageCode=EN&IntKey=33013756&RdoSearch=BEGIN&TxtSearch=gross%20inland&CboTheme=&IsTer=&ter_valid=0&IntCurrentPage=1

12 RAMON - Reference And Management Of Nomenclatures http://ec.europa.eu/eurostat/ramon/nomenclatures/index.cfm?TargetUrl=DSP_GLOSSARY_NOM_DTL_VIEW&StrNom=CODED2&StrLanguageCode=EN&IntKey=33013756&RdoSearch=BEGIN&TxtSearch=gross%20inland&CboTheme=&IsTer=&ter_valid=0&IntCurrentPage=1

necessary to obtain the energy resource in question. This chapter will analyse changes to this indicator over time, placing a special emphasis on imports and exports. The aim is, through a quantitative analysis, to examine the implications of energy dependence more deeply, not only in energy importing countries but also in the countries which export.

Parameters and indicators to be borne in mind:

- **All data used in this chapter** comes from Eurostat
- **Period of study:** refers to data from 1990 to 2012, the date range available from Eurostat.
- **Principal importers and exporters:** refers to the most important countries for the fuel in question, taken as an average over the years 2000 to 2012.
- **Fuels:** grouped into solid fuels, petroleum products and gas. These groupings contain a large number of subcategories
    - **Solid fuels:** Hard coal, coal patent fuels, coke, coal tar, lignite, browncoal and briquettes and peat.
    - **Total petroleum products:** crude oil, natural gas liquids, feedstocks and all petroleum subproducts such as LPG, refinery gas, motor gasoline, aviation gasoline, kerosene and jet fuels, naphtha, gas/diesel oil, residual fuel oil, white spirit, lubricants, bitumen, petroleum coke and other petroleum products.
    - **Gas:** natural gas and derived gases
- **Imports and exports:** Imports represent all entries into a nation's territory excluding quantities in transit (notably via gas and oil pipelines). In annual data collections, imports refer to the country of ultimate origin. For Eurostat, imports or exports for the EU are the sum of those of each member state.

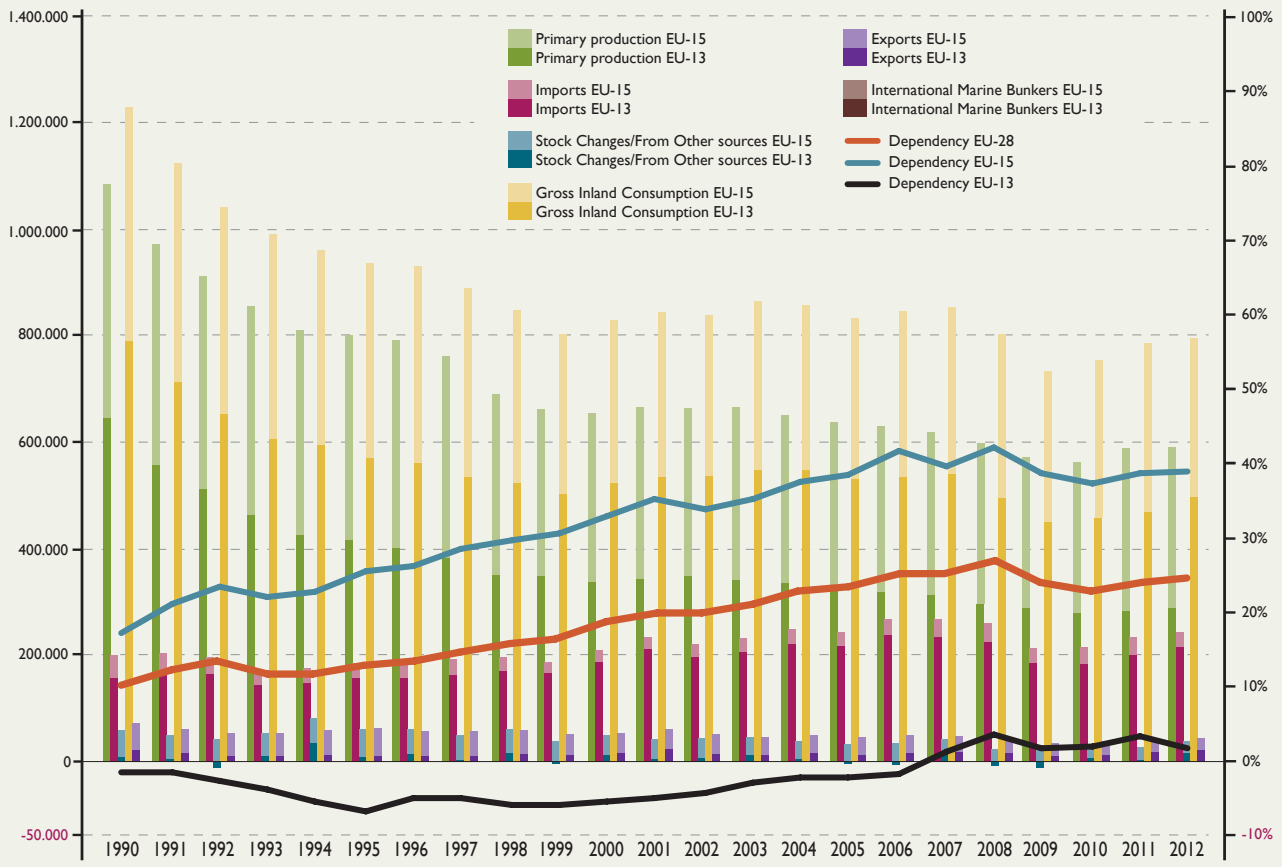
3.2 Solid fuels

a. The EU-28

The consumption of solid fuels in the EU-28 has decreased by 35.3% in the period 1990-2012. This fact could be understood as a positive signal that carbon-intensive fuels are being progressively abandoned, but imports, on the other hand, have increased by 21.3%.

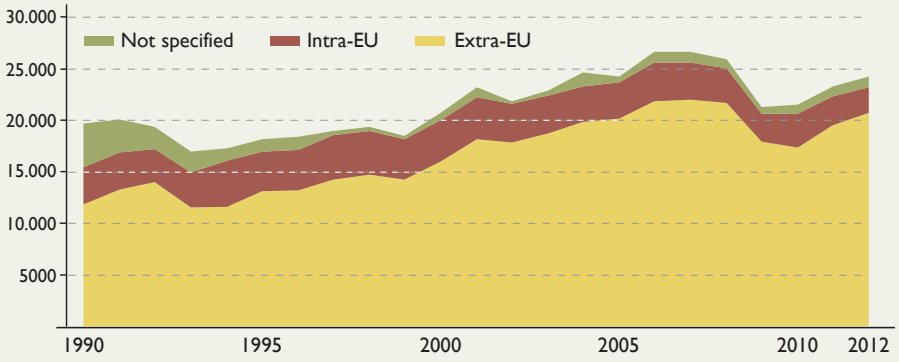
The dependence indicator, contrary to what we might have expected from the decrease in consumption, has risen from 10.5% to 25.1% over the entire EU-28 due to the incorporation of major solid fuel producers such as Poland and the Czech Republic, which accounted for 33.7% of primary production in 2012.

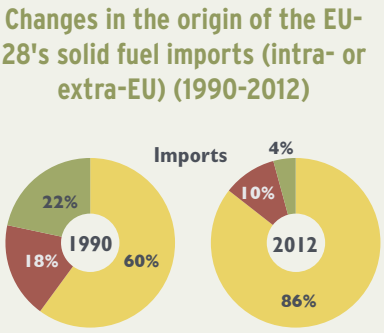
Figure 13. Energy dependence for solid fuels [thousands of tonnes]



Source: Eurostat (online data code: nrg_101a)

Figure 14. Solid fuel imports (intra- or extra-EU) [thousands of tonnes]

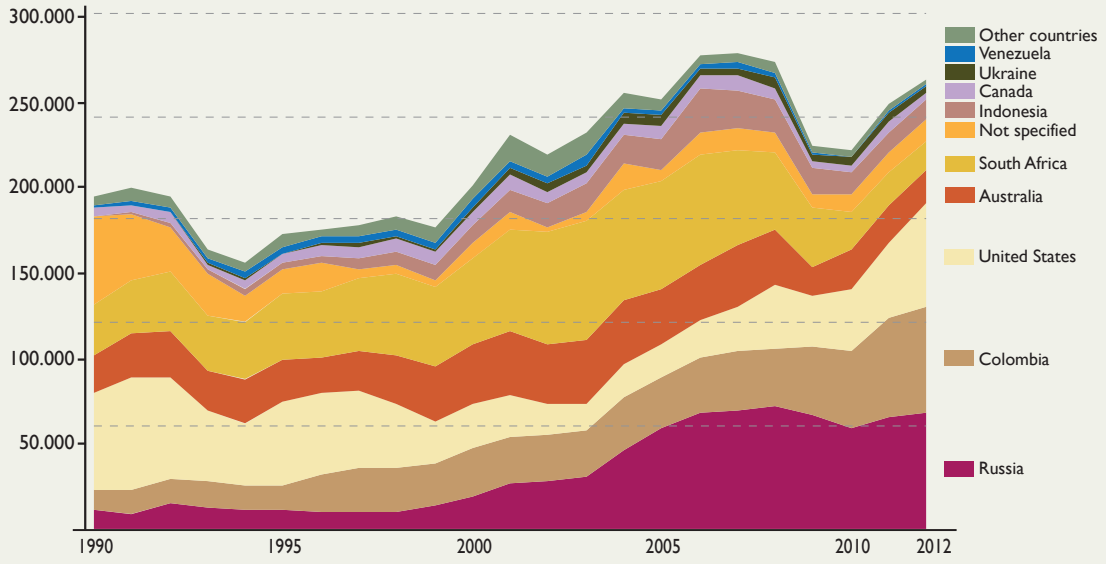




Source: Eurostat (online data code: nrg_101a)

The growth in imports actually comes from countries outside the EU and their share has increased in importance considerably, emphasising the external component of EU activity.

Figure 15. Solid fuel imports, by country of origin [thousands of tonnes], EU-28

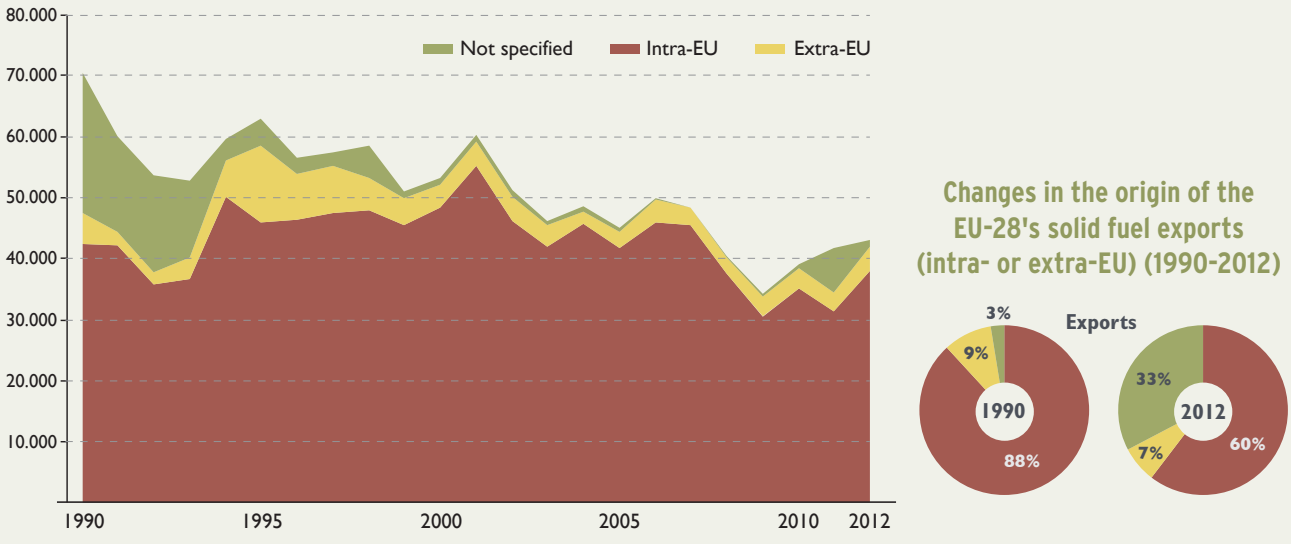


Source: Eurostat (online data code: nrg_122a)

With respect to suppliers, the Russian Federation heads the list with more than 23% in 2012. Colombia has a similar profile to Russia (21.3% in 2012) and the US has regained the importance it had in the early 1990s (20.7% in 2012). Therefore it appears that in the case of solid fuels, diversification has not worked. A block of five countries (Russia, Colombia, US, Australia and South Africa) has consolidated its position, and is responsible for almost 90% of total imports. Two are from the BRICS grouping, and South Africa in particular has experienced recent severe conflicts in its mining sector.

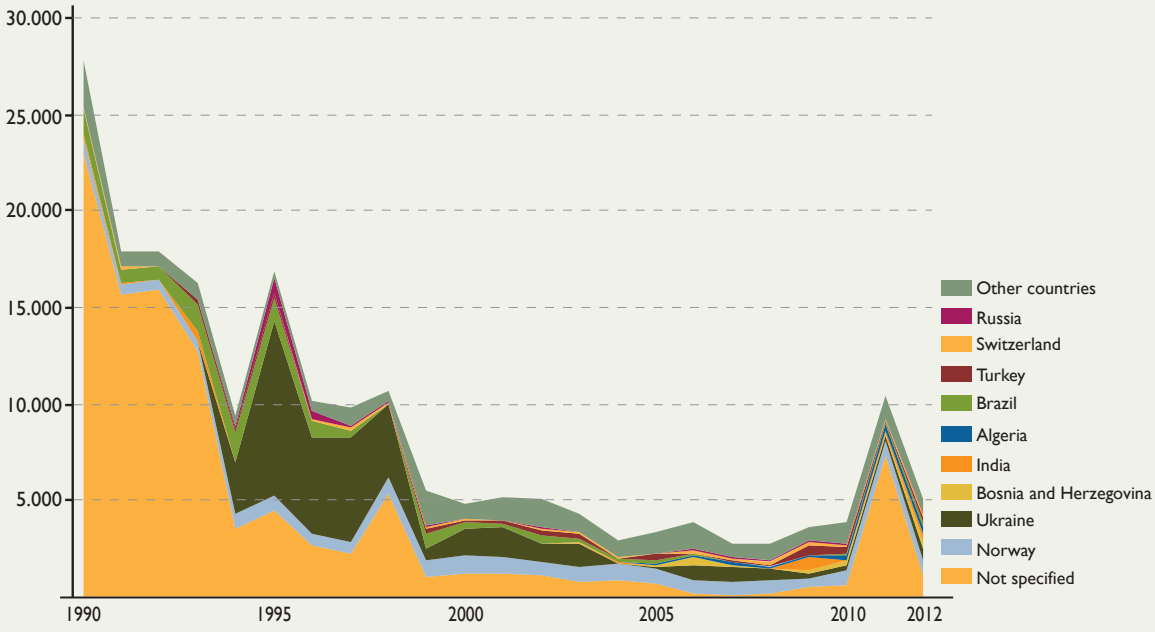
As far as exports are concerned, they are almost totally confined to exports to other member states (88% in 2012). The largest recipient of solid fuels is in the unspecified category, and the only significant increases were to Ukraine in the early 2000s and to Norway.

Figure 16. Solid fuel exports (intra- or extra-EU) [thousands of tonnes]



Source: Eurostat (online data code: nrg_101a)

Figure 17. Solid fuel exports, by country of destination [thousands of tonnes], EU-28



Source: Eurostat (online data code: nrg_132a)

b. Principal importing and exporting countries within the EU-28

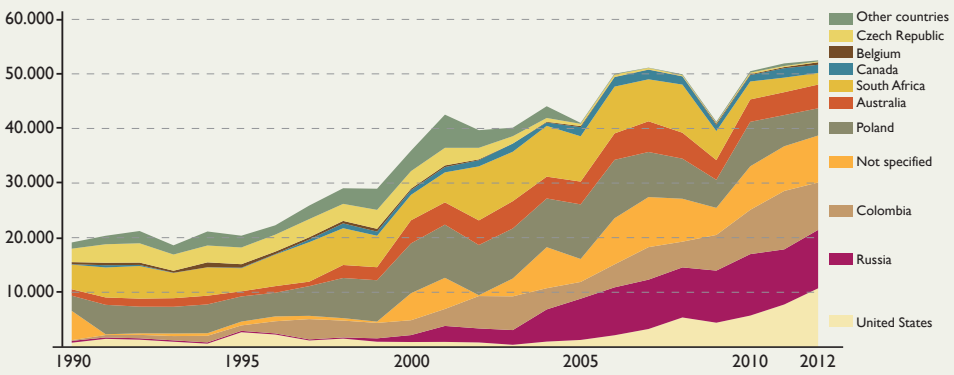
In the case of solid fuels we would highlight the following:

1. The six most important importing nations: Germany, the United Kingdom, the Netherlands, Italy, Spain and France , account for 72% of total EU-28 imports.
2. The three most important exporting nations: the Netherlands, Poland and the Czech Republic, account for 82% of total exports.

The six largest importers follow a similar pattern to the EU-28 as a whole, with Russia, Colombia and the US as their major suppliers; the exceptions are Italy and Spain, for which Indonesia appears on the list of source countries, and France, for which Australia was the second-largest supplier in 2012. The United Kingdom receives the greatest percentage of imports from the Russian Federation, 40.2% in 2012, compared to Germany's 20.4%. The Netherlands maintains a strong connection to Colombia, which supplied 45% of its imports in 2012.

Figure 18. Principal importing countries

Germany.
Solid fuel imports
[thousands of tonnes]



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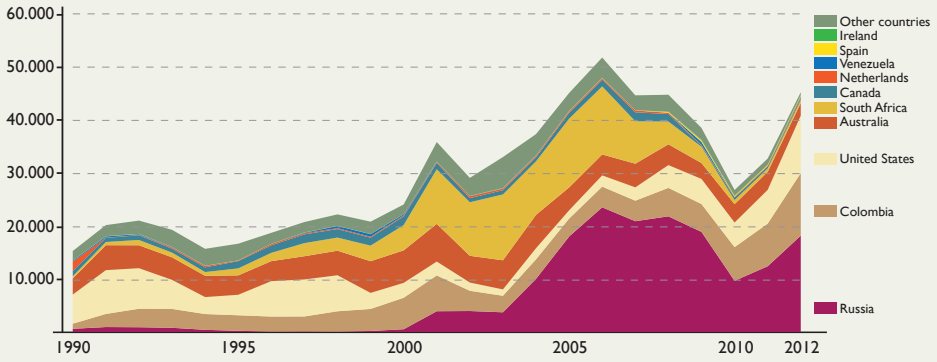
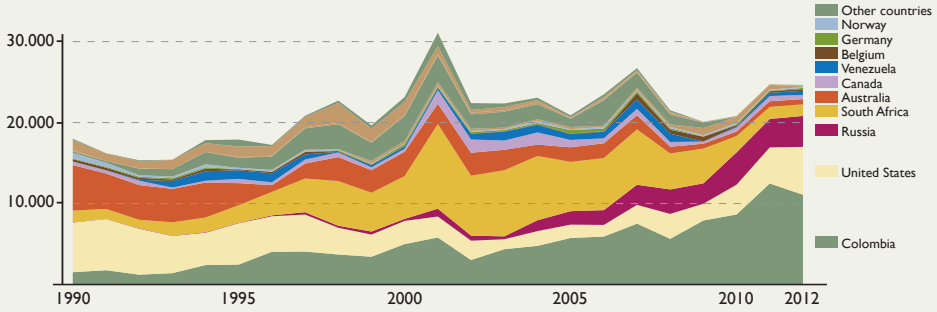
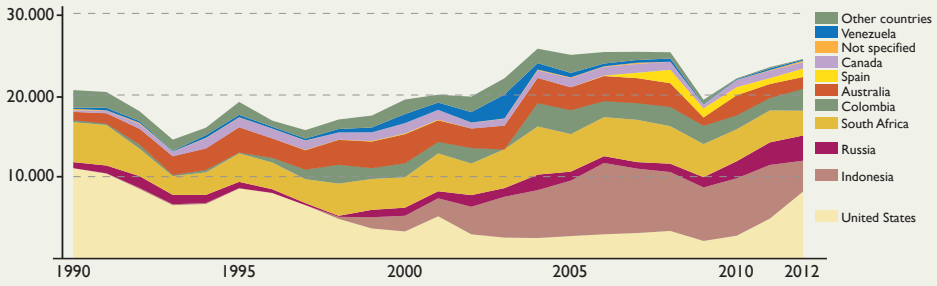
United Kingdom. Solid fuel imports [thousands of tonnes]



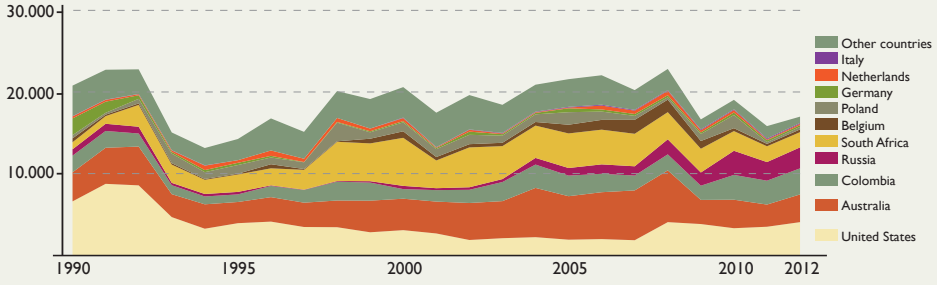
Netherlands. Solid fuel imports [thousands of tonnes]



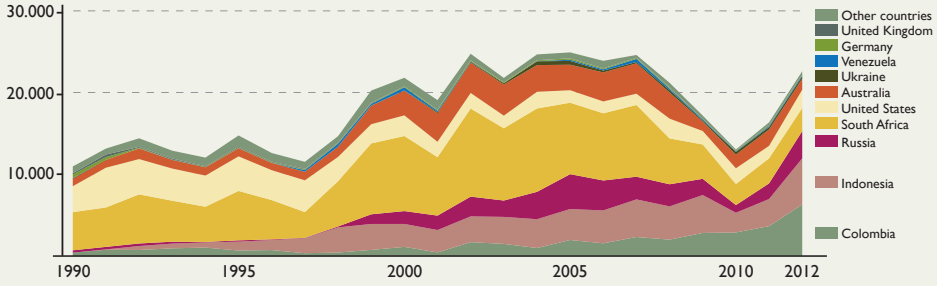
Italy. Solid fuel imports [thousands of tonnes]



France. Solid fuel imports [thousands of tonnes]



Spain. Solid fuel imports [thousands of tonnes]



Source: Eurostat (online data code: nrg_122a)

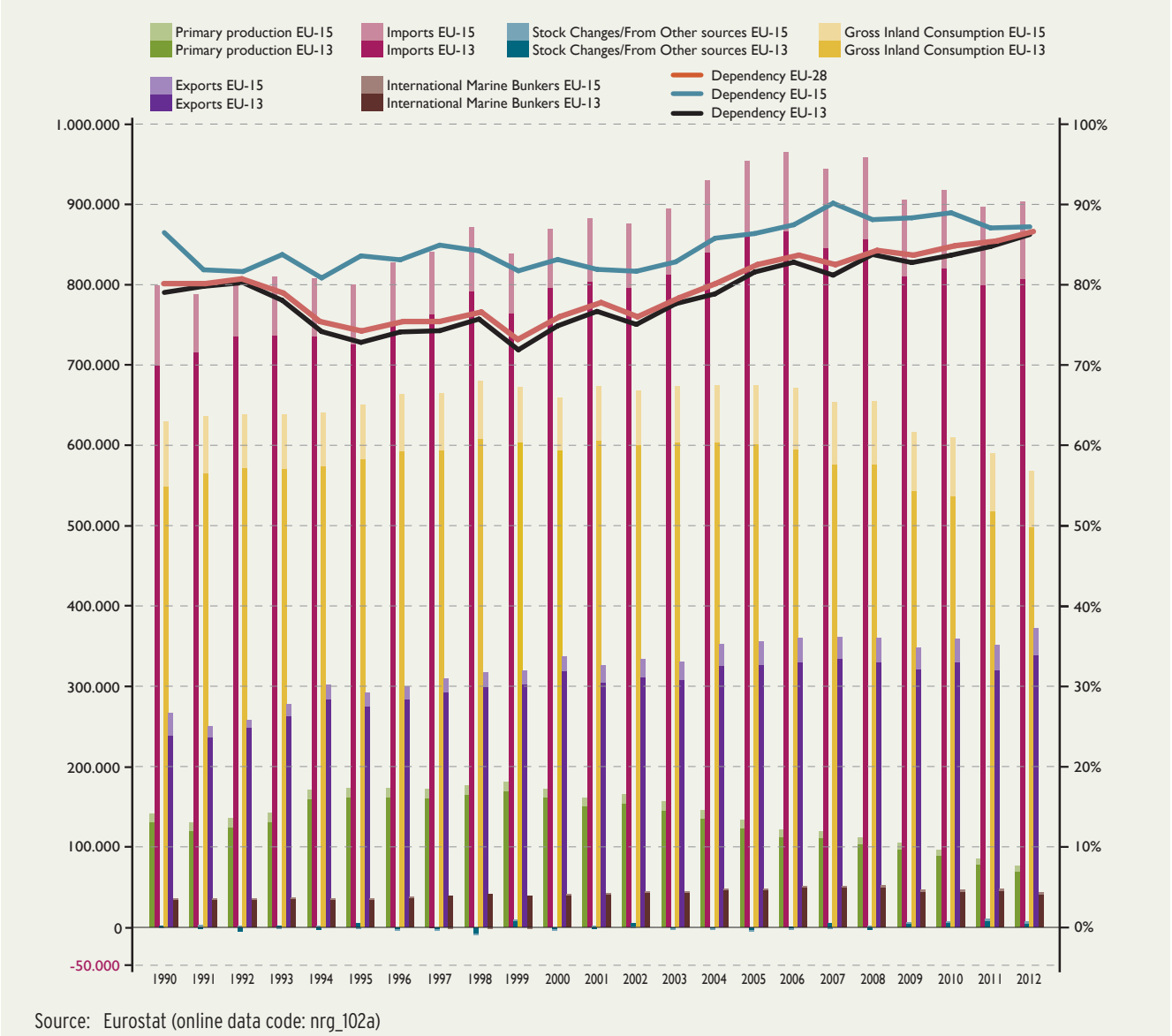
In the case of exports, almost all trade takes place between EU member states or other countries on the European continent such as Norway and Ukraine. Other than this there are only exports from Poland to Brazil, and occasionally to India, Egypt or Algeria, but always in quantities of less than one million tonnes.

3.3 Petroleum products

a. The EU-28

The trend towards growth in petroleum products consumption has changed over the last decade, and in fact, the EU-28's consumption has decreased by 9.65% relative to 1990 levels. It might be envisaged that this would mean a more or less proportional decrease in dependence, but the latter has actually increased by more than six percent (from 80.03% in 1990 to 86.44% in 2012). This was due to the increase in import flows (a 13.19% increase between 1990 and 2012) driven by the fall in primary production.

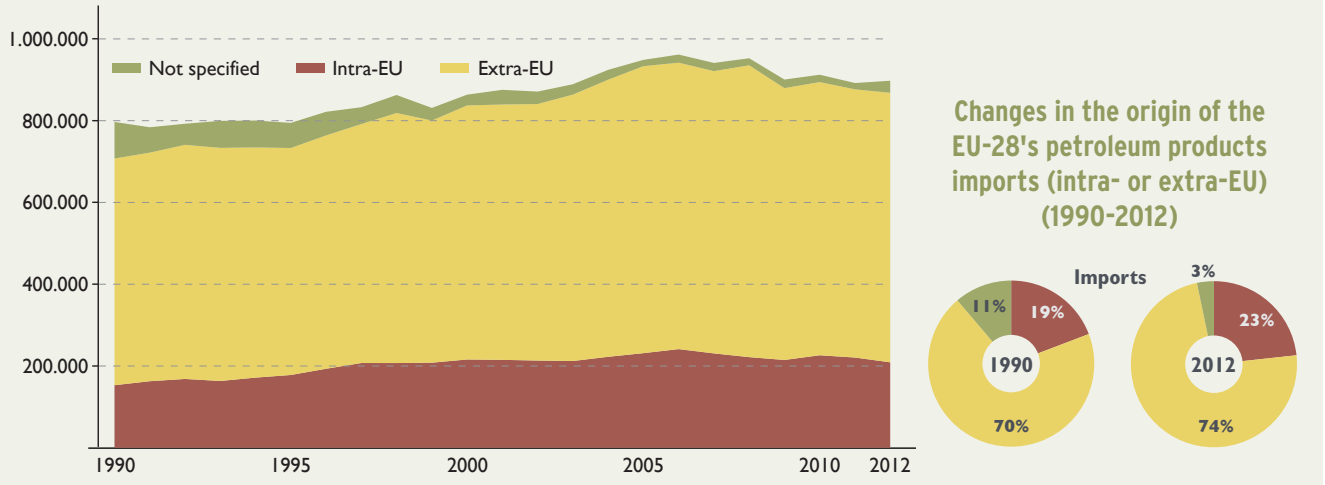
Figure 19. Energy dependence for petroleum products [thousand tonnes of oil equivalent (TOE)]



Source: Eurostat (online data code: nrg_102a)

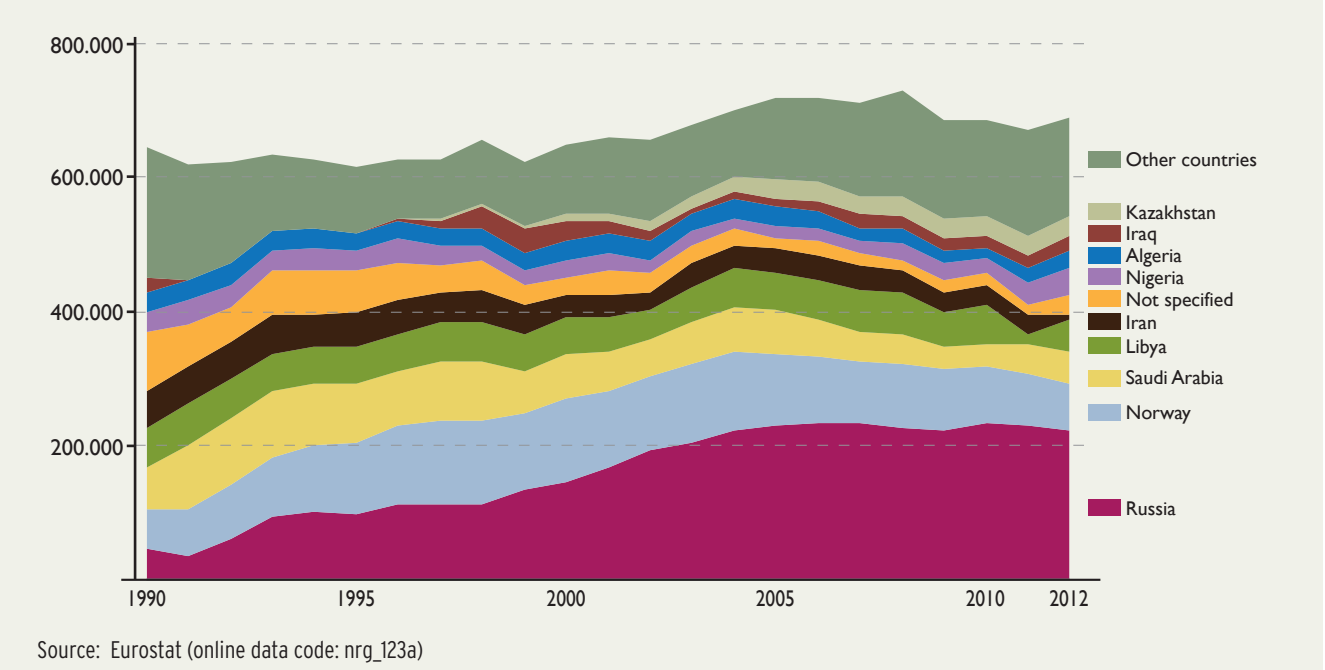
The majority of imports come from third countries and the intra-EU, extra-EU relationship has remained stable over the period of study.

Figure 20. Petroleum products imports (intra- or extra-EU) [thousand tonnes of oil equivalent (TOE)]



Eurostat (online data code: nrg_102a)

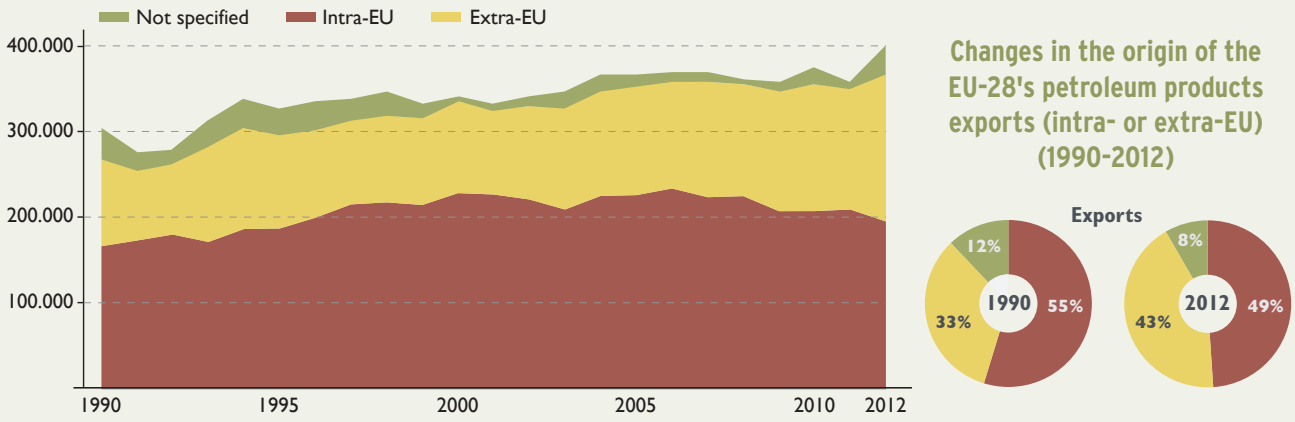
Figure 21. Petroleum products imports, by origin [thousand tonnes of oil equivalent (TOE)], **EU-28**



Source: Eurostat (online data code: nrg_123a)

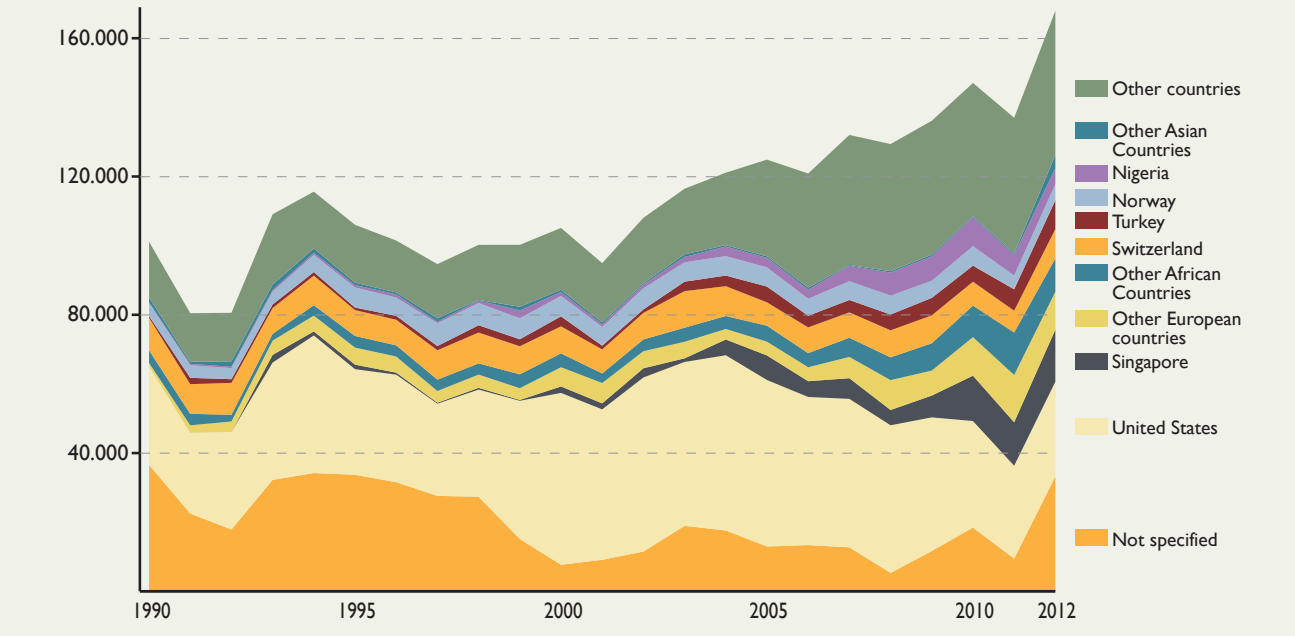
One of the main features of petroleum products imports is the large number of suppliers. Over the period of study, this has increased from 68 to 96, although the number of countries that contribute at least 1% of the total has remained close to 20. The largest exporter, just as in the case of coal, is the Russian Federation. It has increased its share from 6% of total imports in 1990 to 25% in 2012, a figure that appears to have stabilised in recent years. Norway is in second place, followed by Saudi Arabia (which has been losing importance in recent years), Nigeria and Libya. Azerbaijan and Kazakhstan have also consolidated their share.

Figure 22. Petroleum products exports (intra- or extra-EU) [thousand tonnes of oil equivalent (TOE)]



Source: Eurostat (online data code: nrg_123a)

Figure 23. Petroleum products exports, by country of destination [thousand tonnes of oil equivalent (TOE)], **EU-28**



Source: Eurostat (online data code: nrg_133a)

Despite being a net petroleum products importer, the European Union has maintained significant export flows, both internally and to third countries, and this role as an exporter has been becoming more established.

The number of destination countries outside the EU has also increased considerably, from 36 countries in 1990 to 65 in 2012, although it should be pointed out that some of the recipients are also amongst the principal suppliers. The US, Norway and Mexico received mainly petrol, diesel, liquefied petroleum gas (LPG) and raw materials for refineries.

b. Principal importing and exporting countries within the EU-28

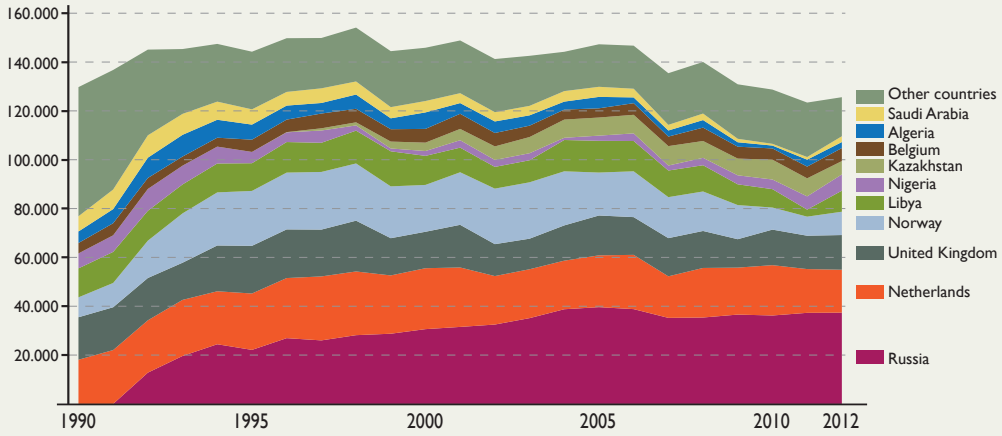
For petroleum products, the following can be highlighted:

1. The six most important importing countries, Germany, the Netherlands, France, Italy, Spain and the United Kingdom, account for 71% of total EU-28 imports.
2. The two largest exporters, the United Kingdom and the Netherlands, account for 48% of total exports.

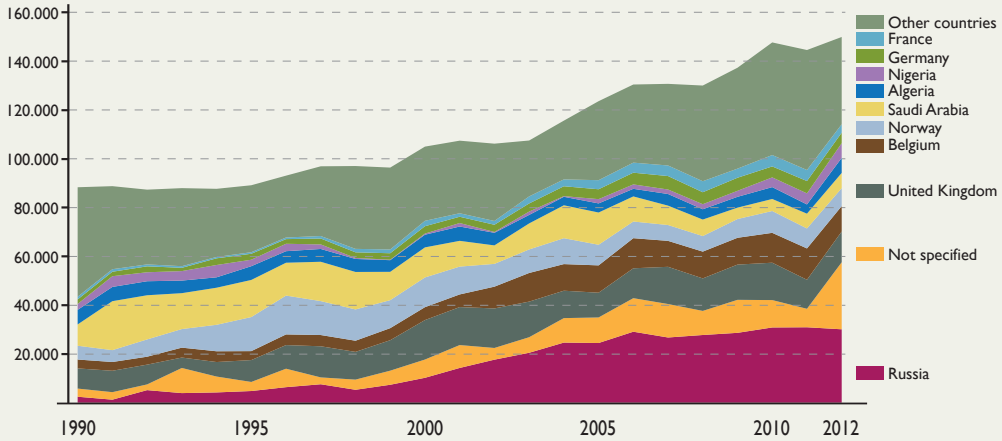
In 2012 the six most important importers all had Russia as their principal supplier, with the exception of the United Kingdom and Italy. The United Kingdom imports more than 30% of its oil from Norway, reaching 50% around the year 2000. For Italy, Libya is the main supplier, maintaining a level of around 25%, which dipped significantly in 2011 as a consequence of the invasion of Libya.

Figure 24. Principal importing countries

Germany. Petroleum products imports [thousand tonnes of oil equivalent (TOE)]



Netherlands. Petroleum products imports [thousand tonnes of oil equivalent (TOE)]



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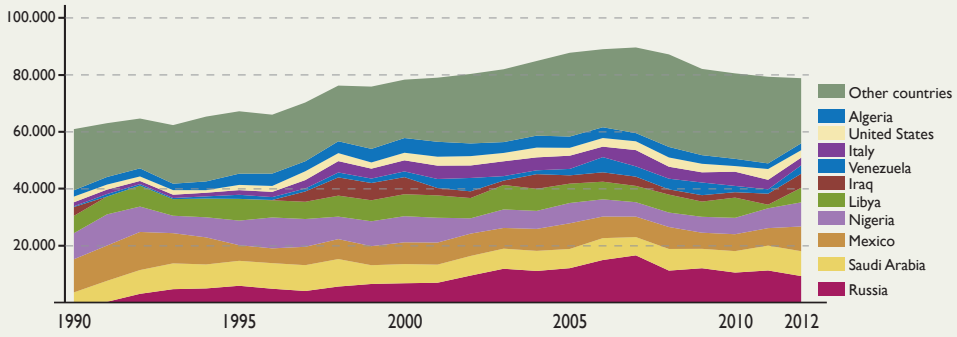
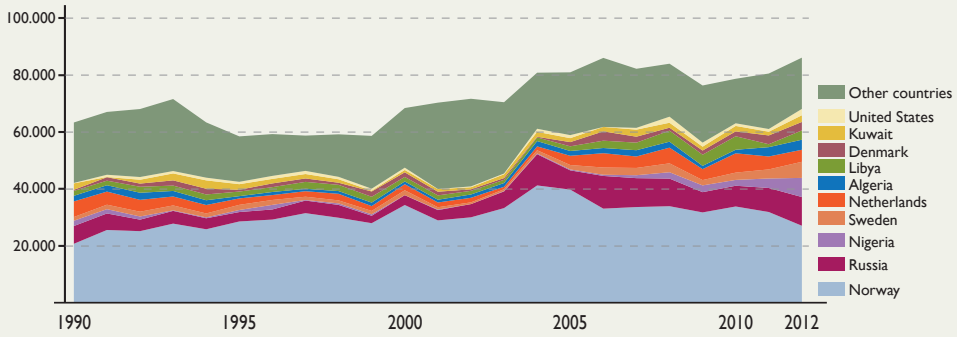
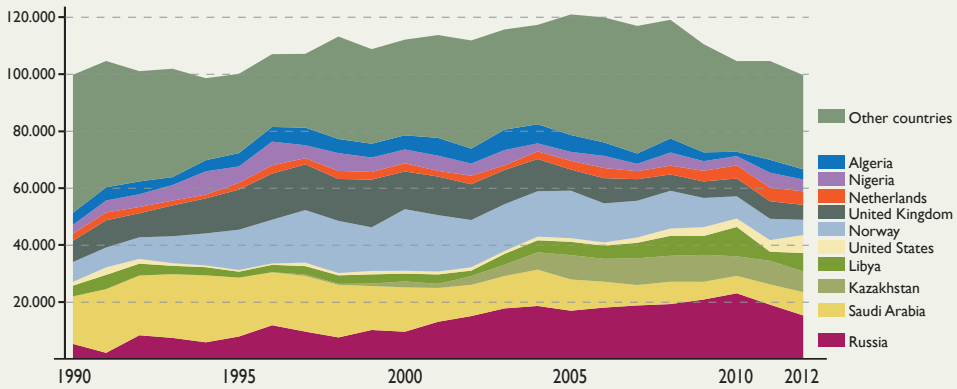
Spain.
Petroleum products imports [thousand tonnes of oil equivalent (TOE)]



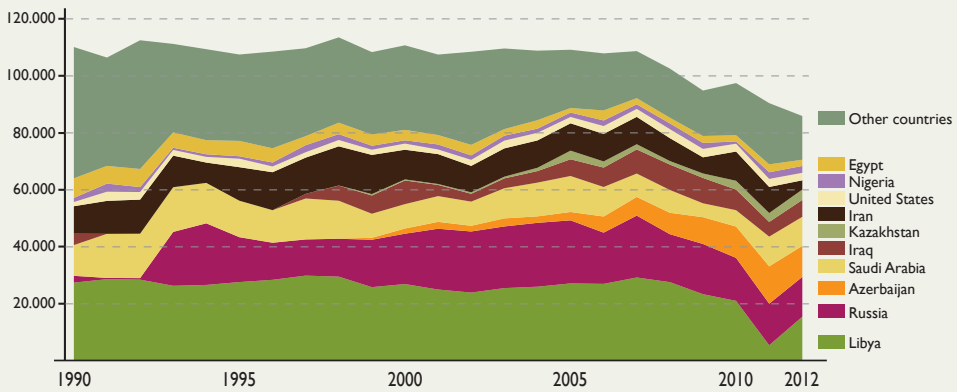
United Kingdom.
Petroleum products imports [thousand tonnes of oil equivalent (TOE)]



France.
Petroleum products imports [thousand tonnes of oil equivalent (TOE)]



Italy.
Petroleum products imports [thousand tonnes of oil equivalent (TOE)]

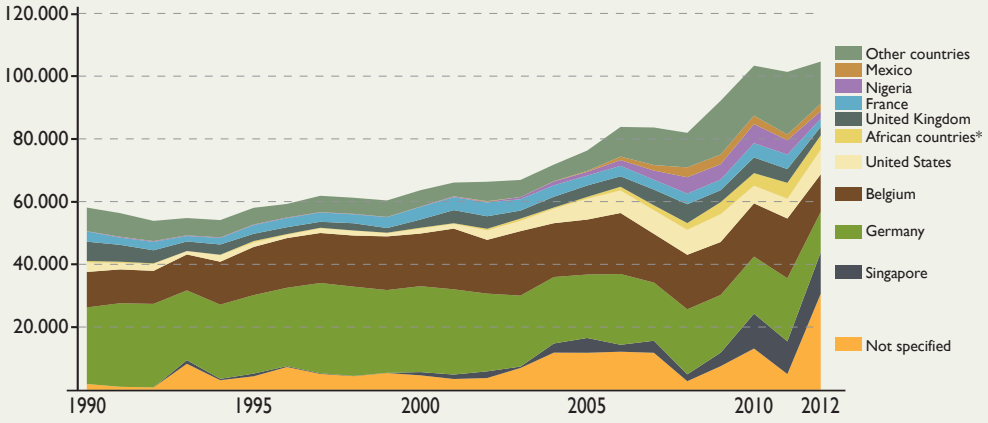


Source: Eurostat (online data code: nrg_123a)

Although much of the Netherlands' and United Kingdom's exports are to European Union members, they also export to countries such as Singapore, the US, Nigeria and Canada. Nigeria, for example, is the largest importer of Dutch petrol, importing more than 4.5 Mt in 2012.

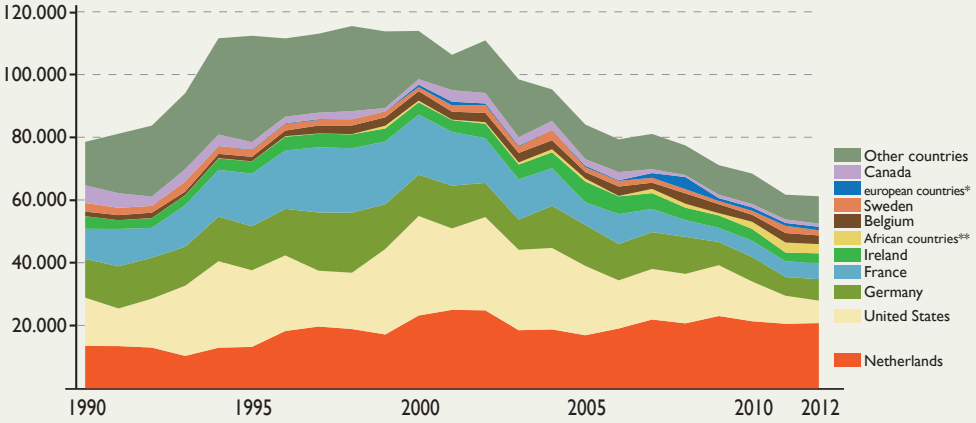
Figure 25. Principal exporting countries

Netherlands. Petroleum products exports [thousand tonnes of oil equivalent (TOE)]



*Other African countries (aggregate changing according to the context)

United Kingdom. Petroleum products exports [thousand tonnes of oil equivalent (TOE)]



*Other european countries (aggregate changing according to the context)
**Other African countries (aggregate changing according to the context)

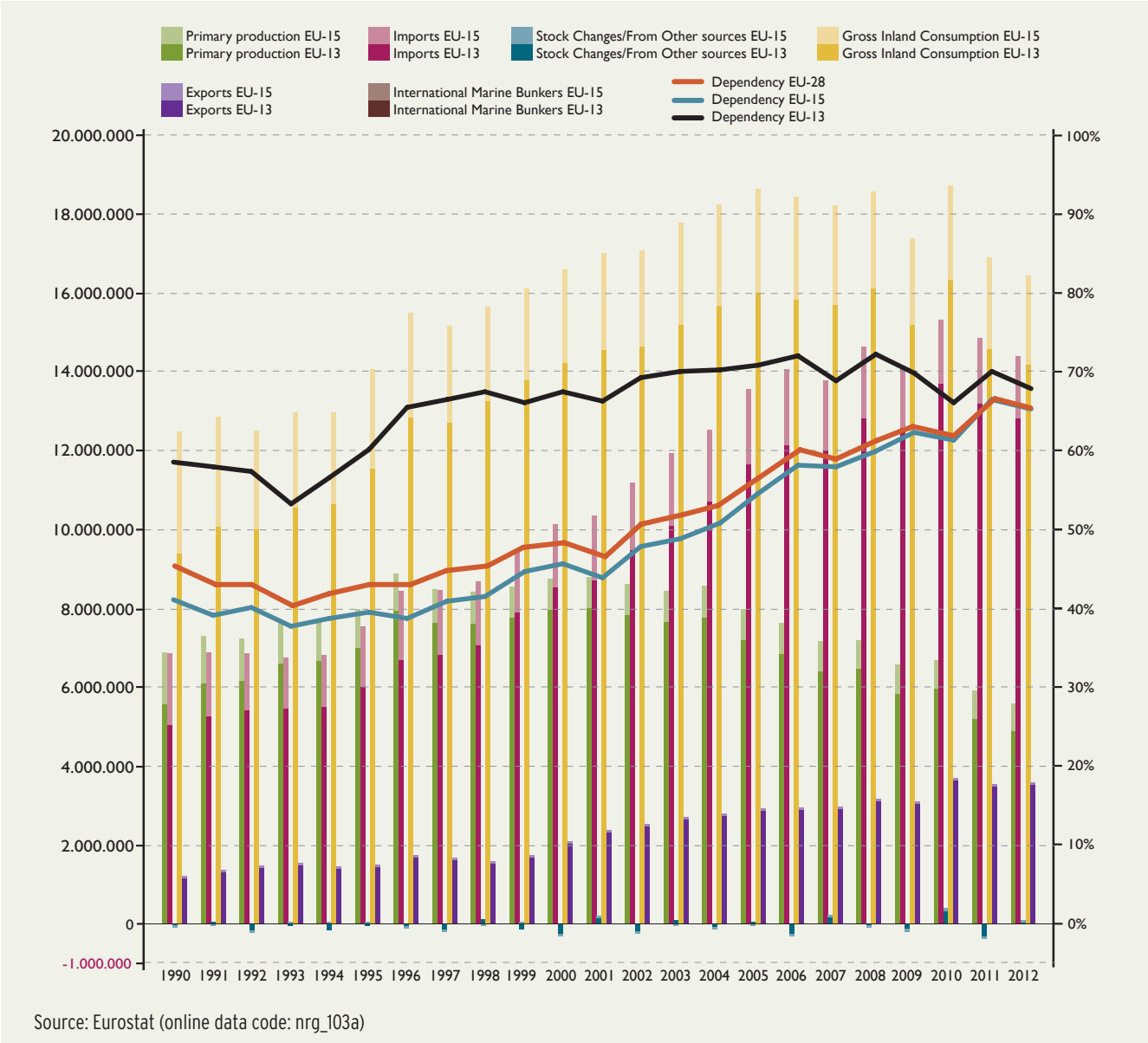
Source: Eurostat (online data code: nrg_133a)

3.4 Gas

a. The EU-28

Gas consumption in the EU-28 has increased by 32.2% compared to 1990 levels and primary production started to decline from the year 2000. Imports have doubled since 1990 and exports have tripled. There has been a substantial increase in the importance of gas and dependence has grown from 44.7% in 1990 to 65.8% in 2012.

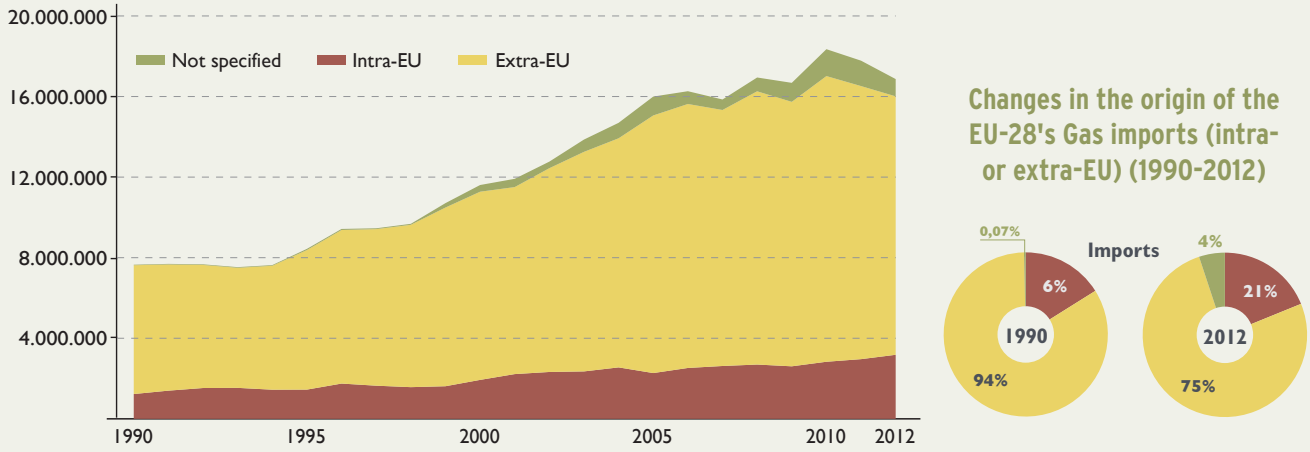
Figure 26. Energy dependence for gas



Source: Eurostat (online data code: nrg_103a)

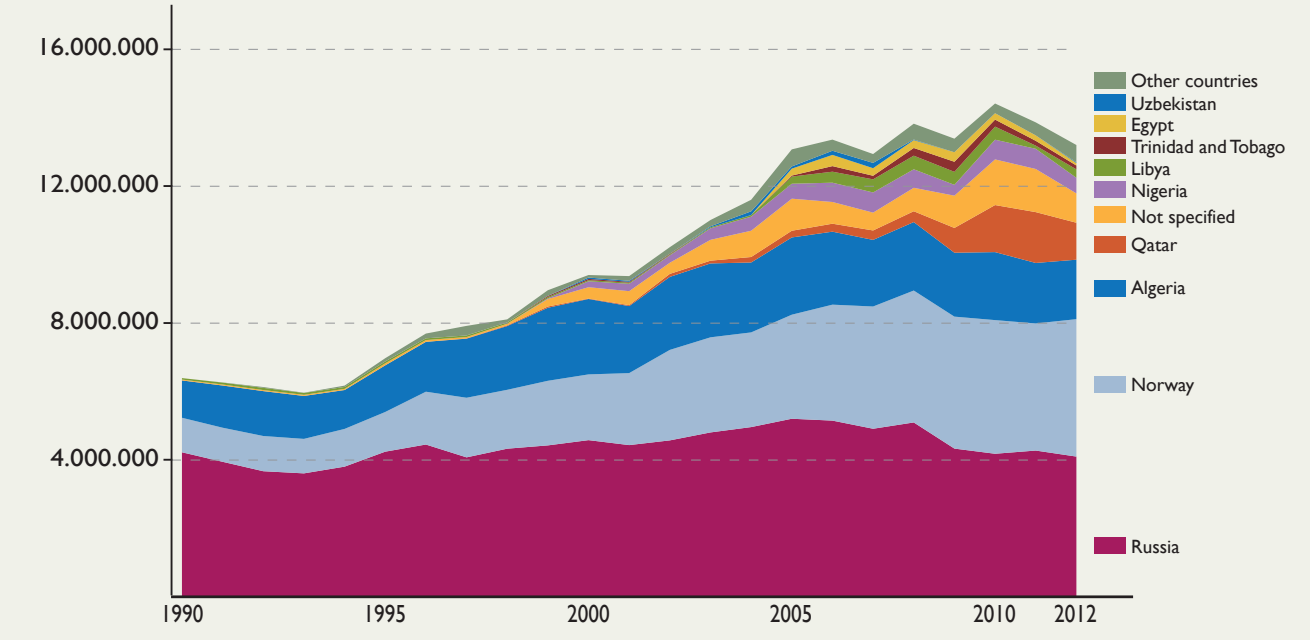
In contrast to petroleum products, the number of countries which export gas to the EU is relatively small. The most recent update in 2012 indicated 26 supplier countries, only 12 of which have a relative share of more than 1% of the total. The leading supplier was still the Russian Federation, despite having decreased in importance relative to other exporters (55.4% of total imports to the EU in 1990 and 25.6% in 2012). Countries such as Norway (which has quadrupled the volume of its exports), Qatar and Nigeria, have absorbed the extra demand created by rising gas consumption.

Figure 27. Gas imports (intra- or extra-EU) [Terajoules (Gross calorific value = GCV)]



Source: Eurostat (online data code: nrg_124a)

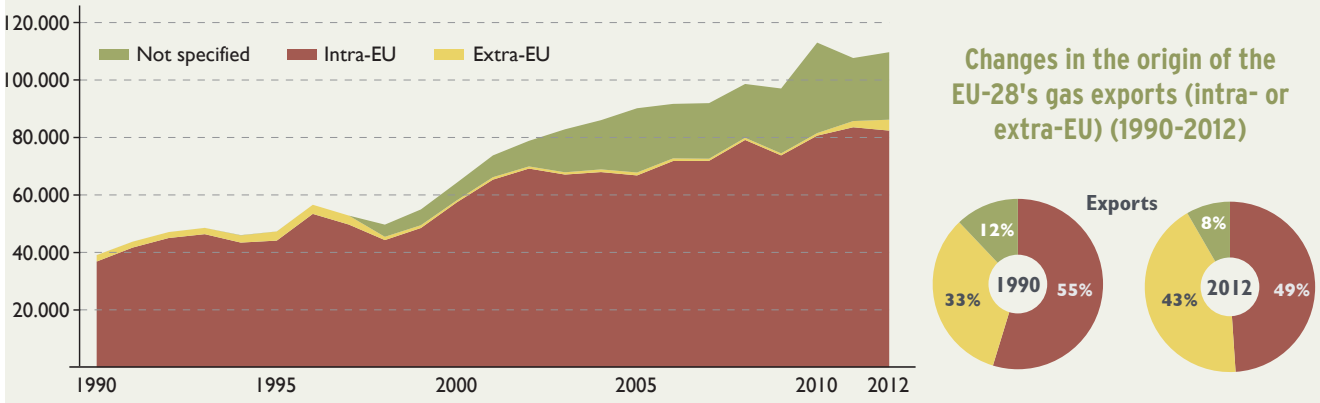
Figure 28. Gas imports, by country of origin [Terajoules (Gross calorific value = GCV)], EU-28



Source: Eurostat (online data code: nrg_124a)

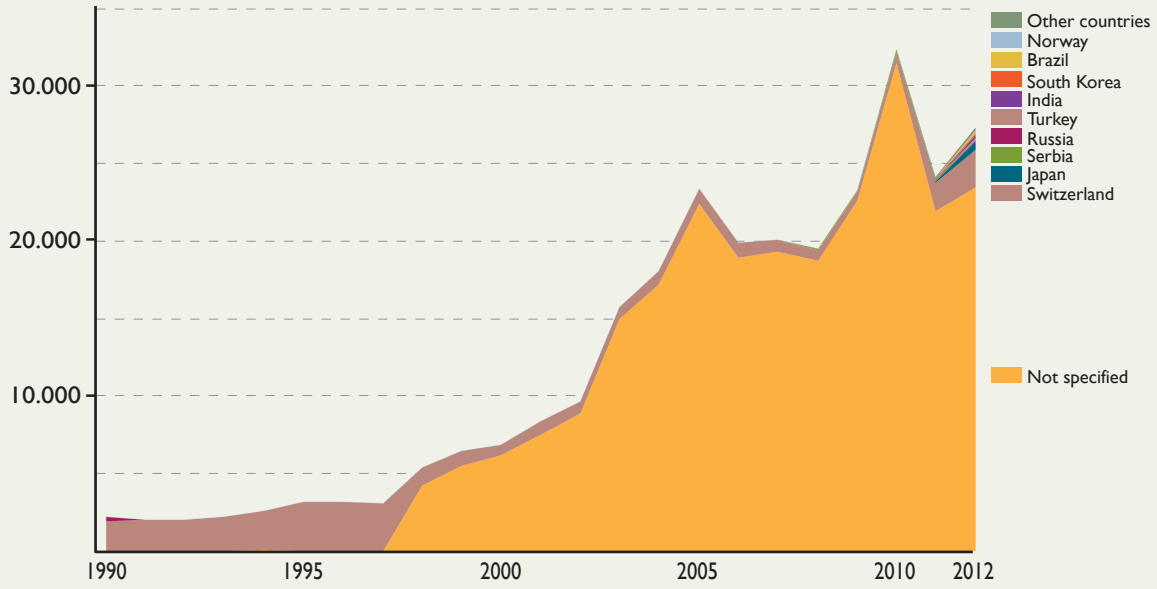
Practically all the gas considered to be exported is distributed within the European Union. Only a small proportion (3.5% of all exports in 2012) ends up outside its borders, in countries such as Switzerland, Japan, Serbia or Turkey. With the exception of countries on the European continent, all other destination countries receive small quantities of gas in certain specific years, without establishing any clear trends. The only fact that stands out is that Spain was the only exporter of gas to Japan in 2012, 528 million cubic metres, a considerable volume which represented 14% of exports to outside the EU in that year, despite Spain's primary production being virtually non-existent. There has also been a large volume of exports for which the destination was not specified (21% in 2012).

Figure 29. Gas exports (intra- or extra-EU) [Terajoules (Gross calorific value = GCV)]



Source: Eurostat (online data code: nrg_134a)

Figure 30. Gas exports, by country of destination [Terajoules (Gross calorific value = GCV)], EU-28



Source: Eurostat (online data code: nrg_124a)

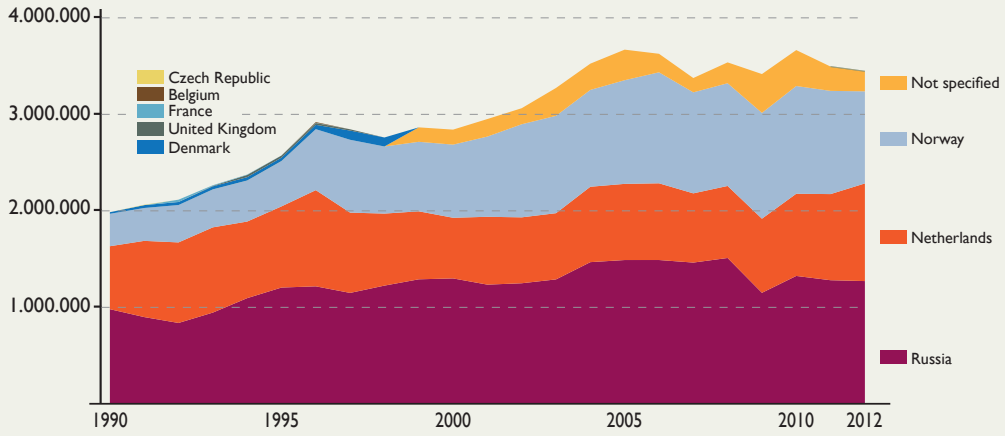
b. Principal importing and exporting countries within the EU-28

For gas, we can highlight the following:

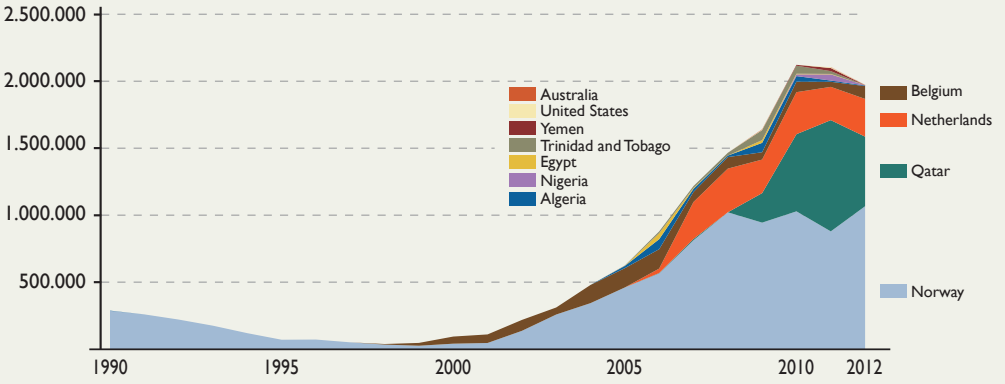
1. The six most important importing countries: Germany, Italy, France, Spain, the United Kingdom and the Netherlands account for 74.5% of the total of EU-28 imports.
2. The three largest exporters: the Netherlands, Germany and the United Kingdom, account for 87% of total exports.

Figure 31. Principal importing countries

Germany. Gas imports [Terajoules (Gross calorific value = GCV)]



United Kingdom. Gas imports [Terajoules (Gross calorific value = GCV)]



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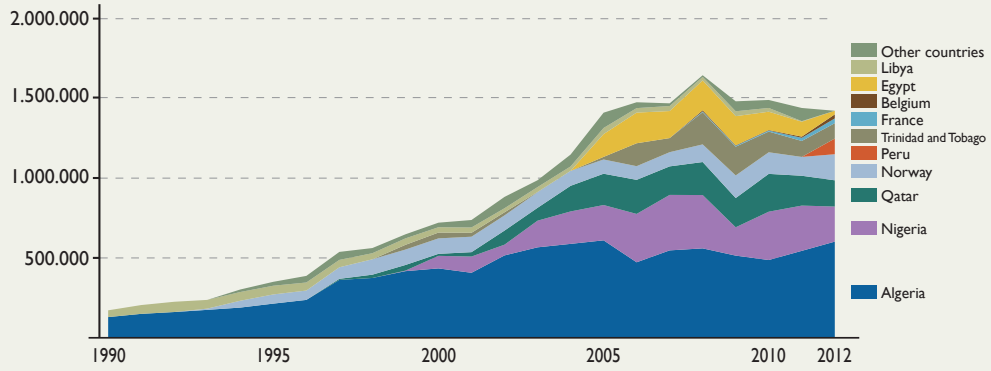
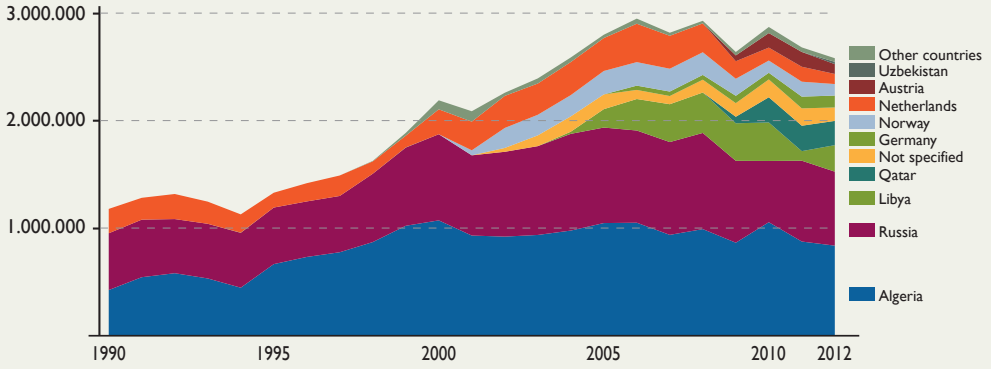
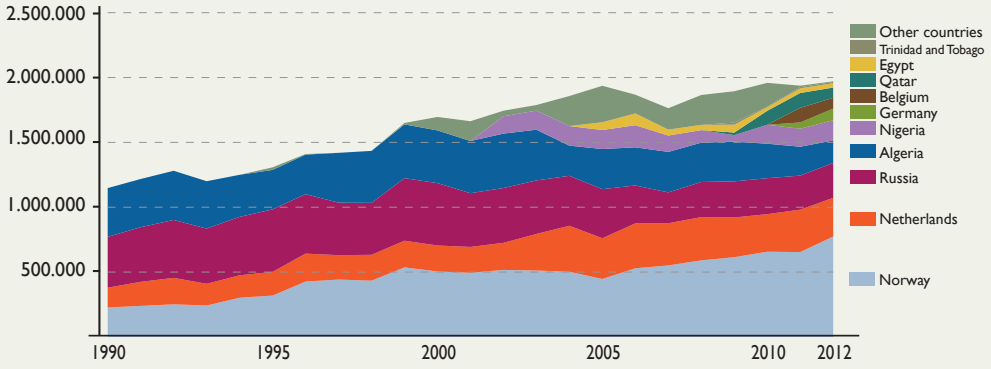
Spain.
Gas imports
[Terajoules
(Gross calorific
value = GCV)]



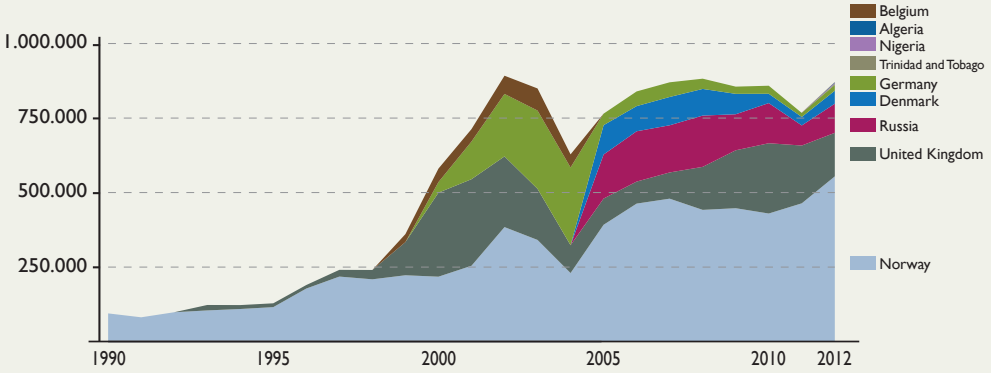
Italy.
Gas imports
[Terajoules
(Gross calorific
value = GCV)]



France.
Gas imports
[Terajoules
(Gross calorific
value = GCV)]



Netherlands.
Gas imports
[Terajoules
(Gross calorific
value = GCV)]



Source: Eurostat (online data code: nrg_134a)

The six largest EU importers show significantly different profiles. Whereas for solid fuels and petroleum products there was a degree of correspondence between individual countries and the general EU-28 trend, the situation for gas is much more nuanced. For example, Germany relies on Russia, Holland and Norway for nearly all its gas (more than 90%). The United Kingdom has increased its imports by a dizzying amount, more than 600% between 1990 and 2012, due to the fall in its primary production, and it now relies on Norway, Qatar and the Netherlands. The Netherlands itself is in a similar situation: a strong increase in imports (586%), with Norway as its principal supplier. Spain has traditionally relied on Algeria, but from the year 2000 onwards actors such as Nigeria and Qatar have made a strong appearance. France has maintained a degree of stability in terms of importers, with Norway, the Netherlands, Russia and Algeria accounting for the majority of gas supplied (100% in 1990 and 77% in 2012). Finally, Italy mainly imports from Algeria and Russia.

With respect to the three main exporting countries, 100% of Germany's exports fall into the category "unspecified". The Netherlands, for their part, mainly exports gas to Germany, and to a lesser degree to Belgium, Italy, France, and from the year 2000 onwards, the United Kingdom. Finally, the United Kingdom mainly exports gas to Belgium and Ireland, followed by the Netherlands.

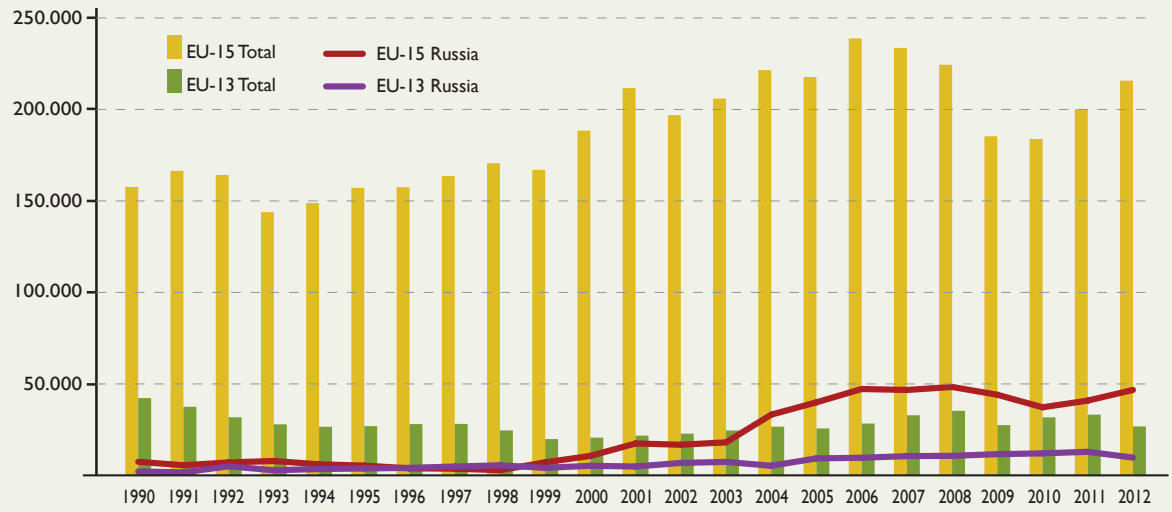
3.5 Looking at dependence from the other side. Supplying countries.

a. Russia, the leading supplier of solid fuels, petroleum products and gas.

The Russian Federation continues its hegemony in the supply of fossil fuels to the EU-28. For practically the whole period 1990 to 2012, and for all three fuels, Russia has always headed the list of countries exporting to the EU. Diversification plans have only had a notable effect in the case of gas, for which although the volume of imports has been maintained, Russia's relative importance has declined due to the increase in imports from other providers.

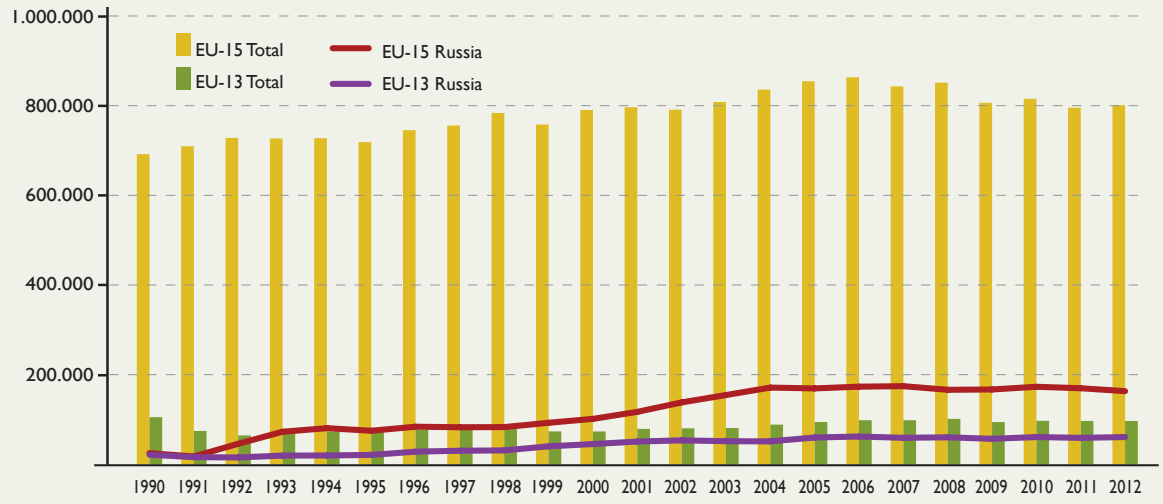
Contradicting what our intuition might tell us, it has not been the EU-13 countries situated nearer to the Russian sphere of influence which increased their imports from Russia in recent years, but instead the long-term members. For gas, which has been such a hobby-horse of European energy policy, there has been an increase of 32.1% compared to 1990 levels.

Figure 32. Solid fuel imports from Russia [thousands of tonnes]



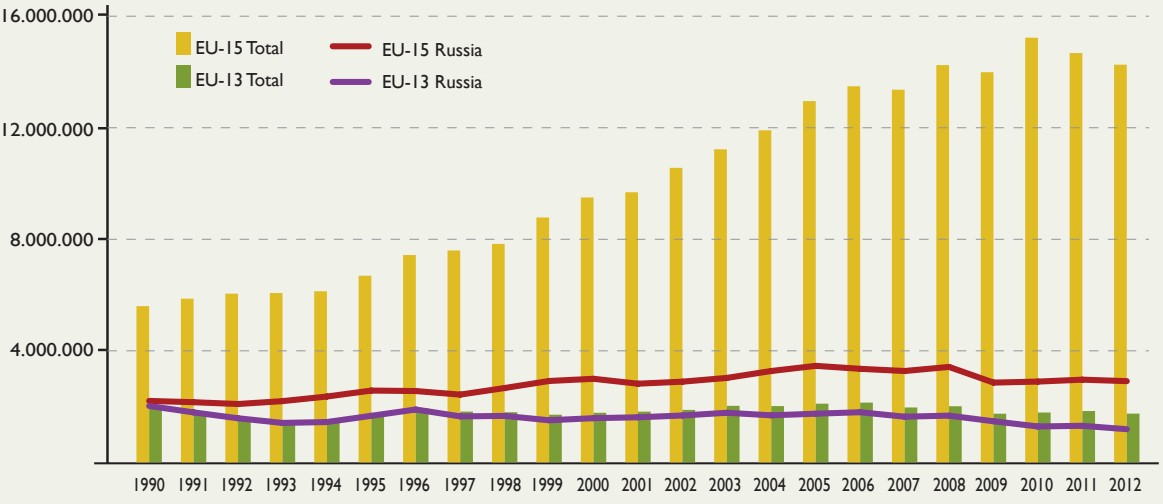
Source: Eurostat (online data code: nrg_134a)

Figure 33. Petroleum products imports from Russia [thousand tonnes of oil equivalent (TOE)]



Source: Eurostat (online data code: nrg_123a)

Figure 34. Gas imports from Russia [Terajoules (Gross calorific value = GCV)]



Source: Eurostat (online data code: nrg_124a)

b. What the concept of energy dependence conceals.

Energy dependence has important limitations as an indicator of the vulnerability of importing countries.

First of all, we find there are some European countries with high levels of imports and exports which seem to be more concerned with their interests in trading (buying and selling) than their actual energy needs. The energy dependence is determined by the difference between the quantities imported and exported, without considering actual energy needs. A country could have a dependence of "zero" for a certain fuel if both their imports and exports were zero, but also if the imports and exports, however large they might have been, were equal. In this second case, that country's economy would suffer if there were significant fluctuations in energy prices. On the other hand, a high level of energy dependence does not necessarily imply heightened vulnerability for the importing country, so any decisions and policies which

it adopts to address this may be flawed. It would be necessary to use a different indicator to determine the vulnerability of importing countries.

Furthermore, energy dependence is only concerned with one side of the relationship, that of the importer. The issue of vulnerability on the other side is evaded.

The largest energy supplier to the EU, Russia, does not only cause problems for European interests. Its own population also suffers the consequences of the energy business, in the form of a very low intensity of democracy, with frequent episodes of authoritarianism. Russian authorities have continued the crackdown on civil society and government critics that began in 2012. Enforcement of the "foreign agents" law led to an unprecedented, nationwide campaign of inspections tat affected hundreds of nongovernmental organizations (NGOs). In addition, Parliament adopted laws restricting LGBT.

The supposed diversification from over-reliance on Russia has not however improved the situation with respect to vulnerability. It has caused an expansion and intensification of Europe's energy footprint in other regions of the world. As well as the traditional players (Algeria, US, Norway, Saudi Arabia and Libya), other new ones have emerged such as Kazakhstan, Turkmenistan, Azerbaijan, Uzbekistan, Qatar and Nigeria.

A review of these new countries would suggest that the current European footprint has become connected with manifestly authoritarian and corrupt governments. Unfortunately, oil profits "have encouraged patronage, fuelled corruption and undermined state institutions. They promote authoritarianism in governments, which centralise power to maintain control over their income" (Revenue Watch, 2012)

It has been calculated that since 1970 the Government of Nigeria has received more than 400 million dollars from oil income (85% of its income and 99% of its exports) but, in contrast, the standard of living of the general population has deteriorated. In 2008, it was discovered that the Nigerian National Petroleum Corporation (NNPC), the Ministry of Petroleum Resources and other government institutions had received more than 180 million dollars of kickbacks for awarding a contract worth more than six billion dollars (Gillies, 2009).

The Republic of Azerbaijan, governed by the Aliyev family dynasty since 1991, is in the hands of a despotic and kleptocratic regime with a list of more than 100 political prisoners, the majority of which are defenders of human rights and democratic freedoms (The list of political prisoners in Azerbaijan, 2014). Its president, Ilham Aliyev, was named as corruption's 'person of the year' by Transparency International (Coalson 2013).

Turkmenistan, according to Human Rights Watch, is also one of the most repressive countries on earth. Berdimuhamedow's autocratic government exerts strict control over the national media and does not allow independent human rights monitors. [13]

A Eurocentric vision of energy dependence conceals the real vulnerability, suffered by the people living in exporter countries. A fairer Europe which upheld principles of solidarity should equip itself with the necessary tools to discover the effects of its energy footprint for the other side of the importer-exporter relationship, and then take action based on its findings.

13 http://www.counter-balance.org/wp-content/uploads/2014/06/PCI-June2014-webnew.pdf

4. EU energy governance

4.1 Instruments of energy governance.

a. EU energy strategy.

From the time of its creation, the European Union has had the intention of developing a common internal energy policy. Despite this, the majority of EU countries (although not all), have been reluctant to cede authority over their national energy policies, since they maintain advantageous relationships with hydrocarbon-exporting nations (Hildyard et al., 2014).

The EU has taken a series of steps in recent years to try to counter this situation, ranging from the Commission's Energy Green Paper (2000) through to its Energy Security Strategy (May 2014). This latter document described the dispute between Russia and Ukraine over gas prices, which had been broadening as the years went on, as the motivating factor behind the new energy strategy. It emphasizes that, above and beyond any other objectives, there is a need for a single EU voice when it comes to questions of energy (a common energy policy) and ensuring the security of energy supplies (or energy security). This motivation has been translated into a series of concrete measures, notable amongst which are the creation of internal markets for gas and electricity, the construction of Trans-European Networks, and the Projects of Common Interest (PCI).

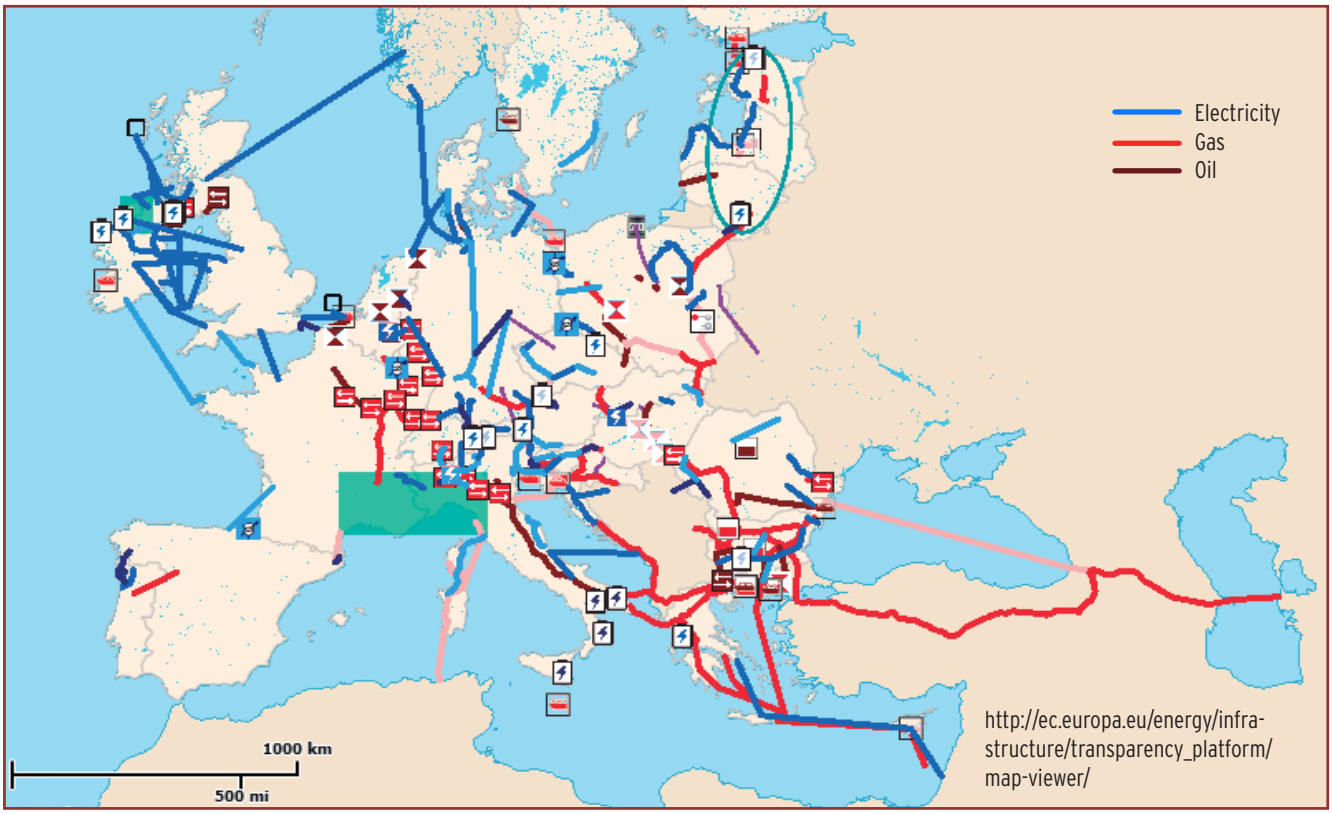
b. Internal markets for gas and electricity

In recent years some ambitious programs have been launched to construct wholesale markets between power generators and retail providers with the assumption that the price will reflect supply and demand, rather than being established by government authorities. These markets, together with new standards and regulatory bodies, require a new physical infrastructure, for both electricity and gas, able to connect all the points of a vast network of cables and pipelines across the length and breadth of Europe.

However, the creation of a "true internal energy market" is not proving straightforward. Not so long ago the Commission emphasised that "2014 is the deadline for completing the internal markets for gas and electricity" to obtain "secure, sustainable and competitive energy" for "the EU economy, industry and citizens" (European Commission, 2011b), which today we know has not been possible.

One of the basic characteristics of an internal energy market in Europe, in contrast to the United States, is that it requires energy supplies from outside, as Europe does not possess sufficient resources to satisfy its current social metabolism (as has been demonstrated in the previous sections).

Figure 35. The European Commission's map of Projects of Common Interest.



c. Trans-European Networks

While the electricity networks planned as part of the European Energy Strategy hardly ever stretch beyond EU borders, the situation is very different for gas networks which extend very significantly towards the south and east.

The so-called Southern Gas Corridor in reality has two main axes: to the East, including the Trans-Adriatic (TAP), Trans-Anatolian (TANAP), South Caucasus Pipeline Extension (SCPX) and the Trans-Caspian (TCP), and to the South, with the GALSI between Algeria and Italy.

The TAP reaches beyond European borders, extending from Italy and the Adriatic Sea via Albania all the way to Turkey, passing through the north of Greece.

The TANAP crosses Turkey lengthwise to its border with Georgia, where it connects to the SCPX, a stretch of pipeline which passes through Georgia as far as Azerbaijan. Finally, the TCP crosses the Caspian to Turkmenistan. Georgia plays another role, as it is also host to the project known as White Stream, which starting from Romania, would then pass under the Black Sea to join with the South Caucasus Pipeline.

Finally, the GALSI between Algeria and Italy heads South through Europe, passing under the Mediterranean to come out in Algeria.

With regard to oil, European expansion follows the same geographic logic, having laid the Baku-Tbilisi-Ceyhan pipeline all the way to the Caspian Sea, supported by the US. The pipeline, which started pumping oil in 2005, passes through, or close to, seven different war zones, including Abkhazia and South Ossetia in Georgia and the Kurdish region of Turkey. The "modest volumes of oil and gas in question", are in dramatic contrast with the colossal amount of "energy" expended to promote or obstruct the various options for routing the pipeline (Shaffer, 2009). This fact, along with the way in which European energy expansion is configured geographically, gives its energy strategy a clear political character which has global consequences (Hildyard et al., 2014).

d. Projects of Common Interest (PCI)

In October 2013 the European Commission produced a list of 248 Projects of Common Interest, reviewable every two years. These projects will "benefit from faster and more efficient permit granting procedures and improved regulatory treatment." When translated to reality, this means that there may be impacts on the quality of environmental impact assessments and opportunities for public involvement, procedures which are fragile even for normal projects.

Estimates of the investment costs required work out at 140 billion Euros for the electricity projects, and 70 billion Euros for the gas projects. The Commission hopes that these amounts, which are not inconsiderable, will be borne by the private sector, and in order to attract this capital investment it has devised various institutional and financial instruments to stimulate investment and reduce the risks for investors, by letting them be assumed by the public purse.

e. Energy governance and the financial sphere

The Commission proposes undertaking a significant part of its interventions through the Connecting Europe Facility, which has already been furnished with 5.85 billion Euros to directly support projects over the period 2014-2020. This instrument will go one step further than existing traditional grants or enhanced loans, but also other financial instruments such as the Loan Guarantee Instrument for Trans-European Network Projects, which is managed by the European Investment Bank (EIB). The EIB's Project Bonds Initiative 2020 is the preferred mechanism chosen to finance infrastructure projects of maximum strategic interest for Europe. These bonds are issued by the project developer with the support of the EIB, and thanks to subordinated loans from the EIB, the bonds have a higher rating than they otherwise would. This is in order to attract investment and artificially improve the general economic situation of the company developing the project.

However, the EIB's activity in recent years has not limited itself to EU territory nor to energy infrastructure priority projects. Since 2009 alone the EIB has committed more than 28.5 billion Euros to investments outside the EU. Of those, almost 7 billion Euros (24%) correspond to investments in the energy sector. The preferred regions are those closest to current EU borders: the enlargement countries[14] and those in the Mediterranean region.

14 Amongst the countries which benefit from EIB energy financing are Albania, Bosnia-Herzegovina, Montenegro and Turkey.

Table 2. EIB investments in total and in the energy sector, by region

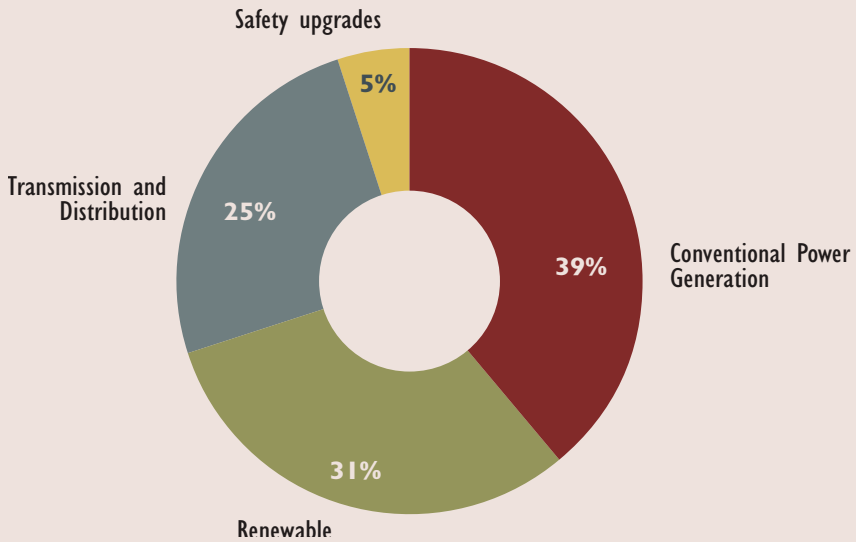
	TOTAL (Euros)	Percentage of total	TOTAL INVESTMENTS IN ENERGY (Euros)	Percentage of Energy Investments
	516,200,000	2	150,000,000	2
	13,437,005,670	47	1,453,763,379	21
	2,569,230,411	9	400,750,000	6
	7,474,995,572	26	2,707,488,256	40
	1,752,194,831	6	491,833,105	7
	1,030,000,000	4	425,000,000	6
	1,733,655,377	6	1,164,514,417	17
TOTAL AMOUNT	**28,513,281,861**		**6,793,349,157**	

Source: Prepared by the authors based on EIB data

The European Bank for Reconstruction and Development (EBRD) for its part mainly aims its strategy at the EU's eastern periphery and its neighbouring countries (as far as Mongolia and Russia), but also at countries in the southern Mediterranean (Morocco and Egypt for example).

Over the period 2006-2013, some 21% of the 52 billion Euros invested by the EBRD corresponded to sectors directly related to energy. From these 6.1 billion Euros (more than 170 projects), the majority was assigned to conventional sectors (39% to thermal power generation and 25% to transportation and distribution), meanwhile 31% ended up in projects connected with renewable energy.

Figure 36. The EBRD's financing of the electricity sector.



Source: EBRD (page 12 of the EBRD's Energy Sector Strategy document)

4.2 Energy Governance Structures

a. European Commission and Member States

The activities of the Commission in leading the European strategy are complemented (and at times contradicted) by those of the Member States. Not only do States act with considerable autonomy in designing their own strategies and signing bilateral agreements with countries and companies outside the EU, but they also exert considerable influence on the Commission in the designation of competences and the definition of the common energy policy.

b. Productive and Financial Markets

The energy companies have the capacity to influence energy decisions in the EU, either directly, or through lobbies, by putting pressure on the institutions of the member countries or on those of the European Union itself. Actors with the capacity to mobilise excess capital and technology to build infrastructures are gaining ground in European governance.

The globalisation of production and increasingly competitive prices have lead to a progressive fall in the rates of return on the productive industries. On the other hand, speculation on the value of shares has become an increasingly attractive and viable option for generating profits. Furthermore, the possibility of making short-term profits through this kind of speculation is dramatically increased by the creation of financial instruments that have their roots in financial deregulation.

However, although the oil companies obtain more and more of their profits from speculation, their market value still depends on the extraction of oil. These companies depend on perceptions of their capacity to generate profits in the future (increased oil reserves) more than on the material goods they hold in the present. Although it may seem that profits are derived from the financial markets and that investments depend on the dictates of finance capital, these nevertheless remain tied to the value of the extraction and trade in real oil, which in turn convert riches in the form of "financial shares in expected future profits" into financial gains (Labban, 2010). The market in oil is not simply a speculators market, nor is it a purely productive market. In reality, it is a "hybrid"[15]: oil is not only bought as a physical product that moves machines, "but also as protection against the fall of the dollar or the conflicts in the Middle East (when the price of oil rises that of other shares falls)" (Yergin, 2010).

At the end of the day, financialisation, by which we mean the process through which investors aim to make profits around 30% per year "greater than those of the market"[16], (Schwartz, 2010), affects the making of key decisions such as how to distribute energy, where it comes from and who it will benefit, keeping those decisions in line with the interests of private investors and companies. The investments favoured are those that maximise profits, with no regard for public interest or the implications for the climate. This is one reason why the governing institutions prefer centralised energy systems, as this logic (like the previous, purely productive one) requires control of all the productive installations to be maintained in order to guarantee large profits for investors (Hildyard, 2014).

15 http://ec.europa.eu/energy/gas_electricity/consultations/doc/2010_07_23/energy_market_consultation_document.pdf

16 http://www.morebusiness.com/running_your_business/financing/priveq.brc "Profit from private equity – Investors Chronicle", undated, http://www.hotbed.uk.com/news/profit-private-equity-investors-chronicle "Five Minutes with Michael Shone", PE Asia, September 2011,

5. Geopolitical Consequences

A complex system: energy geopolitics

In order to better understand energy geopolitics we refer to Zadeh's Principle of Incompatibility: "As the complexity of a system increases, human ability to make precise and significant statements about its behaviour diminishes until a threshold is reached beyond which precision and significance become mutually exclusive characteristics." The unforeseeable events of recent months on the oil market provide to yet more proof of the extreme complexity of current geopolitics. A great diversity of spheres and actors influence the configuration of the global energy complex. The evolution of this multi-layered reality involving many different actors is difficult to predict, and it is currently going through a period of upheaval that will very probably set the social, economic and energy scene for decades to come. The interdependence of multiple and asymmetric elements leads to yet more complexity. Furthermore, in this kind of historical moment that opens the door to change following a long period of stability, decision making intensifies in the short term, provoking rapid reactions from the actors involved, and making things even more difficult to predict.

Under normal conditions, the broad-reaching effects of, for example, the falling price of oil on the global economy are well known. It acts as an international stimulus that is redistributed to a large extent from the oil producing countries to the consumers; and the longer the new prices remain in effect, the deeper the impact is on the structure of industries around the world (Beloki, 2015). This is what we would expect in normal times, but these are not normal times and we are feeling the consequences of that. The foreign dimension of the European metabolism is developing within this complexity and it also significantly contributes to generating it.

a. The Russian Diversification

As has already been made clear, one of the driving forces behind EU energy policy is the diversification of the origins of the supply of fossil energy products in order to avoid dependence on Russia, although this is only proving successful in the case of natural gas.

One of the options for severing ties to Russian gas supplies is to increase self-sufficiency. However, the current data for domestic extraction in the EU does not suggest that there is a neo-extractivist phenomena in gas. Although at both a legislative and an administrative level in both the EU institutions and the Member States a great battle is taking place over non-conventional gas extraction using hydraulic fracturing, and over conventional marine gas in the South of Europe, these have not, in fact, produced significant extraction[17] .

The the actions of the EU and its member states beyond European borders are conditioned by a convergence of the factors: neo-extractivism has not taken off in Europe, levels of energy consumption are stabilised, and there is an intention to reduce the Russian supply. The increase, in recent times, in the number of countries from which the gas used for its metabolism is sourced has extended the EU's footprint further across the globe than it was

17 Danger of prospecting off the coasts of the Western Sahara http://www.ecologistasenaccion.org/article29142.html Al·legacions a l'estudi d'impacte ambiental del projecte de campanya sísmica en àrees lliures del Golf de Lleó, enfront de la costa catalana https://docs.google.com/document/d/1hz0NMeG9AbNX3siQ60k_zj9reX300JnTAhJROD-BWg8/edit?pli=1

in the last third of the twentieth century. With it the relationship of interdependence between the energy-avid European countries, and the gas supplying territories, striving for capital, is also extended. That interdependence is intrinsically asymmetrical insofar as conditions in the commercial relationship are, for the most part, imposed by the European country. The consequences of this asymmetry range from a prioritisation of the search for high profit margins in the building of infrastructures, to the undermining of human, civil, environmental and democratic rights, exemption from taxes and other privileges, and the proliferation of corruption and opacity in government.

This phenomena may recall the European colonial regime of the 16th and 19th centuries. Apart from a certain sophistication in the 21st century, this new colonialism, dedicated to the extraction of energy materials from other territories to feed its metabolism, and the global market, is characterised by the recent appearance of a new power: finance and its diverse actors. The asymmetry provokes what is known as energy grabbing, through which a country (principally its government and transnationals), in line with realist principles, assumes the right to take energy resources from foreign territories using different methods, which include military intervention and occupation when market options prove insufficient. Energy grabbing has important geopolitical implications in terms of foreign control over energy markets, with two converging forces driving that control. On the one hand the grabbing economies require stable flows and low prices. Particularly in energy intensive social metabolisms like the European one, where productivity and growth are directly linked to energy prices (Ramos, 2013). The second force – closely linked to the first – is that which stems from the interest of the energy companies based in the grabbing countries to grow in third countries: to control new markets, obtain new reserves, access new consumers, and diversify risks. Although this has nothing to do with guaranteeing supply to the country of origin, it does supply the global market (Llistar, 2014).

In general terms, EU energy grabbing takes place through the following mechanisms:

- The interdependence established between importing countries and countries with the potential to export energy products whose economies specifically depend on those exports.
- The control generated by an importer when they diversify the countries of export. We find ourselves faced with what we should call the expansion of the "Russian model", which is to say that the EU importing countries expect the same conditions from new exporters as those they are offered by Russia, where, for example, democratic standards are hardly exemplary.
- The technological and economic hegemony of the energy companies based in Europe.

The rise in gas suppliers to the EU in the drive to avoid Russia extends the footprint of the European metabolism to new territories, which are affected by the contracts and markets that influence that expansion.

b. Traditional geopolitics

The expansion of the EU energy footprint to the East and to the South of the borders of the Union, fundamentally through pipelines, has geopolitical consequences that extend beyond the region. Observations at the most local and global levels offer us the confirmation that the intention to reduce dependence on Russia for gas increases the dependence of the countries through which the gas pipelines pass, and is therefore an extension of the territory under the political influence of the Union. Beyond the confines of the EU, the Southern corridor implicates Turkmenistan, Azerbaijan and Georgia on the Caspian branch of the pipeline, as well as Turkey on the inter-connecting branch, and Cypress on the most Southern branch. The Galsi project implicates Algeria and the Adamowo-Brody oil pipeline implicates the Ukraine. In one way this could be seen as an extension of European borders to the limits of Russia, reducing the latter's influence and power. Finding its options closed to the West would force Russia to find energy outlets in the East, and could contribute to creating or reinforcing alliances with Asian countries such as China or India.

The increase in EU control over gas-producing territory in Eurasia and the North of Africa harmonises with US interests, reinforcing historical alliances around the control of energy materials. The isolation of Russia would favour North American foreign policy in relation to the Ukraine and Russian influence in the region. The aggressiveness and antagonism towards Russia and her policies that has appeared in Western editorial and opinion pieces that have a marked pro-North-American bias indicates an intention to intensify the memory of the two world blocks that gave rise to the Cold War (Tucker, 2014).

c. The global gas market

In recent years the United States has increased its interest in the creation of an international gas market, similar to the existing oil market. A convergence of events, among which we can highlight technological advances in the extraction of gas through hydraulic fracturing, the interests of Wall Street, and the political pretensions of the Obama administration both at home and abroad, have led to the belief that US gas could be exported, and that the fever for shale gas could spread to Europe, lowering prices and favouring the creation of a global market. It seems that although the necessary infrastructure for this development requires copious investments, the siren song of the halving of gas prices in the US between 2008 and 2009 (Rogers, 2013) has piqued interest on both sides of the Atlantic. In figures: a methane tanker with a capacity of 160.000 m^3 costs around 155 million Euros at today's rate; the investment necessary to build a liquefaction plant producing liquefied natural gas (LNG) is around 16,000 million Euros, and the construction of a regasification plant costs between 325 and 820 million Euros.

The International Energy Agency also collaborates in this process, predicting that global trade in liquefied gas will grow by more than 40% in the next five years, from 320,000 million cubic meters in 2013 to 450,000 in 2019. Although, to put this into perspective, it can be observed that around 70% of international trade in natural gas uses the pipelines for its distribution, and only the remaining 30% corresponds to marine transport of LNG. That is to say, even today, only around a tenth of the global gas demand is distributed in the form of LNG. Furthermore, in recent financial years, its growth has been paralysed by the fall in demand resulting from the economic crisis: in 2013 the use of GNL only increased by 0.3%.[18]

Another factor that may influence this market is the growing pressure to displace the gas coming into the EU from Russia with gas from the South. Specifically, Spain is proposed as the "recipient for US Liquified Natural Gas, benefiting from the pressure of falling prices, taking advantage of infrastructures, and, always important, becoming a strategic partner for for the US in the field of energy"[19]. Spain's geographic location and the infrastructure at its disposal (37% of European regasification capacity is located in Spain[20]) have even inspired the public powers to present Spain as a candidate to become the next European gas hub[21].

An EU with a more connected internal gas market and an expansion of infrastructures to the East and to the South, which increases the capacity for supply, would definitively contribute to the creation of a global gas market. This would open the door to greater energy-finance hybridisation, of the kind characteristic of the oil markets, increasing the financialisation of energy and reducing the influence of public powers in the service of the people.

Financial Markets

Actors on the financial markets can congratulate themselves in the face of numerous prospects for investment in infrastructure, for which, in the European case, it would be more than reasonable to expect risk protection from public bodies. Both the Project Bonds Initiative and the so-called Juncker Plan, which aims to mobilise 315,000 million Euros in 2015-2017[22], are another step along the way to financialisation. The "Great Coalition" between the "popular parties" and the "socialists" has made the incorporation of the interests of finance and transnational corporations a major project on the long road to European institutional policy[23].

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18 The globalisation of natural gas travels by ship. http://www.expansion.com/2014/10/16/empresas/energia/1413449691.html?cid=SMBOSO22801&s_kw=twitter

19 Ukraine or the importance of inter-connecting Europe http://www.realinstitutoelcano.org/wps/portal/web/rielcano_es/contenido?WCM_GLOBAL_CONTEXT=/elcano/elcano_es/programas/energiacambioclimatico/publicaciones/comentario-escribano-ucrania-importancia-interconectar-europa#.VLpTxCd4iQE

20 Own creation using data from Gas Infrastructure Europe.

21 The Government passes a norm making Spain the European gas hub in the midst of the Russia-Ukraine conflict http://vozpopuli.com/economia-y-finanzas/50234-el-gobierno-cuela-una-norma-para-convertir-a-espana-en-hub-europeo-del-gas-en-pleno-conflicto-rusia-ucrania

22 Of the total, 21,000 million come from eminently public funds,according to European Commission documents.

23 Juncker has considerable experience as Prime Minister of Luxembourg in attracting capital by reducing coporate fiscal obligations to a minimum http://www.elconfidencial.com/empresas/2014-11-05/mas-de-300-empresas-tienen-acuerdos-con-luxemburgo-para-pagar-menos-impuestos_435551/

Geopolitics is becoming the principal setting for the interests of elite transnationals, increasingly disconnected from national interests, offering less and less benefits to the populations of the hegemonic regions.

Transnational companies and free trade agreements

In tandem with the increasing power of financial actors in European political decisions, transnational companies continue to deepen the dependencies they generate in the institutions, sometimes in conflict with the financiers. On the one had, guided by the need to appear attractive to the dominant economic actors, in competing with other territories across the globe; and on the other motivated by the belief that it is necessary to feed international markets, European leaders have, for some time, found themselves engaged in a frenetic battle. In this context, a series of opaque rounds of negotiation have developed for a number free trade treaties with North America that aim to further liberalise the markets, and which would favour some transnational companies and financial actors.

This is the case with the TTIP (Transatlantic Trade and Investment Partnership), a free trade agreement that is currently being negotiated between the EU and the US, which encompasses a population of more than 800 million people and an economic area representing 54% of global GDP. Among its aims we can highlight deepening access to new markets and raw materials in a context of Peak everything[24], the total liberalisation of energy, and the creation of private tribunals or mechanisms for Investor-State Dispute Settlement (ISDS) where companies can sue states for regulatory changes that affect their profits or bring lower than expected gains[25].

There are other, less well known agreements: the agreement between the EU and Canada, the CETA (Comprehensive Economic and Trade Agreement), and the Trade in Services Agreement (TISA), being negotiated between the US, the EU, Japan, Australia and 20 other countries, which includes, among many others, services such as energy supply. The CETA has, before even coming into force, already had consequences for energy on this side of the Atlantic with the paralysing of the Fuel Quality Directive, which will allow the the Alberta tar sands to be imported from Canada[26].

This set of treaties, apart from handing over sovereignty to commercial and financial elites, can also significantly influence global energy geopolitics as it creates a Westernised economic space with even more power. Some authors are going so far as to call it the economic or commercial NATO, although at the same time the US is also negotiating the TPP (Trans-Pacific Partnership) with Japan, Australia and other Pacific countries, and the APEC (Asia-Pacific Economic Cooperation forum) with China, Russia and other countries in the zone. Together these treaties encompass 40% of the world's population, 54% of global GDP and 44% of world trade.

Geopolitical movements relating to the world of energy depend largely on the evolution of a number of these free trade agreements, in which the EU is one of the principal actors. The existing relationship between major energy companies and the financial sector's search for higher profit margins means that they will openly support these treaties. Their calls to open up markets across the globe has not been in vain, as in recent decades it has served to push the process of globalisation and the financialisation of the economy, with a clear bias towards the interests of this kind of actor (Harvey, 2012). We could also find ourselves facing a transfer of economic risk to the communities and peoples in the territories signing these agreements; whereas the private profits of, in the first instance, the transnational companies, and as a consequence also those of the major investors, are protected and guaranteed through a variety of mechanisms.

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24 Phenomena by which it is confirmed that a series of materials that are fundamental to an industrialised and knowledge-based society are reaching their maximum extraction at a global level. Oil, copper, aluminium and rare earths are examples of this.

25 http://es.scribd.com/doc/212043583/Dossier-TTIP http://trade.ec.europa.eu/doclib/press/index.cfm?id=1230

26 http://www.carbonbrief.org/blog/2014/01/who-killed-the-fuel-quality-directive/

CONCLUSIONS

Europe's metabolism is characteristic of advanced capitalist economies. It demonstrates high levels of inertia in materials and energy consumption, which only varies during upsurges in certain areas of the financial economy, such as the 2006-2007 property boom. Flourishing economic sectors such as construction and agroindustry are the key drivers of domestic extraction of materials (non-metallic minerals and biotic materials in particular) which accounts for the majority of EU consumption. On the other hand, material flows are also governed by the Rule of the Notary: the EU specialises in processed exports which attract a higher unit value, while imports from the rest of the world, being essentially raw materials, attract a lower monetary return.

Inelasticity of demand as the oil price fluctuates has meant that Europe has ended up with a metabolic structure which is incapable of making decisions about the materials it ingests (whether price, conditions or quantities), and this affects the rest of its socio-economic structure (less resources for other investments, indebtedness and a potential reduction in environmental, social and labour standards). Although internal EU biomass extraction was under extreme pressure in the early years of this century, the majority of energy materials used in Europe's metabolism are sourced outside the EU (more than 53%), with gas imports experiencing a particularly significant increase (39% in the period 2001-2011). Delocalisation of industrial production has contributed to a delocalisation of waste gases which contribute to climate change, to the extent which the five leading European countries in terms of greenhouse gas emissions associated with the consumer goods they import would top global lists for imported emissions. The fact is that the external dimension of Europe's metabolism is becoming increasingly more relevant, both in terms of its relative importance compared to the internal dimension, and for the degree of complexity it has been acquiring in the last few decades.

As a result of the way this metabolic profile is sustained, dependences are created for flows of energy and imported materials. There is considerable divergence amongst energy dependence profiles which all show a high level of dependence, and this is not always connected to the desire to maintain a secure energy flow, but also reflects the commercial impetus to buy and sell the resource.

It therefore seems that the concept of energy dependence legitimises official discourses which present the importing nation as vulnerable, and the exporter/supplier as an enemy in some cases (if the two countries do not have a clear and long-term alignment of interests), or as a friend (if that would secure the supply in question, even though this friendship might be propping up authoritarian, kleptocratic and corrupt regimes). Plans for diversification to reduce the dependence on Russia are an example. Presenting Russia as an enemy when it comes to energy has eased the diplomatic process of establishing relationships with countries such as Azerbaijan, Kazakhstan or Turkmenistan. Furthermore, this supposed diversification has only been achieved for gas, which hasn't decreased in volume, but has done so in relation to the total amount of imports (between 1990 and 2012: solid fuels +18.5%; oil +19%; gas -29.8%).

In any case, this eurocentric view of dependence, and relationships which treat the exporter/supplier as subordinate, provide a justification for aggressive action to secure resource flows, or whatever other kind of action may be needed. This happens even when these actions end up producing resource grabs or affecting the general population, and they have nothing to do with meeting the needs of the European people, but rather with sustaining and controlling new international markets.

European public financial institutions (EIB and EBRD), through a range of instruments (the Connecting Europe Facility, Project Bonds Initiative, and other more traditional means), are contributing very significantly to the promotion of the growing financialisation of energy, through the high returns offered by investment in infrastructure. The decline of public control over European institutions is in contrast to the growing transfer of risk involved with energy investments from the private sector to public funds (and this is not limited to energy), which has the complicity of, and is directed by, European leaders. This mechanism promotes the development of European plans to expand eastwards and southwards from its borders, in pursuit of its aims to secure energy supplies and for diversification in order to be less reliant on Russia, its principal supplier.

A combination of the growing power of financial bodies and the prominent role played by transnational corporations (which would be favoured if free trade agreements such as TTIP, CETA and TiSA were to be signed), coupled with US intentions to create a global market for gas, define a more complex geopolitical scenario than the one which was in place as the twentieth century drew to a close. The expansion of capital accumulation inherent in a hegemonic economic system is a force to which the energy-linked geopolitics that has shaped the world in the last few centuries has not been immune. It will be the balance of power between economic and financial actors and pro-democracy and human rights movements around the world which will define the global socio-economic scenario in forthcoming decades.

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The social metabolism of the EU behaves like a black box. Its internal functioning, and the mechanisms that promote the entry and exit of energy and materials from interior, hide behind several layers of interconnected and superimposed spheres of decision-making.

In the sphere of politics, the European Commission Energy Strategy and the energy policy in every Member State become mixed. These are, at the same time, closely linked to the financial sector and the international markets through European Financial Institutions that strongly condition what can and cannot be done in terms of energy policy. In addition, Europe's metabolism not only plays a decisive role in shaping economic, social and environmental reality inside its territory, but also beyond its borders (the EU external dimension). Communities living in energy-exporting countries are in a vulnerable situation -related to the interdependence caused by the metabolic needs of the EU- that is often taken for granted, as is the resulting energy grabbing all its forms.

At a moment in history in which the energy scenario shows many uncertainties, Opening the Black box. Energy metabolism, dependence and geopolitics tries to address the EU's behaviour with regard to energy. It searches for the links between how the complex EU social metabolism operates, the influence it has inside the territories in which it has relations, and Europe possible strategic movements in terms of geopolitics.

The text raises five questions that need answering:

What is the relationship between social metabolism and Europe's external actions?

What are the implications of the European strategy for energy security?

How has the increasingly prominent role of finance in the European energy universe come about?

What is the influence of finance on Europe's social metabolism? What role will the EU play in global geopolitics?

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