German Renewable Energy Federation

EU Energy Security Strategy – Tackling the causes, not just the symptoms

Appeal to the European Parliament and to the European Council to improve the EU Energy Security Strategy, proposed by the European Commission on 28th May 2014

Disclaimer

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Introduction

When presenting the European Energy Security Strategy (EESS) on 28th May, EU Energy Commissioner Günther Oettinger gave a remarkable performance: a 35 minute talk without once mentioning renewable energy. This wilful ignorance of one of the European Union's primary successes did not only clash with his institutional duties, common sense and a broad array of facts, it also failed to explain the contents of the document he was presenting. The EESS proposed by the Commission, does, after all, mention renewables as being one of two components within one of the eight pillars of energy security: "increasing energy production in the European Union". Though utterly insufficient, it would at least have been worth a mention during the 35 minutes.

The German Renewable Energy Federation (BEE) welcomes the EESS proposals for immediate action aimed at increasing the EU's resilience to a potential major gas supply disruption, and, in spirit of enhanced European solidarity, for regions more exposed to this risk.

A renewed attention given to energy security issues is required. If, however, this low-level priority and consideration of renewables is maintained by the European Council and by the European Parliament, then it will become a significant and costly barrier to the improvement of Europe's energy security in both the medium and long term.

With this document, the BEE urgently appeals to the European Parliament, to the German government and to all other governments of the EU member states to improve the European Energy Security Strategy presented by the European Commission on 28th May 2014. Moreover, taking the strong link between the role of renewables for energy security and the necessity of stable and ambitious framework conditions into account, the 2030 Climate and Energy Policy Framework presented by the European Commission in January 2014 should be revised to include ambitious European and national renewable energy targets.

Founded in 1991, BEE is the umbrella organization for the renewable energy sector in Germany. We are the voice of 5,000 companies across all technologies and all steps of the value chain, from component manufacturers and local installers to project developers. In Germany alone, the renewable energy sector employs 371,000 people.[1]

[1] "Erneuerbare Energien boten im Jahr 2013 über 370.000 Menschen Arbeit", Federal Ministry for Economic Affairs and Energy BMWi, 26th May 2014. See: http://www.bmwi.de/DE/Presse/pressemitteilungen,did=639960.html.

Executive Summary

Tackle the causes, not just the symptoms

Immediate measures such as gas stock increases, emergency plans and infrastructure, and the pooling of national energy stocks are welcome and necessary, but they can only mitigate the symptoms of a potential acute crisis. Diversification of gas supply sources cannot impede the depletion of limited fossil resources and, in the context of increasing global energy demand, can only, at best, reduce the EU's vulnerability and postpone the emergence of future crises.

We are deeply concerned about the lack of appropriate strategic priorities in tackling the structural causes of EU's energy dependence. Any sign of political divestment from the necessary rapid growth of renewables risks alienating investors, thus further endangering the EU's energy security, competitiveness and prosperity.

More than just "no-regret options": Renewables and efficiency are the only sustainable solutions

There is a broad consensus that energy efficiency measures and renewables are no-regret options not only for climate protection. Renewables and energy efficiency are the only structural and sustainable solution, when considering also energy security. This paper will give an overview of the facts and figures.

Certainty of delivery

Renewables deliver reliably. The last decade has proven the ability of the European renewables industry to deliver impressive deployment and cost reductions. Further progress in reliability is more than likely, as experience is constantly increasing. Fossil and nuclear sources have a less appealing record of accomplishment. Despite two decades of considerable resource investment, the Caspian region's supply of natural gas to Europe is more uncertain than ever. The alleged "nuclear renaissance" cost billions of euros, but failed to deliver a single kWh. In fact, generation of nuclear power is already declining in Europe, and this trend will intensify over the next two decades.

Wide public acceptance

Many opinion surveys consistently showed that renewables are the most popular energy sources amongst EU citizens. Even if individual member states permit the exploitation of unconventional fossil sources, experience has shown that strong local opposition is highly likely, thus making delivery extremely uncertain. Therefore it also begs the question: Why not simply do what people want and turn to efficiency and renewables?

Key recommendations

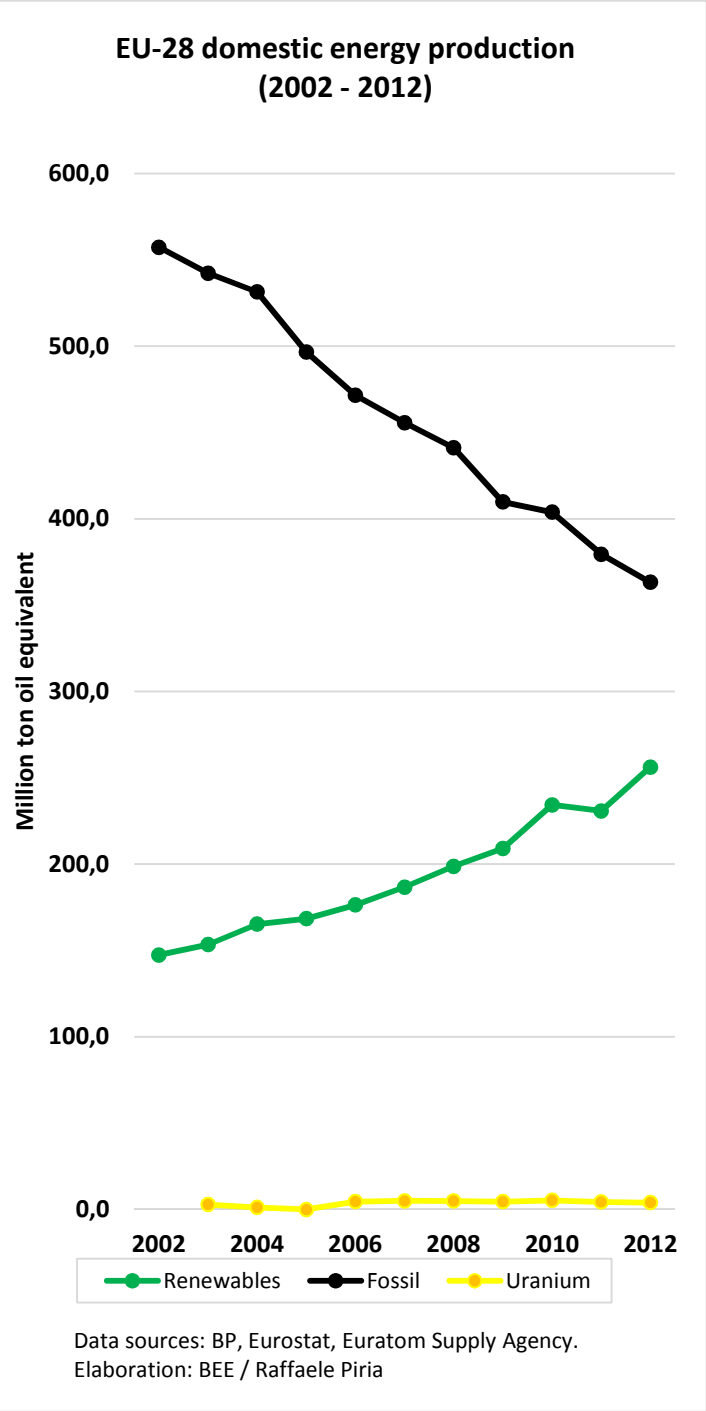
In the light of recently heightened energy security threats, the European Council and the European Parliament should reconsider the Commission's proposals for an Energy Security Strategy and the 2030 Climate and Energy Policy Framework:

- Europe needs ambitious and mutually reinforcing binding 2030 targets for renewables, energy efficiency and greenhouse gas reduction, underpinned by binding national targets.
- National and EU targets should be explicitly considered as minimum targets. Any one member state willing to accelerate renewables deployment beyond their targets should be encouraged to do so, as this will enhance energy security in the EU on the whole.
- Solidarity measures to support the energy security of particularly vulnerable member states are welcome and necessary. Furthermore, they should be linked to enhanced financial support for local renewables and efficiency measures, with close monitoring of target achievements.
- The cost of short-term measures to help reduce the EU's vulnerability should be monitored and taken into consideration when evaluating future investments, particularly when investing in renewables and efficiency as the sole structural and sustainable solutions available.
- Europe needs to develop and agree upon a consistent strategy towards a sustainable energy system, based on domestic renewables and energy efficiency.

With an appropriate regulatory, financial, informational and policy framework behind it, no external power nor uncontrollable event can inhibit Europe from implementing its huge renewables and efficiency potential.

Renewables deliver power reliably

The lack of focus on renewables in the EESS is surprising, especially considering that growth in the energy production from domestic renewables, alongside efficiency improvements in some areas, has been the most noteworthy and positive contribution to energy security in both the EU and other parts of the world.



Within one decade, EU domestic production of fossil fuels has declined by 35%, while domestic uranium production has remained stable at a statistically negligible level. At the same time, the EU domestic production from renewables has increased by 73%.[2]

Renewables, unlike some of the alleged alternatives for Europe's energy security, demonstrated that they deliver reliably. Together with energy efficiency, renewables are the only realistic and sustainable solution to increasing our energy supply security in the medium and long term.

Already in the short term, renewables can achieve a lot. In just one year, from 2012 to 2013, production from renewables in the EU electricity sector increased from 709 TWh to 794 TWh, i.e. from 23.2% to 26.4% of total electricity consumption.[3]

During the last decade, deployment of renewables has been supported consistently in many, but not all, EU member states. Had more targeted policies been in place throughout

[2] In terms of biomass fuels, only domestic production has been considered. Electricity generated by hydro, wind and solar converted to an equivalent primary energy, assuming an average 38% efficiency in thermoelectric power plants, as used in the BP Statistical Review of World Energy (2013).
[3] 2013 electricity generation data taken from the European Network of Transmission System Operators for Electricity ENTSO-E (2014). It refers to EU-28, less Malta.

Europe, growth could have been even greater.

Considering increased experience in project development, now widespread across Europe, as well as the dramatic price decrease of some renewable technologies, we are certain that, under appropriate conditions, domestic renewables production could grow even more quickly in the years ahead.

One of the EU countries that relies most on gas imports is Italy. During the first two months of 2014, the proportion of gas in Italy's electricity mix was 32%, down from 44% during the same months in 2007. The proportion of renewables in the total power demand grew from 15% in 2007 (all year) to 36% in 2014 (Jan-Apr).[4]

Under positive conditions, the already rapid pace of growth in use of renewables in the EU could substantially increase. Renewable energy projects are calculable, and easy to manage. Once permitted, most renewable energy can be produced in (often less) than a year. Two decisive variables for deployment times are permission procedures and investment remuneration schemes. Unlike energy import flows, both these elements are under total domestic control without risks of external interference. The same is true for advanced energy efficiency measures.

If the EU adopts an appropriate regulatory, financial, policy and informational framework, it can be certain to implement the huge potential for energy efficiency and domestic renewable energy production at hand. External events, such as political pressure or uncontrollable crises, would thereby not have any significant impact on our energy security.

Studies have demonstrated that up to 100% renewable electricity supply by 2050 is feasible and presents a favourable economic opportunity.[5] The European Commission's 2050 Energy Roadmap, published in 2011, found that all scenarios compatible with climate targets require very high proportions of renewables, and at modest costs.

In Europe's heating and cooling sector, a vast potential for renewable supply, based on domestic biomass, solar, geothermal and ambient heat resources is untapped. Biomass fuels can be stored in large amounts, which, in turn, can reduce the need for fossil fuel storage. Using seasonal heat storage, solar heat accumulated during the summer can be used during winter. In Sweden and Denmark for instance, large-scale solar district heating covers up to 50% of the heat demand of whole communities. Modern heat pump systems with heat storage can contribute to the integration of variable renewable electricity generation. Several of the scenarios mentioned above assume that, in the very long term, significant proportions of the heating supply would be covered by efficient electrical systems, such as heat pumps using excess electricity from the power system. This is, however, no reason to slow down the

[4] ENTSO-E (2014) and Gestore Servizi Energetici GSE (2014).

[5] Greenpeace/European Renewable Energy Council EREC/Global Wind Energy Council GWEC: Energy [R]evolution (2012). World Wildlife Fund WWF/Ecofys/OMA-AMO: The Energy Report: 100% Renewable energy by 2050 (2011). The German Advisory Council on the Environment SRU: Pathways towards a 100 % renewable electricity system (2011). European Climate Foundation ECF: Roadmap 2050 (2010). Stockholm Environment Institute SEI: Europe's Share of the Climate Challenge: Domestic Actions and International Obligations to Protect the Planet (2009).

deployment of renewable heating in the coming decades: Each additional renewable heating system is an asset in terms of energy security, cost stability and environmental protection. Direct use of heat also prevents losses in transmission.

Within the transport sector, Europe is heavily dependent on imported oil. After uranium, oil is the energy source that has the highest share of EU's import dependence, rating at 85% in 2010.

Road and air transport alone are responsible for 96% of the energy consumed within the transport sector, and for 32% of the entire EU's final energy consumption. In the aviation sector, virtually 100% of energy comes from oil. Despite initial experiments with solar driven light planes having been a success, biofuels are the only feasible alternative to oil in commercial aviation in the foreseeable future, and have already been successfully tested for use in commercial transatlantic flights. The development of large scale, sustainable biofuels will therefore be unavoidable in the long term and strongly advisable in the short term, in order to reduce EU's dependency on imported oil in this crucial field.

In the area of road transport, oil makes up 95% of total energy consumption, with the rest mainly consisting of biofuels, with minimal amounts of electricity (trams, trolleys, electric cars) or gas. Aside from measures taken to reduce the demand for (individual) transport services and increase the energy efficiency of transport means, renewables are the only feasible solution to reduce the EU's dependency upon imported fuels within the transport sector. The raw materials needed for the biofuels used in Europe are, to a very large extent, a product of European agriculture, and the potential for further growth of sustainable biofuels is still great. In the medium and long term, renewable electricity sources can also supply substantial shares of energy for transport.

The precarious alternatives to renewables

If the EU relies on renewables and energy efficiency, it will hold all the cards to rapidly increase its energy security. This, however, will not be the case if it opts for several of the alternative options that allegedly guarantee Europe’s energy security.

Diversification of gas supply: Useful, but not decisive

Diversification of gas supply sources and routes is certainly a useful strategy for spreading risks, but it cannot eliminate them. Moreover, it is arguable how certain the delivery of gas supply diversification in terms of energy security can be. Generally, it will be less certain than that of a strategy focused on energy efficiency efforts and domestic production of renewables.

Despite the considerable resources invested by the EU for more than two decades, the direct supply of natural gas from the Caspian region to Europe still remains uncertain. If successful, it would be limited in volume and duration, and permanently exposed to multiple geopolitical

risks related to other potential buyers (China and other Asian countries) as well as several countries that could easily threaten to interrupt the long supply route.

Azerbaijan's proven reserves amount to just 0.9 trillion cubic metres (tcm), less than the 1.0 tcm proven reserves the UK still had at the end of 2002. Ten years later, the UK's reserves had shrunk by 80% to 0.2 tcm. The region's larger reserves are located beyond the Caspian Sea, mainly in Turkmenistan (17.5 tcm), and to a smaller extent in Kazakhstan (1.3 tcm) and Uzbekistan (1.1 tcm). Turkmenistan is 6,000 km away from Brussels, and borders on Afghanistan, Kazakhstan, Iran and Uzbekistan. Potential supply routes from Turkmenistan to the EU would pass through either Kazakhstan and Russia, or Iran, or through the Caspian Sea, at least two Caucasus countries, and then Turkey or the Black Sea, before reaching EU borders. Central Asia is already connected to Russia: Between 2007 and 2010, two pipelines delivering gas from Turkmenistan to China were built, and a third one is currently under construction. Even under the generous assumption that half of Turkmenistan's proven reserves would be available to the EU, they would only be the equivalent of 19 years of the EU's consumption as it stood in 2012.[6] This may be a good expedient for gaining time, but not a durable solution.

Considering this, the geopolitical complexity of "the great game" for gas in the Caspian, and the high risks faced by investors become more evident. However, it seems less clear as to how the EU could rely on Central Asian gas for a significant and durable improvement of its energy security.

In individual countries, such as the Baltic States, new LNG terminals can relieve the dependency upon a single supplier. However, at EU level LNG imports are generally not restricted due to a lack of LNG terminals in Europe, but rather due to the lack of LNG at sufficiently low prices. In the long term, a greater reliance upon LNG imports would not necessarily increase energy security - the supply routes for a large share of current and (potential) future LNG supplies pass through the Strait of Ormuz, the Gulf of Aden and the Suez Canal, areas vulnerable to interference by various powers or by terrorist attacks.

Diversification of gas supply is a useful strategy in managing the array of risks, and can mitigate dependency upon individual suppliers. In the medium or long term, as gas supply unavoidably becomes scarcer at global level, diversification will partially be able to mitigate the price impact. However, it is illusory to consider diversification as a main structural tool when addressing energy security.

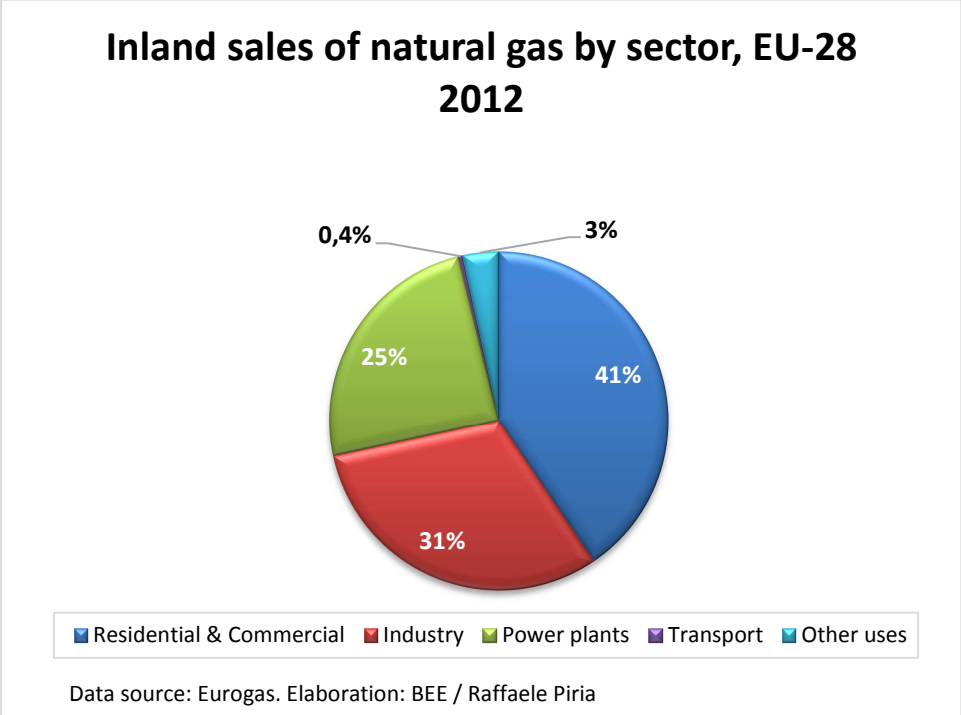
Reducing gas imports: the key role of renewables

As recently as 18th March 2014, the association Eurogas complained that, "Throughout 2013 and since the beginning of 2011, **increased competition from renewables** and the continuing low price trend of coal in combination with low carbon prices have **resulted in a further decline of gas use in power generation**" (our marking).

[6] All data on gas reserves taken from the BP Statistical Review of World Energy (2013). Data on EU's gas consumption taken from Eurogas Statistical Report 2013 (2013).

Indeed, during the decade 2003-2013, the electricity generated from renewables in the EU grew from around 404 TWh to 787 TWh. The renewables' increase (+383 TWh) of the last decade alone matches, almost exactly, the entire electricity produced by gas power plants in the EU in 2013 (384 TWh).[7] Of course, electricity generated by renewables did not only replace gas. Nevertheless, this example shows how quickly deployment of renewables could further reduce gas imports.

Only a quarter of the gas sold in the EU is burned in power plants, as is shown in the chart. Most of the gas consumed in the EU is used to produce heat for residential and commercial buildings, and for industrial processes.



Therefore, if Europe wishes to reduce its gas consumption, it should mainly focus on increasing the energy efficiency of buildings and of industrial processes, as well as on promoting the use of renewable heating. Although growing at a slower pace than renewable electricity, renewable heating production in the EU rose by 40% in just a decade, from 52 Mtoe in 2001, to 73 Mtoe in 2011. 73 Mtoe corresponds to more than 40% of gas sold to residential and commercial consumers in the EU in 2013. Renewable heating from solar thermal collectors, geothermal and ambient heat is 100% domestic. In the case of biomass, the share of EU domestic production is 96%, the import share just 4%.

Domestic hot water and space heating require only low temperatures of heat. That means that, for these purposes, burning precious gas or oil at high temperatures is a needless waste of energy. Efficient renewable heating supply coming from solar thermal, ambient heat,

[7] 2013 data taken from ENTSO-E (2014). 2003 data taken from Fraunhofer-ISI (2014), based on data of Eurostat and Eurobserver. Data refers to EU-27 minus Malta for the sake of comparability.

geothermal heat and biomass, combined with advanced energy efficiency measures, can reduce fossil resources needed for heating by nearly 100% in most parts of Europe. Unfortunately, policy development in the heating and cooling sector is still lagging behind and should urgently be addressed in coming years.

The astonishing myth of nuclear power being a domestic energy source

For decades, nuclear power has been presented as a domestic energy source. This notion also appears in the European Energy Security Strategy[8] presented by the European Commission in May 2014:

> *"In the past two decades, indigenous energy production in the European Union has steadily declined in spite of an increase of renewable energy production. It is however possible to slow down this trend in the medium term by further increasing the use of renewable energy, nuclear energy, as well as sustainable production of competitive fossil fuels where these options are chosen."*

This paragraph is the introduction to chapter 5.1., "Increasing energy production in the European Union", the only one in the Commission's paper to directly address deployment of renewables. The second sentence clearly implies that nuclear energy is considered to be "indigenous energy production".

This presents an astonishing distortion of reality, yet is not surprising, as it has resurfaced many times throughout the years. More surprising – and not compatible with the allegation of nuclear power being a domestic fuel – is the following acknowledgement, found in another point of the Commission's paper:

> *"Today, the EU imports 53% of the energy it consumes. Energy import dependency relates to crude oil (almost 90%), to natural gas (66%), and to a lesser extent to solid fuels (42%) as well as nuclear fuel (40%)."*

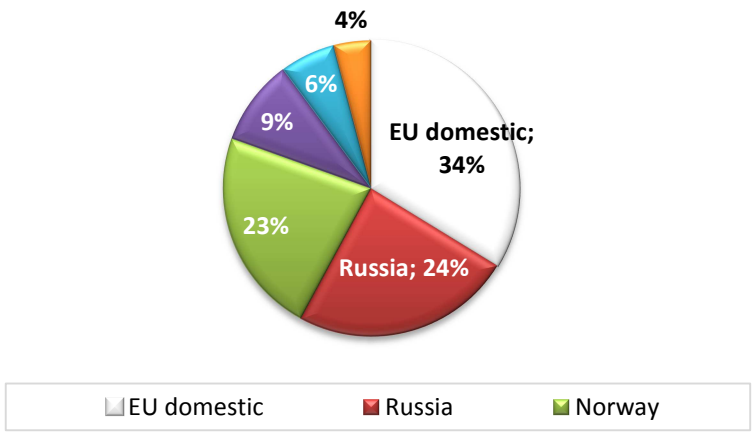
This text contradicts the previous one. If 40% of nuclear fuel is imported, it cannot be domestic, and with this 40%, the Commission is still distorting reality, although in a more subtle way. The oil dependency figure refers to the raw material, i.e. crude oil, and not to the refined product, i.e. gasoline or diesel. However, the Commission refers to nuclear power as refined (i.e. enriched) nuclear fuel. Without this "creative arrangement" of the data, the truth would be apparent: Europe's import dependency for natural uranium (98%) is nearly unabridged, and even higher than its dependency upon crude oil.[9]

[8] European Commission's Communication on the European Energy Security Strategy COM(2014) 330 final, 28th May 2014.

[9] All data about nuclear presented in the next paragraphs and charts of this document is also mentioned in the Staff Working Document attached to the Commission's communication of 28th May 2014. However, it can be assumed that most readers would not dig deep enough to find them. Another reason why the EU's import dependency on nuclear fuel is not broadly known is that, unlike fossil fuels, uranium is not mentioned in the ordinary Eurostat energy import statistics. The original source of the data mentioned here is the annual report of the Euratom Supply Agency (2013), which, like Eurostat, is based in Luxembourg and are formally integrated within the structures of the European Commission.

According to the Euratom Supply Agency, the import share of the natural uranium purchased by EU utilities in fact oscillated between 96.83% and 99.97% during 2003-2013. Looking at enriched uranium, just three companies control 98% of the enrichment services delivered to EU utilities: two of them are based in the EU, the third one is Tenex/TVEL, owned by the Russian government. Its share of the uranium enrichment supplied to EU utilities grew from 22% in 2003 to 41% in 2012.[10]

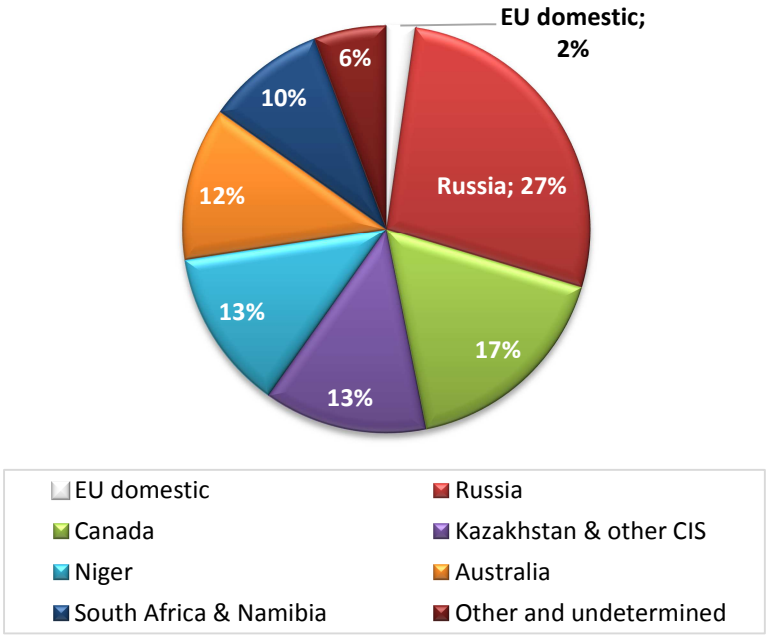
Natural gas supplies in the EU-28, by origin (2012)



Data source: Eurogas. Elaboration: BEE / Raffaele Piria

The chart shows that the EU's dependency on imports is higher for natural uranium than for natural gas. If one includes Norway, an EFTA member state, to be "domestic" (as it is a stable partner country of the EU), then the EU-EFTA currently covers 57% of its gas consumption domestically.

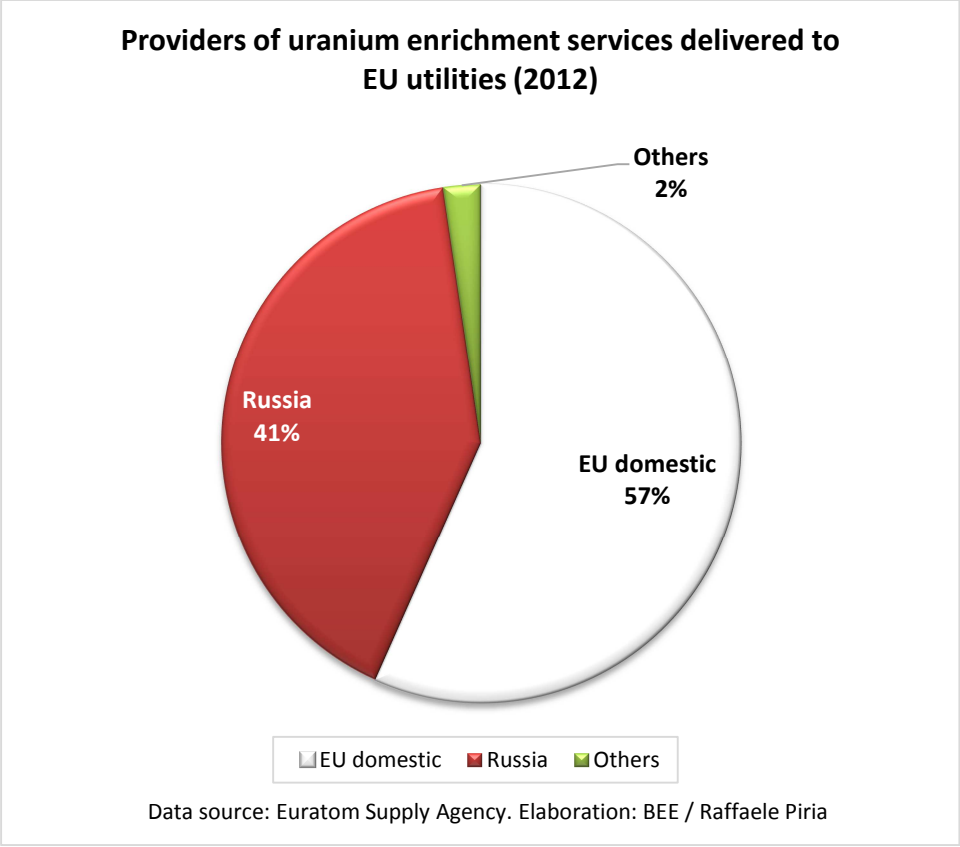
Natural uranium purchases by EU utilities by origin (2012)



Data source: Euratom Supply Agency. Elaboration: BEE / Raffaele Piria

The natural uranium supplier structure is more diverse, but some of them are located in politically unstable countries, with lengthy supply routes and geopolitically uncontrollable from Europe.

[10] Euratom Supply Agency Annual Report 2012 (2013).



The Russian share of imports of the EU's natural uranium consumption is comparable with the Russian share of gas consumption. However, Russia's 41% share in providing technologically more challenging and less substitutable enrichment services is impressive, particularly when taking into account that the operators of a number of nuclear power plants in Bulgaria, Czech Republic, Finland, Hungary and Slovakia cannot change supplier because their reactors can only be fed with Russian manufactured fuel.

On one hand, nuclear fuel can be stocked more easily than gas: At the end of 2012, the EU's uranium inventories were, according to the European Supply Agency, able to fuel the EU's reactors for almost three years. In terms of gas, the EU member states have a legal storage obligation sufficient for just one month of peak winter consumption, or three months of average consumption. Nevertheless, nuclear energy certainly does not count as a domestic energy source for the EU. Mitigation of the uranium (enrichment) import dependency can be expected during the next decade, as nuclear power generation in Europe is likely to decline sharply.

Aside from the fact that nuclear energy is neither a domestic, nor a secure, source of energy the alleged "nuclear renaissance" used up dozens of billions of euros, but failed to deliver a single kWh. According to EDF's latest estimations, construction time for the new EPR in Flamanville (France) increased from a planned 5 to 9 years, and cost estimates increased from €3.3bn to €8.5bn. In Olkiluoto (Finland), the only other EPR under construction in Europe has meanwhile run into a delay of at least 7, probably 9 or more years. The construc-

tor, AREVA, estimates similar cost overruns as in Flamanville, while buyer and seller both submitted reciprocal compensation claims for respectively €1.8 bln and €2.7 bln[11], not a particularly inviting scenario for further investments. In fact, during the last few years, further new programmes have been either cancelled or postponed to a more or less indefinite date in a number of countries, including Bulgaria, the Czech Republic, Poland, Lithuania in consortium with the other Baltic states, Finland, Italy and the Netherlands. In fact, nuclear generation in Europe is already declining, and this trend will intensify over the next two decades, when taking the numerous EU member states with a clear phase-out commitment into consideration and also those that never used nuclear and do not intend to start now.

Coal is not a viable alternative to renewables

Although the EU has large coal reserves, domestic mining has declined. Europe now imports circa 40% of its coal consumption. On the global coal market, there have so far been no significant supply risks.

The main restrictions for coal are climate policy, as well as the weighted local impact of coal mining and coal power plant emissions. As mentioned in the Commission's Energy Security Strategy: "Coal and lignite's CO_2 emissions mean that they only have a long-term future in the EU if using Carbon Capture and Storage (CCS)".

However, more than a decade after the coal and the CCS industry instilled big expectations in CCS, not one project has been realised in Europe and the prospects for CCS deployment at a significant scale have completely vanished. The reason has not only been very low CO_2 prices, but also the fact that the CCS industry substantially underestimated technical challenges, risks and acceptance problems. Moreover, they largely overestimated the expected learning effects.[12] Despite of the billions of euros of support provided by the European Commission and selected member states, the coal and the CCS industry was not prepared to contribute to the investment itself.

In other words, waiting for CCS is a risky strategy, especially when the certain impact of equivalent investments on energy efficiency and renewable is taken into account.

Unconventional fossil fuel sources: Not a durable solution, but irreversible impact

A certain fact about the so-called shale gas "revolution" is that it exploits limited resources. Quite uncertain, however, is how great the additional exploitable resources really are, although one point is completely clear: Irrespective of whether the (relatively) cheap unconventional sources will last a few years or a few decades, their exploitation can only postpone, and for a limited period, the inevitable depletion of fossil fuels.

[11] "Europe's nuclear sector looks worldwide to keep skills sharp", Financial Times, 7th May 2014.
[12] Christian von Hirschhausen et al.: CCTS-Technologie ein Fehlschlag – Umdenken in der Energiewende notwendig, DIW-Wochenbericht 6-2012 (2012). See also the European Commission's Communication on the Future of Carbon Capture and Storage in Europe COM(2013) 180 final, 27th March 2013.

The European Commission's estimation of the "unproven, technically recoverable shale gas reserves" decreased from 15.8 tcm gas (2011 estimation) to 13.3 tcm gas (2013).[13] Even under the very unrealistic assumption that all these reserves were to be confirmed and exploited, regardless of the cost and environmental impact, the entire EU's shale gas reserves would only be enough to cover just 27.5 years of the EU's gas consumption at current (low) levels. In the medium and long term, the switch to renewables and energy efficiency remains imperative. Renewable energy systems must be rebuilt every few decades, but the resources last forever.

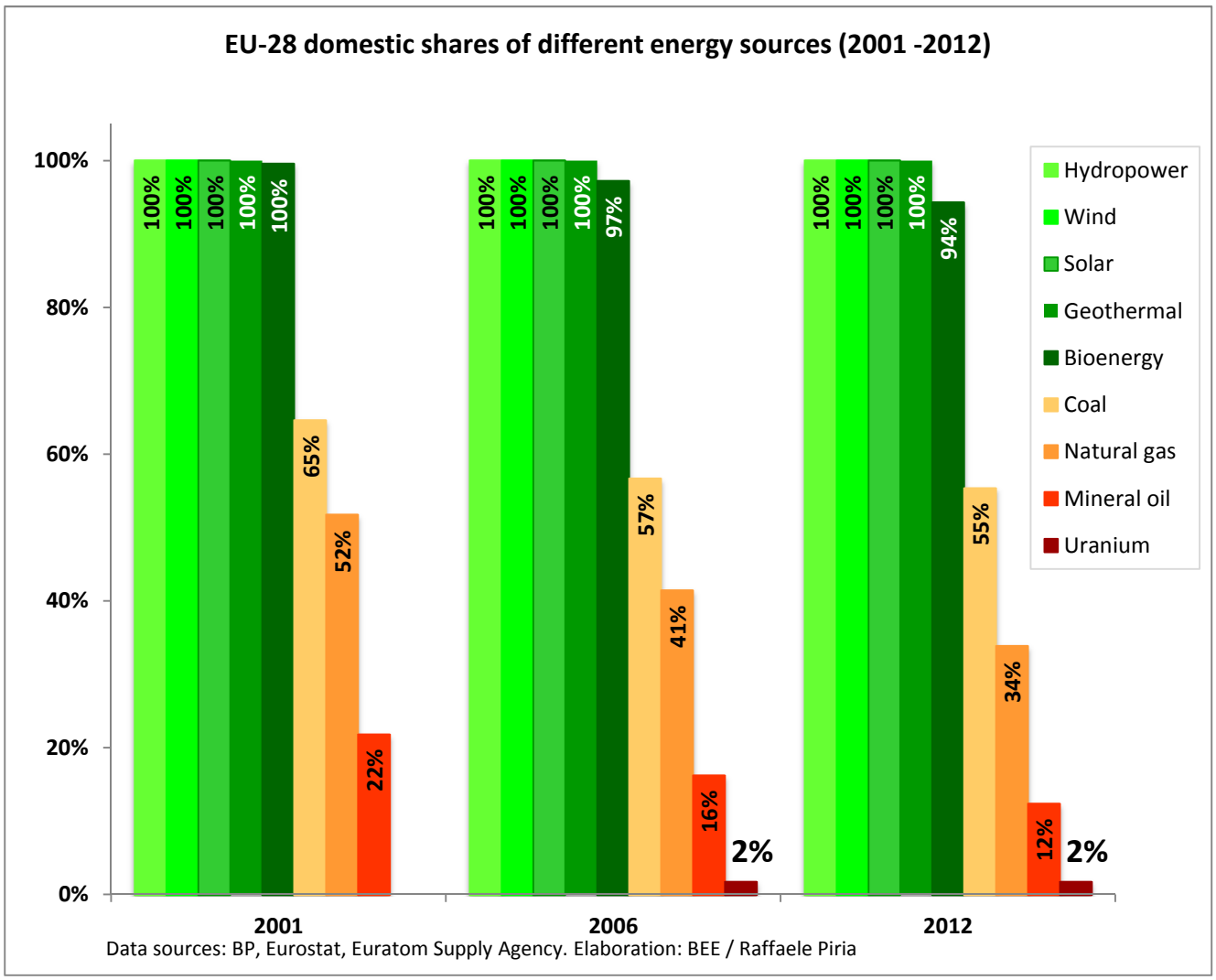
As with cheap conventional sources, cheap, unconventional fossil sources can be burnt just once. If we do it now, we will have one option less in the future. Future generations, however, will also have to live with the irreversible environmental damage at local and global level. Some experts doubt if the overall climate balance of shale gas is much better than the balance of hard coal. Local impacts can be severe and, in some cases, devastating.

A matter of time: Renewables will be the sole domestic energy source for Europe

The following chart presents an overview of all energy sources. For each energy source, the values display the EU's domestic share of total EU consumption in the years 2001, 2006 and 2012. Hydro, wind, solar and geothermal energy are 100% domestic. The domestic share of biomass declined slightly from 100% to 94%, as a part of the rapidly increasing demand for biofuels and pellets was met by imported raw materials.

The domestic share of coal consumption decreased from 64% to 55%. This figure includes both lignite and hard coal. The former is 100% domestic, but Europe imports 40% of the hard coal it consumes. The domestic share of EU gas consumption shrank from 52% to 34%, while the domestic share of oil consumption further decreased from 22% to 12%. In terms of uranium, the Euratom supply agency does not report data before 2003, and therefore the figure for 2001 is missing. However, during 2003-2012, for which data is available, the domestic shares consistently remained extremely low, oscillating between 0.02% and 2.25% of the total primary energy production of nuclear power plants in the EU.

[13] European Commission SWD(2014) 330 final, 28th May 2014, page 105.



Energy security's multiple dimensions: Renewables score well across the board

Energy security is a broad concept with multiple dimensions. This section takes a brief look at some of them, observing how renewables score, the answer being well to very well, across the board.

Disruption of external supply

The most recent EU energy security debate focuses mainly on the potential threat of an interruption in parts of the external gas supply flowing to the EU. However, as seen in the previous section, the exposure to the risk of interruptions is high also in terms of oil and nuclear fuels.

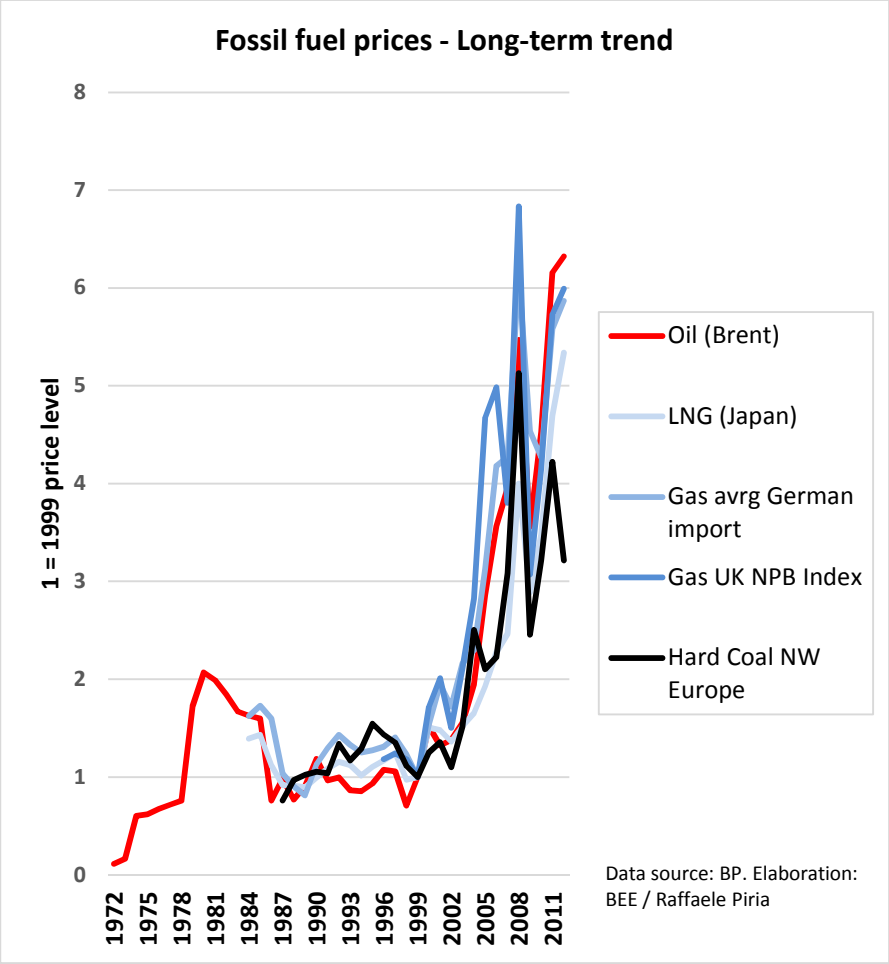
Domestic renewable energy production is not subject to these risks: The higher the proportion of domestic renewables within the EU's energy supply, the weaker the impact of potential external supply disruptions.

Price risks

Price risks can jeopardise energy security in the form of sudden price shocks, or as a creeping, long-term price increase.

Use of renewables prevents both these risks. Except for biomass, renewable energy sources have very low and very predictable operating costs. From the moment of investment on, the total lifetime costs can be confidently predicted. The high proportion of upfront investment costs may present a barrier to deployment, but once renewable energy systems have been constructed, they act as an excellent insurance against price risks.

The recent European energy security debate was very much focused on the risk of a sudden gas supply disruption, particularly following events in Ukraine. However, the impact of long-term price increases on the European economy and society has been strong in the past, and could be immense in the future. Long-term price development remains of crucial importance for Europe's energy security.



The chart shows the strong trend towards higher fossil energy prices faced by the EU since the end of the 1990s, a trend that certainly has already exerted a significant impact upon the European economy.

In the medium and long term, the trend towards increased prices is likely to continue, as global energy demand grows and the extraction of fossil fuels becomes ever more difficult and costly, as it includes extraction from deep oceans, Arctic regions and low energy density, unconventional sources.

Private investors often calculate costs and benefits of investments in renewables by taking constant fossil energy prices as an (implicit) benchmark. If the price of the fossil fuels replaced increases during the lifetime of the renewable energy system, this leads to a systematic underestimation of the benefits of renewable energy investments. Wise policy makers should not maintain this error by repeating it. In fact, renewables hedge against the likely risk of further long-term increases of imported fossil fuels. Renewables can also help mitigate the risk of short-term price volatility, by reducing the volume of demand for heating oil and gas, as well as for oil based transport fuels, and also by reducing the amount of imported fuels in the electricity mix and in the transport sector.

Resilience to political risks and human threats

Within the context of this paper, political risks and human threats include the full range of risks: potential political pressure from energy suppliers or from countries controlling the supply routes, technology availability, and terrorist or potential military attacks.

An energy supply system based on renewables is considerably less vulnerable than a system based on fossil and nuclear energy. With renewables, the main share of energy flow is domestic: Neither the availability of supply nor the external supply routes can be threatened. As for the key technological contents, the EU is at the forefront of development and is well advised to maintain this leadership for all renewable technologies. However, even in the limited areas where the EU's trade balance is currently negative (as seen in certain key PV components), this does not represent any threat to Europe's energy supply: Once installed, PV modules produce domestic energy, regardless where they have been manufactured. Moreover, Europe could easily expand its production capacities, as long as it maintains sufficient technological know-how.

Terrorist or military attacks on nuclear power plants, nuclear waste disposal sites, nuclear waste transports, oil refineries and storage facilities, LNG tankers or terminals can have a devastating impact on human life and on the environment. Moreover, a coordinated attack upon a relatively small number of easily identifiable large power plants could jeopardise and possibly suspend electricity supply to many EU member states simultaneously.

Thanks to their distributed nature, the smaller size of individual devices and plants, and to the inherently low level of technical risk, most renewables do not pose any comparable threat. Moreover, renewable heating systems increase the heat supply's resilience to interruptions in the gas or oil supply. An energy supply system based on renewables will require the expansion of power transmission and distribution grids, which will also have the beneficial side-effect of reducing the system's vulnerability in case of loss or failure of individual lines.

The only exceptions are hydropower dams with large reservoirs, which, in some cases, could entail a significant risk for the local population if they were to become the target of terrorist or military attacks. However, new large hydropower systems have not played a relevant role in the expansion of renewables in Europe over the last decades, and are not likely to do so in the coming decades.

Frequency of threat impacts

1973: first oil crisis; 1979: second oil crisis; 1980-87: Iran-Iraq War; 1991: Gulf War; 11th September 2001: terrorist attacks in the USA cause irritation in the energy markets; 2005: Hurricane Katrina devastates New Orleans; 2006: first Ukraine-Russia crisis; 2009: second Ukraine-Russia crisis; 2011: revolutions in North Africa followed by instability and civil war in various parts of the MENA region affect oil and gas exports; 2011: Fukushima accident leads to sudden, massive increase of Japan's LNG demand; 2014: third Ukraine-Russia crisis.

In all these cases, external events uncontrollable by any European authority, led to potential or real threats to Europe's energy supply security. The list is more than likely to become longer in the future.

No comparable cases have occurred in terms of renewable energy supply, nor are they likely to, even if renewables provide the lion's share of energy supply.

Resilience to natural and technical risks

Critics often claim that the variability of renewables such as wind and solar power poses a threat to the stability of energy supply. A decade ago, it was frequently argued that the power system could not integrate more than 10% variable renewables. Several European countries, however, including Denmark, Germany, Ireland, Italy, Portugal and Spain, now regularly operate their power systems far beyond these alleged technical limits. Recent relevant blackouts in Europe, however, were not caused by the variability wind or solar power, but by trees falling on transmission lines, electrical failures in transformer stations, or other accidents unrelated to renewable deployment.

Indeed, the transition towards a power system with large proportions of (variable) renewables requires significant adaptation of the power system. However, variable renewables are increasingly reliable, and plenty of flexibility options are available to balance them. Some of this flexibility can be delivered by other renewables, such as biomass power plants, or hydropower reservoirs. Further flexibility options include demand response, storage and flexible fossil power plants. Variability is not an issue in terms of implementing renewables in the heating and in the transport sectors, and certainly does not pose a threat to Europe's security.

The impact natural catastrophes or accidents can have on fossil and nuclear facilities is immense. The accident at the oil platform Deepwater Horizon in the Gulf of Mexico alone had

an irreversible impact on a large marine environment and caused economic damages amounting to dozens of billions of euros. A major oil spill in one of the internal European marine basins (Mediterranean, Black Sea, Baltic Sea) would have a devastating impact.

The accident at the Fukushima nuclear power plant may appear to be a “Maximum Credible Accident” (MCA). Fortunately, however, the wind was blowing towards the Pacific Ocean. Had the wind blown in a different direction, the evacuation of Tokyo’s over 30 million inhabitants would have brought Japan to its knees, and shaken the entire global economy.

Except for individual, very large hydropower dams, the MCA of renewable energy systems generally entails a very limited, local risk for society, if any.

Recommendations

Ambitious and binding 2030 renewable targets

In its 2030 policy framework for climate and energy, developed prior to the recent Ukraine crisis and presented in January 2014, the European Commission proposed an objective to increase the proportion of renewable energy to constitute at least 27% of the EU's energy consumption by 2030. The renewable energy sector criticized the low level of ambition, very similar to a business as usual scenario, as well as the lack of specific national targets, which will make the EU targets barely enforceable in practice. Therefore, the renewable energy sector considered that target as a setback and a dangerous sign of political divestment, particularly considering that the more ambitious and binding 2020 framework has provided positive signals to investors in Europe and at global level.

In the light of the new energy security debate, such a low and toothless target agreement is even less reasonable and acceptable. BEE calls for a more ambitious and legally binding renewable energy target for 2030, at EU-level and underpinned by explicit and binding national targets, in the context of three mutually reinforcing targets for renewables, efficiency and greenhouse gas reduction.

Countries that do not develop sufficient renewables and energy efficiency measures not only jeopardise their own energy security, but also that of other member states. This provides strong political justification for adopting binding EU and national targets for both renewables and energy efficiency.

Developing a long term vision of an energy system based on renewables and energy efficiency

Despite its unrealistic assumptions, biased in favour of nuclear energy and CCS, the EU 2050 Energy Roadmap already shows that all scenarios in line with global greenhouse gas

reduction targets will have to be based on dominant proportions of renewables in all sectors: electricity, heating and cooling and transport. Moreover, recent debates on energy security risks show the evident advantage of renewables and energy efficiency, compared with a continued reliance on imported fossil and nuclear fuels. The EU should therefore continue developing a realistic and unambiguous strategy aimed at implementing a fully renewables based energy system by 2050 at the latest.

Encouraging member states to do more

Member states willing to accelerate renewables deployment beyond their 2020 or 2030 targets, in view of increasing their energy security as well as the security of fellow member states, should be explicitly encouraged to do so. Frontrunners provide multiple, positive spillover effects, as well as providing benefits for other member states, not only by supporting cost reductions and technological learning, but also by decreasing Europe's dependence on imports of uranium and fossil fuels.

Linking solidarity measures to heightened support of local renewables and energy efficiency

The solidarity measures required for EU member states most exposed to energy supply disruption risks should be linked to enhanced support from the European Investment Bank, the European Bank for Reconstruction and Development, the European Structural and Investment Funds and other EU programmes for renewable energy and energy efficiency projects in these countries. Moreover, the solidarity measures should be linked to enhanced monitoring and enforcement of the implementation of the Renewable Energy Directive, of the Energy Efficiency Directive and of the Energy Performance of Buildings Directive.

Immediate measures to mitigate risk for the coming winter

While implementing all necessary short-term measures aimed at mitigating the impact of a potential disruption of energy imports, the costs of these measures should be closely monitored and taken into consideration when evaluating future investments, including those in renewables and efficiency as being the only structural and sustainable solutions.