STUDIES

August 2015

The Energy Union

Dominique Auverlot
Étienne Beeker
Gaëlle Hossie

Including contributions by
Marc Oliver Bettzüge
Dieter Helm
Fabien Roques

FRANCE STRATÉGIE
ÉVALUER. ANTICIPER. DÉBATTRE. PROPOSER.

www.strategie.gouv.fr

THE ENERGY UNION

Dominique Auverlot

Étienne Beeker

Gaëlle Hossie

Contributions

Marc Oliver Bettzüge

Dieter Helm

Fabien Roques

FRANCE STRATÉGIE

AUGUST 2015

FOREWORD

Jean Pisani-Ferry
Commissioner General,
France Stratégie

Among the ten priorities outlined by the new European Commission chaired by Jean-Claude Juncker there is notably a desire to give renewed momentum to European energy and climate policy. In fact, the European energy scene is currently in crisis, to the point of becoming a bone of contention between Member States, in a context marked by the Russian-Ukrainian conflict, crisis in the electricity and carbon markets and a lack of coordination between national policies.

This observation was outlined in an initial France Stratégie report published in January 2014 featuring analyses by three European economists, namely Marc Oliver Bettzüge, Director of the Institute of Energy Economics at the University of Cologne, Dieter Helm, a Professor of Energy Policy at Oxford, and Fabien Roques, an Associate Professor at Paris-Dauphine University and Vice-President of Compass Lexecon.

This new study, which includes contributions from the same experts, suggests a number of measures designed to correct flaws in the current system and create a new European energy policy and is based on the following, now widely-shared, observations:

- the economic crisis and the rise in new means of production, and intermittent energy from renewable sources (EnR) in particular, which are remunerated out-of-market, as well as thermal power plants, have resulted in an overcapacity scenario, a price collapse in the wholesale market and the closure of gas power plants owing to a lack of profitability, thus threatening the security of electricity supply;
- the current prices we are seeing in the wholesale electricity market and the uncertainties surrounding their evolution is making it extremely difficult to attract the investment required to guarantee production until 2030;

- at the same time, electricity prices for consumers, both individuals and businesses, have risen significantly, thus increasing energy instability, heightening divides between European countries and the rest of the world, and weakening the competitiveness of industrial players in what is an already gloomy economic situation;
- the European Union is very close to its objective of reducing its greenhouse gas emissions by 20% by 2020 (in relation to 1990), but this reduction is largely due to the switch in its economy towards services, the increase in fossil energy prices and the economic crisis; indeed, in certain Member States, CO_2 emissions have even started to rise again as a result of the increased use of coal to produce electricity;
- certain Member States are highly dependent upon Russian gas, resulting in an asymmetrical relationship in the negotiation of contracts with gas producers.

The creation of a real Energy Union is therefore more important now than it has ever been. Over the course of its session held in March 2015, the European Council chose to base this initiative on five key pillars inherited from the policies that have shaped the European energy scene over the past twenty or so years, namely the full integration of the European energy market, resulting in the construction of cross-border gas and electricity networks, the decarbonisation of the economy, energy efficiency as a way of regulating demand, energy security, and finally research, innovation and competitiveness.

The European Union is therefore seeking to lead by example with regard to fighting climate change in the run-up to the COP21, to develop a sense of solidarity between its members in the supply of gas and to boost its industrial activity. Such ambitions can only be applauded, whilst agreeing on the fact that they may not provide sufficient motivation for such a Union to be recognised.

The European Council has decided to put this issue of the Energy Union back on the agenda for its forthcoming meetings with a view to dealing with a number of unresolved matters. The experts referred to in the present study almost unanimously agree that we have to move forward in the following respects:

- the objectives of the Union's energy policy must be clarified, specifying the decisions to be made, the tools to be implemented and the performance indicators to be used. It is precisely because insufficient or no consideration has been given to the interaction between the three objectives of the energy-climate package (reducing emissions, developing renewable energies and energy efficiency) that the ETS market has become meaningless, when it should be a vital tool in the fight against climate change;
- the European Commission must recognise the flaws in the current structure of the electricity market, which is based solely on paying for the energy supplied. A review is required in order to remunerate based on power and therefore encourage investment. Failing this, many Member States are finding themselves forced to intervene directly in the composition of their electricity mix in order to ensure their security of supply, but

they are doing so in an uncoordinated manner that is jeopardising the energy integration movement that is under way at European level. There are consequently three recommendations to be made. Firstly, the intermittent and unpredictable nature of renewable energies requires them to be developed in accordance with flexibility mechanisms and the corresponding networks. Secondly, there is no longer any reason to provide support through specific mechanisms for technologically mature renewable energy sources, that is those that have been deployed to a certain level. Finally, a thorough review of the regulatory framework governing the electricity sector is required in the medium term in order to adapt it to reflect the new context created by the mass integration of highly capitalistic decarbonised means of production;

- the European Union must rebuild a credible price signal for carbon. It is highly likely that the rules of automatic adjustment that are currently planned will not be enough to prevent the market from collapsing or soaring as a result of the exogenous shocks that will undoubtedly occur. The introduction of a market regulator that could act quickly (when authorised to do so) would restore the credibility of the market. In more general terms, it is important that the Commission undertake the necessary reflection on the benefits of mapping out a trajectory of carbon prices; this could take the form of the creation of a hybrid system, introducing upper and lower price limits, managed by a regulator, to the ETS market;
- to conclude, we can expect major technological progress over the next twenty years, in terms of thermal motorisations, electricity storage, CO_2 capture and storage, solar panels, biofuels and even the use of graphene and nanotechnologies. It is preferable to support the corresponding research and development rather than the mass deployment of immature technologies.

Beyond these points of virtual consensus, the present study refers to a number of debates, the first of which concerns attracting investment in electricity production and relates implicitly to the role we want the market to play. Some believe that once the wholesale electricity market is cleaned up, the market will prompt the initiation of long-term investment in a neutral technological framework. In this respect, and in accordance with the Lisbon Treaty, it is no longer the States that determine their electricity mix but rather market forces, which should result in the eventual standardisation of the electricity mixes in the various Member States, taking into account the natural benefits afforded by their respective resources and their sunlight and wind conditions. Others, on the contrary, have no faith in the market's ability to offer future prices that will provide sufficient indication. They therefore support a deliberate public intervention. This intervention could take the form of a national planner responsible for signing agreements to ensure that the facility is profitable for the investor. Or it could take the form of capacity markets designed to remunerate installed capacity rather than energy. In the current context of divergent energy policy choices, it is unlikely that a capacity market will take place in the near future. Some Member States can fear that it would be used as a way to provide support to a specific means of production (nuclear in France and in the United Kingdom, coal and lignite in Germany, etc.). However, it is possible and desirable for Member States to coordinate their initiatives in the field, whilst keeping the objective of a long term convergence.

The second debate reiterates the close ties that exist between energy and geo-politics. What sort of attitude should be adopted with regard to Russia? “Firm but with an outstretched hand”, say some – in other words, forcing Gazprom to comply with the Union's rules within European territory, seeking other suppliers, authorising the creation of central purchasing bodies for Eastern European countries, developing alternative and indigenous energy sources and yet at the same time still considering a long-term energy partnership with Russia. Others settle for the initial measures and refuse to discuss a partnership for as long as Russia has still not withdrawn from Crimea.

The final debate relates to our vision of the European electricity production mix of 2050. Some believe that it will comprise over 75-80% renewable energy sources, which will require high-performance electricity storage facilities. Based on the rapid progress in the adaptation of supply and demand, some even believe in the emergence of a model whereby production is entirely decentralised, almost autonomous and governed, for an important part, by the town or city itself. Such a scenario would leave little room to nuclear energy. Others foresee an electricity mix comprising large-scale production facilities, including nuclear plants, supported by decentralised facilities, in which the network would maintain its solidarity function.

These three debates on crucial choices today divide the Europeans. One should not hide how important and difficult these questions are. But that should not obscure the fact that the tensions facing any energy policy in a context of open economy and fight against climate change are more easily resolved at a European level than at a national level. And we must keep in mind that if Europeans find themselves unable to agree and face together the challenges of energy transition, they will jeopardize one of the European Union’s raison d’être.

This European level does not necessarily coincide with the Union. Solidarities built on energy supply and distribution networks today have a sub-regional dimension. One of the challenges for the coming years is precisely to articulate this level with the Union level, by allowing, within a common frame, closer cooperation based on interdependences and shared preferences.

I would like to thank those involved in producing this study – both the three university experts cited and those from France Stratégie – and hope that their work will contribute to the future of the Energy Union.

CONTENTS

CONTRIBUTIONS

SUMMARY

THE ENERGY UNION: WHICH TOOLS FOR WHICH OBJECTIVES?

Dominique Auverlot, Étienne Beeker, Gaëlle Hossie[1]

1. The European energy scene in crisis

The symptoms of the energy crisis Europe is currently experiencing have been outlined in an initial report by France Stratégie[2] and are now very well known:

- the economic crisis and the development of new means of production, notably intermittent energy from renewable energy sources (RES), remunerated outside the rules of the market, as well as thermal power plants, have led to an overcapacity scenario and a price collapse in the wholesale market;
- this situation has resulted in the closure of thermal power plants, and gas in particular[3], owing to a lack of profitability, despite the fact that such plants are essential to maintaining the balance between supply and demand; uncertainties regarding their future are ultimately preventing the investment that will be required to ensure future production, which represents a threat to the security of supply;
- at the same time, electricity prices for consumers have significantly increased, notably as a result of the cost of systems designed to support renewable energy and an increase in taxes and network costs[4]. Energy poverty is on the rise and European industrial players[5] are witnessing a widening of the gap between the price they pay

(1) Department of sustainable development, France Stratégie.
(2) France Stratégie (2014), *La crise du système électrique européen,* January, available at: www.strategie.gouv.fr/publications/crise-systeme-electrique-europeen.
(3) 21 GW of gas power plants were closed in 2013 alone, that is nearly 5% of thermal production capacity within the European Union.
(4) European Commission (2014), "Energy prices and costs report", *Commission Staff Working Document*, March.
(5) The decrease in the wholesale market price nevertheless resulted in a drop in the price of electricity for German manufacturers consuming between 70 and 150 GWh a year between 2008 and 2013. Source: *Comparaison des prix de l'électricité en France et en Allemagne*, Les Cahiers de la DG Trésor, November 2013.

for their kilowatt-hours (kWh) and what their global competitors, particularly in America, pay for theirs, which weakens their competitiveness;

- with regards to electricity production within the European Union (EU), the low prices of CO_2 quotas encouraged greater use of coal to the detriment of gas, to the extent that the prices of these two fuels changed in favour of the former, resulting in an increase in CO_2 emissions in a number of Member States since 2011.

Added to this are the following two factors, which are somewhat discouraging where the European energy scene is concerned:

- an ageing refinery system, the gradual closure of which would reduce our security of supply of refined products, and notably diesel fuel, which accounts for a particularly significant proportion of the market in Europe owing to the structure of its vehicle fleet;
- an almost exclusive dependence on the part of certain countries on Russian gas, resulting in an asymmetrical relationship with regards to negotiating contracts with gas producers.

Member States are divided, in terms of both reacting to the Russian-Ukrainian conflict and dealing with the fears it has created with regards to security of gas supply, and finding solutions to the crisis in the electricity and CO_2 markets. In accordance with the rights granted to them by the respective treaties, they have had a direct say in the composition of their energy mix, including the implementation of long-term contracts for low-carbon energies and capacity auctions in the United Kingdom, the creation of strategic reserves in Germany, the development of a capacity market in France, capacity payments in Spain, etc.

Such uncoordinated measures are likely to contradict the movement towards energy integration that has been under way at European level since the 2000s. The ten priorities outlined by the new European Commission include a desire to give renewed momentum to European energy and climate policy. As far as its president, Jean-Claude Juncker, is concerned, this must result in a “Union that is more resilient in terms of energy and implements a visionary policy with regards to climate change”.[1]

The European energy scene is therefore very much in its formative stages. With this in mind, France Stratégie called upon the expertise of three European economists, namely Marc Oliver Bettzüge (University of Cologne), Dieter Helm (Oxford University) and Fabien Roques (Paris-Dauphine University and Vice-President of Compass Lexecon)[2]. Based

(1) Jean-Claude Juncker, A New Start for Europe: My Agenda for Jobs, Growth, Fairness and Democratic Change, Political Guidelines for the next European Commission, 15 July 2014; http://ec.europa.eu/priorities/docs/pg_fr.pdf.

(2) Their contributions form the second part of this study: Dieter Helm, “European Energy and Climate Policy: Time for Something New”, November 2014; Marc Oliver Bettzüge, “European energy policy – dogma or strategy?”, April 2015; Fabien Roques, “Toward a consistent EU energy policy?”, December 2014. The

on the arguments exchanged between the three experts, the present summary suggests a number of actions designed to help create a new European energy policy and rectify flaws in the current system. These suggestions are by no means binding of the aforementioned experts.

2. Clarifying objectives and redefining priorities

An analysis of the current situation and of past experiences has resulted in the identification of the following four principles and seven objectives that should guide European energy policy for the duration of the Commission's term:

- **a principle of responsibility**: according to the terms of Article 194 of the Treaty on the Functioning of the European Union, Member States determine the general structure of their energy supply, as well as any changes that take place with regards to the corresponding means of production. Within an increasingly interconnected electricity and gas network, however, their decisions, which are often made unilaterally, inevitably have consequences for their neighbours, consequences that Member States have to take into account when it comes to outlining and developing their own energy policy;
- **a principle of solidarity**: this requires all Member States to commit to helping any other Member States that might suffer an energy shortage. This principle, which already features in the Lisbon Treaty[1] and is reiterated in the regulations on the security of gas supply of October 2010, is worth underlining and explaining. Such European solidarity must notably and naturally be put into practice on a subsidiary basis, once the State concerned has implemented the appropriate measures designed to deal with any shortcomings on the part of a supplier. This principle also requires each Member State to publish the measures it intends to apply within its territory in the event of a crisis of supply and the effective implementation of these measures in the event of a crisis prior to the solidarity concept coming into play;
- **a principle of economic rationality**: it is important that a socio-economic analysis of the decisions made in the field of energy policy be systematically performed. This implies, notably, having as complete a picture as possible of the technologies' costs and all of their externalities. Simultaneously, it is necessary to have an accurate estimate of subsidies provided for each technology;

three documents are also available in a French translation on the France Stratégie website: www.strategie.gouv.fr/publications/lunion-de-lenergie.

(1) Article 122 of the Treaty: "Without prejudice to any other procedures provided for in the Treaties, the Council, on a proposal from the Commission, may decide, in a spirit of solidarity between Member States, upon the measures appropriate to the economic situation, in particular if severe difficulties arise in the supply of certain products, notably in the area of energy."

– **a principle of resilience**: the global environment changes very quickly, sometimes unexpectedly, as demonstrated by the latest fall in hydrocarbon prices. European energy policy has to be able to adapt to such changes, which can greatly affect it and over which it sometimes has very little, if any influence. It has to adopt economic models that are as resilient as possible to these various shocks; just a few months away from the climate conference in Paris[1], for example, it is difficult to predict how much will be done to reduce emissions by 2025 or 2030 on the part of the European Union's main partners, which might require European efforts to be revised, as anticipated by the European Council of October 2014[2].

3. Objectives

3.1. Specifying the objectives of the EU's energy policy without concealing their internal contradictions

The premise of European energy policy – according to which its three pillars, namely fighting climate change, competitiveness and security of supply, are naturally complementary – has proven to be incorrect. The Poles are using coal to guarantee their security of supply and their economic development. In more general terms, this fuel is starting to be viewed as an alternative to gas in the event of any shortfall on the part of a major supplier. The development of renewable energies, particularly in Spain and Germany, places a heavy burden on both consumer buying power and companies' competitiveness. Contradictions between the various objectives of the Union's energy policy mean that it is important to clarify these objectives, stating the decisions to be made, and to outline a series of indicators to help evaluate their achievement. This energy strategy could be outlined by 2030, in addition to the energy and climate policy-related decisions that the Council made in October 2014. A series of instruments, and even secondary objectives, will also be adopted and must be carefully calibrated in light of the previously specified primary objectives.

An analysis of the impact of the new 2030 framework performed by the Commission, for example, shows that policies designed to develop renewable energies and improve energy efficiency can reduce the price of CO_2 in the ETS (Emission Trading Scheme) market. It is therefore essential to simultaneously choose the objectives assigned to reducing CO_2 emissions in the ETS market, to energy efficiency initiatives and to developing renewables, taking into account their interactions and minimising the collective expenditure required by the decrease in greenhouse gas emissions.

(1)"Paris Climate 2015", 30 November-11 December.
(2) Conclusions of the European Council of 23 and 24 October 2014:
www.consilium.europa.eu/uedocs/cms_data/docs/pressdata/fr/ec/145423.pdf.

3.2. Rebuilding a credible price signal for carbon and promoting the use of a carbon consumption indicator

Nearly ten years after its implementation, the price signal established for the ETS market is not yet credible, to the point where investors and bankers no longer consider it in their project evaluations and have no incentive to favour investments in low carbon energies. This dysfunction is primarily due to the decline in demand for allowances (because of the economic crisis, but also the development of renewable energy and improvements in energy efficiency) and an inflexible, abundant supply, since the rules governing this market were established before the crisis. Today, there is a surplus of allowances amounting to their annual limit, giving rise to a very low carbon price on the spot market, as well as very low price expectations. The market therefore provides no incentive to invest in means to reduce greenhouse gas emissions.

In view of these conditions, the Commission proposed to introduce, from 2021, a market stability reserve to regulate supplies according to pre-defined automatic rules in case of unexpected changes in demand. There should be the potential to improve this mechanism by advancing its date of implementation, optimising its trigger thresholds and not putting back on the market any quotas that have now been withdrawn in the framework of *backloading* operations; such quotas could be placed directly into the reserve set up by the Commission.

The fundamental question that arises, however, is whether such a mechanism can restore true credibility and visibility to the carbon price: its adjustment rules are automatic but the date currently planned for re-examination of the operation of the mechanism to review its parameters seems far in the future. It is quite likely that difficulties will arise earlier; furthermore, its effect on prices, which has not been analysed in depth by the Commission, is uncertain. Finally, this mechanism is only concerned with the surplus and not its sources. Under these conditions, it is important that the Commission undertake the necessary reflection on the benefits of mapping out a trajectory of carbon prices. This could be achieved by establishing a hybrid system, governing the current ETS market with floor and ceiling prices managed by a credible regulator with a clearly defined mandate.

Another approach aims for this market to be governed by a series of pre-determined automatic rules, although the first ten years of operation nevertheless showed that it was not possible either to predict all potential forms of fraudulent behaviour or the different exogenous shocks. In other words, automatic rules are likely to be insufficient in many cases in which a rapid response is required; a market regulator, on the other hand, can act quickly (when authorised to do so) and lend credibility to the market through the decisions it makes.

The final option would be to introduce a European carbon tax to replace the market, although this solution would need to win the unanimous support of the Member States.

Regardless of the option selected, one of the central aspects of the Union's climate policy is that it should take into account any changes in world climate negotiations and the policies implemented by non-EU countries, and by China and the United States in particular; indeed, a pro-active approach does not mean that it is acceptable to overlook the signals sent out by other countries, at the risk of contradicting the sustainability and credibility of the policy.

Furthermore, the Commission should encourage the switch from a greenhouse gas emissions indicator to a carbon footprint indicator, including greenhouse gas emissions linked to the manufacturing and transportation of imported products and excluding those linked to exported goods. This would allow more accurate accounting of the actual evolution of personal carbon footprints, independent of changes in countries' industrial structure. This calculation may be a complex one, but that is no reason for it not to be performed. Initially, the Commission could calculate the carbon footprint of the EU-28 and translate its reduction target into this new unit.

3.3. Ensuring security of gas supply in the Ukrainian crisis

Russian-European relations took a significant turn for the worse in early 2015, despite the fact that the European Union and Russia have good reasons for cooperating given that the former needs Russian gas and the latter European currencies. It is this special relationship, or rather partnership, that the new European Commissioner for Energy will seek to preserve, if not rebuild, in the wider and more uncertain context of the evolution of Russian-European relations.

The Paris Summit of October 2000 helped launch an energy partnership between Russia and the EU, known at that time as the “Prodi Plan”, which led to the “EU-Russia Energy Dialogue”. Although it was unable to prevent the crisis of 2009 and the refusal of Russia to ratify the Treaty on the Energy Charter, this process permits dialogue between the actors. It also led to the “Roadmap of the EU-Russia Energy Cooperation”, signed in March 2013 by the European Commissioner for Energy and the Russian energy minister. This dialogue, currently stalled, must be restarted. Naturally, it can only be resumed if peace is sustainably restored in the eastern Ukraine.

In the coming months, the European Council will re-examine the issue of energy security in 2015 in order to assess the progress made to date. Several issues could be addressed at that time.

All Member States agree on the need to support the countries in the eastern part of the EU in their negotiations with Gazprom. Beyond the position of the European Council, inviting the Member States and companies concerned to get support from the Commission in their contract negotiations with Gazprom[1], two other measures can be envisaged. The first would involve allowing countries in the eastern part of the EU, or rather their gas operators, to form a central purchasing body to give them greater weight against Gazprom, without incurring any sanctions from the Commission for failing to respect the rules of competition. The second measure would mean allowing them to join forces, within a central purchasing body, with a gas operator in a western EU country. A variation on this would consist of allowing players with a share of the European gas market that falls below a certain level to join forces.

At the same time, the Commission will need to resume its dialogue with Gazprom for the purposes of ensuring that the company honours the obligations resulting from the Third Energy Package and complies with the findings of the survey undertaken by the DG Competition on its abuse of its dominant position[2]. To this end, the European Commission initiated proceedings against Gazprom on 22 April 2015 for hindering competition by issuing the Russian group with a “statement of objectives”; it notably accuses the group of hindering competition in gas markets in eight Member States (Bulgaria, the Czech Republic, Estonia, Hungary, Latvia, Lithuania, Poland and Slovakia). In more general terms, it will need to find pragmatic and partnership-based solutions in order to overcome the inconsistencies between the model outlined by the Third Package and the Russian gas company. In a word, it will need to rebuild a trusting and long-term relationship with Gazprom by clearly outlining the potential conditions under which the company will intervene in the European market.

Building a long-term partnership in the context of a well-understood relationship of interdependence does not mean submission. Gas supplies from sources other than Gazprom must therefore be implemented in parallel. As envisaged by the European Council 2014, and provided that the socio-economic analysis of the planned projects shows them to be cost-effective, this will require a number of LNG terminals to be created, along with new gas pipelines, particularly in the southern European gas corridor. This is all the more important given that Russia abandoned the rival “South Stream” project in early December 2014 and now plans to supply the European Union with gas from Turkey and Greece rather than the Ukraine, and to double the supply capacities to Germany. With this in mind, the Commission needs to re-examine the benefits and indeed the scale of this gas corridor, assess the profitability thereof and, in the event that it is found to be profitable, enable it to be completed within a reasonable time frame.

(1) See the Conclusions of the European Council of 23 and 24 October 2014.
(2) The contracts offered by Gazprom should not result in any form of discrimination between the various European countries, and in more general terms, Gazprom must be subject to the same rules of non-discrimination and competition as other European operators.

3.4. Rectifying current shortfalls in the electricity market

The Commission must start by recognising that the current structure of the electricity market, whilst it might have helped effectively coordinate the short-term management of the means of production available in a number of countries[1], does have several major flaws. As highlighted in the previous France Stratégie report on the matter[2], wholesale market prices have collapsed and no longer offer any relevant indication to stimulate any type of investment (off-peak, semi-peak and peak generation, means of storage, demand management, and peak in particular, etc.). There is, of course, a risk of future under-investment in all of these sectors, particularly as the major electrical firms are already in a very fragile position, which represents a lingering threat to the security of supply.

At the same time, the prices charged to end-consumers continue to rise, owing notably to renewable energy aid, taxes and networks costs, resulting in a threat to both household purchasing power and companies' competitiveness. In more general terms, this lack of organisation within the electricity sector is disastrous with regards to public opinion; after all, how can the public understand the increase in retail prices when wholesale prices are actually decreasing, and how can it approve of European intervention if it results in this kind of situation?

Incorporating a high proportion of renewable energy in the energy market presents a new type of problem owing, on the one hand, to its almost non-existent operating costs, and on the other, to production levels that vary depending on weather conditions, which requires the power to be paid for, in some way or other, and not just the energy. Furthermore, its intermittent nature and its geographical positioning in locations that enjoy good wind and sunlight conditions and that are not necessarily close to high-consumption areas mean that it is important that networks be reinforced.

Europe finds itself forced to innovate since no other region of the world of a comparable size has yet deployed renewable energy sources on such a large scale or even yet faced up to such a challenge. Whilst the “energy only” market and the couplings that have taken place have demonstrated their effectiveness in optimising short-term exchange (day-to-day spot market), they have also revealed their limitations when it comes to encouraging long-term investment and ensuring a very short-term balance (lasting just a few minutes). A thorough revision of the European electricity sector is essential and should begin with reflection on its organisation and operation ten years from now, reflection that should incorporate the need to pay, in some way or other, for power, and not just for the energy provided. A number of improvements must, however, be made to the “energy only” market as a matter of urgency.

(1) By optimising the merit order from day to day at European level and through the coupling of markets.
(2) France Stratégie (2014), *La crise du système électrique européen, op. cit.*

Allowing Member States to introduce their own capacity mechanisms but encouraging them to coordinate their initiatives

Many Member States are introducing – or have already introduced – so-called "capacity" mechanisms in order to ensure the long-term security of their supply. Such mechanisms can take a variety of forms (capacity payments, strategic reserve, capacity market, contracts for difference, etc.), owing to the disparity that exists between electricity mixes and various problems that are specific to each of the Member States.

Each Member State therefore undertakes the structural reforms required to incorporate high proportions of renewables, to ensure a balance between supply and demand, including during peak periods and in the event of variations in the energy[1] supplied by certain means of production, to ensure the profitability of the different means of production used (at the risk of some being definitively ceased, despite the fact that they may be necessary to securing the supply), to give rather high price signals to ensure the triggering of renewed investment in production and in managing demand, and also to minimise collective expenditure. There are a number of plans that could be put in place[2], all of which pay out, in one way or another, based on power rather than on energy alone.

For this reason, a European capacity mechanism would not really be feasible for the time being[3]. Each Member State must be able to create its own mechanism (in accordance with European regulations), provided that its compatibility with the mechanisms put in place by its neighbours is examined transparently in accordance with those adopted by

(1) This issue is becoming increasingly critical. During the solar eclipse of 20 March 2015, for example, Europe lost some 17,000 MW of solar energy production in the space of a few minutes, a loss that had to be offset by more flexible conventional production methods.

(2) A first plan of action seeks to complete the current market via tenders, "Brazilian style", that remunerate power. Under this scheme, energy producers propose a price, guaranteed for several years, to provide electricity to a given number of users (e.g. a city), thus establishing a competitive market. Then, energy suppliers sell the electricity to individuals. The UK is moving towards long-term contracts for low-carbon energies, supplemented by a capacity market. France complements the "energy only" market with a capacity market that could be used to remunerate the off-peak and semi-peak load facilities. In this scheme, the energy provider is responsible for the capacity obligation, meaning that it has the obligation to prove that it can ensure the supply of electricity to its customers at all times. In late October, Germany had opened a consultation period for a Green Paper on the changes required in the electricity system in order to integrate a greater proportion of renewable energy. Germany therefore envisages the possibility of establishing a "2.0" energy market (rather than a capacity market) that would be based on a strengthening of spot markets, an overhaul of the operational rules for power reserves and the option for network operators to refuse to absorb green electricity if need be.

(3) Germany also implicitly defends this perspective, ruling out the possibility of using the capacity mechanisms of its neighbours. It considers the capacity market, as proposed by France, to be overly complicated and primarily fears that this complexity may be a concealed way of subsidising conventional production facilities, resulting in an increase in charges that would then be attributed to the development of renewable energy.

the Commission[1] and that the possibility for electricity production facilities in neighbouring countries to contribute to the mechanism, as far as possible and under conditions to be specified, be guaranteed.

With this in mind, informal instances of coordination such as "peer reviews", which are often implemented at regional level, could be put in place to make neighbouring countries aware of any investment programmes in which a particular country is involved, as well as the design of its capacity mechanism, and to take this into account as they make their own choices. The practical coordination of such mechanisms could, however, be sought immediately since in an optimised system, given that the acceptable rate of failure is the keystone of the building represented by a "suitable"[2] electricity mix, a common definition, or at least one that is shared at regional level, is desirable. Common methodologies for evaluating the production facilities available and certifying and monitoring such facilities with the help of network operators could also be established. Finally, the potential to share electricity management models with neighbouring countries is crucial to verifying the availability of interconnections (in other words, the absence of any congestion) at times when demand is particularly high in a given State.

Given the major transformations that are expected to take place within the various electricity mixes over the course of the next ten to fifteen years across the different Member States, it should be possible to design a regional, if not European, capacity mechanism by this time, and reflection on this matter could be initiated within the centre-west region as a whole and in close conjunction with the Commission.

Viewing mature renewable energy sources as a general means of production and encouraging R&D in the field of non-mature renewable energy sources

Renewable energy sources have thus far and during their initial phase benefited from a series of conditions designed to encourage their development and reduce the costs they entail. This objective has been achieved, with over 40% of electricity production in Spain stemming from renewable sources, 26% in Germany, etc. Renewable energies have now begun to mature, which means making them a more significant part of the electricity system, in other words, adapting the conditions under which they are used to the share they occupy within the electricity mix, taking into account their highly capitalist nature and

(1) The United Kingdom, for example, had submitted its "contract for difference" system to the European Commission for approval in what represents a major turning point in history since, having championed the liberalisation of electricity systems in the 1980s-1990s, the country is now moving back towards greater public regulation, for the purposes of both ensuring the security of its supply and moving towards a carbon-free electricity system.
(2) In a market in which the price would be passed on to the end customer and where the latter would be in a position to step down in the event that the price is too high for them, it is this price, on average, that would serve as the underlying criterion.

both their positive (CO_2, energy independence, etc.) and negative externalities (effects of intermittence on network management, land use, etc.).

There is no longer any objective reason for the development of technically mature renewable energy sources, that is those that have been deployed to a significant extent (several percent of the overall mix), to be financially supported; indeed, such development should gradually result from a need (expressed by the market) and from anticipated CO_2 savings (assessed based on a mechanism that is to be revised).

Until such time as these incentives start to take effect, those support systems still in place and that are likely to die out should not, or at least minimally, disrupt the interplay within the markets. At the same time, a system for monitoring new capacities that arise – by means of invitations to tender, for example – must be implemented in order to adapt the pace at which renewable energy sources are developed to the ability of the electricity system to absorb them.

The guidelines regarding State aid for energy, published in June 2014, for example, aim to encourage the integration of electricity produced from renewable sources into the market; with this in mind, it is important that beneficiaries sell their electricity directly on the market (potentially, with regards to the smallest of producers, by enlisting the services of aggregators, as is the case in Germany) and that they be subject to market obligations[1]. They may receive public aid in the form of a bonus, but as recommended in the previous France Stratégie report, these guidelines stipulate that the bonus cannot be paid during periods when the wholesale market price is negative. They also anticipate that over the course of the 2020-2030 period, existing sources of renewable energy will make it possible to power the network at competitive prices, meaning that subsidies and exemptions from responsibility for balancing would have to be gradually withdrawn. With this in mind, renewable energy facilities, just like any other means of production, will have to be managed by a Balancing Manager[2], who would be encouraged to do the following:

(1) The following conditions will apply to all new schemes and measures as of 1 January 2016: a) aid is granted in the form of a bonus added to the market price at which producers sell their electricity directly on the market; b) beneficiaries are subject to standard balancing responsibilities, except in the event that no competitive intra-day balancing markets exist; c) measures are put in place to ensure that producers are not encouraged to produce electricity at negative prices.

(2) According to the definition adopted by the CRE (French Energy Regulatory Commission), balancing managers are operators with a contractual obligation to RTE to fund the cost of any discrepancies observed *a posteriori* between the electricity injected and the electricity consumed within a contractual balancing perimeter. This could be an electricity supplier, a consumer or any third party (bank, broker, etc.). The contractual balancing perimeter comprises means of injection (physical production sites, Stock Exchange purchases and purchases from other players, imports, etc.) and withdrawal factors (physical consumption sites, Stock Exchange sales and sales to other players).

- *evaluate their future production plan as accurately as possible*, particularly on a day-to-day basis, with a view to limiting the cost of discrepancies with actual production levels; this must entail a more reliable wind and solar energy production forecast;
- *contribute to the adjustment mechanism* (decreasing, or even increasing, supplies of power), resulting in their power being adjusted to reflect the needs of the network.

In the framework of the insurance-related interruptibility mechanism, this also means that network managers will be able to very quickly modify the planned operating programme, as is already the case in Germany and Spain, and disconnect such renewable energy facilities as needed should they be found to be causing network surges or congestion.

Furthermore, it is important that renewable energy be subject to the same obligations with regard to balancing the network as other means of production, particularly when it comes to contributing to providing system services (primary and secondary reserves), potentially by enlisting the services of production aggregators.

Introducing mechanisms that reveal the cost of flexibility in order for this to be assumed by those using it and remunerate those supplying it

Since electricity cannot be stored, the amount of electricity injected into the network must be equal to the amount being withdrawn at all times. In physical terms, the balance between production and consumption, both of which are subject to ebbs and flows, is maintained in real-time by RTE. In order to achieve this, RTE has to have real-time access to a power adjustment reserve to enable it to either increase or decrease power levels as appropriate. With this in mind, it calls upon producers and consumers that are connected to the network to very quickly adapt their planned operating programmes by means of the adjustment mechanism that has been in place since 2003. From a financial perspective, discrepancies between injection and withdrawal come at a cost, and one that is borne by the balancing managers. This being the case, the adjustment mechanism is also a mechanism that encourages all players to ensure that the balance within the network across the flows of electricity for which they are responsible is maintained.

Nowadays, the volumes called for by RTE in France in the framework of this adjustment mechanism (or imbalance settlements) are relatively modest (less than 1% of overall production) and the corresponding prices do not differ greatly from the energy prices. Given the increasing integration of renewable energy sources, the power of which can vary significantly and to some extent unexpectedly, measures should be taken to see that they greatly increase.

It is therefore important, now, to reflect upon the appropriate mechanisms that will help establish the real cost of flexibility in order for those externalities linked to the unpredictability of operating a production facility to be assumed by the operators responsible for them.

Despite the discussions that have taken place between the various Member States, no technical solution has yet been identified with regards to a system (in other words a network code) that is suitable for all. The most straightforward solution now would involve reinforcing the powers of the ENTSO-E[1] and the ACER[2] by granting them authorisation to resolve the issue. Given its complexity, it might be possible to initially outline a series of regional solutions involving Member States that fall within the same electricity area[3].

3.5. Decisively reducing our oil consumption levels and preserving our refining facilities

The decrease in oil prices is something of a blessing for the European economy and is expected to encourage its economic growth. It will, should it last, provide a unique opportunity to review energy policy whilst increasing taxes on oil products, and on diesel fuel in particular (which would help reduce the shortfalls in the European refining system), by standardising them and by basing them on a carbon basis. It is important that signals be sent to consumers to encourage them to adapt their energy use as appropriate, for the purposes of decisively pursuing initiatives designed to reduce oil consumption and improve energy efficiency and to ensure that the hundreds of billions of dollars in income that suddenly pass from producing countries to importing countries are put to good use. It is important not to repeat the errors committed during the oil glut of 1986, since in the wake of the 1973 crisis, huge efforts were made to reduce consumption and improve energy efficiency, and these efforts were relaxed somewhat during the period of low hydrocarbon prices that spanned from 1986 into the early 21st Century.

European refinery capacities will inevitably decrease as a result of reduced oil consumption levels and greater competition from the new mega-refineries of the Middle East and Asia. With this in mind, once the European refining industry has had its health check-up, it would be preferable for the Commission to adopt a strategic vision of the European refining industry stretching to 2030 in order to help protect the security of our supply and limit the increase in our trade balance deficit. Security, of course, requires a residual refining capacity that is proportionate to energy consumption to be maintained and this, in turn, requires a series of measures and tools to be put in place for the purposes of dealing with such restraints.

(1) The ENTSO-E, European Network of Transmission System Operators represents 41 transmission system operators (TSOs) from 34 European countries.
(2) The ACER, Agency for the Cooperation of Energy Regulators, is a European agency created by regulation (EC) n° 713/2009 and introduced in 2010 to help complete the internal energy market (gas and electricity) and to strengthen links between regulators in Member States.
(3) Enderlein, H. and Pisani-Ferry, J. (2014), *Reforms, investment and growth: an agenda for France, Germany and Europe*, November, www.strategie.gouv.fr/publications/reformes-investissement-croissance-un-agenda-france-lallemagne-leurope.

3.6. Supporting an ambitious R&D policy, coordinated at European level, for immature technologies

Europe is responsible for less than 10% of worldwide greenhouse gas emissions, but it can serve as a testing ground for technologies that can improve its competitive position in the global context. The massive use of feed-in tariffs (which reach tens of billions of euros annually) is not suitable for immature technologies. It is important instead to channel public support into R&D and into targeted demonstration initiatives. Beyond the traditionally listed technologies – such as next-generation solar energy, which captures a greater proportion of the solar spectrum, for example, or marine energy, electricity storage, the capturing and storage of CO_2, energy efficiency, smart grids, etc. –, it is important that we also support cross-functional technologies (notably nanotechnologies, and graphene in particular), whilst being wary of choosing the winners without knowing the facts, since innovation often occurs in sectors in which it is not expected, particularly with regards to the use of energy, new materials and even information technologies.

Current thinking regarding the prolongation of the SET-Plan and its Integrated Roadmap should lead to the adoption of an action plan that stimulates European energy R&D, promotes cooperation and improves links with innovation and industry in order to make the European economy greener and more competitive. This action plan must be based on systematic comparisons with the programmes of other world economies, notably the United States and Japan[1], which invest heavily in R&D.

It is also desirable for policies designed to support innovation to be coordinated with industrial policies that include a training element. A comparison of the cost of installing photovoltaic panels in Germany and in France, for example, shows that very significant productivity gains can be achieved where both installers and equipment maintenance are concerned. A European-wide industrial policy could also help secure the successful industrial development of future green technologies where Europe has failed in the past.

3.7. Developing a framework to encourage investment in the energy sector as part of the Commission's plan to relaunch investment

The EU suffers from a lack of investment: in 2012, its level of investment was lower by 15% on average against pre-crisis levels. The recently announced plan to help restore growth in Europe is expected to generate €315 billion of investment. In the energy sector, immense investments are needed for proper operation of the system and to reduce European emissions of greenhouse gases by a factor of more than four: more than €200 billion in networks by 2020, nearly €2 trillion (according to the IEA) by 2035 in electricity production and emissions reduction. Approximately one quarter of these expenditures will

(1) Cf. Top Runner programme in Japan and DOE programmes in the U.S.A.

be devoted to energy efficiency. Although some countries are experiencing overcapacity, some of Europe's electricity production facilities need to be modernised by 2030.

However, several factors now impede these expenditures: the price collapse in the wholesale market, which deters investment in new production facilities and, more generally, uncertainty about the profitability of energy projects (e.g. housing insulation), the lack of visibility for the carbon market (which has lost all credibility) and the loss of confidence on the part of actors, which has led bankers to set borrowing rates higher than for the rest of the economy.

Under these conditions, in conformance with the first paragraphs of this text, the Commission must initially seek to restore credibility to the carbon allowance and wholesale electricity markets. Next, and in conformance with the recovery plan, it must favour the undertaking of new projects, based on private investment, benefiting from mutual guarantee schemes and reimbursable advances implemented in cooperation with the EIB. In the domain of energy efficiency (a high priority in order to reduce energy consumption), it would therefore be desirable to implement, in conjunction with the EIB, systems of third-party guarantors, particularly for thermal renovation of public buildings. However, energy efficiency projects must not take place solely on the basis of their cost-effectiveness: given equivalent economic viability, those providing maximum reduction of greenhouse gas emissions must be favoured.

Kick-starting investment could also encourage the thermal renovation of the least energy-efficient of buildings, along with the development not only of heating but also of cooling networks.

PRINCIPLES AND RECOMMENDATIONS

Four principles

A principle of solidarity: the first step of building a European energy policy requires all Member States to commit to helping any other Member States that might suffer an energy shortage.

A principle of responsibility: it is up to the Member States to determine the general structure of their energy supply, as well as any changes that take place with regards to the corresponding means of production.

A principle of economic rationality: in a difficult economic period, it is important that a socio-economic analysis of the decisions made in the field of energy policy be systematically performed.

A principle of resilience: European energy policy has to be able to adapt to global environment changes, which can greatly affect it and over which it sometimes has very little, if any influence.

Seven recommendations

Specify the objectives of the EU's energy policy without concealing their internal contradictions. This energy strategy could be outlined by 2030, in addition to the energy and climate policy-related decisions that the Council made in October 2014. A series of instruments, and even secondary objectives, will also be adopted and must be carefully calibrated in light of the previously specified primary objectives.

Ensuring security of our gas supply by supporting the countries in the eastern part of the EU in their negotiations with Gazprom, by ensuring that the Russian company complies with European rules on EU territory, by diversifying the EU's sources of supply and by building the southern European gas corridor, while rebuilding a trusting and long-term relationship between EU and Russia, once the Russian-Ukrainian conflict has subsided.

Rectify the current structure of the electricity market. The Commission must start by recognising that the current structure of the electricity market does have several major flaws and needs to be reformed. The question of how power is remunerated must be addressed, to take into account the new context brought about by the massive integration of decarbonised and highly capitalistic means of production. Unfortunately, a European capacity mechanism would not be feasible for the time being: each Member State must be able to create its own mechanism (in accordance with European regulations), provided that its compatibility with the mechanisms put in place by its neighbours is examined. Member States must nevertheless coordinate their investments – notably through "peer reviews" – in order to optimize the costs on a global level and to ensure the security of the network. Mature renewable energy sources, as planned by the guidelines on State aid for energy published in June 2014, must be integrated into the market. To ensure the balancing of the network in the short term, appropriate mechanisms must be implemented so that the costs due to flexibility (in response to great variations in production) can be estimated and charged to the users, while remunerating the suppliers. Renewable energies must contribute as the other means of production to providing system services (primary and secondary reserves), which could imply their interruptibility as in Germany and Spain and the enlistment of production aggregators.

Rebuild a credible price signal for carbon and more generally restore credibility to the climate policy. A regulator, who could intervene quickly (with a clearly defined mandate), would lend credibility to the market through the decisions it makes. More generally, the Commission should undertake a reflection on the benefits of mapping out a trajectory of carbon prices. This could be achieved by establishing a hybrid system, governing the current ETS market with floor and ceiling prices managed by a credible regulator.

Adopt a strategic vision of the European refining industry, taking into account the necessity to protect the security of our supply, under any circumstances outside the EU, and the possible additional costs for the taxpayers and the consumers.

Intensify and coordinate the efforts in research and development in favor of non-mature technologies to enable the transition towards a decarbonised energy system; define coordinated roadmaps (European Union and Member State) in fields of shared interest, in order to optimize the use of public research funds.

Encourage investment in the energy sector as part of the Commission's plan to restore growth in Europe. The Commission must seek to restore credibility to the carbon allowance and wholesale electricity markets. In accordance with the recovery plan, it must favour the undertaking of new projects, based on private investment, benefiting from mutual guarantee schemes and reimbursable advances implemented in cooperation with the EIB.

SECURITY OF ELECTRICITY SUPPLY

Étienne Beeker[1]

"Security of supply is the ability of an electricity system to continuously meet the foreseeable demand within the market."
Glossary of the French Energy Regulatory Commission

It is difficult to imagine a modern society without electricity, which is perceived by the majority of the population as a "basic commodity" that we tend to take for granted. However, whilst access to electricity may be considered a right to all individuals and businesses, there is a great lack of awareness regarding the physical restraints associated with this right.

Electricity systems are without doubt the finest example of a complex system operating with a lean supply flow, with the need to continuously adjust the supply to reflect the demand and with a major risk of imbalance at all times in the event that the appropriate technical recommendations regarding voltage and frequency are not observed. The reasons behind this risk are no secret; after all, demand is unyielding, storing electricity is both difficult and costly[2], means of production can vary in terms of their flexibility and any failure on the part of one facility can result in load shedding that cascades right through the network.

This complexity demands close coordination at all times between energy producers and suppliers, network managers and even consumers – something that the market is not always in a position to guarantee. There are, of course, economic, financial, geopolitical (with regard to the supply of fuels in particular) and internal security (protection of strategic infrastructures) aspects, which require action on the part of the public authorities, to be taken into account. The latter also have a role to play in seeking to maintain their influence over the fixing of tariffs and in specifying the quality of the electricity supply that consumers require.

(1) Department of sustainable development, France Stratégie.
(2) Hydraulic storage is the most economical form but the available sites are already saturated.

1. Ensuring a balance between supply and demand across all time scales

It is important that the electricity system be balanced across all time scales:

- in the **long term** (several years). This requires the necessary investments to be planned and combined with policies designed to manage demand that reflect the restraints that are likely to affect the system in the future. It is important that facilities be "adapted" as much as possible, meaning that they should incorporate the right proportions of off, semi-peak and peak generation depending on the structure of demand;
- in the **medium term** (from several months to a year). It is not believed possible to adjust generation capacity by means of new investment and it is important that it be appropriately managed (hydraulic reserves, fuel purchases, managing maintenance stoppages, etc.). This is a task typically entrusted to operators (network managers and balancing managers) in accordance with certain techno-economic criteria;
- in the **short term** (by the day, or even within a few hours). Every player has various means of production ready to deploy and/or sales and purchase contracts with other players. These are ranked by increasing marginal costs ("merit order") to meet demand or to operate in wholesale electricity markets;
- in **real-time**: economic criteria give way to technical criteria, the network manager being responsible for maintaining frequency and voltage at all times and dealing with various unpredictable factors, such as facility outage (VHV line or production plant), variations in demand and deviations from the weather forecast. The tools at their disposal (primary, secondary and tertiary reserves[1]) have more to do with regulatory recommendations (notably regarding the volumes to be kept in reserve) than the market itself (even if prices are specified for the purposes of settling imbalances).

The development of large quantities of (primarily intermittent) renewable energy represents new problems with regard to the security of electricity systems at either end of these time scales:

- in the long term, there is the risk that insufficient investment will be made;
- in the very short term, the system becomes extremely complex to manage, resulting in a risk of blackouts.

(1) These reserves are the system services that will be looked at in greater detail later in the text.

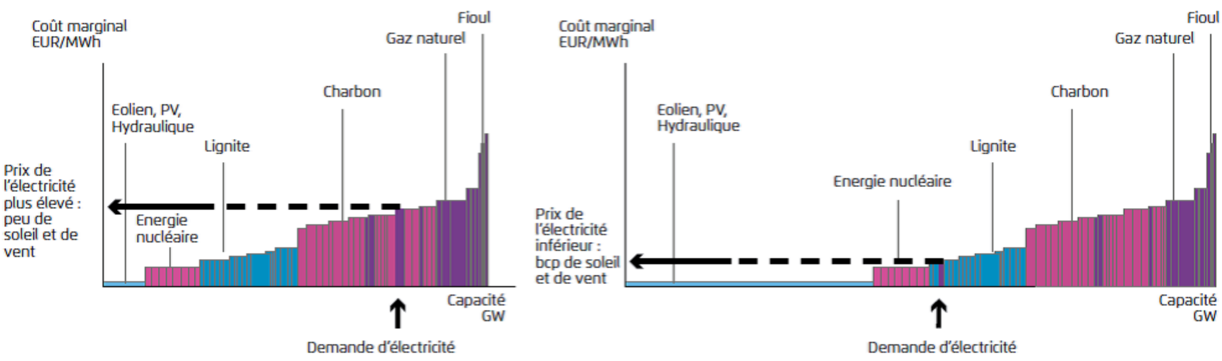
2. The threat to long-term security of supply

The impact of integrating large amounts of renewable energy

The first effect of renewable energy penetration is a shift in the “merit order”. Indeed, owing to their non-existent marginal costs (and because they take priority with regard to injection into the network), renewable means of production take precedence over other means of production. As a result of the very rapid growth of wind and photovoltaic farms in Western European countries, the corresponding impact on the European market quickly became significant.

The pricing policy adopted in the wholesale market (so-called merit order curve)

Period with low levels of wind and sunlight **Period with high levels of wind and sunlight**



Source: Agora Energiewende (2012)

Owing to the way in which they are supported, renewable energy producers, as the beneficiaries of feed-in tariffs, generate energy without having to take the actual needs and restrictions of the electricity system into account. This lack of exposure to the balance between supply and demand results in anomalies within the electricity market, as well as the distortion thereof, with clear consequences that include the following:

- a decrease in kWh prices within electricity markets (so-called wholesale markets), meaning that such prices no longer send out a sufficiently motivating signal to investors, thus threatening the long-term security of supply;
- worse still, certain semi-peak stations are either provisionally or definitively withdrawn from the network as they are not profitable (51 GWs have been decommissioned or mothballed in Europe over the course of the past two years). Such units, primarily gas power plants, are also the best placed to provide a back-up for renewable energy in the absence of sufficient wind or sunlight.

Since the previous France Stratégie report[1], the European Commission adopted, in April 2014, a series of guidelines on supporting renewable energy that came into force on 1 July 2014. This overhaul of renewable energy support mechanisms has resulted in feed-in tariffs being withdrawn in 2015 in favour of direct sales within the market, combined with public aid in the form of a conditional bonus that is notably dependent upon the balance of the network. Public support will also be provided through invitations to tender, which will become compulsory on 1 January 2017. This reform does not currently affect lower-capacity projects.

Various Member States have started to review the conditions governing their support for renewable energy, generally by introducing an additional *a posteriori* payment (similar to the British CfD or contract for difference). Whilst this mechanism represents a step forward from the feed-in tariff system, whether it rids the market of any form of distortion remains to be seen, with renewable energy producers still benefiting from a strong guarantee of receiving payment, regardless of the market conditions at the time they deliver their kWhs. These points will be detailed below.

The electricity market has not had the opportunity to operate in “uninterrupted” mode

The issue of knowing whether out-of-market renewable energy funding is solely responsible for the ineffectiveness of market signals in encouraging investment might be raised since the introduction of renewable energy into the electricity system has more or less coincided with the effective launch of the European wholesale market. The market started to become operational as of 2004, with prices taking a number of years to stabilise at levels that more or less reflected production costs (European plants were generally running under capacity). The so-called “3 x 20” directive dates back to 2008[2], whereas renewable energy had started to develop significantly out of market in certain countries (Germany and Spain).

The markets have therefore never had the necessary perspective to confirm that they can indeed send the right signals to various players, encouraging them to invest, when they are not interrupted by the out-of-market development of renewable energy. The debates on the issue that had taken place (and even raged) over the course of the 1980s-1990s were never truly put to bed and could, in fact, be reopened. The issue of “missing money”[3], for example, recently raised its head again and the capacity market

(1) France Stratégie (2014), *The Crisis of the European Electricity System. Diagnosis and possible ways forward*, January, www.strategie.gouv.fr/publications/crise-systeme-electrique-europeen.

(2) Directive 2009/28/EC transposing the 2008 energy-climate package: by 2020, the European Union must reduce its greenhouse gas emissions by 20%, achieve a 20% energy saving and raise the proportion of renewable energy in its energy mix to 20%.

(3) As far as certain economists are concerned, a market based solely on energy – and therefore, theoretically, on marginal production costs – does not allow for the remuneration of investment in extreme

that France is establishing may be considered a response to this issue, seemingly independent of the presence of renewable energy in the mix.

Other factors have to be taken into account, particularly with regard to signals designed to encourage investment that is sent out by the market and that can come into play at too late a stage to prevent shortfalls, since procedural and construction time frames are long and electricity cannot be stored, meaning that public authorities, operators and regulators will always have to face up to their joint responsibility.

These potential debates might also be fuelled by the major turning point in history that is taking place in the United Kingdom. Having championed the liberalisation of electricity systems at the time and revised its market rules several times, it is now shifting back towards more public initiatives and greater regulation for the purposes of both ensuring the security of its supply in the medium-term and making its electricity system carbon-free.

In the meantime, each Member State has introduced a capacity mechanism in response to an issue that is specific to the State in question, with security of supply remaining within the sovereign power of each State.

Europe finds itself forced to innovate in order to ensure the security of its supply

Given the threats with which it is faced, security of supply comes top of the list of concerns for the European Union, which finds itself forced to restructure its electricity system and restore its operators' ability to invest in the means of production required to ensure that the balance of the system is maintained.

A less than obvious reorganisation of the electricity market is therefore required. As the first continent to tackle the integration of such a significant proportion of intermittent renewable energy into its network, Europe finds itself in unknown territory, forced to innovate in both legal and institutional terms in order to regulate its energy sector. Furthermore, not all Member States are faced with the same issues. Indeed, a rapid analysis of the situation of the three largest States, namely France, Germany and the United Kingdom, highlights the following significant differences:

– an increase in peak demand in France owing to the thermal sensitivity of demand here;

---

peak facilities, and it is this absence of remuneration that is responsible for the lack of peak capacity. The solution, for economists, lies in the addition of a capacity mechanism that encourages investment under all circumstances. For other economists, and as highlighted in the first France Stratégie report, an energy market that is free of any restraints would help remunerate such investment.

- a short-term deficit in off-peak means of production in the United Kingdom as a result of chronic underinvestment;
- a great need for flexibility in Germany owing to the extremely rapid development of intermittent renewable energy.

Separating the capacity market and the energy market presents a theoretical problem

Hoping to juxtapose an energy market (kWh) with a capacity market (or a power market, kW) presents a number of theoretical problems, since both of these quantities are strongly linked to time (h). The energy contained in one kWh will operate a 1kW facility for one hour. By way of illustration, these two quantities can be compared to a distance and a speed (1km is the distance travelled by a moving object travelling at 1km/h for one hour), to which they appear to be strongly linked.

According to the theory developed notably by Marcel Boiteux[1], appropriate facilities should comprise a mix of off-peak, semi-peak and peak means in such proportions that if you want to produce 1kWh of additional energy at moment *t*, it makes no difference whether you operate 1kW of a facility that is not running at full capacity for one hour or invest 1kW in a new means chosen on an optimal basis and also operating it for one hour.

In the former case, expenditure relates only to kWhs (which would correspond to a transaction in the "energy-only" market) and in the second to kWs and kWhs (corresponding to a transaction both in the capacity market and in the "energy-only" market). The theory claims that with appropriate facilities, short-term marginal costs (€/kWh) are equal to long-term marginal costs or those associated with development (€/kW).

Both the mass integration of renewable energy and the economic crisis, which distorted the demand curve, have resulted in a complete maladaptation of the facilities available, thus widening the gap that already existed between short-term and long-term marginal costs. The introduction of a capacity market in addition to the energy market should aim to reconcile these two costs, but since these are correlated, and bearing in mind that the markets are not independent of one another, it is important to ensure that they do not incur any additional costs.

Germany has the opposite problem in that its facilities are also poorly adapted but in this case owing to excess capacity (resulting in negative prices and operators

(1) See, for example, Varoquaux, W. (1996), *Calcul économique et électricité*, Paris. PUF, Que sais-je ?, n° 3201.

closing non-profitable stations). The issue with which German regulator the BNetzA is now faced involves determining which stations to maintain within the network for the purposes of continuing to ensure the optimal security of the system's supply. Furthermore, there are clear theoretical benefits to jointly optimising the composition of the German and French mixes, regardless of the limitations stemming from the capacity of the interconnections that link the two countries.

In light of these uncertainties and malfunctions, the majority of Member States have decided to introduce, sometimes as a matter of urgency, various mechanisms designed to supplement – albeit temporarily, according to some – an "energy-only" market that does not perform the functions it is supposed to. These mechanisms vary, with technical solutions adapting to reflect specific issues.

France fears for its peak demand

The *Réseau de Transport d'Electricité* ("Electricity Transmission Network", RTE) regularly reiterates in its forecast report that peak demand has increased on a regular basis over recent years, even when consumption appears to have stabilised. With this in mind, RTE has alerted the public authorities to a potential deficit in production facilities as of winter 2015-2016, with a number of old coal and fuel oil power stations set to be decommissioned in 2015.

The French law introduced in the year 2000 had given public authorities the ability to launch invitations to tender in an attempt to deal with the foreseeable lack of means of production (specifying, where appropriate, whether these should be peak, semi-peak or off-peak). Since such invitations can prove unsuccessful, the so-called NOME Act of December 2010[1] introduced a capacity obligation system for the purposes of increased security, whereby "each electricity supplier, in accordance with the consumption patterns of its customers, contributes, in terms of both power and energy, to the security of supply within continental metropolitan France".

This capacity obligation is combined with a power market, since suppliers are able to exchange their capacity guarantees should they find themselves in a position of oversupply or in deficit, and this power market (in which kWs are exchanged) supplements the existing energy market (where exchanges take place in kWhs).

(1) The decree of 14 December 2012 outlines the general structure of the Act.

A return to State control over investment in the United Kingdom

National Grid, which manages the British network, has recently issued a further warning regarding an increase in the significant risk of power cuts and "brownouts"[1], since the electricity system is unable to deal with a cold wave occurring every twenty years (one chance in twenty). In light of the power outages that the electricity market has to deal with and with a view to limiting exposure to the long-term price risk, the United Kingdom announced the launch of its own system, the so-called CfD (contracts for difference) system, in June 2014 with the aim of providing an additional payment for decarbonised means of production (both renewable energy and nuclear).

An initial invitation to tender for 53.3 GWs in production, shedding and storage capacity has been launched and the value of the payment will be determined by a bidding process (the first taking place in December 2014). Successful bidders will receive payment for the production capacity they are able to provide and will be required to guarantee the availability of these subsidised production facilities during periods of peak consumption in return. Costs will need to be covered by the electricity supplier, depending on the contribution of their customer portfolio to peaks in demand. Production facilities located abroad are not eligible to participate in the first bidding process, although this situation is expected to change for forthcoming 2015 bidding processes.

Germany deals with its most pressing issues in an attempt to put an end to station outages

Germany, for its part, finds itself dealing with something of an overcapacity scenario and faced with operators seeking to close down their plants owing to a lack of profitability. As we have seen, it is often the gas power stations, some of which have only very recently opened, that they plan to decommission, despite the fact that they are essential to maintaining the balance between supply and demand at times when there is insufficient wind or sunlight. The country has adopted a strategic reserve mechanism whereby certain stations are forced to remain operational following negotiations between the operators of such stations and federal network regulator the BNetzA.

Such measures have been declared temporary by the German government, which published, in late October 2014, a Green Paper on the reform of the electricity market which highlights the need to adapt the rules by which the market operates to reflect the increasing proportion of renewable energy. As far as the government is concerned, the reform should first and foremost improve the ability of the markets to send out the right price signals, both to producers and to consumers. The government has suggested a

(1) "Blackout" is the term used to refer to a widespread consumer power cut whereas a "brownout" will affect only certain consumers, possibly in turn (rotational power cuts).

strengthening of spot markets, along with an overhaul of the operational rules for power reserves to encourage renewable energy producers, storage operators and consumers to participate in such reserves. In order to improve the stability of the system, it has also considered the possibility of network operators refusing the absorption of green electricity in the event of situations of extreme imbalance and has reasserted the importance of the "energy only" market as the preference over any mechanism designed to explicitly remunerate power.

Germany believes that the potential for optimisation must be fully exploited prior to the decision being made to intervene in such a "radical" way to restructure the markets. It believes that the priority lies with adapting the market rules to reflect the need to integrate renewable energy by introducing "quarter-hour contracts" within the intraday market, for example. This does, however, require energy market prices not to be capped, which could result in them reaching extraordinarily high levels[1] and does not, therefore, appear to meet widespread approval in Germany.

In this respect, Germany is steering clear of the French model for the time being, believing that the various capacity markets are all at risk of hindering the flexibility of the electricity system, despite this being vital to the integration of renewable energy into the German electricity system. There is also the fear of an increase in charges that could be attributed to the development of renewable energy sources.

Indeed, the German analysis of the mechanism that France hopes to introduce and would like to see extended across Europe is not unfounded, and in light of its complexity, the Germans remain hesitant and are leaving the designers to experiment for themselves. Brussels, for its part, has always demonstrated a degree of caution with regard to the idea of supplementing the "energy only" market with capacity-based remuneration. It has, however, approved the reforms that the United Kingdom wishes to introduce.

The ENTSO-E (European Network of Transmission System Operators for Electricity) association, to which European network operators belong, meanwhile, has underlined the impact that a capacity mechanism will have on the "energy only" market. This observation is rather a matter of common sense, since power and energy are connected by a simple link, namely the operating time of means of production (see also box above). The ENTSO-E does, however, recognise that such mechanisms may be necessary in certain areas, but that they must be designed in way that takes account of market price signals and aims to achieve an actual rather than a perceived objective[2].

(1) Peak facilities could therefore reach a certain level of profitability, even operating for only very few hours.
(2) ENTSO-E presentation to France Stratégie on 16 September 2013.

RECOMMENDATIONS

To allow Member States to establish their own capacity mechanisms that reflect the specific features of each electrical system.

An element of overlap in outlining the criteria for security of supply (acceptable shortfall level) would be desirable.

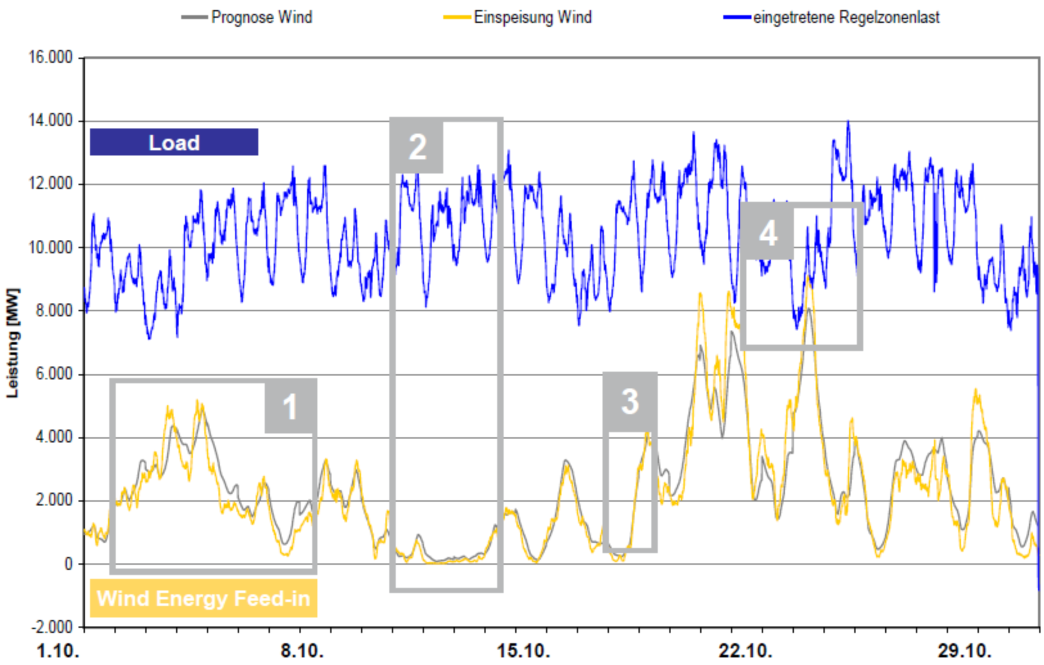
At the same time, it is essential that a peer review body be set up whereby each State is required to outline to the other States any major decisions made in the framework of its energy policy that might have repercussions on the balance of the electricity systems in other Member States.

3. The very short-term reliability of the electricity system is weakened

The European electricity system currently finds itself in a paradoxical situation in that whilst demand for electricity is at best stable and often in decline, and European plants find themselves with unutilised capacity, which might appear to bode well, the system is, in fact, weakened by a production mix that is no longer appropriate in the very short term.

Indeed, whilst intermittent renewable energy may become more or less integrated with off-peak facilities in the long term (since its average statistical production is relatively distributed throughout the year), the power it provides in the short-term is by no means guaranteed. Where renewable energy accounts for a significant proportion of instantaneous production, such a situation can result in rapid and significant variations in the levels of power injected into the network (see graph below), which may jeopardise the stability of the electricity system in the event that insufficient rapid reserves are available to compensate for such variations. Furthermore, the system is far more complex than it used to be, with a soar in the number of players involved and a very low level of coordination between them, not to mention thousands of unpredictable production sources involved.

Integrating intermittent energy into the electricity system: typical situations to be addressed by the system



Source: operator 50Hertz based on data for northern Germany in October 2010

The four main types of situation that the electricity system finds itself having to deal with as a result of intermittent and unpredictable energy are as follows (using wind energy as an example):

1. deviation from forecast (the wind comes slightly earlier or later than expected): need for rapid reserves;
2. absence of wind: need for back-up in order to ensure additional production;
3. rapid and unexpected variation in wind energy production: need for flexibility;
4. overproduction of wind energy owing to insufficient demand: need to be able to curtail wind energy production.

For the time being, demand is considered to be rigid and virtually inelastic, at least in the short-term, and means of production will need to find ways of adapting to any situation in accordance with a hierarchical top-down model. Such adjustment still stems primarily from centralised means of production – hydraulic and thermal plants, of course, but also nuclear power plants, which, at least in France, are sufficiently flexible. Operators have thus far succeeded in making the system work and have faith in its technical ability to continue to ensure security of supply.

Some, however, such as RTE, claim that appropriate technical solutions already exist but that it all boils down to funding. A study by the Agora Energiewende[1] institute, for example, concluded that as long as the proportion of renewable energy does not exceed 60% of the electricity mix, the development of electricity storage operations will not be a pre-requisite to the continued installation of wind and photovoltaic facilities, provided that some of them are disconnected from the network at times of peak production. This figure is extremely high (corresponding to a wind and PV solar power level of over 200 GW, that is four times the average power required in Germany). The results of this study have also been contested by the DENA[2].

In theory, it would be possible to do without storage since it is still possible to either increase flexibility resources for the purposes of what is known as load monitoring, or to invest in semi-peak power stations to provide a back-up, or even to disconnect renewable energy sources from the network when production exceeds demand ("curtailment"), which is increasingly the case in Germany. All of this comes at a cost, and one that is undoubtedly high and difficult to determine (in theory, it is established by comparing the costs of managing the system both with and without intermittent energy sources) and must, as is the case with any externality, be assumed by those responsible for causing the imbalances.

4. Changes to the role of electricity networks

The network performs a primary function within a given consumption area, that function being to connect consumers to the appropriate producers for the purposes of ensuring a balance between supply and demand. Since the various areas within the country are not all independent with regard to their electricity supply, the network also performs a very important secondary function in that it connects consumption areas with one another, thus making it possible for excesses in some areas to compensate for shortages in others. This inter-regional balancing is achieved by means of the very high voltage (VHV, 225 kV and 400 kV) network, which was designed to reflect the current geographical distribution of means of production and the primary points of consumption. One of the criteria on which the choice to invest in a line is based is the overall saving to be made in terms of production costs. In the case of interconnections, the benefits of building a line are measured in terms of the discrepancy between market prices, on the one hand, and border prices, on the other.

(1) Agora Energiewende (2014), *Stromspeicher in der Energiewende*, September.
(2) DENA: *Deutsche Energie Agentur* ("German Energy Agency").

The difficulties associated with building new high-voltage lines between the north and the south of the country lie at the heart of political debate in Germany

Germany, which has been developing high levels of intermittent renewable energy for a number of years in the framework of its *Energiewende*, is currently facing a number of problems with regard to the management of its electricity system, including difficulty in evacuating excess output in the north of the country, where the wind energy sector has primarily been developed, a lack of capacities in the south, where the high-energy-consumption industries are located, technical problems with regard to maintaining the stability of the network in the short and very short term (the volumes exchanged on the intra-day market have increased ten-fold in five years) and above all difficulties connecting these two regions with one another by means of VHV lines as a result of opposition on the part of the respective populations to have them installed.

In the event of congestion in the lines supplying the Bavaria region in particular, network managers are required to redispatch power stations, meaning starting up stations in the south that are more costly than those in the north. Additional costs amounted to some €115m in 2013 and the forecasts for 2014 are greater still. The federal government has threatened to create an area (southern Germany) that is subject to higher prices if the lines are not built[1], which would challenge the existence of a single market in Germany itself.

The functions performed by the network will need to be developed in the future to allow for the integration of renewable energy in light of the following two restrictions:

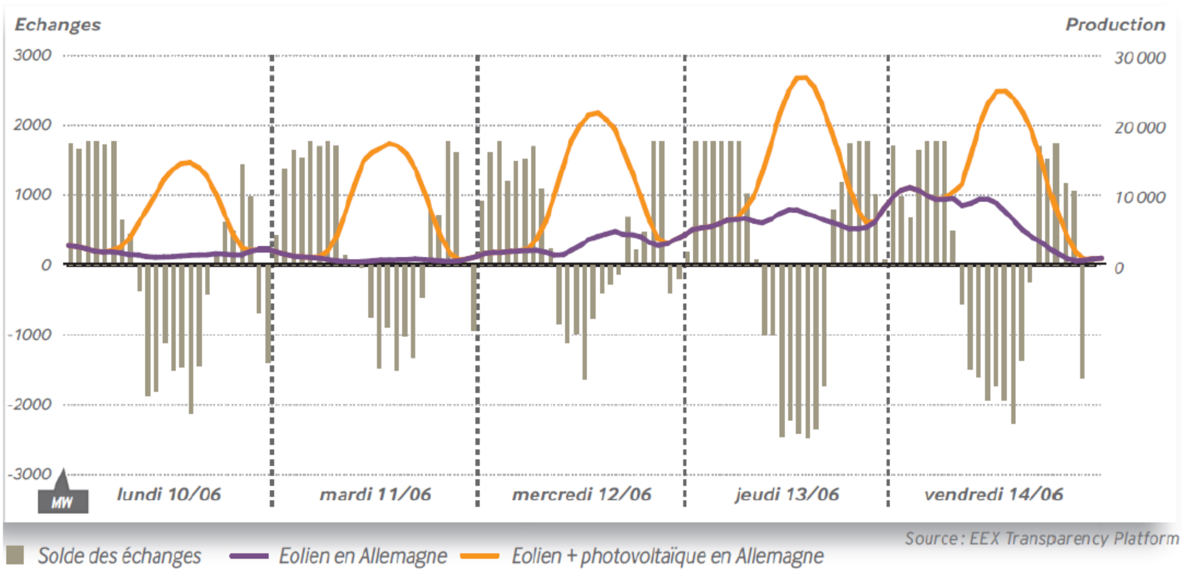
- wind and solar production facilities are *a priori* located in areas that get a lot of wind or sunlight, which, in the case of France, tend to be a good distance from where the energy is actually used (as is often the case in Europe, and Germany in particular, with its north-south imbalance);
- since these facilities produce on a purely intermittent basis, the ratio of their power to the energy they deliver is high[2], meaning that those networks designed to accommodate peak demand need to be strengthened.

The development of a trans-European network also plays a major role in the reliability of the electricity system by allowing for the production capacities of different countries to be

(1) “Streit ums Energienetz: Süddeutschland muss höhere Strompreise fürchten”, *Der Spiegel*, 5 March 2015.
(2) The ratio is between 3 and 4 for a wind turbine, around 6 for a solar facility and around 1.2 for an off-peak facility.

pooled and optimised and by taking advantage of the “expansion” of such means on a wider geographical scale. The graph below shows the exchange that takes place on the Franco-German border. It appears that this exchange can be reversed twice a day; basically, when there is plenty of wind and/or sunlight in Germany, France imports energy at a very low marginal cost and at night it exports electricity at a better price than German fossil fuel power stations. Interconnections, which were originally designed to route blocks of energy over varying periods of time (some are even saturated, in a way, for a significant part of the year), are therefore witnessing a change in their role, enabling the system to “breathe”, with daily variations in the direction of current flow (the relative flow total may be close to zero).

Comparative trend in the balance of exchange at the Franco-German border and wind and photovoltaic production in Germany



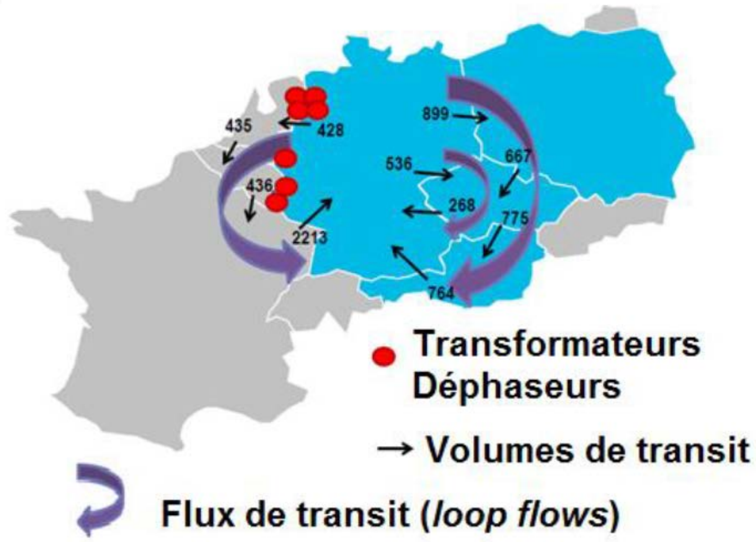
Source: RTE - Electrical report 2013

Clearly, this change in the role played by the network is implicitly acknowledged by the aforementioned ENTSO-E, which estimates the proportion of work to extend and improve the European transportation networks required to develop electricity from renewable sources at 80% in its ten-year development plan (valued at 104 billion euros).

The emergence of loop flows, such as those resulting from the mass installation of wind turbines in northern Germany and the delay in the construction of high-voltage lines to the south, can sometimes saturate and weaken networks in neighbouring countries (see figure below). In an attempt to prevent the risk of blackouts, the Czech Republic has therefore warned that it planned to be able to block any new inflow of renewable electricity that was likely to create a failure in its network by constructing a giant phase shifter transformer to regulate the acceptable input power, which is set to be in operation by 2017. Poland also plans to install such facilities at its border with Germany.

The need to call upon means of production such as phase shifter transformers can be taken as evidence that the presence of interconnection lines does not always have a positive effect. Indeed, such lines can offer a variety of benefits, demonstrating, if indeed further proof were still needed, the need for the appropriate technico-economic studies to be performed in each case.

Loop flows in countries neighbouring Germany in 2011-2012 (MW)



Source: Bloomberg-BNEF

RECOMMENDATION

The economic benefits of interconnection lines must be assessed on the basis of services provided for the European electricity system in the wider sense and with regard to security in particular.

Basing anything solely the short-term market prices observed on either side of a border is meaningless in today's world, not only because such price signals are not grounded in any form of economic reality (such as in the framework of production investment), but also because the criteria for securing the system must also be incorporated in any evaluations.

5. The contribution of renewable energy sources to certain system services is essential

Nowadays, renewable energy under purchase obligation is still remunerated based solely on the kWhs it provides for the network – a system that reflected a desire to develop new sources of energy during an initial launch phase, at least where the quantities concerned were of a marginal nature, and not affect the major balances within the electricity system. Some of these sources of energy have now matured to a degree that can be measured with regard to the quantities found within the network (over 12% in Germany, over 20% in Spain and over 5% in many other countries) and that no longer justifies such support.

As the intermittent energy integration diagram (*cf*. *supra*) shows, one of the affects is a result of the discrepancies associated with the unpredictability of renewable energy, that is the difference between the best possible production forecast and actual production levels. Nowadays, the extent of the reserves required is still assessed based on other unpredictable factors to which the electricity system is subject (loss of a production unit or transport structure or a demand forecast that proves to be incorrect as a result of a change in the weather, for example), despite the fact that the "renewable energy" factor is on its way to becoming more significant. Current additional costs are estimated at some €20-30m/year (source: CRE[1]) and are borne by the obligated buyer, EDF, but are expected to increase rapidly and in a non-linear manner as the proportion of renewable energy in the mix increases.

Renewable energy under purchase obligation is not bound by the obligation to provide RTE with a reserve for system services (frequency-power adjustment and tertiary reserve). It should at least be sufficient to supply primary reserve capacity and to participate in downward adjustment bids.

For some Member States, injecting renewable energy into the network is a priority, and one that should come "naturally" given its non-existent marginal cost and the fact that renewable energy sources rank at the top of the "merit order". Nevertheless, it can sometimes be uneconomic to draw energy from these facilities, even if it does cost nothing, because it means that others (generally traditional fossil fuel power stations) have to be shut down for quite short periods of time, resulting in high stop-and-start costs. Such situations inevitably lead to the symbolic negative prices that we see, indicating that these producers are prepared to pay during such periods rather than shut their facilities down. Economic theory states that renewable energy sources should not be used to provide energy during these periods, since their marginal cost is greater than the market price.

(1) The French Regulatory Commission of Energy.

The obligation to constantly maintain voltage (wave) quality[1] lies with distribution network managers. Indeed, the majority of renewable energy facilities are connected to public distribution networks and now have the technical capacity to contribute to adjusting the voltage, notably by supplying or absorbing any reactive energy[2]. The CRE believes that this capacity is currently underexploited, despite the fact that using this capacity would help significantly reduce both investment expenditure (strengthening of networks, means of compensating for reactive energy, etc.) and the cost (losses) associated with operating distribution networks. Regulations must be reviewed in order to enable decentralised producers to effectively contribute to such adjustments, which, as primary contributors to connection costs, would also benefit from the savings to be made.

A consensus was reached some time ago with regard to developing the method by which renewable energy is integrated into the network. The European Commission guidelines issued in April 2014 notably state that exemptions from responsibility for balancing should be gradually phased out as of 2020. This principle must come into effect as soon as possible, and certainly before 2020, if possible.

RECOMMENDATIONS

The priority with regard to injecting energy into the network must be abolished since it gives rise to negative market prices that have come to symbolise a degree of malfunction. The injection of renewable energy into the production network should be prohibited during such periods, or when it is likely to create congestion in the network. Continuing to remunerate renewable energy producers during such periods is uneconomic and should be reconsidered.

Renewable energy producers should be encouraged to forecast their production levels by means of a mechanism that requires them to ensure loads similar to those required of a balancing manager. The ACER Framework Guidelines on electricity adjustment reflect this approach[3].

(1) A perfect wave would form a sine curve. In reality, it is disrupted by various harmonics that also come into play, along with power glitches and variations in its frequency and maximum value.
(2) There is still a degree of phase difference between the voltage and intensity waves responsible for the emergence of reactive power. This is the imaginary part of the complex apparent power and can be either “produced” (capacitive circuit) or “consumed” (inductive circuit) by the various components of a circuit. Whilst it may be imaginary, reactive power certainly has a very real physical significance and its value is crucial to the scaling and stability of electricity networks. This phase difference can be manipulated (using capacitors, for example) to adapt voltage to bring it back to a nominal value (220 V for the domestic end-user) at certain points in the network (generally at the ends of lines).
(3) ACER: Agency for the Cooperation of Energy Regulators. 2013 report on capacity mechanisms and the domestic market.

Renewable energy needs to quickly be in a position to supply certain system services, such as the primary reserve, and to participate in downward adjustment bids.

Decentralised renewable energy production facilities must contribute to maintaining the quality of the current by being able to target reactive energy.

6. The importance of managing demand

Being less dependent upon a given resource is an excellent way of increasing security of supply and this requires good demand management. With regards to this electricity, this demand has to be effectively managed across all time scales; indeed, given that both off-peak and peak means of production exist, as well as facilities designed to safeguard the flexibility of the system, action can be taken based on a long-term vision or indeed based on instantaneous and limited consumption.

Long-term management: demand-side management (DSM) and energy efficiency

In order to reduce overall demand in the long run, energy efficiency policies that result in energy expenditure being replaced by investment in efficient equipment wherever such a move would be profitable must continue to be implemented or even stepped up. Since this matter has been broadly discussed elsewhere, we shall not dwell on it here.

It is, however, important to remember that demand-side management does involve a number of specific factors that should be pointed out. It is an energy carrier that can replace any other form of energy and security of supply must be evaluated in the wider sense, taking primary energy into account. This can result in an improvement in the electrification of the economy, also for the purposes of fighting climate change, by targeting savings in fossil and imported energy as a matter of priority.

Pricing plays a crucial role in the long term since it is one of the primary criteria when it comes to choosing equipment and regulation must intervene in cases in which it proves to be ineffective (generally as a result of an asymmetry of information).

RECOMMENDATIONS

Demand-side management (DSM) increases long-term energy independence and must be implemented on the following bases, among others:

a) in accordance with economic profitability criteria;

b) with a view to reducing the amount of energy imported;

c) with a view to reducing greenhouse gas emissions.

Pricing plays a central role and must reflect production costs as closely as possible, in terms of both level and structure, wherever possible. Pricing changes must be introduced slowly and expectedly in order to enable both domestic and industrial consumers to adjust to such changes, the former by adapting their behaviours and usage, the latter by planning their investments in energy-efficient equipment or processes.

Very short-term management: shedding and demand response

In the very short term, demand remains fairly rigid on the whole and is unable to respond to pricing signals in real time, for example. Smart grids will be the tools that will help change consumer behaviour by transmitting such signals to the consumer themselves, or more specifically to the various devices within the home, targeting the least energy-efficient of devices in particular (with thermal devices taking priority), for the purposes of ensuring optimal economic management of such devices. Being able to eliminate the consumption of certain devices for a few hours helps save investment in peak facilities, and such "shedding capacities" are recorded as such in most capacity mechanisms (particularly where the French so-called NOME Act is concerned).

Network managers may also trigger very brief outages (lasting only a few seconds, minutes or tens of minutes) in the event of an emergency (demand response). This type of intervention is, of course, intended to be linked to the reserve mechanism (secondary or tertiary), which is only very partially covered by the market.

It is important to note that the anticipated flexibility must work both ways, in that during periods when market prices are very low, or even negative, it can be beneficial to encourage users to consume. It simply does not make a lot of sense to save energy at any cost because you only save what is rare (and expensive!) whereas there can, at times, be an excess of electricity available for reasons that have been broadly outlined above.

The other factor that promotes flexibility, that is the storage of electricity, is also very expensive, meaning that relatively little thought has been given to the possibility of incorporating it into the market. In economic terms, managing storage is not dissimilar to managing demand in that there are appropriate storage technologies to suit different time scales, from supercapacities for real-time management to large hydraulic dams for long-term management.

However, whilst there has been a great deal of discussion regarding smart grids in recent years, their development has been rather slow as a result of various technical (communication protocols are not stable and even less standardised), economic (the return on investment is not always guaranteed, which explains why a number of Member States have abandoned the widespread deployment of smart meters) and institutional factors (they will have a profound effect on the value chain).

RECOMMENDATION

Efforts to develop renewable energy must take into account the ability of the electricity system to integrate such energy.

It is important, in particular, to be able to combine the quantities deployed with flexibility tools that already exist or are in the process of being developed.

Conclusion

The balance of the electricity system must be maintained across all time scales, both to the nearest millisecond and for years at a time, if security of supply is to be guaranteed. Developing large quantities of (primarily intermittent) renewable energy weakens the European electricity system in the following ways:

- in the long term, since the conditions that would encourage investment are no longer there,
- and in the very short term, since the increased number of unpredictable factors and the increased difficulty associated with monitoring the load result in a greater risk of blackouts.

A variety of different capacity mechanisms have been put in place in different Member States but these are often incompatible since they have each been designed to provide a solution to a specific type of problem. It would appear to be a wise move for Europeans to reach an agreement regarding a definition of security of supply and the acceptable failure level where consumers are concerned (although this level may vary from one State to another since each economy will have its own specific characteristics).

Since Member States will maintain their sovereignty over the energy mix owing to the principle of subsidiarity outlined in the Lisbon Treaty, it is also important that they at least be required to keep other Member States informed of any major decisions they make with regard to investment (or indeed decommissioning) that will affect the balance of the European electricity system as a whole.

It is the real-time management of the system that is going to present the greatest number of problems in the short term if the proportion of intermittent and unpredictable renewable energy continues to increase at a sustained pace. Tools designed to promote flexibility, such as smart grids (with regard to the demand management aspect) and storage, are not yet economically mature enough to be deployed on a large scale, which must be taken into account when it comes to setting objectives in the field of renewable energy.

SECURITY OF THE EUROPEAN UNION'S GAS SUPPLY CALLED INTO QUESTION

Dominique Auverlot[1]

Since late 2013, the conflict between Russia and Ukraine has pushed security of gas supply to the top of the list of priorities where European energy policy is concerned.

This might appear to be somewhat paradoxical; after all, European demand slowed during the crisis, and thanks to the exploitation of unconventional forms, gas has never been so abundant or as widely distributed around the world[2]. During a visit to Brussels in March 2014, the President of the United States pointed out that the United States had already granted licenses for the export of gas[3] – and of shale gas in particular – in quantities that closely reflected the volumes consumed by the entire European Union (EU)[4]. Indeed, some of the unused coal from the United States is sent across the Atlantic[5] and used as a substitute for gas, to the point of becoming its main rival in terms of electricity production.

Current concerns stem from the state of relations with Russia, or rather the fear that the supply of gas from Russia will cease. Russia resumed its deliveries to the Ukraine in late October 2014, following the signing of the tripartite agreement between the European

(1) Head of the Department of sustainable development, France Stratégie.
(2) Although the LNG market, which, along with gas interconnections and storage, is one of the three pillars that give the French gas system its strength, remains just as strained.
(3) It should be clarified that the licenses have been issued for the open market and should be used by Asia or South America rather than by Europe.
(4) By mid-August 2014, licenses had been granted for the export of 260 Mt/year to countries with free trade agreements with the United States and 69 Mt/year to countries that did not have such agreements in place (*cf. Panorama énergies-climat*, 2014 edition, French Ministry of Ecology, Sustainable Development and Energy; www.developpement-durable.gouv.fr), with gas consumption among the EU-28 estimated at 386 Mt in 2013, according to Eurogas. These deliveries are destined primarily for South America and Asia, although they do also generate quantities that are then available on the global market.
(5) "The European Union imported 472 Mt of U.S. coal in 2013, up from a mere 13.6 Mt in 2003. The UK alone increased its coal imports from the United States by ten-fold in that time frame. Germany raised its imports of US coal a good bit, too – from 1 Mt in 2003 to over 15 Mt in 2013"; www.wallstreetdaily.com/2014/05/16/u-s-coal/.

Commission, Gazprom and NAK (Naftogaz of Ukraine) that incorporates a European and international aid component amounting to some 4.6 billion dollars. In February 2015, the Minsk 2 agreement resulted in a ceasefire and the creation of a demilitarised zone in the Ukraine – signs that the situation in the region was indeed improving. This return to normality was all the more credible given that relations between the European Union and Russia are not based on dependency but rather on interdependency in that the weight of gas exports within the Russian economy is such that Russia cannot afford to suspend its exports for too long.

Efforts to restore peace, however, remain somewhat fragile. The Russian-Ukrainian agreement on the supply of gas is only temporary and needs to be followed up with new negotiations. Despite the aid provided by the IMF, the Ukraine continues to find itself in a very difficult financial situation. The Russian economy is unstable as a result not only of Western sanctions but also of the drop in the price of oil. Finally, Russia's international relations with the European Union (and with its Member States) are deeply affected as a result[1].

With regards to the gas industry, the first tangible consequence of this conflict for the European Union was Russia's abandonment of work on constructing the South Stream gas pipeline in early December 2014, stating that it wanted to construct a link to Turkey - now Gazprom's second-largest customer after Germany – and to Greece, as announced in June 2015. This announcement was very poorly received by certain eastern EU countries (and the Czech Republic and Serbia in particular), who saw it as a challenge to security of supply. More concerning still, in January 2015, Gazprom informed the new European Commissioner for Energy, Maroš Šefčovič, that in future it would be delivering gas to European consumers via Turkey rather than the Ukraine and that they would need to have the necessary infrastructures put in place. Whilst it is difficult to believe that Russia would stop selling to the EU owing to the absence of a new gas pipeline, this change in tone on the part of Gazprom, which does little to reinforce faith in the reliability of its deliveries, is indicative of a deterioration in Russian-European relations. The memorandum signed in June 2015 by Gazprom, Shell, E.ON and OMV for the construction of a second Nord Stream, which would compensate the decline – more rapid than expected – of the European production (especially Groningen), still proves that the gas companies have the capacity to come to an agreement in this context.

(1) In late September 2014, the President of the United States stated that the aggression in the Ukraine was one of the three greatest threats to international order, along with the Ebola virus and the Islamic State group (IS). In the speech he gave in Sochi on 24 October 2014, President Putin referred to the new world order in which the “so-called victors” of the Cold War interpret international law in accordance with their own interests. In late November, the German chancellor, for her part, pointed out that the Russian threat did not “only concern the Ukraine but also Georgia and Moldova and [that] at this rate, Serbia and the Western Balkan States will also be affected”.

Faith in the Russian partner had greatly diminished by early 2015, meaning that security of gas supply within the European Union should remain a matter of top priority for the new Commission.

A great deal of work has already been conducted in this respect; indeed, as of June 2014, the Commission, in conjunction with the Member States, conducted a series of "virtual stress tests" to assess the consequences of a six-month disruption in supplies from Russia (autumn-winter 2014-2015), whether partial (corresponding to those supplies coming via the Ukraine) or complete. In the absence of a cooperative approach and any additional national measures, a shortage of gas of over 40% should, in either case, occur at the end of the winter in the countries in the south-east of the European Union and, to a lesser extent, in all eastern EU countries in the event of a complete disruption of supply. The adoption of national measures and a cooperative approach based primarily on the market, however, should significantly reduce the impact of such disruption of supply.

In light of the recommendations outlined in this study conducted by the European Commission, the European Council of October 2014 adopted a number of measures designed to improve the security of gas supplies in the EU[1]. Such measures must notably be implemented in a context that questions the intentions of the Russian partner. The Council also made the decision to re-examine the issue of energy security in 2015 in order to assess the progress made to date. With this in mind, there are a number of points that might now be examined, including the following:

- reasserting the principle of solidarity that exists between Member States;
- rectifying the asymmetry of negotiation that exists between gas companies in eastern European Union countries and Gazprom;
- re-establishing a long-term partnership between the EU and Russia in the energy sphere;
- re-building a sense of trust between Gazprom and the Commission;
- continuing and extending traditional initiatives designed to improve security of supply through diversification, the strengthening of connections and storage facilities, and improved energy efficiency;
- improving energy security without burdening the fight against climate change.

(1) The European Council places particular emphasis on energy efficiency initiatives, on the diversification of sources of supply and on the possibility of increasing energy security by using independent sources of energy and safe and sustainable technologies that generate low levels of CO_2 emissions; www.consilium.europa.eu/uedocs/cms_data/docs/pressdata/fr/ec/145423.pdf.

The European Union and Russia have every reason to cooperate with one another and maintain a good relationship since Europe needs Russian gas and Russia needs European currencies. It is indeed this special connection that the new European Commissioner for Energy will seek to preserve in the wider and more uncertain context of the evolution of Russian-European relations.

1. Reasserting the principle of solidarity that exists between Member States

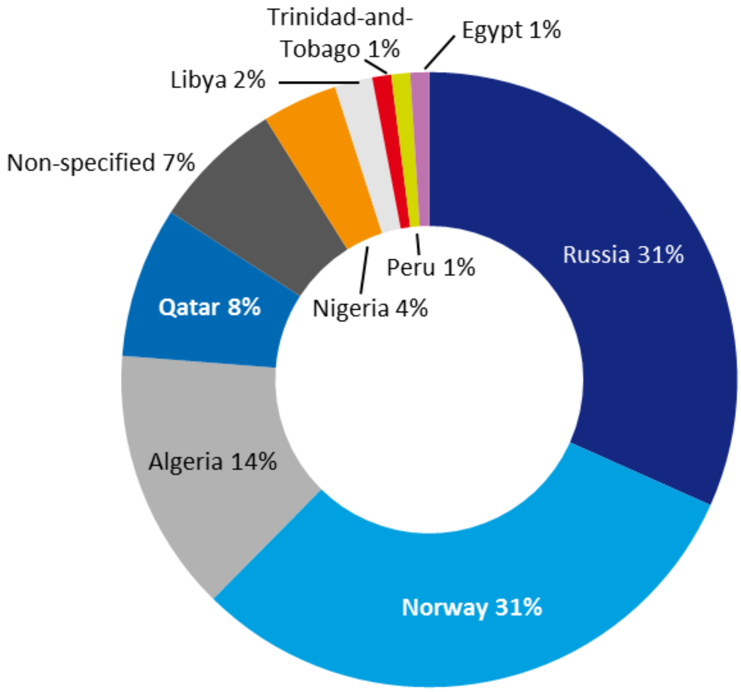
Whilst Russian gas accounts for only a quarter of EU consumption (27% in 2013[1]), six of its Member States, namely Bulgaria, Estonia, Finland, Latvia, Lithuania and Slovakia, are entirely dependent on this source (and have not really sought other sources of energy since 2009 owing to the attractive price of gas from Russia). Furthermore, those countries that suffered the most as a result of a shortage of supply that occurred in January 2009, namely the eastern European countries, are now fearful that this phenomenon might be repeated, whereas the less dependent countries in the west, and France in particular, are far more at ease with this threat, whilst nevertheless remaining vigilant with regards to the potential soar in prices. Moreover, stress tests have shown that eastern European countries have far more to fear of a disruption to Russian supplies than those in the west. There appears, then, to be a geopolitical divide within the European Union itself, between those countries closer to Russia that want to move away from their almost total dependence on Russian gas and those countries that are further away (Germany, Italy in particular, France to a lesser extent) and that, on the contrary, are keen to establish long-term partnerships with the country. This division is accentuated by the fact that the route taken by the new gas pipelines constructed over recent years bypasses those countries closest to Russia, with the Nord Stream avoiding Poland, Belarus, the Baltic States and the Ukraine. This divide also emerges from the findings of the stress tests performed. These countries have no problems with their supply since they are very well connected to the Russian gas network; they are, however, highly dependent upon the trade policy implemented by Gazprom, as their almost exclusive supplier.

(1) With significant variations from one year to another. The proportion of Russian gas among the gas imported by the EU dropped from 45% to less than 30% in 2012 and 40% in 2013.

Orders of magnitude

The EU-28 imported 65.8% of the gas it consumed in 2012, its main suppliers being Russia (32%), Norway (31%) and Algeria (14%).

Origin of gas imported by the EU in 2012 (in terms of energy)

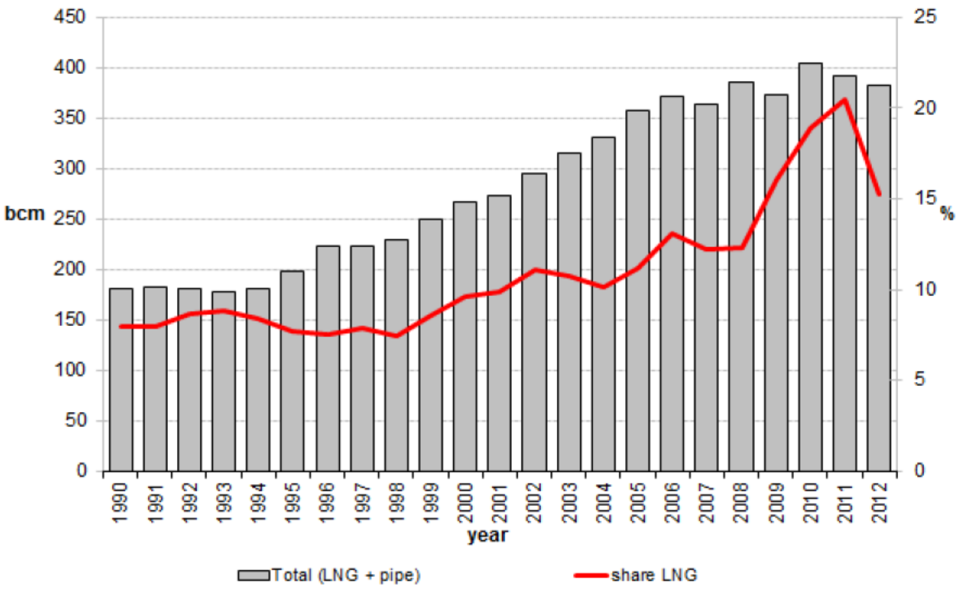


Source: European Commission (2014)[1]

LNG imports decreased in 2012, and even more so in 2013, as a result of the attractive prices available in Asia, and were counterbalanced by gas from Russia. As a result, the European Union's main suppliers in 2013 were Russia (39%), Norway (34%), Libya (13%) and Qatar (7%).

(1) European Commission (2014), "In-depth study of European Energy Security", Commission Staff Working Document accompanying the Communication from the Commission to the Council and the European Parliament: European Energy Security Strategy, *COM(2014) 330 final*, July.

European Union gas imports



Source: European Commission (2014)[1]

The construction of LNG terminals on the Baltic Sea in the neighbouring countries of Poland, Lithuania, Latvia and Estonia (not to mention the one developed in the enclave of Kaliningrad), which was supported by the Commission, demonstrates the desire on the parts of these countries to diversify their supply.

Beyond the technical measures planned by the Commission, it is important, first and foremost, that the European Union rebuild a sense of trust from within with regards to its desire, and indeed that of all of its Member States, to help the countries to the east of the EU-28 in the event of a crisis; indeed, although there was already evidence of this concept in the regulation of October 2010 on security of supply, the reassertion of a strong principle of solidarity and support for gas supply in the event of a disruption is crucial and even a pre-requisite to the decision to build new gas pipelines.

Such European solidarity must notably and naturally be put into practice on a subsidiary basis, once the State concerned has implemented the appropriate measures designed to deal with any shortfalls on the part of a supplier, in accordance with a well-understood principle of responsibility. Each Member State must therefore publish details of how it plans to respond in the event of a supply crisis. The 2010 regulation on security of natural gas supply fails to clearly outline the power the European Commission has over any Member States choosing to disregard this concept of solidarity. The European Council of last October decided to review this regulation, and this point must be clarified in the new version of the text.

(1) European Commission (2014), “In-depth study of European Energy Security”, *op. cit*.

RECOMMENDATION

The development of a European energy policy that safeguards security of supply requires both the Commission and all of the Member States to reassert a founding principle of solidarity; as soon as a Member State finds its supplies under threat, the other States must step in to help rectify the situation.

This notion already appears in the Lisbon Treaty (and was reiterated in the October 2010 regulation on security of gas supply); indeed, the difficulties encountered by Poland and the Baltic States with regards to their supplies of energy from Russia had led to them requesting that the objectives of European energy policy be implemented with a sense of solidarity between the various Member States.

The European Union will need to decide whether or not to extend the principle of solidarity to the Ukraine. Applying the principle would, of course, reduce the likelihood of crises such as the one we are currently witnessing recurring in the future, as well as sending a positive signal to the Ukrainians.

2. Rectifying the asymmetry of negotiation that exists between gas companies in eastern EU countries and Gazprom

As previous negotiations have clearly shown, whilst the connection between the EU-28 and Russia is based on a relationship of interdependence, and whilst companies in the west are in a position to deal with Gazprom on an equal footing, the same cannot be said of gas companies operating in certain eastern EU countries that are heavily dependent on Russian supplies and have an asymmetrical relationship with Gazprom. Negotiations with the Polish company in 2009 are an example of this; indeed, Gazprom may, quite logically, seek to impose long-term contracts that hinder the search for alternative sources in the country in question, whether in terms of LNG supply or the development of unconventional sources of gas, and all of these countries complain about the prices charged.

There are two potential solutions, the first of which involves the European Commissioner for Energy providing support for a gas company located in one of these countries in its contractual negotiations with Gazprom, as was the case in Poland in 2009. The European Council approved this solution in principle at its meeting in October 2014. It is important, however, to take into consideration the major changes in the situation of such countries over recent years as a result of the markets becoming more open to competition; Member States are not the main parties in the supply contracts signed between companies and producers, or even the negotiations that take place between them. In other words, the Commission and the States can play only an advisory role, with no direct operational authority whatsoever over past or future negotiations with producers, which are the sole prerogative of the gas companies themselves.

The second solution involves the introduction of a central purchasing body[1], in other words, either a group of gas operators that want to join forces for the purposes of negotiation or a single player who will negotiate on behalf of a number of operators. The main advantage of this solution lies in the hope that it will improve negotiations with Gazprom, which would help bring down gas prices and maintain the competitiveness and the buying power of the countries concerned. This was, in fact, the solution chosen by the then Prime Minister of Poland Donald Tusk in his proposal of April 2014; indeed, by joining forces in such a way, gas buyers would hold greater weight against Gazprom than if they were to act individually.

It is important, however, that the following two factors be taken into account:

- as the DG Energy has pointed out in no uncertain terms, such a notion goes against both the Lisbon Treaty and the Third Energy Package, and even the rules of the WTO, which favour the development of competition and frown upon agreements. The 2009 condemnation of the Megal[2] group, which was formed (in 1975!) by E.ON and GDF for the purposes of constructing a gas pipeline, is the most evident application of this and will dissuade any new operator from implementing such a setup without the explicit consent of the Commission, a consent that could nevertheless be challenged by the European Union Court of Justice;
- more importantly, the contracts signed between major European gas operators and Gazprom nowadays are not always limited to the purchase of volumes of gas but can instead incorporate a contribution to developing Russian deposits or the sale of certain technologies to Russia. This being the case, every contract is different and each major gas operator in the EU has developed its own partnership with Gazprom (in some cases on a long-term basis of twenty to thirty years). It is unlikely that negotiation on a collective or individual basis will reflect the specific needs of each buyer (in terms of flexibility, delivery conditions, etc.) as outlined in their respective contracts.

Forcing European gas operators to join forces in the framework of a compulsory central buying service would therefore be counter-productive and potentially detrimental to the smooth running of the market (*cf.* oil market). Nevertheless, once the European

(1) For a detailed analysis of this concept see Centre d'Analyse Stratégique (2010), *La sécurité gazière de l'Europe : de la dépendance à l'interdépendance*, report by the working group chaired by Christian Stoffaës, May, http://archives.strategie.gouv.fr/content/rapport-la-securite-gaziere-de-l'europe-de-la-dependance-l'interdependance-0.

(2) The condemnation it received nevertheless related more to the idea of the two operators sharing the market than to the part of the agreement relating to the construction of a new gas pipeline.

Commission has given the green light, there are two types of central buying service that might be created:

- one that would enable gas operators in the eastern European Union to join forces for the purposes of negotiating a gas supply contract with Gazprom (or another supplier) with or without the help of the Commission. A variation on this would consist of allowing players with a share of the European gas market that falls below a certain level to join forces. This more neutral option would therefore more strongly encourage competition; and
- one that would enable a gas operator in an eastern EU country to join forces with a gas operator in the west to assist the former in its negotiations with Gazprom; in practice, this would result in the contractual clauses negotiated with Gazprom being applied to both operators.

RECOMMENDATION

All Member States agree on the need to support the countries in the eastern part of the EU in their negotiations with Gazprom. Beyond the position of the European Council, inviting the Member States and companies concerned to get support from the Commission in their contract negotiations with Gazprom, two other measures can be envisaged. The first would involve allowing countries in the eastern part of the EU, or rather their gas operators, to form a central purchasing body to deal with Gazprom, without the threat of them incurring fines for failing to respect the rules of competition; the second would mean joining forces, within a central purchasing body, with a gas operator in a western EU country. A variation on this would consist of allowing players with a share of the European gas market that falls below a certain level to join forces. The creation of a compulsory European central purchasing body could, however, prove counter-productive or even dangerous and detrimental to the smooth running of the market. It is better to leave it to private operators to join forces by their own accord, should they so wish, rather than imposing a (potentially public) structure for which they may well have no need.

3. Re-establishing a long-term partnership between the EU and Russia in the energy sphere

Entering into a long-term conflict with your main supplier is never a good thing. The armed conflict in eastern Ukraine has tended to put energy issues on the back burner (especially since the Ukraine still has supplies of electricity, nuclear fuel and even gas). Once this conflict is over, the new Commissioner for Energy will need to resume the dialogue that had been established with Russia prior to the crisis with a view, notably, to examining the outlook both for developing the demand for gas on the part of the EU-28 and for production in Russia. The Paris Summit of October 2000 helped launch an energy partnership between Russia and the EU, known at that time as the "Prodi Plan". Although it was unable to prevent the crisis of 2009 and the refusal of Russia to ratify the Treaty on the Energy Charter, this process permits dialogue between the actors; a "Roadmap of the EU-Russia Energy Cooperation" was consequently drawn up and signed in March 2013 by the European Commissioner for Energy and the Russian energy minister.

RECOMMENDATION

It is important that a long-term energy partnership between the European Union and Russia be rebuilt. Dialogue with Russia on the matter is currently on hold owing to the problems in the Ukraine but will need to be resumed once these problems are over. The Commission needs to establish such partnerships with the European Union's other main suppliers.

4. Re-building a sense of trust between Gazprom and the European Commission

One of the main tasks of the new Commissioner for Energy will be to re-establish a relationship with Gazprom based on trust and partnership. Aside from the more general relationship between Russia and the European Union, the connection between the Commission and Gazprom, one of the EU's main gas suppliers and one that highlights the fact that it has always ensured a supply, even at the lowest points in the Cold War, is now strained:

- at the request of Lithuania, the European Commission (DG Competition) launched an inquiry into alleged anti-competitive practices on the part of Gazprom in 2012. It accused the company of overcharging its customers based in eastern Europe, preventing the emergence of other suppliers and obstructing the free circulation of gas throughout the European Union[1]. In opposing the development of a single gas market between Member States and in obstructing the diversification of gas supplies, **Gazprom would be contravening Article 102 on the Treaty on the Functioning of the European Union.** To this end, the Commission initiated proceedings against Gazprom on 22 April 2015 for hindering competition by issuing the Russian group with a "statement of objectives"; it notably accuses the group of hindering competition

(1) Source: www.euractiv.fr/sections/concurrence/lue-prete-accuser-gazprom-de-pratiques-anti-concurrentielles-308650.

in gas markets in eight Member States (Bulgaria, the Czech Republic, Estonia, Hungary, Latvia, Lithuania, Poland and Slovakia);

– in early May 2014, Russia submitted a request for an opinion to the WTO regarding the alleged discrimination it had suffered at the hands of the Commission. Within the framework of this procedure, both parties have sixty days to reach an agreement. In the event of failure to reach such an agreement, the plaintiff may contact the conflict resolution body. The crux of the request relates to the inequality with which different gas pipelines have been treated; the future gas pipeline known as TAP, for example, which will enable the EU to obtain a supply from Azerbaidjan without going through Russia or the Ukraine, has been granted certain dispensations that allow it to operate at full capacity, whereas the gas pipeline owned by Gazprom in Germany, downstream of the Nord Stream, can only operate (in accordance with the directive governing third-party access to the network) at a capacity of 50%, under the principle of separation between the activities of gas production and gas transport management.

More importantly, CNRS research fellow Catherine Locatelli has emphasised the gap that now exists between the Third Energy Package and the Gazprom model[1]. Spurred on by this text, the Commission wanted to continue to liberalise the sector; the initial version therefore withdrew the option for a gas company to be an integrated operator, in other words to be able to undertake production and distribution activities whilst still maintaining ownership of the transport network. At the suggestion of both France and Germany, the final text refers to the notion of ownership unbundling merely as one of the options available to a Member State. It also allows for an integrated company to maintain ownership of its gas network, should the country in question so wish, provided that the management of the network is delegated to an independent system operation (ISO), which can take the form of a public limited company, for example, or a subsidiary of the integrated operator, but has to be managed separately and have its own Board of Directors, in order to openly limit the influence of the parent company. Furthermore, in order to facilitate the emergence of a single gas market right across the EU, this same Package aims to strengthen the role of the regulator and provide compulsory access for third parties (other than the supplier and the consumer) to the transport infrastructures under their control. Finally, the Package includes a clause, often referred to as the "Gazprom clause", that limits the option for energy companies belonging to third countries to purchase distribution networks in order to prevent gas producers from outside of the EC from actually becoming an integrated operator and posing a potential threat to the energy security of the European Union.

(1) Locatelli, C. (2013), "Les enjeux de sécurité dans la relation gazière UE-Russie", *Revue d'économie industrielle*, n° 143, p. 35-69, www.cairn.info/revue-d-economie-industrielle-2013-3-page-35.htm.

Unfortunately, as logical as it might be, this Package will result in inconsistencies in relation to Gazprom's development. The following three examples lie at the heart of the inquiry conducted by the DG Competition and the appeal lodged with the WTO:

- whilst the Commission will want to limit long-term contracts with a producer to help diversify sources of supply and develop unconventional sources of gas, Gazprom will seek to rely on such contracts to develop its deposits, which require very significant levels of investment;
- aware of its issues with the Ukraine and of the associated risk of gas supplies being blocked, Gazprom has created the Nord Stream gas pipeline in northern Europe which bypasses the Ukraine, thus ensuring a direct supply of gas to the European Union. However, whilst the Nord Stream has been recognised as an intergovernmental gas pipeline and therefore benefits from certain dispensations from the regulations of the Third Package (unbundling does not apply and neither do the rules regarding third-party access or pricing), the gas pipeline downstream of the Nord Stream, known as Opal, does not enjoy such dispensations, forcing Gazprom not to exceed 50% of its capacity! Neither did the landfall of the South Stream gas pipeline enabling Russia to supply the European Union by bypassing the Ukraine to the south benefit from such dispensations. At the same time, the Commission has reached the conclusion that the gas pipeline project, designed to supply gas from Azerbaidjan to southern Europe without going via Russia, is a project of common interest, diversifying the EU's sources of supply and not just the routes said supplies take, and that it should indeed be granted such dispensations;
- over recent years, Gazprom has acquired shares in a variety of European companies (transport and distribution network operators, distribution companies, etc.). The Third Package, however, questions this strategy. At the end of the Third Package, Lithuania, for example, opted to unbundle ownership between producers and networks, meaning that Gazprom was forced to sell the 37.1% it held of the Lithuanian distribution operator's capital. In those countries that choose to create an independent entity, Gazprom will no longer be in a position to determine transport prices.

European gas operators need, in particular, to have the option of entering into long-term contracts with the Russian operator. The medium-term supply of large quantities of gas to the European Union requires immediate investment to be made for the purposes of developing deposits. Such investment can only be made in the framework of long-term contracts that will enable Gazprom to recoup it over time and therefore to remain competitive. The argument that states that any hesitation on the part of the European Union will encourage the Russians to sell their gas to China is irrelevant since the deposits in question are in Siberia and do not supply gas to the European Union. It is not, however, out of the question for short-term contracts or too much hesitation to result, in the future, in the creation of a new gas pipeline to China and, in the shorter-term, in

Russian investment being channelled primarily into those fields intended to supply China rather than those intended for the EU.

In highly technical terms, it is important, finally, to ensure that the production of a series of network codes in the framework of the gas target model[1] does not challenge security of supply; indeed, the development of the pricing code could serve to encourage the capacity reservation spot market with regards to existing gas pipelines and penalise those operators looking to reserve long-term capacity for the purposes of securing their supply.

RECOMMENDATION

The Commission will need to resume its dialogue with Gazprom for the purposes of ensuring that the company honours the obligations resulting from the Third Energy Package and complies with the findings of the survey undertaken by the DG Competition on its abuse of its dominant position. To this end, the Commission initiated proceedings against Gazprom on 22 April 2015 for hindering competition by issuing the Russian group with a "statement of objectives". In more general terms, it will need to find pragmatic solutions in order to overcome the inconsistencies between the model outlined by the Third Package and the Russian gas company; with this in mind, it must be possible for the relevant parties to sign the long-term contracts required for the purposes of investment. In a word, the Commission will need to rebuild a trusting and long-term relationship with Gazprom by clearly outlining the potential conditions under which the company will intervene in the European market.

5. Extending initiatives designed to increase security of supply

Since the disruption to the gas supply that occurred in early 2009, a number of measures have been taken under the impetus of the European Commission in an attempt to lessen the EU's dependence on Russia for its gas. A regulation regarding measures designed to guarantee the security of the EU's natural gas supplies was adopted in October 2010, storage capacity has been developed and possibilities of reverse flows in gas pipelines have been introduced or are in the process or being created; the April 2014 agreement between Slovakia and the Ukraine, which could enable the latter to receive up to 8 billion cubic metres[2], purchased on the market, that could come from Norway (the EU's second-largest supplier, just behind Russia), for example, or from various LNG sources, as well as, to a lesser extent, the reopening of the reverse flow between Hungary and the

(1) For further information visit www.congresdugaz.fr/doc_com/online/at8/s_zimmer_cre.pdf.
(2) The Ukraine now imports around 10 billion m^3 per year from Russia.

Ukraine. The commissioning of the 4 billion m^3 methane terminal in Klaipėda, Lithuania, in October 2014 to enable the country both to obtain all of its gas supplies from Norway, should it so wish, once its contract with Gazprom comes to an end (in 2015)[1], even at a slightly higher cost, and to help other Baltic States including Latvia and Estonia to cover the majority of their needs, is another good example.

Following the virtual stress tests performed by the Commission during the latter half of 2014, the European Council of October 2014 adopted a number of measures designed to improve the security of gas supplies in the EU. It places particular emphasis on energy efficiency initiatives, on the diversification of sources of supply[2] and on the possibility of increasing energy security by using independent sources of energy and safe and sustainable technologies that generate low levels of CO_2 emissions. Such measures must notably be implemented in a context that questions the intentions of the Russian partner. The Council also made the decision to re-examine the issue of energy security in 2015 in order to assess the progress made to date. Whilst the Russian-European energy partnership may be rebuilt over the coming months and come out of the current crisis stronger than it was before, it is important to look at the possibilities of creating alternatives to a gas supply that comes predominantly from Gazprom:

- Russia's decision to abandon the South Stream (which gained little support from the European Commission because it failed to meet the criteria for third-party access to the network as outlined in the Third Directive) reinforces the benefits of a gas pipeline serving the south-eastern European Union countries. One of the best possible investments lies in the creation of the southern European gas corridor that would supply the EU from Azerbaidjan via Georgia and Turkey; indeed, despite its capacity being distinctly lower than that of the Nord Stream, it would provide an initial guarantee in the event of disruption to the supply. Furthermore, this corridor would, to some extent, help limit the increase in Russian gas prices. Finally, it might be worth considering the possibility of later extending the corridor to deposits in the Middle East and Turkmenistan. The European Council of October decided to implement a number of critical projects of common interest in the gas sector, this corridor being one of them; indeed, **the new Commission will need to allow the corridor to be completed within a reasonable time frame, putting the failure of the Nabucco gas pipeline project behind it**, whilst first ensuring that this is indeed the best possible economic situation in comparison with other potential solutions (such as methane terminals, among other options);

(1) Gazprom currently delivers 2.7 billion m^3 per year to Lithuania.
(2) The European Council notably agreed to “implement critical projects of common interest in the gas sector, such as the North-South corridor, the Southern Gas Corridor and the promotion of a new gas hub in Southern Europe as well as the key infrastructure projects enhancing Finland's and the Baltic States' energy security, to ensure diversification of energy suppliers and routes and ensure market functioning”.

- more efficient exploitation of the hydrocarbon resources available to each country would also increase security of supply. This would require operators to improve current oil deposit recovery rates (notably using unconventional oil exploitation techniques) or seek new hydrocarbon sources. Member States are moving forward in their own individual ways with regards to the exploitation of unconventional sources of gas, which are emerging as a beneficial alternative to obtaining supplies from outside of the European Union. The Commission, for its part, could emphasise the need for States to determine the appropriate fiscal conditions to ensure that part of the mining income generated through the exploitation of new deposits is clearly and transparently attributed to local, regional and national public funding;
- various European directives have encouraged Member States to develop their storage capacities, with the 2009 crisis reinforcing the importance thereof. With this in mind, capacity has been developed based on a simple economic model, namely that the difference in the price of gas between summer and winter could offset the cost of storage. This difference in price has lessened over recent years, with the improvement of the European gas network, the disparity in storage obligations between the different Member States and the distancing of the threat of a supply crisis, to the extent that at the start of winter 2013, the volumes of gas in storage were not sufficient to ensure sufficient supplies in certain countries in the event of a harsh winter. Eventually, in accordance with French legislation, suppliers may be required to have a minimum volume of gas in reserve prior to the start of the winter. This could be accompanied by a payment, charged to the gas consumer, if the difference between the summer and winter prices is insufficient to cover storage costs, which would strongly encourage suppliers to use such infrastructures;
- finally, improving energy efficiency (primarily where imported energy, and gas in particular, in concerned) is a matter of priority and must allow for various initiatives designed to reduce gas consumption to be implemented, provided, of course, that they prove profitable, potentially by encouraging transfers of use.

RECOMMENDATION

Building a long-term partnership with Russia in the context of a well-understood relationship of interdependence does not mean submission. Gas supplies from sources other than Gazprom must therefore be implemented in parallel. Following on from the initiatives already ruled upon by the Commission, there are four measures that could be adopted:

a) enabling the southern European gas corridor to be completed within a reasonable time frame and anticipating the return of LNG to Europe;

b) improving current deposit recovery rates and preparing to determine the appropriate fiscal conditions to ensure that part of the mining income

generated through the exploitation of new deposits is clearly and transparently attributed to local, regional and national public funding;

c) **considering introducing a requirement for suppliers to have a minimum volume of gas in reserve prior to the start of the winter;**

d) **encouraging initiatives designed to improve energy efficiency.**

6. Improving energy security without burdening the fight against climate change

The example of Poland is the perfect illustration of the compromises that must be made between the three pillars of European energy policy; indeed, Poland continues and will continue to use great proportions of its coal, which is currently less expensive than gas and furthermore gives it a minimum degree of energy independence from its Russian neighbour. In such a context, fighting climate change is a matter of secondary or even tertiary importance. The use of coal resources in Poland can only realistically be reduced if the country has alternative competitive and well-priced solutions available, of which energy efficiency is, of course, one, even if it will not alter the Polish merit order between gas and coal. One of the best solutions with regards to changing this situation would be to strengthen the ETS system, enabling a carbon market to issue a price signal that is conducive to low-carbon investment.

RECOMMENDATION

Whilst security of gas supply is once again a matter of priority with regards to EU-28 energy policy, it should not, however, burden other objectives, which include fighting climate change and pollution, as well as safeguarding European competitiveness. Impact studies performed prior to the adoption of measures designed to increase security of supply must identify the potential effects such measures might have on other pillars of energy policy so that the relevant decisions can be made in full knowledge of the facts.

Conclusion

There are a number of lessons that have emerged over the past few months of conflict between Russia and the Ukraine with regards to security of gas supply. In the short term, the European Union can manage without Russian gas provided that it increases its LNG supplies, implements a number of measures in each country and strengthens cooperation between all Member States. This is the positive outcome of the stress tests performed in 2014. Over these early months of 2015, however, whilst the fear of the

Russian-Ukrainian conflict resulting in disruption in the gas supply to the Ukraine has subsided, Russian-European relations have greatly deteriorated. The European Union and Russia are, however, interdependent and it is in the interests of both parties to work together, since the European Union will still need Russian gas in 2030, meaning that Russia will need to start exploiting new deposits, and Russia needs European currencies; the partnership between Russia and the European Union is therefore a natural one. It is also a partnership that the new European Commissioner for Energy will seek to preserve, if not rebuild, in the wider and more uncertain context of the evolution of Russian-European relations.

Capacities of the main gas pipelines from Russia (and Caspian Sea)

Gas pipeline to EU	**Capacity**
Nord Stream (2 pipelines with a capacity of 27.5 Gm^3 per year, brought into operation in November 2011 and October 2012) Nord Stream 2 (project)	55 Gm^3 per year 55 Gm^3 per year
Gas pipeline via the Ukraine	120 Gm^3 per year
Blue Stream (connecting Russia to Turkey underneath the Black Sea)	16 Gm^3 per year
Transadriatic Pipeline (TAP), not yet built, designed to provide Europe with gas from the Caspian Sea, extending the Trans Anatolian Natural Gas Pipeline (TANAP) project, which bypasses Russia *via* the south.	10 Gm^3 per year (maximum 20 Gm^3 per year)
Turkish Stream (in project phase, designed to serve Greece)	63 Gm^3 per year
Abandoned South Stream gas pipeline (not built)	63 Gm^3 per year

REFORMING THE ETS MARKET TO STRENGTHEN THE CREDIBILITY OF EUROPEAN CLIMATE POLICY

Gaëlle Hossie[1]

Ten years after it was created, the Emission Trading Scheme or ETS market is still struggling to meet the objectives that underpinned its creation. Whilst the introduction of an annual cap on quotas has helped to control emissions in those sectors covered by the ETS, this tool, which was introduced as the spearhead of European climate policy, has nevertheless failed to encourage investment in low-carbon technologies. Indeed, with current spot and future prices having been lower than 7 euros/tCO_2 since late 2012, it has provided no indication that would guide decisions regarding exploitation and investment towards ways of reducing greenhouse gas emissions.

The Commission's proposal of a market stability reserve to resolve this situation does not appear to be a satisfactory solution. It will, of course, help to regulate and monitor surplus quotas in the market and should therefore mechanically support prices, although its effects will be very gradually felt; indeed, according to the Commission's simulations, surplus quotas, which currently stand at around 2.5 billion, should reach 800 million by 2028. Furthermore, there are a number of uncertainties preventing the accurate estimation of its impact on CO_2 prices; it is therefore difficult to comment on its ability to respond to the current situation. Moreover, and more importantly, the reserve automatically comes into play to regulate the surplus but is not concerned with the reasons behind it. It is particularly unconcerned with the interaction that takes place between the ETS market and other policies (developing renewable energy sources, improving energy efficiency, etc.) that have an impact on the decrease in CO_2 prices. It is possible to improve the mechanism by bringing forward its date of implementation, optimising its trigger thresholds and determining its institutional operation; this would represent significant progress but would also mean partially eluding one basic issue,

(1) Department of sustainable development, France Stratégie.

namely the “correct level” of the price of CO_2 and therefore the European Union's actual aim with regard to fighting global warming.

The European Union (EU) has demonstrated its commitment to fight climate change by setting a goal to decrease emissions of greenhouse gases (GHGs[1]) by 80%-95% before 2050, in accordance with IPCC recommendations to keep the global temperature increase below 2°C.

This long-term commitment is in conjunction with short- to medium-term GHG emission reduction targets that are binding on EU Member States: -20% by 2020 in the climate and energy package adopted in 2008 and -40% by 2030 in the new package adopted in October 2014.

Europe's climate objectives were embodied by the establishment in 2005 of a Community system for the exchange of CO_2 emission allowances, known as the ETS or EU ETS (European Emissions Trading System). Considered the cornerstone of Community climate policy, the EU ETS covers about 45% of the European Union's GHG emissions. The goal of a 20% reduction in GHG emissions by 2020 should be met, and even exceeded: the EU reduced its emissions by 19% between 1990 and 2013[2] and the European Commission is considering a reduction of 24% based solely on a continuation of current policies[3]. However, two key concerns arise around the credibility and robustness of European climate policy:

- spot prices of CO_2 allowances on the ETS market are currently around €5/tCO_2 (having ranged from €4 to €7 since the end of 2012[4]), while they approached €30/tCO_2 in mid-2008. Prices of futures contracts are also low (see Appendix 1). The allowances therefore provide no incentive for investment in emission reduction technologies, whether concerning coal to gas transition for power generation, capture and storage of CO_2 or development of renewable energy sources (RES). Even more worrying than low prices are the credibility of the ETS market, and, more broadly, the lack of confidence in the sustainability of European climate goals. These are now the real obstacles to overcome: according to a recent survey of facilities covered by the EU ETS performed by Thomson Reuters Point Carbon, 69% of those surveyed in 2013 believe that the EU ETS will continue to exist in 2020, against 77% in 2011;
- the second worrying trend is the increasing use of coal for power generation, since coal plants have twice the emissions of natural gas plants (using current technology and in the absence of significant technical progress for the capture and storage of

(1) See the Conclusions of the European Council of 4 February 2011, 29 and 30 October 2009.
(2) *Ibid.*
(3) Communication from the Commission to the European Parliament, the Council, the European Economic and Social Committee and the Committee of the Regions, “A policy framework for climate and energy in the period from 2020 to 2030”, 22 January 2014.
(4) With a record low of €3/tCO_2 in May 2013.

CO_2). Power generation from steam coal and lignite, which had basically been decreasing since the 1990s, has been rebounding since 2009. The increase is significant between 2009 and 2012 in four of the five largest electricity producing countries in the EU;

– Germany +9%[1], UK +39%, Italy +23.6% and Spain +53.4% – accounting for almost half of the EU's electricity production (and more than half of its GHG emissions). In contrast, electricity production rose at a much lower pace: Germany +5.7%, UK -3.4%, Italy +2.3% and Spain +1%. This resurgence of coal relative to gas was not anticipated; expectations were rather for increased use of gas accompanied by development of RES. The move from gas to coal for electricity production is essentially due to the relative prices of the two fuels and of CO_2. However, in 2011, the gap widened between the prices of gas and coal, and since mid-2010, the spot price of CO_2 is lower than the "switch price" (the price it would take to reverse the order of economic merit for coal plants and gas plants). Even if the malfunctions of the ETS market were rectified, it cannot be guaranteed that gas plants will be more profitable to operate than coal plants. This profitability depends on the price of both fuels, and therefore the dynamics of the associated markets, whose scope extends far beyond Europe. This raises a question: should the reversal of the merit order be a goal in itself or should we let the ETS market – once reformed – orient power generation technologies, which appears to be *a priori* the most efficient economically? Should we go as far as regulating the construction of new coal plants at European level, as the UK and USA have done? The reform of the UK electricity market introduced a limit of 450 gCO_2/kWh for power plants in baseload operation. Given that a supercritical coal plant emits about 790 gCO_2/kWh and a modern gas plant 360 gCO_2/kWh, this bans, in practice, the construction of new coal plants that do not have a system for capture and storage of CO_2. The US Environmental Protection Agency (EPA) proposes limits equivalent to approximately 450-500 gCO_2/kWh for new coal plants.

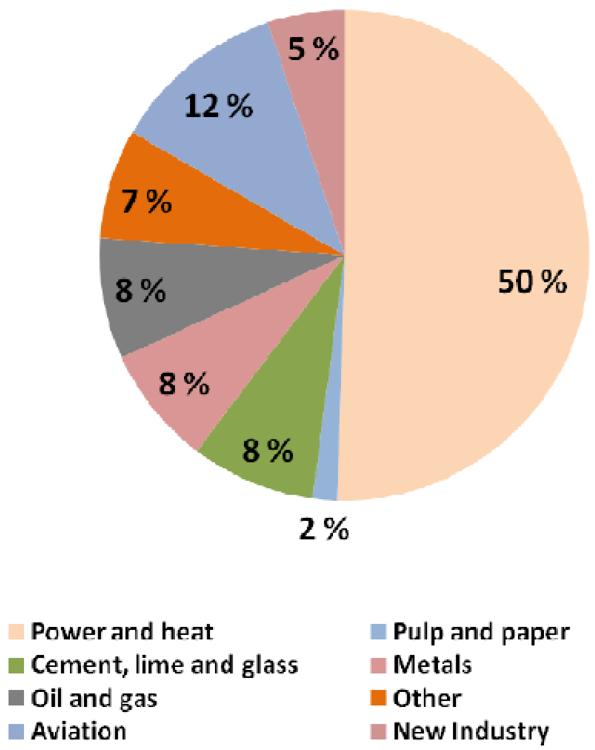
1. The impact of the ETS market on its scope

Established in 2005, the EU ETS (European Emissions Trading System) uses the trading of CO_2 emission allowances to control emissions of GHG (CO_2, N_2O and PFCs) from about 12,000 power plants and other industrial facilities in energy intensive sectors[2] (cf. appendix 1) as well as commercial flights in the 31 countries of the European Economic Area (i.e. the EU and three other countries: Iceland, Norway and

(1) Source: Eurostat.
(2) The sectors concerned are: production of electricity and heat; energy intensive industries such as refineries, steel mills, the production of iron, aluminum and other metals, cement, lime, glass, ceramics, paper pulp, paper, cardboard, acids and organic chemicals.

Liechtenstein). The operators of these facilities receive CO_2 allowances for free or at auction (the case for about 45% of allowances allocated in 2013). Each year, they are obliged to return a number of allowances equal to their verified CO_2 emissions. The number of allowances issued each year is capped (2,084,301,856 in 2013) and determined in advance: in 2013-2020, the third phase of the ETS, this number will decrease annually by a linear factor of 1.74% against the average annual total issued between 2008 and 2012 (as specified in Directive 2009/29/EC, published in June 2009).

Figure 1 – Breakdown of emissions for sectors covered by the ETS



Source: Jelena Simjanović, Thomson Reuters Point Carbon, IETA/BPMR, Seoul, 27 September 2013

The ETS was designed to be a linchpin of European climate policy and the primary instrument to reduce GHG emissions from European industry. The ETS directive explains that the system was set up to help the EU meet its emissions reduction commitments (under the Kyoto Protocol and the climate and energy package) in a consistent and more efficient manner, since the emissions cap ensures that objectives for reduction will be achieved. The ETS was also intended to allow issuing a price signal for CO_2 that would encourage investment in low-carbon technologies. That price signal was supposed to orient actors in both their day-to-day operational decisions and their investment strategy.

The ETS now seems to have achieved its primary objective: throughout the first two phases, 2005-2007 (learning phase) and 2008-2012 (phase where the Kyoto Protocol was applied[1]), the annual emissions cap exceeded expectations, because the CO_2 emissions of the EU ETS fell by about 11%, with a significant decrease between 2008 and 2009 (-11.9%, see Figure 2). The third phase, which began only recently, appears to continue with this trend: emissions covered by the ETS fell by 3% between 2012 and 2013 (at constant scope between the two years).

Figure 2 – Trends in emissions from facilities covered by the EU ETS from 2005 to 2012 (at constant scope, and therefore omitting Bulgaria, Iceland, Norway and Romania)

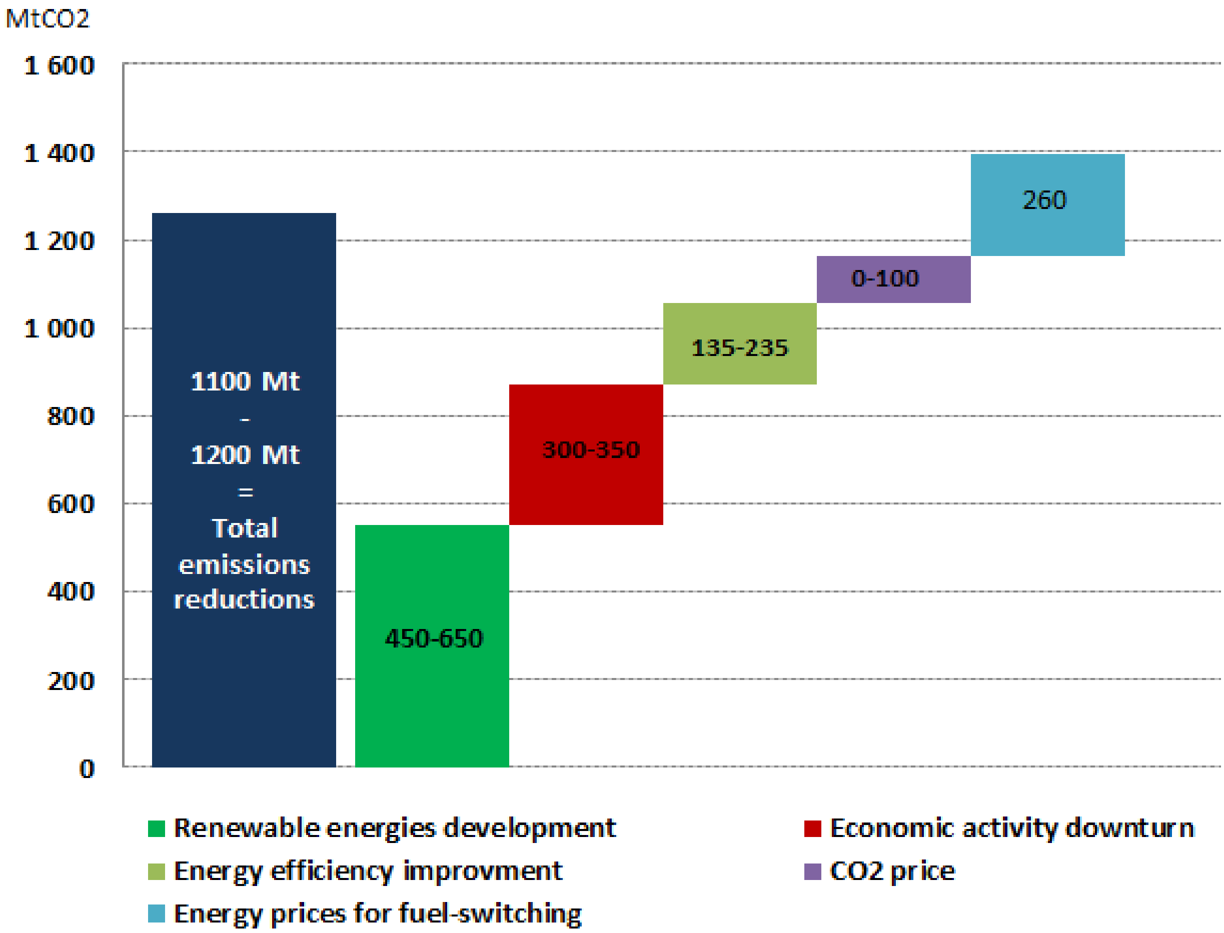
Source: Gloaguen and Alberola, CDC Climat, October 2013

However, the true contribution of CO_2 prices established by the ETS to reducing CO_2 emissions within its scope is debatable. An econometric analysis by CDC Climat[2] proposes the following explanations for some 1.1 Gt of CO_2 emissions avoided between 2005 and 2011 in the scope of facilities subject to the ETS in 21 European countries:

- approximately 45% due to the development of RES for electricity production;
- approximately 20-30% due to reduced industrial activity because of the economic crisis;
- approximately 20% due to price substitution effects between coal and gas;
- approximately 10% to 20% due to improvements in energy intensity.

(1) During this 2008-2012 phase, the EU signed the Kyoto Protocol, committing itself to reduce emissions of GHG by 8% against 1990 levels.
(2) Gloaguen O. and Alberola E. (2013), "Assessing the factors behind CO_2 emissions changes over the phases 1 and 2 of the EU ETS: an econometric analysis", *Working Paper,* No. 2013-15 CDC Climat Research, October.

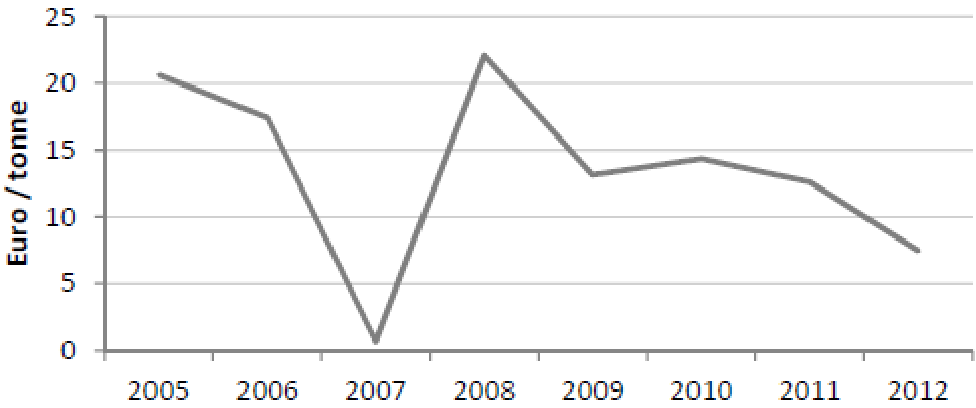
Figure 3 – Relative contribution of the CO_2 price to ETS emissions reductions (2005-2011)



Source: Gloaguen and Alberola, CDC Climat, 2013

CDC Climat thus concludes that the CO_2 price had a very limited or nonexistent role in the reduction of emissions from ETS facilities. The CO_2 price remained too low in both periods to stimulate investment in low-carbon technologies. Instead, those investments resulted from policies to develop RES and improve energy efficiency, implemented in the framework of the 2020 climate and energy package. These findings raise the question of interactions between the ETS market and the 2020 climate and energy package, particularly the fact that development of RES and improved energy efficiency reduce the price of CO_2 by decreasing demand for allowances and generating surpluses.

Figure 4 – Trends in the annual average spot price for one ton of carbon



Source: Gloaguen and Alberola, CDC Climat, October 2013

However, the ETS played a role at microeconomic level: annual surveys of enterprises covered by the ETS, conducted by Thomson Reuters Point Carbon, indicate that between 2007 and 2012, 46% to 59% of respondents believed that the ETS had reduced CO_2 emissions in their enterprise. In contrast, the 2013 survey indicated that for 20% of respondents, the ETS had definitely reduced emissions at first, but currently had a weak impact.

Impact of CO_2 price on market prices

Today, it is generally agreed that the price of CO_2 on the ETS market is not high enough to allow favouring the use of Gas Combined Cycle plants (GCC) over coal plants due to the significant price difference for the two fuels. The price of coal in Europe is about $70/tonne, or nearly €8/MWh th (thermal); gas costs $8/MBtu, or almost €22/MWh th.

The table below estimates the cost per MWhe (electric), which depends on the efficiency of the power plant concerned (37% and 55% on average) plus the CO_2 price (currently €6/tonne), taking into account the specific emissions of each of the two fuels. This demonstrates that a MWhe produced by a coal power plant costs €27 (for fuel), against €42 for gas, and explains why coal is favoured for electricity production.

The last line calculates what CO_2 price would make these costs equal: the switch price for the merit order of coal and gas, €32/tonne CO_2. The resulting cost per MWhe is then about €52/MWhe, an increase of €25/MWhe over the previous figure of €27/MWhe. These assessments only provide an order of magnitude and should be used with caution because they are affected by plants' efficiency. Thus, the best-performing GCC plants (60% efficiency) are competitive much sooner with coal plants having poor efficiency (around 30%) and vice versa.

The assessments are also extremely sensitive to both coal and gas prices; the latter are currently undergoing significant variations. Less than six months ago, the price of gas was close to €26/MWh, giving a switch price exceeding €40/tonne CO_2, yielding an increase of €35/MWhe for coal plants' production cost.

Strictly speaking, the period of marginality should be evaluated for each production method, and therefore the part each one plays in the European market price per MWhe, approximately €36 in Germany and €42 in France. In any event, the expected increase in the market price of electricity could exceed 50%.

Impact of CO_2 price on generation costs with coal and gas

	Coal	**Gas**	**Early october 2014 forecasts**	
Efficiency	37%	55%	1 €	1,26 $
Fuel price	70 $/t 10.0 $/MWh th 8.0 €/MWh th	8 $/Mbtu 27.3 $/MWh th 21.7 €/MWh th	Mbtu 1 t coal 1 t CO_2	0.29 MWh th 6.98 MWh th 6.00 €
Generation cost (fuel part)	21.5 €/MWhe	39.4 €/MWhe		
CO_2 specific emissions	0.34 t/MWh th	0.20 t/MWh th		
CO_2 emissions per MWhe	0.92 t/MWhe	0.37 t/MWhe		
CO_2 part	5.5 €/MWhe	2.2 €/MWhe		
Generation cost (fuel + CO_2)	**27.0 €/MWhe**	**41.6 €/MWhe**		
Switch price	**51.3 €/MWhe**	**51.3 €/MWhe**	**1 t CO_2**	**32,5 €**

Source: France Stratégie calculations

2. Why reform the ETS market?

In its 2012 report on the state of the carbon market[1], the European Commission recognised the need to conduct a structural reform of the ETS market to reduce the growing imbalance between supply and demand for allowances, which reached more than 2 billion allowances at the beginning of phase 3[2]. The currently-observed excess of allowances results from the structural imbalance between a very rigid supply of emission

(1) European Commission (2012), *The State of the European Carbon Market in 2012*, Report from the Commission to the European Parliament and the Council, 14 November.
(2) The surplus more than doubled between 2011 and 2013. In the absence of specific measures, the imbalance of allowances would continue to grow, reaching over 2.6 billion by 2020 before declining gradually to 2.1 billion by 2028. Source: Commission staff working document, Summary of the impact assessment, 22 January 2014.

allowances[1] and a variable demand for them. Indeed, the number of allowances available each year was set in 2008-2009 (just as the auction schedule was established by regulation in late 2010), in anticipation of a return to favourable economic conditions; it is also possible, within certain limits, to make use of credits from the Kyoto Protocol flexible mechanisms. In contrast, demand for allowances varies depending on economic conditions, fossil fuel prices, complementary policies impacting emission reductions (energy efficiency measures, renewable energy integration), etc. Based on the Commission's analysis, the two factors most responsible for the rapid formation of the surplus over the period 2008-2012 are the economic crisis, which has significantly reduced industrial activity[2] and therefore demand for allowances, and the use of a large number of international credits (somewhat over 1 billion during phase 2[3], equivalent to nearly two-thirds of the total number of international credits authorised for compliance during phases 2 and 3). To a lesser extent, the Commission also called attention to the influence of interactions with other climate and energy policies[4].

The existence of a certain surplus on the allowance market is normal, and even rational, to the extent that it reflects actors' expectations regarding market trends and their need to manage risk (particularly in the case of electricity producers): this offers them protection against price fluctuations. As long as this surplus remains below a “reasonable” level, it does not impede proper functioning of the market. Yet, the current surplus of more than 2 billion allowances (equivalent to the quantity issued in 2013) is so large that it reduces the dynamic efficiency of market mechanisms, which would normally ensure a proper distribution of reduction efforts over time, encouraging investment and R&D. The surplus therefore diverts the price of CO_2 from the optimal path that would encourage the investment necessary to achieve the decarbonisation target at minimum cost over time. Short-term low prices therefore do not reflect the scarcity that will arise (and engender higher prices) in the long term and do not encourage emission reductions in the short term. Although the emission reduction objective is achieved, such a situation could trap the EU in a carbon-intensive approach to infrastructure and investment (a “lock-in” phenomenon). In the medium and long-term, it could therefore result in higher overall

(1) The supply rigidity for allowances is related to the rigidity of the auctions, which are defined according to a predetermined fixed schedule. Placement on the secondary market of allowances that were allocated free of charge to operators covered by the ETS varies according to demand; the operators are not motivated to sell their allowances when demand is low.

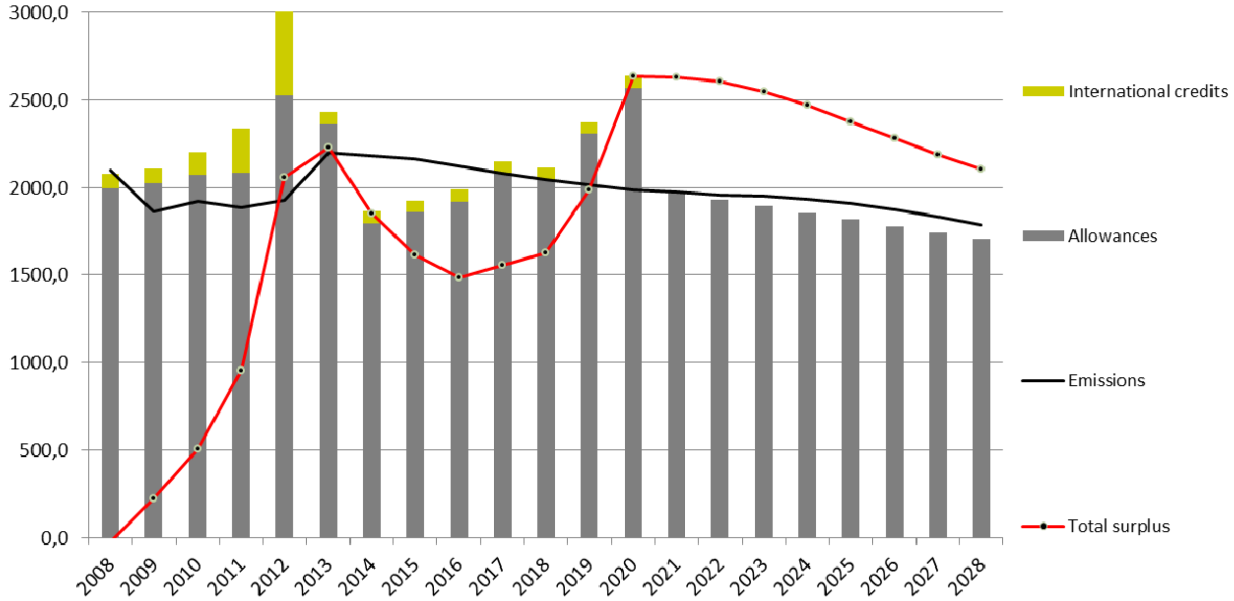
(2) The production of sectors covered by the ETS fell by more than 10% over three years compared to its pre-crisis level. Source: Sartor O. (2012), “The EU ETS carbon price: To intervene, or not to intervene?”, *Climate Brief,* No. 12, CDC Climat Research, February.

(3) Source: Commission Staff Working Document, Impact Assessment accompanying Communication on “A policy framework for climate and energy in the period from 2020 up to 2030”, 22 January 2014. Nearly 1.2 million international credits were used between 2008 and 2013, out of a total number of international credits authorised between 2008 and 2020 estimated at 1.5-1.6 million. Source: EEA Report, 2014.

(4) European Commission (2014), “A policy framework for climate and energy in the period from 2020 to 2030”, *Com 2014(15) final,* 22 January.

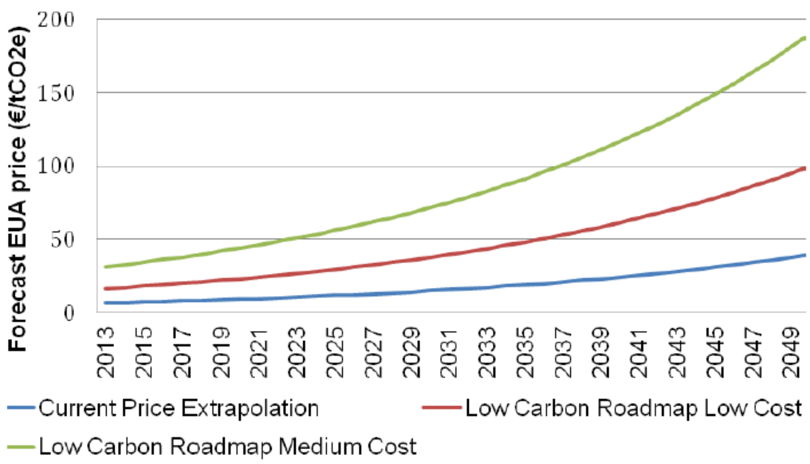
costs to combat climate change. The structural reform of the ETS is therefore designed to deliver the lowest possible cost, ensuring that the total cost to combat climate change is as low as possible.

Figure 5 – Historical and forecast trends in supply and demand with backloading of allowances



Source: Commission Staff Working Document, Impact Assessment, 22 January 2014

Figure 6 – Market Implied Current UEA price pathway to 2050 vs. Abatement Cost Forecasts of Low Carbon Roadmap



Notes: this Figure shows an extrapolation of the average Jan-2013 EUA day-ahead futures prices as quoted on ICE, out to 2050, based on an assumed real risk-free discount rate of 5% p.a (the blue line) compared with two similarly discounted 2050 EUA prices forecasts as reported in the European Commission's Low Carbon roadmap impact assessment.

Source: Berghmans et al. (2013), "Reforming the EU ETS: Give it some work!", CDC Climat, February

The Commission's 2012 report on the state of the carbon market carries out a rapid analysis of six options:

- increasing the emissions reduction target to 30% in 2020;
- permanently retiring a certain number of allowances in phase 3;
- early revision of the linear reduction factor for the annual limit of allowances;
- extension of the scope of the EU ETS to other sectors;
- limiting access to international credits;
- discretionary price management mechanisms.

In the report, the Commission emphasises its disapproval of mechanisms that manipulate prices, such as the carbon price floor or the reserve of allowances, directly limiting the price of CO_2. According to the Commission, because such mechanisms are based on prices, they alter the intrinsic nature of the ETS market that is – and must remain – a quantity-based market instrument. In addition, these mechanisms require difficult negotiations between governments to decide on the level of the price floor or the price levels that would activate the reserve mechanism: the carbon price would become the product of administrative and political decisions, rather than the result of interaction between supply and demand. These mechanisms clearly provide more certainty to investors and providers of low carbon technology, but, according to the Commission, there is a significant risk of imposing excessive emission abatement costs on ETS market participants and on society. If the price level is too high, it increases abatement costs; if it is too low, the mechanism is not effective. Stakeholders have also expressed this point of view. The majority would be opposed to the use of price management mechanisms for the same reasons: it would run counter to the foundations of the ETS market and it would be particularly difficult in practice to obtain an agreement on the “right” price.

The solution finally proposed by the European Commission for a structural reform of the ETS market, currently the subject of much debate, is to create **a market stability reserve** in 2021[1] (the beginning of phase 4). The rules for placing allowances into the reserve and releasing them are predefined[2] and will therefore not be subject to

(1) While recognising that the establishment of a market stability reserve starting in phase 3 would be beneficial, the Commission considers it preferable to wait until the beginning of phase 4 to give market participants time to adapt and to provide them adequate legal security during phase 3, especially since the measure to backload allowances should provide temporary, short-term relief.

(2) The market stability reserve regulates the number of allowances in circulation. It constitutes a direct measure of the imbalance between supply and demand, i.e. the difference between (i) the sum of the free allowances, auctioned allowances and Kyoto credits since 2008 and (ii) the sum of verified emissions since 2008 and the allowances in the new entrants' reserve: when the quantity of allowances “in circulation” exceeds 833 Mt, 12% of this quantity is removed from the number of allowances auctioned – as long as the number removed remains above 100 Mt – and is added to the reserve. When the number of allowances “in

discretionary measures. In addition, this mechanism will be managed by the institutions that already manage the allowance auctions. Besides setting a reduction target of 40% by 2030, two additional measures have been proposed to improve how the ETS functions:

- **increasing the reduction factor for the annual allowance limit**: 2.2% annually from 2021 against 1.74%[1] over the 2013-2020 phase, representing the goal of reducing an additional 550 Mt CO_2. This factor leads to an emissions reduction of 43% in the ETS sector in 2030 against 2005 (if extended until 2050, the reduction would reach 84%[2] in that year). With this measure, the surplus of allowances would be about 2.3 billion in 2030;
- **the prohibition, after 2020, to use international carbon credits** (from the Kyoto Protocol's flexible mechanisms: Clean Development Mechanism and Joint Implementation mechanism), unless the objective of 40% was achieved during the 2015 climate negotiations.

The market stability reserve, which was not among the six options initially proposed[3], emerged during the public consultation of stakeholders that followed the publication of the Commission's report on the state of the European carbon market[4] (between December 2012 and February 2013). By making the supply of emission allowances to be auctioned more flexible, the Commission intends to meet two objectives: reducing the current imbalance and protecting the ETS from sudden and unexpected variations in demand. Moreover, according to the Commission's impact analysis, the market stability reserve would address variations in demand regardless of their origin, whether due to macroeconomic trends or other factors such as complementary policies (e.g. measures promoting RES and energy efficiency). It would also allow management of changes on the supply side, such as an influx of international credits.

---

circulation" is less than 400 Mt, 100 Mt are taken from the reserve to be added to future volumes of allowances to be auctioned. There is also an emergency threshold for removing allowances from the reserve: if, for six consecutive months, the price of allowances exceeds three times its average value over the previous two years, 100 Mt are removed from the reserve and added to the number to be auctioned in the current year.

(1) The linear reduction factor of 1.74% applies to the average number of allowances issued each year between 2008 and 2012, equivalent to an annual reduction of about 38 Mt of CO_2.

(2) According to the projections made in the framework of the "Roadmap for moving to a competitive low carbon economy in 2050", to ensure an 80% reduction of the EU's internal emissions by 2050, emissions from the ETS sector would have to decrease by 90% against 2005, which is not possible with the linear reduction factor of 2.2%: the factor would have to be increased to 2.4% until 2050.

(3) The report on the state of the carbon market stated clearly that the list of six options was not exhaustive.

(4) European Commission (2012), "The State of the European Carbon Market in 2012", report from the Commission to the European Parliament and the Council, COM(2012) 652 final, 14 November.

This type of mechanism seems to attract the widest consensus among stakeholders, who stressed their preference for a mechanism that:

- is non-discretionary, operating according to automatic rules;
- is volume-based, so that prices continue to be determined by the market;
- does not influence the overall emissions cap, making the supply of allowances more flexible without affecting the overall supply.

According to the Commission's impact assessment, the creation of the market stability reserve, with the proposed rules for placing allowances into the reserve and releasing them, would reduce the surplus to approximately 800 million allowances[1] at the end of phase 4 (2028), against nearly 2.5 million allowances at the beginning of phase 4. However, as in the case of backloading, the Commission is unable to evaluate the quantitative impact of the market stability reserve on the price of CO_2 because of excessive uncertainties regarding when the mechanism will intervene, the behaviour of actors that hold a surplus, trends in the demand for allowances for hedging purposes and, finally, whether market participants have already anticipated the effects of that reserve. In any case, qualitative analysis emphasises that this mechanism should support CO_2 prices by reducing the surplus because trends in those prices will be more closely linked to the emissions cap and the emissions level rather than to the supply of allowances. The market stability reserve should also help smooth long-term price trends and avoid extremes. Note that in the Commission's 2013 reference scenario (which assumes the implementation of all policies adopted before spring 2012), the price of CO_2 on the ETS market is €10/t in 2020, €14/t in 2025 and rises to €35/t in 2030 and €100/t in 2050[2] (in 2010 euros). The impact assessment of the climate and energy package in early 2008 predicted CO_2 prices in 2020 on the ETS market of €30 to €47/t, depending on options.

(1) By selecting, from the options tested by the Commission, the one whose operating rules are closest to those of the proposed mechanism. With other options, a surplus of 500 million allowances is calculated for 2028.

(2) The baseline scenario for 2009, which considers the effects of the economic crisis while remaining optimistic about an economic recovery, predicted CO_2 prices of €25 in 2020 (in 2008 euros) and €39 in 2030 (in 2008 euros). The 2009 reference scenario, which, unlike the baseline scenario, assumes the full implementation of the climate and energy package, predicts prices of €16 in 2020 and €20 in 2030 (in 2008 euros). Source: European Commission (2010), *EU Energy Trends to 2030 – Update 2009,* 2010.

Figure 7 – EUA prices (€/tCO_2) from 2005 to 2014

Source: Desai, Z., Alberola, E. and Berghmans, N. (2014), "Introducing short-term flexibility in the EU ETS to assure its long-term credibility", Climate Report, *No. 45, July*

3. The Commission's proposal does not completely remedy the structural shortcomings of the ETS market

While the mechanism proposed by the Commission should allow raising the price of CO_2 (as most analyses acknowledge), the real question is whether it addresses the structural shortcomings of the ETS market. Indeed, it is commonly accepted (but in varying proportions depending on the analysis in question) that today's low prices are caused by:

- the declining demand for allowances (due to the economic crisis and its impact on industrial activity, as well as the development of RES and improvements in energy efficiency);
- the abundant (mainly because of access to international credits) and rigid supply;
- actors' expectations, in particular regarding their scepticism that allowances will be scarce after 2020 and their doubts about the sustainability of the EU's commitments on climate issues.

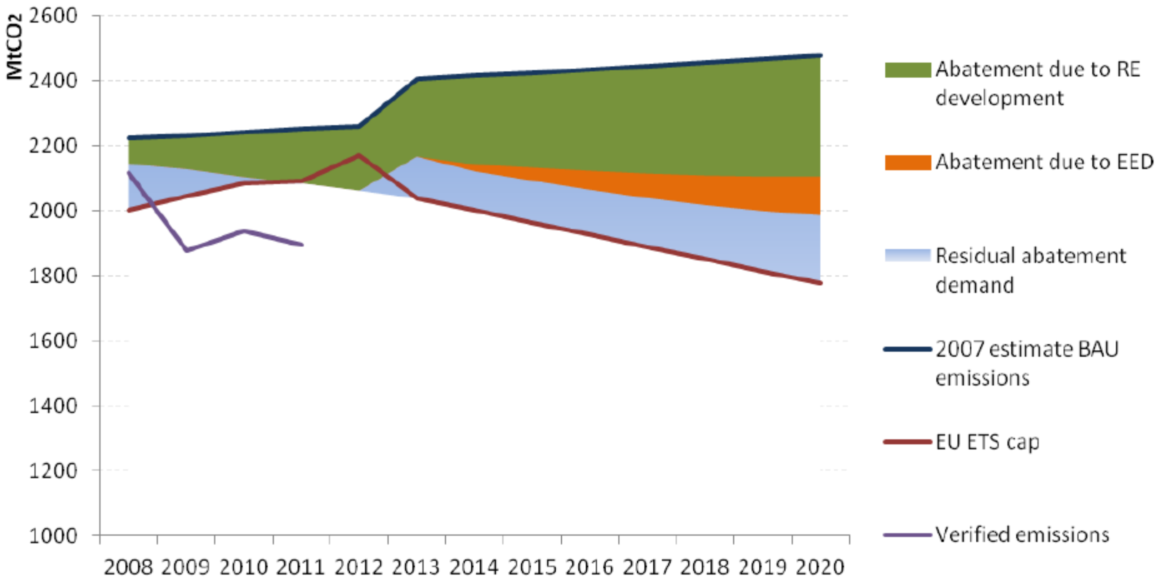
Falling prices on the ETS market and the existence of more than 2 billion surplus allowances are therefore, in reality, symptoms that expose structural shortcomings[1]:

- the absence of a credible commitment on an emission reduction cap for the ETS market after 2020;

(1) Source: Berghmans N. *et al* (2013), "Reforming the EU ETS: Give it some work!", *Climate Brief*, No. 28, CDC Climat Research, February.

- the fact that, because of complementary policies on emission reduction and access to international credits, the proportion remaining for the ETS market to promote emission reductions within its scope is quite small (only about 20% of emission reductions for 2020 are expected to be achieved through the price signal issued by the ETS market);
- the absence of institutional mechanisms and regulatory framework to adjust the supply of allowances in case of unexpected demand shocks, as was the case with the crisis.

Figure 8 – Abatement from renewable energy and Energy Efficiency Directive in EU ETS Scope



Source: CDC Climat Research from, impact assessment of the Climate an energy package (2008), CITL data, impact assessment on the Energy efficiency directive (2011) and reports on MS' National Renewable Action Plan (2011)

The Commission's proposed reform partially addresses two of these shortcomings:

- the adoption of an objective for 2030 at the European Council of October 2014 allowed the European Union to clarify its post-2020 commitment and demonstrates its voluntarism. This objective includes some uncertainty related to the results of the 2015 climate conference;
- the market stability reserve allows regulation of the supply in case of unexpected variations in demand, but it reacts in an automatic, non-normative manner. Unable to distinguish between variations in demand that should result in an adjustment of the supply and those that should not, it treats all events affecting demand identically. Yet, one could legitimately ask whether the economic crisis' repercussion on demand

should lead to a reduced supply. The link between economic activity and carbon prices is generally considered beneficial and desirable for reasons of economic efficiency: when economic activity declines, CO_2 prices fall, reducing costs for companies in a difficult economic situation, thus promoting their activity, and vice versa. This would argue for the establishment of a regulatory and institutional framework to carry out a thorough analysis of situations in which surplus and low prices are considered harmful and those where they are not. In addition, it seems crucial, in view of lessons learned and unmet expectations, to provide an institutional framework for review of the market stability reserve's operating rules: the range of surplus considered acceptable today falls between 400 and 833 million allowances, but the calibration of these thresholds is extremely difficult and error-prone. While the proposal provides that certain parameters of the mechanism can be revised by 2026 following review by the Commission, it seems much more important to specify the modalities of this review. First, 2026 seems distant for an operational review of the reserve because difficulties may arise earlier. Second, more than a year elapsed between the first report on the state of the carbon market and the structural reform proposal, and at least two years will elapse between the first report and the reform's validation, which argues for the establishment of a more responsive body or process;

- finally, there is no proposal that resolves the third shortcoming that was identified: insufficient consideration of interactions between CO_2 prices and complementary emission reduction policies. In its analysis of impact of the 2020 climate and energy package, the Commission recognised that policies to develop renewables would lead to a reduction in CO_2 prices against a scenario of 20% reduction in GHG without an objective to deploy RES, while estimating that this reduction would be moderate: €49/tCO_2 to €39/t CO_2 in 2020 (in 2008 euros). It also recognised that complementary policies for GHG reduction played a role in the formation of the surplus, but only a marginal one (however, without specifying that role, while other empirical analyses estimate that the impact of increased wind and solar production on the CO_2 price exceeded that of access to international credits from the Kyoto mechanisms[1]). In the impact assessment of the new 2030 framework, conducted by the Commission itself, it is quite clear that policies for renewable development and improved energy efficiency greatly reduce the CO_2 price: in the scenario with the unique goal of a 40% reduction in GHG emissions by 2030, the CO_2 price would be €40/t in 2030 (in 2010 euros), while in the scenario also containing an objective of 30% RES and explicit measures to support energy efficiency, the CO_2 price would be €11/t. Thus, the impact on prices has been evaluated but no conclusion has been drawn concerning the impact on ETS operation.

(1) Koch N. and Grosjean G. (2014), “What does the carbon price reflect?”, presentation at the “Emissions trading in the 2030 framework“ conference, Mercator Research Institute on Global Commons and Climate Change (MCC) and Potsdam Institute for Climate Impact Research (PIK), Paris, 3 September.

The ETS is not a conventional market. The annual supply of allowances, which determines current and future constraints, is, in fact, solely the result of political decisions and does not reflect an intrinsic rarity. In addition, as mentioned several times, demand for allowances also depends on decisions outside the market such as measures designed to develop RES and improve energy efficiency. Therefore, it appears that reforming the system requires first recognising that it is the product of political decisions. Moreover, the objectives of the ETS are twofold. First, controlling the maximum quantity of GHG emitted each year by all facilities subject to the ETS: the "quantity control" objective. However, until 2020, emitters may exceed the designated annual threshold by buying a limited number of international carbon credits (i.e. from the Kyoto Protocol's flexible mechanisms). Second, giving rise to a CO_2 price trajectory that minimises the total cost over time to decarbonise the sectors in question: the "lowest total cost" objective. It is this second objective that the Commission considers as not currently being reached, arguing that the excess of existing allowances diverts the current prices from the optimal decarbonisation path. This calls into question the dynamic efficiency of the mechanism; establishing a stability reserve should correct it. However, considering that the problem is related to quantities, the stability reserve is a mechanism that targets a given level of surplus, thus addressing that surplus irrespective of its causes (in particular, economic ones). Its impact on prices – not analysed by the Commission – is very uncertain and therefore does not guarantee that the second objective will be achieved. Some analysts even believe that the stability reserve would increase the volatility of CO_2 prices.

Moreover, it is becoming increasingly difficult to avoid discussing the "right level" for CO_2 prices. Current criticisms of the ETS focus predominantly on price levels that are insufficient to encourage investment in low carbon technologies. Therefore, if triggering new investment is truly an objective of the ETS (like the "quantity control" objective), all actors should be constantly provided with a credible price signal. In the current framework of the ETS market, this could be achieved by fixing the floor and ceiling prices.

Appendixes

Appendix 1: Activities and sectors covered under the EU ETS

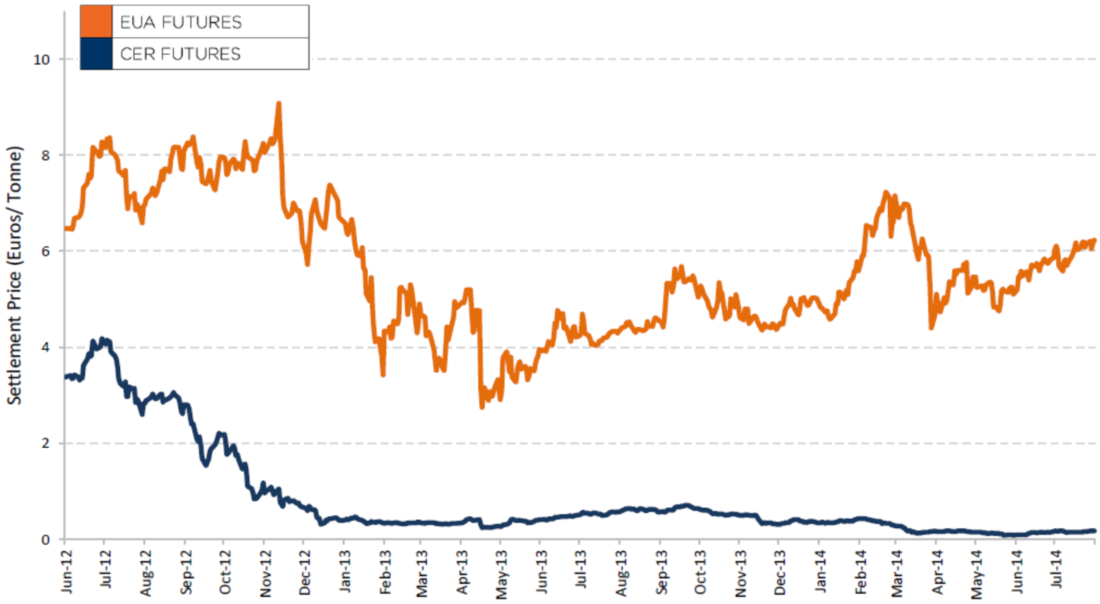
Table 3.1 Activities and sectors covered under the EU ETS

Sectors	Activities	Verified emissions (Mt)			Share of 2013 emissions (%)
		2005	2008	2013	
Combustion	20 Combustion of fuels	1 473	1 524	1 346	70.6 %
Refineries	21 Refining of mineral oil	154	157	142	7.4 %
Iron steel and coke	22 Production of coke	19	21	23	1.2 %
	23 Metal ore roasting or sintering	7	4	3	0.2 %
	24 Production of pig iron or steel	114	120	101	5.3 %
	25 Production or processing of ferrous metals	0	1	8	0.4 %
Cement clinker and lime	29 Production of cement clinker	166	177	129	6.8 %
	30 Production of lime or calcination of dolomite/magnesite	12	14	13	0.7 %
Other	26 Production of primary aluminium	0	0	7	0.4 %
	27 Production of secondary aluminium	0	0	1	0.0 %
	28 Production or processing of non-ferrous metals	0	0	5	0.3 %
	31 Manufacture of glass	20	23	19	1.0 %
	32 Manufacture of ceramics	15	14	14	0.7 %
	33 Manufacture of mineral wool	0	0	0	0.0 %
	34 Production or processing of gypsum or plasterboard	0	0	1	0.1 %
	35 Production of pulp	3	3	3	0.1 %
	36 Production of paper or cardboard	27	29	25	1.3 %
	37 Production of carbon black	0	0	0	0.0 %
	38 Production of nitric acid	0	0	2	0.1 %
	39 Production of adipic acid	0	0	0	0.0 %
	40 Production of glyoxal and glyoxylic acid	0	0	0	0.0 %
	41 Production of ammonia	1	1	14	0.8 %
	42 Production of bulk chemicals	2	8	16	0.8 %
	43 Production of hydrogen and synthesis gas	0	0	8	0.4 %
	44 Production of soda ash and sodium bicarbonate	1	1	3	0.1 %
	45 Capture of greenhouse gases under Directive 2009/31/EC	0	0	0	0.0 %
	46 Transport of greenhouse gases under Directive 2009/31/EC	0	0	0	0.0 %
	47 Storage of greenhouse gases under Directive 2009/31/EC	0	0	0	0.0 %
	99 Other activity opted-in under Art 24	0	23	25	1.3 %
	All activities	**2 014**	**2 120**	**1 908**	**100.0 %**

Notes: New activity codes and definitions were introduced in 2013 in order to account for the new sectors included in the scheme, but also to define activities already covered more specifically. All new installations entering the scheme are automatically assigned a new activity code. However, not all installations that were already part of the scheme before the start of the third trading period have changed to the new activity codes; they have retained the old codes instead. In this table, old codes have been merged with new ones. Please see the EEA's ETS data viewer manual for details of the mapping from old to new sector codes.

Source: EEA, 2014e.

Appendix 2: Prices of futures contracts on the ETS market

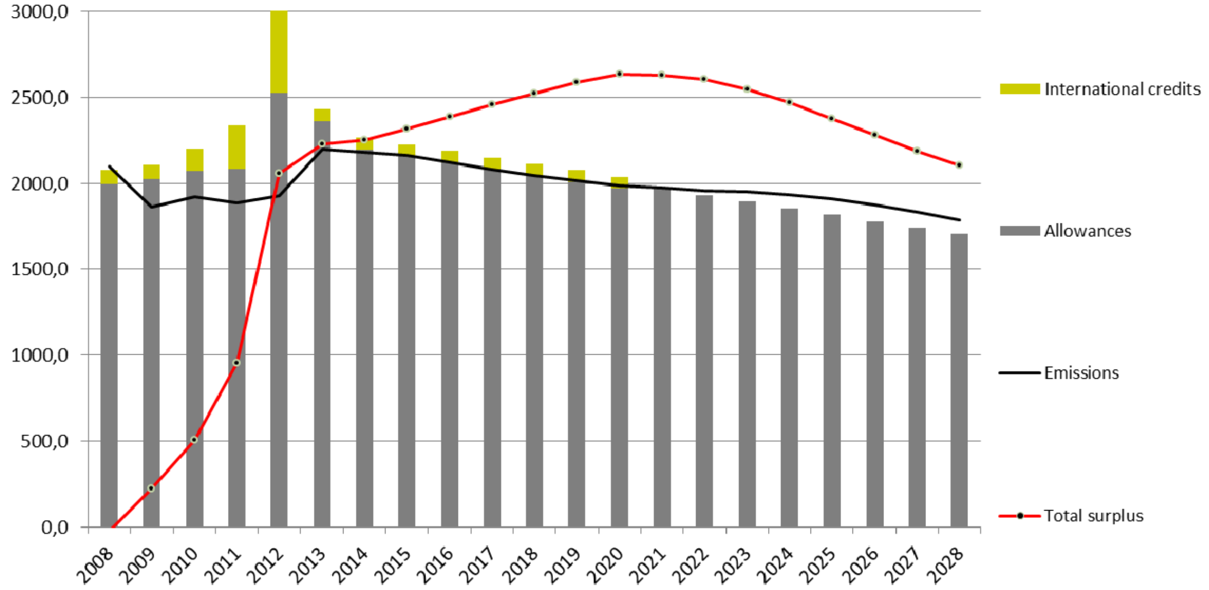


Source: ICE Monthly Utility Report, July 2014

Appendix 3: Impact of the backloading measure

In November 2012, the Commission proposed a short-term measure to delay until 2019 and 2020 the auctioning of allowances originally scheduled for 2013, 2014 and 2015, the so-called "backloading" of 900 million allowances, which was officially validated in February 2014 by amending the schedule for releasing allowances in 2014, 2015 and 2016. This measure was not intended to reduce the structural surplus of allowances, but rather to address the rapid increase in the surplus during the transition from phase 2 to phase 3 due to temporary factors[1] and to reduce price volatility generated by that transition.

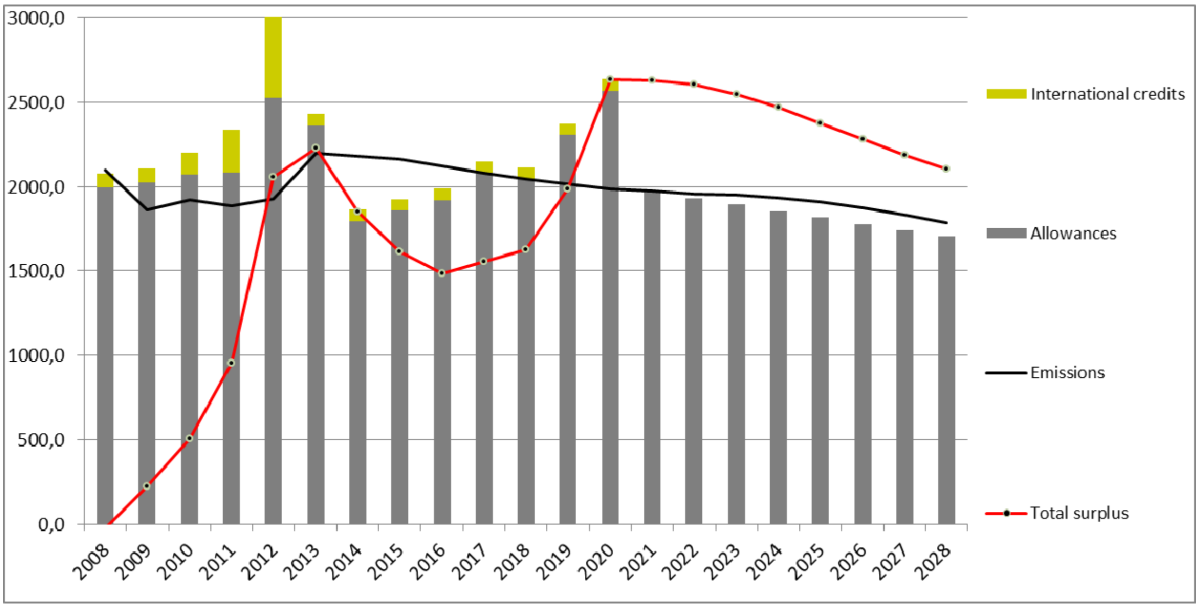
Figure A – Historical and forecast trends in supply and demand to 2028 (without backloading of allowances)



Source: Commission Staff Working Document, Impact Assessment, 22 January 2014

(1) The allowance supply increased in 2012-2013 due to forward sales of phase 3 allowances to generate funds for the NER 300 programme for carbon capture and storage and innovative RES, early auctioning of 120 million allowances in the last quarter of 2012 to meet hedging needs in the electricity sector, the sale of leftover allowances in the national phase 2 new entrant reserves and the influx at the end of phase 2 of international credits, some of which are no longer valid in phase 3. The number of international credits used for compliance purposes has thus doubled between 2011 and 2012. Sources: Report from the Commission to the European Parliament and the Council, "The State of the European Carbon Market in 2012", Commission Staff Working Document, Impact assessment, 25 February 2014.

Figure B – Historical and forecast trends in supply and demand with backloading of allowances



Source: Commission Staff Working Document, Impact Assessment, 22 January 2014

By reducing the surplus of allowances at the beginning of phase 3, this measure should also raise CO_2 prices: in the Commission's reference scenario dating from 2013[1], i.e. in the absence of backloading and structural reform, the price of CO_2 is €5/t in 2015 and €10 in 2020[2] (in 2010 euros). While the Commission considers it impossible (due to excessive uncertainties[3]) to calculate the impact of this measure on CO_2 prices, a number of analysts' studies confirm that backloading raises CO_2 prices in the short term, yet disagree on its longer-term (2020) impact. Barclays' analysts state that backloading will have no effect on the price in 2020, while Thomson Reuters Point Carbon's analysts say that it will give rise to lower prices in 2020 (possibly surpassing -30%).

(1) This is the reference scenario selected for the impact assessment of the 2030 climate and energy framework. The 2009 reference scenario foresaw CO_2 prices of €25 in 2020 (in 2008 euros) and €39 in 2030 (in 2008 euros).
(2) European Commission, Impact assessment accompanying proposal for a Decision of the European Parliament and of the Council, 22 January 2014.
(3) Uncertainties regarding the behaviour of actors with surplus allowances, trends in demand for allowances for hedging purposes and how market participants may have already anticipated the impact of backloading.

Table 3: Overview of carbon price projections by market analysts with no backloading

Amount backloaded	Min price 2013-2015	Max price 2013-2015	2020	Sources*
	(all prices are nominal, €)			
Option 0				
0 Mt	4.5	5.5	10	Barclays
0 Mt	4	5	12	Thomson Reuters Point Carbon
0 Mt	4.5	8		Tschach Solutions**
0 Mt	6.2	6.7	29.2	Bloomberg New Energy Finance

*Sources: see section 6.1 for more information
** Tschach Solutions only projects price impacts up to 2014 prices, first two quarters.

Table 4: Overview of projections of impacts backloading by market analysts

Amount backloaded	Min price 2013-2015	Max price 2013-2015	Sources*
	(all prices are nominal, €)		
Backloading options similar to options 1 to 6			
400 Mt	5.5	6	Barclays
	6	8	Thomson Reuters Point Carbon
	7.3	11	Bloomberg New Energy Finance
500 Mt	9.75	19	Tschach Solutions**
700 Mt	7.5	11	Barclays
800 Mt	9	11	Unicredit
900 Mt	10	12	Thomson Reuters Point Carbon
	8.6	20	Bloomberg New Energy Finance
	13	23.5	Tschach Solutions**
1200 Mt	9	20	Barclays
	13	14	Thomson Reuters Point Carbon

*Sources: see section 6.1 for more information
** Tschach Solutions only projects price impacts up to 2014 prices, first two quarters.

Table 10: Carbon price forecasts by Barclays (prices in €, nominal)

Change	2013	2014	2015	2016	2017	2018	2019	2020
0 Mt	5.5	5	4.5	4.5	4.5	5	7	10
400 Mt	6	5.5	6	5	4.5	5	7	10
700 Mt	7.5	10	11	8	7	7	8	10
1200 Mt	9	14	20	13	9	7	10	10

Source: Derived from figure 27, Barclays, Commodities Research, Quarterly Carbon Standard, 22 June 2012

Table 12: Carbon price forecasts by Bloomberg New Energy Finance (price in €, nominal)

Change	2013	2014	2015	2016	2017	2018	2019	2020
0 Mt	6.3	6.2	6.7	7.8	9.0	19.5	24.2	29.2
400Mt	7.3	8.6	11.0					
900Mt	8.6	12.6	20.0					

Source: BNEF, September 2012

Table 14: Carbon price forecasts by Thomson Reuters Point Carbon (prices in €, nominal)

Change	2013	2014	2015	2016	2017	2018	2019	2020
0 Mt	4	4	5	6	8	9	10	12
400 Mt	6	8	7	5	6	7	9	11
900 Mt	10	12	11	5	5	6	6	8
1200 Mt	13	14	13	7	5	5	6	8

Source: Thomson Reuters Point Carbon, Cancellation is the magic word, 27 August 2012.

CONTRIBUTIONS

EUROPEAN ENERGY AND CLIMATE POLICY: TIME FOR SOMETHING NEW

Dieter Helm[1]

Introduction

During 2014, European energy and climate change policy has moved centre stage. The annexation of Crimea and the destabilization of Eastern Ukraine have raised tensions with Russia to levels not seen since the Cold War. The EU has responded with an energy security plan, and sanctions.

Developments elsewhere have further complicated matters. In the Middle East, the rapid advances of ISIS (now called the Islamic State), the internal conflicts in Libya, the war in Gaza, and the continuing negotiations with Iran on nuclear matters suggest that early optimism about the "Arab Spring" was at best misplaced, and chronic instability has returned. In the US, the energy revolution continues to change the geopolitics of oil and gas, with the early skepticism about the scale of the changes and the shift towards North American energy independence giving way to recognition that the changes are permanent and profound – for both global energy markets and Europe. The full implications of the end of the commodity super-cycle are both profound for European energy policy and very poorly understood. Commodity prices have tumbled, with oil prices falling below $80 a barrel.

On climate change, there is almost certainly not going to be a continuation of the Kyoto style international framework after the Paris conference in December 2015. Chinese emissions per head have now exceeded those of the Europeans, and it is at last being recognized that the climate change problem is one in which China, not the EU, is centre stage. China has announced that it does not intend to cap its carbon emissions until after 2030, by which time they may peak anyway – from a very much higher base after another decade and a half of increases. The Paris conference will see a series of "pledges" and "commitments" very much on the pattern of the Copenhagen Accord, not

(1) Professor of Energy Policy at the University of Oxford. This paper was written in November 2014. A French translation is available on www.strategie.gouv.fr/publications/lunion-de-lenergie-0.

the credible, enforceable legally binding measures that had been proposed at the Durban Conference of the Parties in 2011.

Global emissions are now growing at almost 3 parts per million, the 400 ppm threshold has been breached, and in Europe, Germany now has rising emissions as coal continues to dominate the electricity generation energy mix. The maximum 2 degrees warming target looks unattainable.

Though many European leaders have been anxious to claim that these external developments in both security and climate change confirm the relevance of existing policies, notably the Internal Energy Market and the Climate Change Package, this position is increasingly difficult to sustain. Something new is needed.

This paper sets out a possible way forward for European energy and climate policy. Section 1 discusses the economic fundamentals, and particularly the trends in commodity prices and in technology. Given this background, section 2 considers the conceptual framework and how the policy instruments can be designed to meet the objectives and targets. This builds on the preceding paper[1]. Sections 3, 4 and 5 deal respectively with each of the main policy elements – security, climate and affordability. Section 6 considers the next steps and the policy options facing Europe.

1. The economic fundamentals

Energy policy floats on the surface of economic fundamentals. Mostly these can be taken as given, but there are points in the history of energy policy when structural change alters the nature of the game. Now there are two – on the costs of fossil fuels and on technologies.

Europe's energy policies have been built around the assumption of ever higher fossil fuel prices. Back in the last decade when the Climate Change Package was being put together, the Commission and the leading politicians in Europe convinced themselves that oil, gas and coal process would keep on going up, so that the renewables would become competitive and by 2020 the subsidies could start to wither away.

As with all such dangerous assumptions about the future market prices, this has turned out to be at best seriously misguided. Energy policy should not be based around assumptions about the outcomes of market processes beyond the control of the policy makers. In fact coal prices fell sharply, gas prices in Europe during 2014 halved, and oil prices slid below $80 a barrel.

(1) Helm, D.R. (2013), "The current situation and mid-term prospects for European electricity markets", October.

The commodity super cycle which lay behind these assumptions has come to an end as a result of a combination of economic fundamentals – a slow down in China cutting into demand growth, and increases in supply, including the coming of shale oil and gas, and the remarkable increase in US production. The high super-cycle prices contained the seeds of their own destruction – and the markets have reacted accordingly. Commodity prices are now at a 5-year low and still falling. There are few reasons to assume that the ending of the commodity super-cycle will stabilize in the near future, notwithstanding the projections made by the official bodies like the IEA. Indeed the IEA's record on forecasting is extremely poor. At the end of the 1970s, when a similar commodity cycle peaked it projected ever higher oil prices, to be confronted with the opposite. It failed to predict the current sharp falls, and it has little credibility in making projections of rising prices going forward (whatever, in fact, turns out to be the case).

The reasons why the commodity super-cycle has turned are fundamental economic ones. High prices cause more investment in supply, more energy efficiency and they tend to damp down economic growth. Eventually lower demand comes up against higher supply. Once prices fall, producing countries struggle to balance their budgets, and the result is that they tend to increase supply to compensate. Eventually, these factors play out and the cycle turns again – provided there are no new cheaper alternatives. In the case of oil, the transport demand is vulnerable to the electrification process and next generation solar might make big inroads into the demand for oil. It may even be possible that oil demand never recovers very much – in other words, it may be the demand for oil that has peaked, not the supply.

The policy implications of lower commodity prices are profound. The renewable subsidies will need to be permanent not temporary if Europe is to continue to address climate change with wind turbines and other current generation renewables. The fossil fuels will remain competitive, unless the carbon price is sharply increased. For nuclear, it means that new nuclear at the current development costs will struggle against cheaper coal and gas without a high carbon price.

The end of the commodity super cycle coincides with the potential for rapid technical change. Whilst existing renewables (despite most official forecasts and optimism to the contrary in defense of the political mistakes that have been made) have little serious chance of ever being competitive or indeed sensible ways of addressing the massive challenges of global warming, next generation technologies (and especially next generation solar) have the potential to make big inroads. Indeed the development of new solar film-based applications as well as greater use of the light spectrum holds out the possibility that it might compete head on with fossil fuels. Graphene and nano-technologies add a broad set of interacting technologies. There are also big potential advances in storage, the coming of electricity transport, new transmission and distribution technologies and the wider application of smart communications to all dimensions of the industry, and especially to the demand side. The time scales are uncertain, but it should be born in mind that the experience in the last two decades of the rapid diffusion of mobile and internet-based technologies has been extremely rapid. Furthermore since the existing renewables cannot solve the climate change problem, there is no option but to try to speed up the R&D and innovation of the next generation of renewables. Sadly spending billions of euros on existing wind and current generation solar does not help, whilst at the same time it absorbs customers' money which could have been better spent on R&D.

All these technologies hold out the possibility that the economics of electricity might look more like the economics of the internet – zero marginal costs, fixed price contracts, and rapid obsolescence.

Together these developments hold out the prospect of a very different future for the energy industries, and energy policy should be designed with this uncertainty in mind. Instead the history of energy policy points to a rather different conclusion. Policy makers tend to take technology as given and misinterpret the current trend in prices for a permanent trend. They look out the back window, rather than designing in flexibility to account for different commodity prices and new and often surprising technologies.

2. A conceptual framework for EU energy policy

Policy should be flexible to the future possibilities. With this in mind, there is nothing inherently difficult from a conceptual perspective to designing a European energy and climate change policy framework. It is the politics that inhibits a proper framework being designed. It requires three main things: clear objectives; clear trade-offs between the objectives where these conflict; and a set of policy instruments to achieve them.

2.1. The objectives are not defined

A prime reason why EU energy and climate change policy is in such a mess is that none of its objectives has been properly defined. European politicians have avoided them, for fear of confronting the citizens with the implications of their policy choices. Instead there has been much talk of the mutual compatibility of the "trilemma", and how European citizens can be secure, reduce their carbon footprints, and have competitive and affordable energy all at the same time. Unfortunately such a happy coincidence is not possible.

Defining an objective is not just a matter of stating some political platitude. An objective requires a definition of what is to be achieved in a clear and unambiguous form, which can be monitored and measured. Being in favour of "more security" is not an objective, but rather a vague aspiration. "Security" needs to be defined, and the target needs to be given empirical content. Questions have to be answered. What is security? How much of it is the objective? What are the causes of climate change to be targeted? Is the objective global emissions, and if so what is the target and over what period of time? Is it a global objective, or is it a unilateral target, even if it means global emissions going up? Does it matter if the basket of greenhouse gases goes up if say carbon dioxide goes down?

It is immediately apparent that not only are security and climate objectives ill defined, but also many dimensions are not amenable to EU control. An objective that cannot be achieved because the EU does not control the relevant variables is not a properly defined objective for policy purposes. Yet it is also immediately apparent that the EU cannot control global emissions, and it cannot control all the sources of energy supply – unless security means autarky and self-sufficiency, in which case it is likely to be so costly as to be unachievable in any realistic political scenario.

To security of supply, and climate change, the EU frequently adds a third objective – variously referred to as "competitiveness" or "affordability". This is better considered an *outcome* of the pursuit of the other objectives, and of global markets. In theory the EU could aim to have an energy cost, adjusted for exchange rates, set at some maximal level relative too the countries or a basket of countries. It could even aim to have the energy costs of a particular group – say internationally trading companies or the poorest 10% of retail customers – below some international threshold. Given however that the EU has little or no power over international prices, and little ability to determine the energy policies and prices in other countries, this is a tall order – even before the placing of security and carbon objectives as subsidiary to prices.

2.2. The trade-offs between the objectives are not defined

If none of the objectives is properly defined, little serious progress can be made in constructing a coherent policy framework. But if they were, then the next step would be to define the trade-offs. Contrary to the political rhetoric, and some of the lobbying by NGOs, there are real conflicts between them. For example, security might be best achieved by burning more coal. Coal is abundant, widely available from diverse sources of supply, it can be stored, and there is no realistic prospect that there will be any substantive hold-ups in supply. No countries could play an OPEC role in the coal market. There are also some indigenous supplies. Coal too is cheap – unless there is a serious carbon price (either explicitly or implicitly in the price of low carbon technologies) and prices for the other emissions associated with coal production and consumption. Coal is however the last fuel to turn to in any credible climate change policy. The route suggested to address these problems via CCS is unlikely to have much impact: the sheer scale of the CCS reservoirs that would be needed given the volume of the gas is out of all proportion to the level and growth of the emissions.

This is just one stark example of the trade-offs that exist between the objectives. The EU has studiously avoided defining these trade-offs, and the result is in this example seen in the incoherence of both pursuing a climate change policy and increasing the coal burn across Europe, with Germany standing out as the leading example of promoting "green" policies and sharply increasing the coal burn and adding new coal-fired power stations. "Brown" might be a better colour to represent the high pollution route Germany is in fact pursuing.

2.3. The instruments are not properly targeted on the objectives

Even if the objectives are defined, and the trade-offs are also defined, there needs to be a set of credible and coherent policy instruments to achieve them. But instead of a clear assignment of instruments to targets, there are a plethora of measures designed to placate various lobbies and interest groups. On security of supply, the instruments are those that meet the least resistance. Hence there is no serious attempt to enforce the EU's competition policy on Gazprom, and no requirement for minimum conditions, like the rights to resell gas, the ruling out of price discrimination, or a determination to develop credible alternative pipelines like Nabucco.

On climate change it is even worse. There are multiple ill-defined and overlapping policy instruments, from protection of "winning" technologies at great cost, to the EU ETS set at so low a level as to make no significant difference, and an absence of credible R&D policy instruments. No serious attempt is made to deal with the conflicts and overlaps between these instruments.

The conclusion that emerges is that Europe does not have well defined objectives or trade-offs between them and has a complex mess of overlapping instruments not properly linked to the objectives. Conceptually it is straightforward – and Europe fails badly on this score. This is reflected in each of the main areas of concern to which we now turn.

3. The 2030 targets and the climate change instruments

For at least two years, the Commission has been debating proposals for a new set of targets for 2030 for carbon, renewables and energy efficiency. The Council of Ministers in October 2014 has settled on 40-27-27. The 40 refers to carbon production (not consumption), whilst the other two are at best intermediate targets, but really are effectively instruments. It is a muddle, and fails the test of clear and defined objectives discussed above.

The rationale for this set of targets grows out of the earlier 20-20-20 set. In both cases, the approach has been political, with little if any economic content. As explained in

The Carbon Crunch,[1] 20-20-20 is highly unlikely to be efficient: the chances that all the targets add up to the magic number of 20, in the year 2020 is obviously close to zero. And so it has proved. The main reason for the performance on the overall target has been the economic depression, lowering European GDP by perhaps 20% below the level it might have been expected to achieve when the 20-20-20 targets were being formulated. This has also helped with the renewables targets – the total energy demand has fallen as a result of a combination of lower GDP and higher prices.

The renewables target has little if anything to do with climate change. Current renewables have negligible impact of global emissions, and by driving up European energy prices they encourage de-industrialisation and hence open the gap between carbon production and carbon consumption. They are incredibly expensive too – and are more so as commodity prices fall. Subsidies will not then wither away between 2020 and 2030, but rather become a permanent feature of the European budgetary scene with a new renewables target, and impact permanently on customer bills.

Why then repeat the folly in for 2030? The answer lies more with the lobbying and vested interests of all those in receipt of the subsidies and with the campaigning of "green" groups. The 20% renewables targets have created great economic rents and rent-seeking companies and organizations have pursued them with vigour. The renewables industry has developed formidable lobbying organizations.

The energy efficiency target lacks even the necessary definition to make it coherent. Is it independent of price – and hence the price and income elasticities? What exactly is the counterfactual? It is far form clear there is any practical operational answer to these questions.

The overall carbon production target of 40% has the political merit of being twice the number 20, but again it is far from clear what relationship it bears to the global emissions. It is presented as unilateral, and it is on production not consumption. Yet, it is also "flexible", depending on what others offer at the Paris 2015 Conference. So far, China has offered *not* to accept any cap until 2030. Whatever the eventual number, it has nothing to say about Europe's carbon footprint and hence carbon consumption.

An efficient overall carbon target aimed at global climate change should address these questions. Once set, there is no obvious reason why the policy instruments should not be defined as the most efficient. This means a carbon price, and the noticeable feature of the EU's current and proposed approaches is that it has multiple explicit and implicit carbon prices. The EU ETS provides one price – currently well below € 10, and hence for all practical purposes it is irrelevant for the determination of either the coal-gas trade-off,

(1) Helm, D.R. (2013), "The carbon crunch: how we're getting climate change wrong—and how to fix it." London: Yale University Press.

or the future of low carbon generation. It merely makes lots of money for traders, protects incumbents, and gives political cover for the lack of effective actions.

The renewables carry another set of carbon prices – implicitly. Thus offshore wind has an implied carbon price of more than € 200 per tonne once the full cost has been taken into account (roughly the scale of the UK FiT subsidy and *before* any consideration of the network and intermittency impacts). New nuclear has a price three times the EU average wholesale price, and hence a big implied carbon tax too.

What would a credible carbon policy look like? It would contain the following three elements:

- a conditional carbon consumption target,
- a credible long term, stable and rising carbon price,
- an R&D policy focused on future renewables.

All three are noticeable by their absence. The result is that the EU makes no significant difference to reducing global emissions, its carbon prices have little impact, and it is missing out on the chance to develop next generation solar and a host of related technologies that might make a difference, as well as contribute to the growth of the EU's economy.

In failing to put these three elements in place, the EU's proposed climate change total package of 40-27-27 will not improve security, will damage competitiveness and makes electricity less affordable for retail customers particular those in fuel poverty. The 27-27 components are particularly unhelpful. The 40 overall production target hits the wrong element, but at least if the sole binding target, and if tied to a reformed EU ETS, would produce a carbon price to provide *some* incentives for de-carbonization. A carbon consumption target would be superior and with a border carbon price address some of the competitiveness issues. The practical details are beyond the scope of this paper. However contrary to a number of suggestions that such an approach would be unduly complex, it is important to bear in mind that it is a small number of energy intensive industries that account for the bulk of carbon trade, and that there are upstream and downstream options. Whilst all such measures are necessarily approximations, it is better to be roughly right than (as with production-based approaches) precisely wrong.

4. The EU Security Plan

The security of supply objectives are vague and general. There are claims that security is measured by total import dependency and hence the objective is to reduce this. But why would the EU want to reduce the share of oil that is imported given that production is so low? Reducing oil consumption does not reduce the share of oil that is imported.

Its economic impact depends mainly on its relative price, not the country of origin. There are no claims that imports as a share of the coal burn should be reduced, though many that coal should be less important in the total energy mix. On gas, it is argued that an objective is to reduce gas imports in total, and also to reduce gas imports from Russia. But again the best short-term policy to reduce gas imports from Russia, and generally, is to burn more coal, and hence the security objective turns out to be to reduce the gas burn regardless of source.

Oil, coal and gas imports are not the only interpretation of the objectives of security of supply. There are narrow measures, related to the electricity generation margins, the risks of power cuts, and the vulnerability of particular countries.

The second problem with the security objectives is that there is no percentage target. A general target is just that – and best regarded as a general aspiration. To be a credible objective it needs to be monitored and measured. A general aspiration does not meet this criterion. Security of supply needs to be defined. In doing this, the EU needs to recognize that there are trade-offs within the various components of security of supply and trade-offs between security of supply, climate change objectives and competitiveness and affordability. The budgets are not open ended – spending on Nabucco was clearly regarded as too much for the EU. Spare generation capacity remains a significant cost, as would strategic gas storage at the EU level. Interconnectors are also a claim on the EU and member states budgets. Finally, if Russian gas is cheaper than LNG, what is the trade-off between the extra security from LNG versus reliance on Russian supplies?

The EU security plan does not answer these objectives questions. Rather it seeks to suggest that the measures that the EU is already pursuing – the Internal Energy Market and the Climate Change Package – are the basis for implementing its vague objectives. In effect, these two policy packages have become objectives rather than instruments. In doing so, the EU ducks away from measures that really would make a difference.

There are three possible approaches the EU security plan could take as a response to the perceived and actual threat that Gazprom and Russia represent to the security of European gas supplies. These are: the Polish proposal for an energy union with a single buyer; the application of competition policy rules to Gazprom and the contracts European gas companies can enter into with Gazprom; and to directly invest in alternatives, and their associated mutual protection, pipelines and LNG facilities. The implied objective in the three cases would be to reduce Gazprom's market power, but not necessarily to reduce European import dependency either generally or in respect to Russia.

A pure central buyer would be the contracting agency for all Russian gas on behalf of the member states and the companies that seek to import Russian gas. It would have maximum market power, since Gazprom would either have to stop supplying Europe or agree terms. These might include: the right to resell gas; cost related pricing; and the prohibition of any price discrimination on grounds other than costs. The Russians would therefore face the prospect of the loss of considerable revenues and all this implies for a state 70% dependent for its national budget on oil and gas revenues if it failed to reach agreement. A partial central buyer for the eastern countries would have less impact, but nevertheless reduce the discrimination.

An alternative, which might reach a similar result, is to apply competition law to Gazprom. European competition law is based upon the two pillars of the prohibitions of the abuse of market power and discrimination. Arguably, Gazprom violates both. In addition, it leverages political and state power to influence outcomes in the market. If the same vigor was applied to Gazprom as was applied to Microsoft and now Google, then European companies would not be allowed to enter into the sorts of contracts they currently have with Gazprom. Banning resale would be illegal, as would the undue influence on reverse flows. Oil indexation might also come under pressure. The price discrimination in the market would be illegal too.

Mutual protection might also form part of a coherent EU energy security plan. This would include not just a requirement to come to the aid of any member state facing gas shortages, but would extend to gas storage and EU control of gas storage. An energy union would have at its disposal the availability of gas storage, the interconnectors to make sure it could reach the various parts of the EU, and the powers to direct its use in the event of a threat to security. There could be financial support (possibly through the EIB) for security enhancing investments, including LNG facilities and key interconnecting pipelines and strategic storage.

Guaranteeing sufficient electricity generation capacity to avoid power cuts and price spikes has been – and remains – overwhelmingly a national preoccupation. The Lisbon Treaty retains the choice of the energy mix to member states. Yet it is apparent that security of supply for electricity generation is a portfolio issue, and the portfolio effects are greater the more interconnections there is. A number of factors combine to make this much more a European issue.

The two prominent factors are: the coming of greater scope for the technologies of cabling and electricity transfers; and the problems of intermittency of supply from the growing current generation renewables. These augment the underlying advantages of interconnections between countries – that national energy policies and the interests of the incumbents have so far managed to limit the development of.

A European electricity grid has a great deal going for it as an economically efficient way of handling electricity supply, of helping to arbitrage the variance in prices across the EU, and to provide much greater security of supply. Interconnection adds portfolio benefits which reduce the total amount of capacity needed to meet a given electricity demand. It also greatly enhances security of supply – for both electricity and the gas side, where gas is the marginal fuel for electricity generation.

As security of supply problems increase with the intermittency and as old plant retires, the inadequacy of an energy-only market in wholesale electricity supply have become increasingly apparent. Some form of capacity mechanism and capacity payment will required as and when capacity margins tighten (sooner in some cases like the UK, and further out in excess capacity countries like Germany). There are obviously competitive advantages of having a common European approach to capacity market design. Yet this is precisely what is not happening, further fragmenting the markets. The result is that there is a direct trade-off between this dimension of security of supply and the competitiveness agenda.

5. Competitiveness and affordability

Whilst the EU has been pursuing its climate change and security objectives, the world around it has changed. In the energy markets, there have been two powerful developments. On the demand side, the commodity super cycle looks to be at an end as China's economic growth catch up starts to fade and normalization of economic growth in China is gradually reasserting itself after two decades of phenomenal expansion. On the supply side, the revolution in unconventional oil and gas has turned the US's energy supply position on its head, with the prospect that by 2020 it will require much less by way of imports and may even start to seriously export. This in turn displaces supplies in the global market in both oil and gas, and therefore puts downward pressure on prices. In 2014 the fall in commodity prices has gradually gathered pace.

There are two main effects on the EU. First, the gap between energy costs in the US and Europe has grown. Whilst it is true that the EU has deindustrialized to a significant degree over the last two decades, and now suffers from very low growth, the impacts at the margin on industrial location, competitiveness of existing industrial energy intensive users and consequently on jobs and growth are significant.

The second impact is to open up the gap between fossil fuels and current renewables. It is no longer credible to argue that the EU's current renewables are going to be cost competitive by 2020 given the ending of the commodity super cycle and the economic fundamentals, and it raises the costs of the various proposed 2030 targets significantly. The 2008 Climate Change Package was based upon the *assumption* that oil and gas prices would keep going up, and that there would be a significant EU and global carbon price. The reality is pointing in the opposite direction. The EU ETS price is currently around € 6, the oil price has fallen to below $80 a barrel, and during 2014 European gas prices at one stage halved. Coal prices keep on falling, and other commodities, like iron ore, point towards a much weaker general commodities market.

It is nonsense to pretend that the specific European climate change proposals will improve competitiveness. They will make little contribution to security of supply. Indeed their intermittency can make matters worse.

The competitiveness objective is, like the security and carbon objectives, poorly defined. There are no measures of relative price targets, and indeed very few instruments other than subsidies with which to deliver it. At any point in time most of the energy infrastructure is given, so the focus for policy instruments is on future rather than current competitiveness.

6. Where next for Europe

A repeat of the failures of the 2020-20-20 failures is not inevitable. The incoming Commission has inherited much of the baggage of the outgoing Commission, but it has real choices as to the path forward. With a single carbon target, the Commission will need a serious carbon price. The EU ETS does not currently provide this, nor under the various proposals to tinker with it, is it likely to be sufficient. A first call on the new Commission is therefore to work out how, given the EU ETS, to rectify this key policy instrument.

It would be sensible to include some conditionality into the overall carbon target. The “flexibility” element matters. If China has no cap until 2030 (it has suggested a cap after 2050), if India fails to adopt any target, Russia obstructs, Canada, Australia and Japan make little commitment, and Africa also stays outside, it is legitimate to consider whether a EU target would make any difference to global warming.

A carbon consumption target, and a carbon tax with border adjustments initially directed at the main energy intensive industries involved, makes unilateral action more plausible, given it ameliorates the competitiveness issues. In this case the objective is clearly set, the trade off with competitiveness is at least in part addressed, and the policy instrument is well aligned.

On security, there is no serious problem for coal or oil supplies and little need for additional measures. The real focus is on gas, and in a world of falling prices and abundant supplies, the issue is very much focused on Gazprom and Russia. Either an energy union as a single buyer or the rigorous application of competition policy on Gazprom would make a significance difference. With lots of alternative potential sources of supply, the obstacle is infrastructure not physical gas shortages. This infrastructure is the obvious policy instrument.

For security of electricity supply, the issue of generation margins in the presence of intermittent renewables has been largely a national concern. As margins tighten, there is a good case for capacity contracts. The various national designs limits competition and the new Commission should consider how these might be harmonized. The size of the portfolio requirement depends upon market size, and interconnections have a considerable role to play. Moving towards a European grid is a policy goal that should be given higher prominence.

But whilst the Commission grapples with these particular policies, the most important step it could take is to define the objectives properly. That would force political leaders to make choices, and it would be a game changer.

EUROPEAN ENERGY POLICY: DOGMA OR STRATEGY?

Marc Oliver Bettzüge[1]

Introduction

Between 1990 and 2007, European energy policy was mostly concerned with creating a large, integrated, and competitive energy market. Not by coincidence, this spirit of cooperation also inspired the European Union's original approach to the global negotiations on climate change, by agreeing on a joint objective ("bubble") with a heterogeneous burden sharing at the Kyoto conference, and by implementing the market-based European emission trading system (EU ETS), still the largest such scheme in the world.

Over the past decade, however, attention has shifted. At least since the 2007 council meeting which coined the threefold '20-20-20'-objectives, the energy policy of the European Union (EU) has been shaped by the belief in a "triune grail" of reducing CO_2-emissions, increasing the share of energy provided by so-called renewable energy sources, and decreasing the amount of energy consumed in the EU.

By now, these three dimensions, and the quantitative objectives set for them, seem to have acquired the status of a dogma in the European debate about energy policy. For national policymakers within the EU, the '20-20-20'-approach provided welcome legitimacy for increased political intervention into national energy markets, in particular in the electricity sector. While liberalisation and EU integration implied – and required – a reduced influence of national policymakers in the field of energy, the idealization of the '20-20-20'-dimensions have served as a justification for regulatory activity on the national level, most of which remains fully uncoordinated between the member states.

(1) Director of the Research Institute for Energy Economics at the University of Cologne. This paper was written in April 2015. A French translation is available on www.strategie.gouv.fr/publications/lunion-de-lenergie-0.

Moreover, measures to attain the three quantified objectives have been inconsistent, not only between member states but also between the measures themselves. In particular, the comprehensive nature of the EU emission trading system (ETS) does not seem to be well appreciated, as policymakers continue to introduce complementary measures on the European or national level, especially with respect to renewable energy sources and energy efficiency. Within the sectors comprised by the EU ETS, none of such measures can have any meaningful impact on the level of emissions.

Finally, conflicts with other political objectives, such as e.g. wealth creation, distributive equality, or geopolitical interests, are not actively managed. In line with this omission, global developments, e.g. in the world's fuel markets, in technology, in geopolitics, or in the global negotiations on climate change, have little or no impact on Europe's energy policy – as if, in energy terms, Europe were an island unconnected to the outside world – or, as if, in energy terms, Europe were able to dominate the world.

The shift in attention from driving integration to micro-managing specific desired outcomes based on dogma rather than on strategy has led to a confusing European energy policy over the past years. Slowly, but steadily, Europe is faced with the consequences of such an energy policy full of contradictions, inconsistencies, and neglect of developments in the rest of the world. Energy prices keep rising for European consumers, industrial investment activity remains low, the global efforts to curb greenhouse gas emissions remain largely unaffected by Europe's example, and the geopolitical fault lines around Europe become more and more visible.

So far, the answer of European policymakers largely is: more of the same inconsistent approach, particularly on the level of the individual member states. It is more than likely that such interventions make matters rather worse at least in the long-term, as they keep adding to an already inconsistent array of European and national policy interventions.

Against this background, this paper sets out by analysing the EU's energy situation from a strategic perspective. Abstracting away from the political capital invested into issues of energy efficiency and renewable energies, it concludes that an immediate investment need only exists with respect to certain parts of the transport infrastructure within the EU, power and gas. In contrast, both electricity generation and gas import infrastructure exhibit significant overcapacity, not least because of the continuing economic problems in some parts of the EU. Moreover, import prices of fuels have plummeted. Together, this would provide the EU with a breathing space to confine activist policies to the minimum and to rethink its approach to climate and energy policy.

With a view towards such a fundamental reappraisal, this paper will argue that unfettered European competition enabled by further integration and harmonization continues to be the single largest opportunity for the EU's energy policy. In this context, it will also be argued that significant benefits would accrue to the EU from reinvigorating the EU ETS while at the same time reducing the use of technology- specific and/or national policy instruments.

Unfortunately, both the Lisbon treaty and current political practice leave significant room for national policymakers to add to the inconsistency, rather than to reduce it. As there seems to be little chance for a general overhaul of the European framework in the foreseeable future, the paper points to the potentially beneficial impact of bilateral or regional initiatives for further integration.

On the geopolitical side, the paper argues that Europe largely has to be seen as a "price-taker" – in terms of global fuel prices, global prices for CO_2, or global cost of energy technologies, and it would be well-advised to make cost efficiency the key criterion for evaluating policy choices.

Moreover, no matter which policies it chooses, Europe will continue to be highly dependent on fuel imports. In order to remain at least somewhat cost competitive in the global arena it needs to procure these fuels from sources in the immediate neighbourhood. While generally being geographically well-positioned in the proximity of Russia, the Middle East, and North Africa, all of these regions exhibit significant risk from an EU perspective. Political country risk becomes an even more pressing issue if the respective transit countries such as Turkey, Syria, the Ukraine, or Belarus are included into the picture.

As both the global developments in the climate and energy domain and the geopolitical context for the EU are highly uncertain, maintaining or even increasing flexibility carry a significant option value for Europe. This paper will discuss the most important opportunities to reap such option value, notably improving the resilience of the EU's import and transport infrastructure and keeping all technologies and all potential transport routes available for Europe.

Furthermore, the paper deduces that the number of legally binding quantitative targets for the energy sector should be kept to a minimum. Therefore, a comprehensive EU climate and energy scorecard should comprise many more dimensions than the three dimensions selected by the Council in 2007. However, only the target for greenhouse gas emissions actually needs to be legally binding.

The paper is organized as follows. Section 1 will briefly discuss the major global developments in the field of climate and energy and their impact on the EU. Section 2 then discusses four key structural challenges for the EU's energy policy. Given this background, section 3 critically reviews European energy policy from 2009 to the European Council decisions in autumn 2014. Section 4 will argue that two alleged "silver bullets" (investing into renewable energy sources and energy efficiency) are not as useful a short-cut to meeting Europe's energy challenges as public perception has it. Turning to opportunities, the paper then explores the potential upside from improving European competition and enhancing the EU ETS in section 5. Section 6 discusses the issue of market organization with a particular focus on the concern that the government should step in to replace long- term markets for hedging investment risk in electricity generation. Section 7 looks more closely at the challenge of increased import dependency and potential political action to counter it. Finally, the paper concludes with an overall appraisal of the priorities for a European energy strategy adapted to the existing challenges.

1. Global developments and the EU

Global energy markets have been characterised by several major trends since the global economic crisis in 2008:[1] continued growth in energy consumption (+1,264 million toe, or +2.4% p.a.), happening mostly in non-OECD countries; unabated growth in the consumption of coal (+564 million toe annual consumption, or +3.2% p.a.), almost entirely driven by China (+556 million toe, or +7.0% p.a.); a significant increase in U.S. gas production (+106 million toe, or +3.8% p.a.), associated with an implosion of U.S. gas prices (from 8.85 USD per million Btu to 3.71 USD per million Btu); a strong reduction of North American coal consumption (-115 million toe, or -4.2% p.a.); and the impressive increase of consumption of energy taken from non-hydro renewable energy sources (+17.6% p.a.), although still at a very low absolute level (279 million toe in 2013, or 2.1% of total primary energy consumption). Most surprisingly, the astonishing expansion of U.S. oil production (+144 million toe, or +8.1% p.a.) has led to upheaval in the global oil market, sending the oil price down to an average of some 53 USD per barrel of WTI.

During the same period, primary energy consumption in the EU has dropped by 118 million toe from 2008 to 2013 (-1.4% p.a.) mostly because of the on-going economic problems in the EU. Thus, the EU had a share of 13% in global primary energy consumption in 2013 (1,676 million toe), down from almost 16% in 2008. Energy taken from non-hydro renewable resources had a share of 6.6% of total primary energy consumption in the EU in 2013. While this represents a higher share than on a global level, fossil fuels still dominate the EU energy mix as everywhere else, with 77% of the total, with oil making up almost half of this share.[2]

Between 2008 and 2013, EU oil production has declined by almost half (-37 million toe, or -8.4% p.a.), EU gas production has gone down by roughly a third (-40 million toe, or -5.2% p.a.), and EU coal production has decreased by a bit more than 10% (-21 million toe). In addition, mostly due to the nuclear phase out in Germany, the civil use of

(1) All numbers derived from BP Statistical Review (2014).
(2) All numbers in this paragraph derived from BP Statistical Review (2014).

nuclear energy has decreased in the EU by about 10% (-14 million toe). In contrast, the use of energy from non-hydro renewable energy sources has doubled (+58 million toe), in particular in Germany, Italy, Spain, and the United Kingdom. This substantial capacity expansion was fuelled by generous promotion schemes financed by EU electricity consumers. Thus, the – rather costly – increase in indigenous renewable energy capacities compensates only half of the decline in the other indigenous energy carriers.[1] At the same time, the share of the EU in the global production of non-hydro renewable electricity has declined from 43% (2008) to 40% (2013). More significantly, the EU share in global new installations of wind power plants has decreased from 71% (2004) to 32% (2013)[2], and in photovoltaic capacity from 85% (2009) to 41% (2013)[3].

From a geopolitical perspective, the most important aspects of these developments are the dramatic reversal of the fortunes of the U.S. – re-industrialisation, turning from an importer of energy to an exporter – and the fact that OPEC seems to be no longer able to support the price of oil at above 100 USD per barrel, in spite of significant turmoil and instability in the Middle East and North Africa.

For the EU, both these effects put up some question marks, as its high dependence on a stable oil market is currently safeguarded mostly by U.S. military power projected into the Mediterranean and the Middle East. Also, the re-industrialisation of the U.S. might threaten the remaining industrial base in Europe given their low gas and electricity prices for industrial customers. Critical exposure of the EU to global developments has therefore significantly increased over the past few years, not mentioning the recent emergence of serious conflict with Russia, the main source for oil, gas, and coal imports into Europe. Also, a unilateral emission mitigation strategy becomes relatively more expensive, since the price of the fossil alternative has dropped for everyone not (as much) engaged in mitigation.

As a result of the major global trends, global emissions of carbon dioxide have continued to increase by 3,479 million tons from 2008 to 2013 (+2.1% p.a.), the five- year-increase on a global level thus being in the same order of magnitude as the total emissions of carbon dioxide within the EU (2013: 3,913 million tons).[4] Over the same time period, emissions in the EU have been reduced by 495 million tons (-2.3% p.a.), mostly due to the decrease in energy consumption, but partially also reflecting a slight reduction in the carbon intensity of the EU's energy system. Thus, assuming the absence of any compensatory effects, the EU's reduction of emissions would have slowed down the

(1) All numbers in this paragraph derived from BP Statistical Review (2014).
(2) Global Wind Energy Council (GWEC), Global Wind Report (2012, 2013); EU COM (2014), Eurostat – Energy Database.
(3) European Photovoltaic Industry Association (EPIA). Global Market Report (2013) and Outlook for PV (2014-2018); EU COM (2014), Eurostat – Energy Database.
(4) Recent data by the IEA and the Global Carbon Project indicate that 2014 has seen some progress in the decoupling of global economic growth and CO_2 emissions.

global increase by 0.3 percentage points (from a hypothetical growth rate of 2.4% p.a. to the actual growth rate of 2.1%). The EU's share in global emissions of carbon dioxide has consequently dropped from 14% (2008) to 11% (2013), down from a level of 18% at the time when the Kyoto-Protocol was signed. Thus, the leverage for the EU in global climate negotiations has been significantly reduced over the past one and a half decade.

Partially due to China, and partially due to the growth of decentralised PV- equipment in rural areas, the share of the EU in the global market for renewable energy capacities will continue to shrink, thus reducing the potential impact EU policies to promote further deployment of these technologies in Europe can have on their technological development on the global scale.

Going forward, most scenarios expect a continuation of the major trends listed above, however with some interesting variations. In particular, China actively tries to reduce the enormous growth rate of coal consumption by shifting the energy mix towards other energy carriers such as gas, nuclear, and renewables, thus reducing the upward pressure on global CO_2 emissions.

From a current perspective, one would identify two major – and closely related – uncertainties for the global energy market: on the one hand, the development of demand, in particular from China but also from the global economy at large; and on the other hand the political (in-)stability of the Arab world.

Apart from this, most observers do not expect a significant break-through in the global negotiations on a binding international agreement to mitigate greenhouse gas emissions. However, both of the two largest emitters, China and the U.S., find reducing their own greenhouse gas footprint a less frightening prospect than a couple of years ago, albeit for different reasons. This means that even without a binding treaty, unilateral decarbonisation efforts might significantly increase across the globe over the next couple of years.

Thus, the EU seems to have a relatively small, and declining, potential direct influence over global developments in the energy domain – politically, economically, and technologically. And the exposure of the EU to the risks in these markets will most likely increase, most importantly with respect to the security of oil and gas imports and to the development of its industrial base.

2. Europe's key challenges in the energy sector

Europe faces at least five key challenges in defining a coherent and successful energy policy: a structural cost disadvantage relative to other world regions; geopolitical issues of import dependency; defining an effective contribution to the global fight against climate change; the challenge how to optimally organise the European energy market; and Europe's governance challenge with respect to formulating energy policy.

To start with, Europe does not enjoy the benefit of large, and cheap, energy domestic sources relative to the size of her economy. The resulting cost disadvantage to other world regions, notably North America, is most prominent in natural gas, where transportation costs are substantial relative to its production cost. Indigenous natural gas can be produced competitively but with limited remaining potential (conventional). While there is some more potential for non-conventional gas production in Europe (assuming social acceptance issues can be mitigated), production cost are expected to be higher than in North America.

However, given Europe's geographic location in the proximity of many important gas producing countries, notably Norway. Russia, and the Middle East, Europe currently still enjoys a cost advantage in natural gas relative, e.g., to East Asia, as long as these sources remain accessible for Europe. Without such access, the EU's cost position would deteriorate further.

The increased use of renewable energy sources is unlikely to alter the cost disadvantage to Europe's favour. In principle, Europe has, at its periphery, some wind and solar sites which are more or less competitive to the best renewable sites globally, and which are also meteorologically sufficiently diversified in order to provide capacity without too much need for expensive storage. However, in order to benefit from these high-quality sites Europe would have to coordinate its national energy policies and to significantly expand its grid infrastructure. Both conditions seem to be very challenging. Hence, Europe will likely continue to locate its renewable investments at inefficient and meteorologically homogeneous sites, thus adding to the cost burden of the European consumer relative to other world regions.

Moreover, compared e.g. to good locations in the U.S. or in Australia due to more geography with good conditions plus a much lower population density (Europe: 116 persons per square kilometre, U.S.: 33; Australia: 3), the potential area available at globally competitive natural conditions is much more restricted in Europe.

Taking everything together, therefore, Europe certainly does not enjoy a cost advantage in the field of energy over other world regions, rather the contrary. Given these structural disadvantages, cost efficiency[1] in the provision of energy is of utmost importance.[2] In particular, any additional objective, like e.g. reducing import dependency or reducing

(1) Cost efficiency is a concept which is very different from the concepts of energy efficiency (measured by changes in the ratio of GDP over energy demand) or even absolute demand reduction. Both of these figures are results of market forces, resulting partly from the cost disadvantages. Cf. section 4.
(2) Note that this is statement on the level of the economy, not on the level of specific producer or consumer groups.

emissions of carbon dioxide, should be pursued with mechanisms that are selected with cost efficiency as the main criterion.

As a second key challenge, Europe as a heavy importer of energy is exposed to potential supply interruptions driven by political actors. Also, it leads to a permanent transfer of economic rents into exporting countries whose governments already are, or could potentially turn, hostile to the European Union.

Geopolitically, the challenge mostly concerns Russia and the Middle East, and to some extent North Africa. It is relevant for oil and gas, but not for coal. Economically, the challenge mostly concerns securing competitive gas prices. As Russia, the Middle East, and North Africa could potentially be long-term providers of substantial gas volumes at rather low cost, these issues mostly merge into one.

However, obviously, there is an inherent conflict to be solved: independence of Russia, North Africa, and the Middle East, which seems politically attractive to many in the political arena, simultaneously means depriving Europe from sources of competitive energy. And there is no realistic alternative unless at much higher cost (renewables, nuclear; significant increases in technical energy efficiency) or requiring expensive additional conversion technologies to replace oil and, in particular, gas in all of their uses (coal, renewables, nuclear). Thus, Europe cannot eat the cake and have it.

Moreover, more critical than dependence on producing countries or regions might be dependence on certain transit countries or regions, such as e.g. the Ukraine, Turkey, or Syria. Security of energy routes, thus, is at least equally important as security of supply. Direct links between producing countries and the EU eliminate any transit risk, and they should therefore sit high on European policymakers' security agenda.

In such a situation, "realpolitik" would imply active engagement with Russia and North Africa rather than the attempt to avoid using their energy. Neighbourhood stabilization is a strategic "must" for the EU.

One of the main challenges in this context certainly is posed by the unsatisfactory governance structures of most of the countries concerned – by themselves at least partly a direct result of the enormous size of the resource rents. Partnership with the main providers of our energy resources, however, is a much broader political project than just "securing energy for Europe", and it cannot be solved with the means of energy policy by itself.

A third challenge arises from the threat of global climate change which European policymakers and their electorates take very seriously. Also, they give high priority to mitigation, i.e. to the objective of reducing of greenhouse gas emissions. However, mitigation can only be effective at the global level, i.e. if mitigation efforts lead to a decrease of global greenhouse gas emissions. Due to the nature of the atmosphere there is no physically meaningful concept of "regional emissions".

From a mitigation perspective, thus, a reduction of carbon dioxide emissions on EU territory is desirable if and only if it leads to a reduction of emissions on the global scale, either directly for lack of compensatory effects (leakage) or indirectly by promoting the global adoption of emission-mitigating policies.[1]

A unilateral mitigation policy by a single world region, ceteris paribus, encourages both a shift of production to places where CO_2-emissions have a lower (or no) price, and a reduction of the global prices of fossil fuels – with corresponding dynamic reactions both by energy consumers and suppliers. While there is significant uncertainty about the exact size of these effects, it is safe to assume that such compensation does take place, thus reducing the impact of the unilateral mitigation effort on global emissions. In fact, it cannot be excluded that these effects might actually fully compensate for the mitigation effort – which would mean that the mitigating region is incurring cost without a tangible benefit for the global effort against climate change.

The key challenge on the global scale is to devise an institutional setting which can credibly administer the monitoring and the sanctioning of emission pledges. Any such agreement would require, among other aspects, significant transfer payments between world regions, especially from the highly industrialised countries to developing countries. Europe does not seem ready to support such a transfer scheme on the scale needed to make a difference in the global negotiations. Rather, Europe puts all his hopes on continued unilateral mitigation of emissions.[2]

Remedy for some – not all – the problems from a unilateral mitigation strategy could come from so-called border-tax-adjustments, i.e. the taxing of imported goods from places with lower CO_2-prices at the EU border, and according to the CO_2-content of the product. If properly implemented, such border-tax-adjustments could, in principle, reduce the leakage issue as it would make EU citizens pay for the CO_2 content of their entire consumption, and not just for that part which is based on fossil energy consumed inside

(1) Two major leakage channels need to be taken into account: changes in the trade patterns (competitiveness channel), and changes in the global supply-demand-balance for fossil fuels (international energy price channel).

(2) A unilateral mitigation commitment by the industrialised nations has in deed helped to arrive at the Kyoto agreement in 1997. However, ever since, the EU's pledges did not contribute much to promote a binding agreement on a global scale. There might be a variety of reasons for this failure. Maybe, with a shrinking share in the global emissions, the EU's efforts are becoming less and less relevant from the point of view of the other negotiating parties. Or, since the pledges are well known, they are already "priced-in"; leaving the EU limited leeway for applying pressure within the negotiations. Or, those countries with emerging economies accuse the EU – not without substance – that the EU's citizen's carbon dioxide footprint should be measured by the carbon dioxide emissions generated by its overall consumption patterns (accounting for imports and exports), rather than by the emissions on its territory.

the EU. However, border-tax-adjustments – even if properly done – would not be able to fully absorb all the compensatory effects from leakage.[1] Moreover, they would unilaterally make European consumers worse off, and their implementation would most likely create conflicts within the world trade framework.

In summary, the case for unilateral action for mitigating the EU's CO_2 emissions – which currently is the main driver for the EU's energy policy – is much less compelling as public perception has it.

The fourth challenge relates to the way the energy market is organised, especially in the grid-bound electricity and gas sectors. In general, competitive markets have proved to be the most efficient coordination mechanism for an advanced and complex modern economy.[2] In energy, notably in electricity, many societies have been, and are, reluctant to introduce true competition.[3]

In Continental Europe, e.g., most countries still had regulated monopolies in the electricity sector until 1998. Reasons for this approach included motives of national political control over the electricity sector and the large size of individual power plant investments relative to the size of the (national) market. Also, in the phase of large growth rates in electricity demand after World War II, policymakers gave high priority to steady investment pathways in order to avoid power crunches on the national or sub-national level. The inefficiency of the sector was of little concern to policymakers, given the small share of electricity in consumers' average budgets. And large industrial consumers had no reason to complain because they were typically cross-subsidised by the household sector, especially since central control allowed for a high level of technical supply security. The enormous extent of the loss in efficiency entailed by the monopolies only became evident after liberalization started in 1998.

Today, European policymakers still have the inclination to trade-off efficiency for state-control, at least in the energy sector. And, as e.g. the German renewable levy shows, European consumers still seem rather patient in accepting the additional burden, and the redistribution of rents towards industry, imposed on them.

(1) In particular with respect to the fuel-price-channel.
(2) In essence, their specific quality results from combining competitive prices with the individual freedom of choice. Individual decision makers take prices as the basis for their decisions on investment and demand or supply; prices adjust such as to balance supply and demand at any moment in time. Because of more detailed information being processed, this way of organizing coordination between economic agents is much more efficient as a central planning approach. Moreover, external effects can be remedied by appropriate mechanisms which include the relevant additional information into the individual decision (e.g. through taxes).
(3) The often-heard justification that energy is an essential good does not seem convincing, because modern states are quite happy e.g. with a competitive market for food.

However, while monopolistic “planification” was a consistent form of market organization, today’s hybrid system of European competition and national “planification” is not. In fact, reverting back into “planification” seems to be neither desirable nor possible.

Not desirable because some fundamental changes imply that the former advantages of “national monopolies” have been greatly reduced. Firstly, European integration and liberalization have significantly increased the size of the relevant market from national at least to regional level.[1] Secondly, the set of potential technology options has multiplied. Smaller scale generation units e.g. are available at competitive cost to the energy consumer. Also, the number of agents in the energy sector has exploded, as liberalization has allowed indiscriminate market access. Preferences become more individual, business models more fragmented, and cheap ICT provides for an avalanche of relevant data. As a result, long-term energy planning will less and less be able to manage an increasingly complex energy system and its interdependencies. Thus, the relative cost of “planification” has significantly increased and competition is much better suited to efficiently coordinate the decision-making of the millions of decision-makers in the industry, especially on the demand side. And fourthly, European electricity demand is stagnant at best, and it is very unlikely to revert back to a strong growth path in the near future.

Not possible, because Europe has already opted to integrate its national energy markets. If the member states were to return to consistent “monopolistic planification” regimes, they would either have to close internal borders again (with high efficiency losses and big political damage to the European project). Else, they would have to coordinate the “planification” on a supranational, i.e. European, level, for which the EU totally lacks the appropriate institutions. The continued attempt by policymakers and regulators to “micro-manage” agents’ decisions thus cannot be organized with an appropriate geographical scope[2]. Moreover, in the current institutional setting policymakers cannot comprehensively control the market – rather, certain parts of the market are managed, adding further politically induced volatility to the remaining parts of the market; and it cannot appropriately account for the complexity and the many feedback effects.

In summary, a competitive EU internal market will prove to be the superior approach, and it is the only setting consistent with current European institutions. Europe needs to be careful not to overestimate the degree as to which policy can actively and beneficially

(1) This is particularly true for Scandinavia and the Continent. The UK is an exception because physical integration still is limited (in electricity). Similarly, Iberia needs to be looked at differently, however, physical interconnection is about to be significantly improved.
(2) Notable exceptions, for lack of interconnection, are Iberia and the British Isles. Also, due to their Western location these regions are much less exposed to the security of supply concerns troubling the rest of Continental Europe.

control the developments in the energy sector.[1] However, the challenge for Europe consists in making this approach to market organisation compatible with the political dynamics in the member states.

The fifth, and final, challenge therefore concerns the complex energy governance within the European Union. The most important opportunities for Europe – especially in the context of improving cost efficiency – generally arise from synergies between the 28 member states, and from embracing competition, both within and between the member states.[2]

Some important progress has in fact been made towards more integrated markets structures both in electricity (e.g. market coupling, or the new common grid codes) and in gas (e.g. the improvement of West-East-interconnection after the 2009 Ukraine-crisis, or the development of more liquid wholesale markets in Western Continental Europe).

However, many challenges remain. The persistent difficulties in achieving a fully liberalised EU internal energy market can partly be explained by a lack of infrastructure connecting some of the member states, leading to physical bottlenecks and thus a lack of cross-border competition.

Most importantly, however, the internal market's woes are due to a double inconsistency in the EU's approach towards organising this market, which is embodied in Article 194 of the Lisbon Treaty: The Treaty combines the quest for an integrated internal market with a political prerogative to shape the energy mix. In a market, however, technology choice would be determined endogenously by competition. Moreover, the Treaty allocates this political prerogative to the member states (rather than to the European level), thus creating room for substantial distortions to the functioning of the internal market.

On this basis, the individual member states have reclaimed significant leeway for individual interventions into the market, thus reducing the scope for unfettered and Europe-wide competition. Recent decisions by the EU Commission to apply a rather loose interpretation of the state-aid guidelines to the electricity sector underline the tendency towards renationalisation of electricity and gas markets. As a result of these 28+1 interventionist approaches to market organisation, market participants are increasingly confused about

(1) Both on the European and the national level there is a history of using long-term scenarios to derive objectives and to legitimize certain measures. By necessity, such scenarios are based on today's knowledge, and cannot encompass developments about which we will only learn in the future. The more complex the environment and the set of options, the more mistaken it is to apply central planning based on such scenarios.

(2) Potential synergies become most obvious when looking at wind and solar electricity generation, where cooperation between the member states would leverage both cost advantages from optimal siting and diversification effects from spreading the RES deployment over different meteorological conditions. Moreover, completing the large single European market still offers significant upside for further efficiency improvements by harnessing the forces of an increased intra-European competition.

the direction the EU internal market (including the EU ETS) is going to take. Such confusion certainly is not helpful for innovation and investment activities of the sector.

Unfortunately, therefore, Europe's energy challenges are rendered even more difficult by an increasingly complex and heterogeneous energy governance, failing to effectively coordinate actions by the member states. And actions by member states continue to be driven by internal member states' politics rather than the EU's common interest.

3. From 20-20-20 to 40-27-27(30) and the "Energy Union"

The 2009 climate and energy package was mainly meant to implement the so-called 20-20-20 targets set by the European council in March 2007.[1] These targets comprise the joint objectives of reducing the EU's emissions of carbon dioxide by 20% (relative to 1990), of reducing the EU's consumption of energy by 20% (relative to business-as-usual projections)[2], and of increasing the share of renewable energy in final energy consumption to 20%, all of these targets to be met by 2020.

As of today, it seems likely that the EU will reach the targets on carbon dioxide and on renewable energy sources. However, the EU will most likely fail to meet the reduction target for energy demand (in spite of a weak economy). The fact that two targets out of three will be reached is interpreted by many policymakers as a sign of success of the current approach towards energy policy. However, it is more than questionable whether the three dimensions of the 20-20-20-targets render an adequate and complete picture of the health of the European energy sector and of the EU's contribution to the global efforts against climate change. For example, the 20-20-20-targets are fully silent on dimensions relevant to the competitiveness of the European energy sector, or the impacts of energy policy on the competitiveness of European energy consumers, or to issues of security of supply.

The political rhetoric crafted around the adoption of the 20-20-20-targets has suggested that the dimensions chosen – and in particular a generous support for the built-up of renewable capacities – could offer a "magic formula" addressing the missing dimensions as well. In particular, it was suggested that the additional cost of this strategy were compensated by corresponding gains in terms of job creation and increased security supply, i.e. that the well-known trade-offs between differing policy objectives had miraculously disappeared. Theory and empirical evidence of the past five years show, however, that these trade-offs do in fact still exist.[3]

(1) The package also contained a qualitative pledge to continued progress towards a functioning internal market.
(2) Cf. Directive 2012/27/EU.
(3) Cf. Section 4 for a more detailed discussion.

Moreover, the adoption of the 20-20-20-targets as main driver for EU energy policy was justified by three key assumptions: that unilateral EU commitments on further greenhouse gas mitigation would positively support a global agreement at the Copenhagen summit in 2009; that global prices for fossil fuels would continue to increase, constituting a growing "risk of supply failure" in global energy markets;[1] and that "boosting investment, in particular in energy efficiency and renewable energy should create jobs, promoting innovation and the knowledge-based economy in the EU".[2] In hindsight, none of these assumptions – which were contested by many observers already at the time – turned out to be correct.

Firstly, the Copenhagen summit clearly displayed the irrelevance of unilateral EU commitments for the global negotiations, and the EU's insistence on the importance of binding reduction targets has not supported – to put it mildly – a more flexible exploration of potential points of agreement.

Secondly, fossil fuel prices, as described above, have not continued to increase, quite to the contrary, especially in North America, they have rather contracted.

And, thirdly, the development of overall employment and the competitiveness of the EU has been disappointing since 2008. While, unsurprisingly, there have been some positive developments in the sectors receiving subsidies or state guarantees, especially in the renewable energy value chain, these effects largely have proved to be transitory and dependent on continued subsidies, thus not self-sustaining. Moreover, while policymakers like to dwell on the gross effect in individual sectors, the relevant figure to look at is the net effect on jobs in the overall economy, including the negative effects across all sectors caused by the increase in energy prices due to the higher taxes or levies which fund the subsidies.

Therefore, it turns out that the three dimensions chosen by policymakers in the 20-20-20-targets have not served their intended purpose well. In particular, the failure of the 20-20-20-targets to slow down the global increase of CO_2-emissions, and the significant cost they have imposed on European economies, could have led European policymakers to fundamentally reconsider the "climate"-part of their "climate and energy policies".

As the EU Council in October 2014 has shown, however, there currently is only limited impetus across the EU to openly engage in such a fundamental reappraisal: basically, the Council agreed to continue on the chosen path, adopting a 40-27-27(30)-target.[3] Public debate before and after the Council's decision has mostly focussed on the order of magnitude of the three figures replacing 20-20-20, and on the degree to which these targets will be binding for the member states. The general logic, however, of the

(1) Cf. Com (2007) 1, 1.2.
(2) Cf. Com (2007) 1, 1.4.
(3) Cf. EUCO 169/14.

triple-objective has not been put into question, and there has been only little critical reflection of the actual merits and achievements of its 2007/09-strategy.

In summary, thus, EU energy policy has been, and still is, shaped by an incomplete, and partially inconsistent set of quantitative objectives for particular features of the overall energy system. Moreover, these latter objectives have been, and still are, derived from a rather shallow, and partly even erroneous, analysis of the global "boundary conditions" for European climate and energy policy.

The recent proposals by the Commission regarding a so-called "Energy Union" address some of these concerns.[1] In particular, they give stronger emphasis on grid interconnection and market integration than previous documents. Also, they explicitly discuss energy security as a second objective next to the ecological objectives captured by 20-20-20. However, cost efficiency as a third important objective does not get the attention it would deserve. Neither do the various trade-off between these objectives and potential ways to manage them. Moreover, the suggestions for the "Energy Union" are still largely based on the idea of state-administered change in the energy sector, especially through active technology choice, both with respect to investment and R&D.

4. Overconfidence in two "silver bullets"

Overall, thus, energy policy constitutes a complex challenge for European policymakers, involving in particular an uncertain global environment, conflicting political objectives, and an incomplete and inconsistent European energy governance. Shunning this complexity, ever since adopting the 20-20-20-goals two measures are being put forward which are claimed to cut across all trade-offs: the reduction of energy demand in Europe, and the expansion of the use of renewable energy sources. These two measures are often described, and they are politically treated, as if they were no-regret options because they would simultaneously serve to decrease CO_2-emissions and reduce Europe's import dependency.

However, compelling as it may sound, the logic underpinning such a sweeping and one-sided claim are hard to grasp. In fact, it ignores relevant trade-offs, especially in terms of economic cost, and feed-back effects.

To start with, consuming energy delivers a service. Thus, ceteris paribus, consuming less energy means reducing services and thus reducing wealth. E.g., roughly a third of the EU's energy consumption is devoted to transport. Obviously, the EU could theoretically refrain from using this amount of energy by stopping to move people and goods. But this would tremendously reduce our citizen's welfare. The same is true in general, and has been a shaping force for history, especially in the past 200 years: energy use is a key

(1) Cf. Com (2015) 80.

driver for wealth (and political might), i.e. in economic terms energy must strictly be considered a “good” and not a “bad”.[1] Thus, an absolute reduction in energy demand cannot be a reasonable political objective by itself.

But even a relative reduction in energy demand, often labelled as an increase in “energy efficiency”, is not an unconstrained desideratum. Rather, the concept of “energy efficiency”, i.e. the idea to receive the same amount of service (on the level of an individual piece of equipment) or wealth (on the level of the economy) with less input of energy, needs to be applied with care.

On the level of the economy, “energy efficiency” is typically measured as the rate of change in the ratio between the economic product (e.g. GDP) and primary energy consumption. Obviously, both the numerator and the denominator are the aggregate result of a plethora of individual decisions throughout the economy, including those which affect the technical efficiency of the capital stock, but also including structural effects arising from trade relationships with other countries. Therefore, setting a normative target for the relative improvement in this “macroeconomic energy efficiency” can hardly be justified in purely (environmental) economic terms. It simply is unclear whether a situation with a higher such rate is socially more desirable compared to a situation with a lower rate. Thus, “macroeconomic energy efficiency” can neither be a goal nor a mean towards a goal. In essence, it is just a statistical observation of a complex aggregate effect.

On the level of an individual piece of equipment, “energy efficiency” takes on a different meaning. Typically, it refers to relative improvements of technical input/output-ratios. Such improvements of the capital stock are, in fact, an important driver of wealth creation. In the aggregate, it is well-known from the literature on the rebound-effect that increases in “technical energy efficiency” are often associated with increases in energy demand.

Investments into improving the technical efficiency of the capital stock need to earn a return. Hence, there always is an economic limit; not every measure which improves the technical energy efficiency is economically reasonable. In essence, the decision boils down to comparing the present value of the savings in energy spent with the investment cost for the new, or improved, equipment. Thus, price expectations for energy prices play a crucial role here. And unexpected future price developments have a significant influence on the return earned on such an investment, either positive if prices turn out to be higher than previously expected or negative the other way round. Thus, investments into energy efficiency are not reasonable per se, but only if their expected return exceeds the risk-adjusted rate of return which could be earned with other types of investment.

Even without policymakers meddling, the economy will invest into such measures – up to a point. By trying to increase technical energy efficiency above the level provided by the

(1) For a very long-turn perspective on this issue cf. e.g. Morris (2010).

market itself, policymakers therefore risk directing the European economy into investments which will deliver a lower risk-adjusted return than potential alternatives, thus, making Europe poorer off in the long-run.[1] In particular, policymakers cannot claim to better understand the price dynamics in the global fuel markets than the market. Recent experience rather points to the opposite conclusion.

The only way to argue for a role for policy in improving “technical energy efficiency” above the level provided by the market, thus, is market failure. Market failure might, in deed, be claimed in certain areas of household energy demand, e.g. for lack of transparency or in the context of the owner-tenant-conflict about passing on the cost of efficiency improvements. But these are specific issues which certainly do not warrant a general political imperative for boosting technical energy efficiency but specific interventions to fix such specific market failures.

Exactly the same argument can be made for investments into renewable energy sources. In fact, such investments can be seen as one specific type of energy efficiency investments.[2] Again, the market would choose to invest into these type of efficiency improvements according to price (plus tax) expectations, and in comparison to other investment opportunities.

And what about environmental externalities? Environmental externalities of energy use should be, and mostly already are, internalised by corresponding taxes or other forms of regulation (e.g. EU ETS, emission standards etc.). If this is properly done, no additional action on energy efficiency is required. If it is not properly done, the internalisation should be corrected; measures on energy efficiency (or the endorsement of any other specific technology) are not a useful substitute for such corrections.[3]

From a carbon dioxide-perspective, both of the measures proposed (renewable energies and reduced energy demand) constitute specific mitigation technologies – among a very long list of other options to the same effect. Hence, they are inefficient within the energy

---

(1) Sometimes it is argued that Europe is facing an investment shortfall which should be remedied by politically administered investment schemes. Even if this were true, it is highly unlikely that investments into “energy efficiency” or renewable energy sources would be the optimal choice for such public investment. There are other types of investment, such as e.g. roads, digital infrastructure, or research and education, which would most likely provide a much higher benefit to society because of the obvious network effects associated with them.
(2) By replacing fossil fuels, they increase the technical efficiency of the energy system measured against primary fossil energy demand – at the plant level for the case of co-firing, at the system level for the case of 100%-renewable installations.
(3) Whether or not Europe today is overinvested or underinvested in terms of technical energy efficiency crucially hinges on the question whether the full array of explicit and implicit energy taxes appropriately reflects the external cost of energy use. The answer to this question is far from obvious, but beyond the scope of this paper.

sector regulated by the EU ETS, reducing the cost of the certificates (not the amount of emissions) at too high a cost.

For example, the implicit mitigation cost of subsidised renewable energy sources in Germany lie above 40 € per ton of carbon-dioxide for wind on-shore, and far above 100 € per ton of carbon dioxide for wind off-shore or solar.[1] As the price for EU ETS certificates, which reflects the marginal cost of abatement in the EU ETS sector in Europe, is significantly lower, it is clear that the EU could achieve the same amount of emission-reduction much more cheaply than with the current policies. In particular, member states that want to unilaterally contribute to a further reduction of greenhouse gas emissions in Europe could simply buy up EU ETS certificates at the current market price.

Outside the EU ETS, the two alleged "silver bullets" might in deed contribute to reduced European CO_2 emissions. However, as usual, rebound effects need to be taken into account, and alternative measures have to be compared in terms of their cost and benefit. And in any case, they have an unclear impact on global CO_2 emissions due to potential leakage effects.

Thus, from a CO_2-perspective both energy demand and the share of renewable energy sources should be a result of choices by the actors in the economy based on reliable price (tax) signals for the cost of CO_2 rather than a politically predetermined quantity.

And what about the contribution to reducing Europe's import dependence? Well, the perception of a critical import dependency of Europe currently mostly concerns the share of Russian natural gas in the European energy mix. An increased share of renewable energy sources increases system dependence on gas-fired power plants. Contrast this with an alternative decarbonisation path that would arise from efficiency improvements in coal and lignite power stations rather than from forced investments into renewable energy sources. Computations consistently show that such a pathway would be cheaper, and it would at the same time serve much better to increase Europe's resilience against disruptions to its natural gas supply.

Moreover, a reduction of the EU's gas demand would not necessarily imply a reduction of the share of Russian pipeline gas in the European gas supply. Rather, based on fundamental cost structures it is LNG supplies to Europe which are likely to be the swing supply which would find alternative destinations first. Thus, with lower gas demand, the share of imported pipeline gas would probably increase rather than decrease. Therefore, in order to have the desired impact on the security of supply, LNG import terminals (and, by the same token, underground storage facilities within the EU) becoming redundant in such a course of events would need to be kept operational by some form of public

(1) Cf. e.g. EWI (2015).

subsidies. But then it is this subsidy which increases security of supply, not the decrease in energy demand.

A final claim in the context of "no regret" is the idea of "industrial network externalities". By forcing the entire economy to adopt "energy efficiency" or "renewable energies", the argument goes, spill-over effects occur in R&D, creating additional value for the economy. Theoretically, for an open economy such as Europe which will import a significant part of the equipment aimed at increasing energy efficiency or decarbonising power generation, this argument would need additional justification. Empirically, there is limited evidence that such spill-over effects can effectively be harnessed by policymakers. The experience of the Japanese economy over the past 30 years, for example, does not provide an encouraging example for the economic value of policies actively directed at increasing energy efficiency above the level provided by companies and consumers on their own. On top, it would need an argument why such spill-over effects are more relevant in the field of technical energy efficiency or renewable energies than in any other sector of the economy.

From this perspective it becomes clear that neither "technical energy efficiency" nor "renewable energies" are the silver bullets many policymakers claim they are. As any other investment opportunity, investments into technical energy efficiency or, even more specifically, into renewable energy sources have to be weighed against their cost. The optimal level of such investment is determined by the cost of the alternatives, including environmental or other external factors.

Two important implications stand out: Firstly, "more" of such investments is not necessarily "better", but there is a choice as to which, and a limit to how much, of such investments are reasonable. And, secondly, as in every other sector of the economy, there is no reason to believe that policymakers know better about the type and the level of this optimal investment than the individual actors in the economy.

Both investment choices therefore should be seen as the result of market forces, especially market prices[1], supported by an appropriate internalisation of external (environmental) effects rather than as an end by itself.

If policymakers thus continue to single out these two particular technological options as "no regret" or "silver bullets" it might be for other reasons than those they officially state. Instead, political motives might play a dominant role, in particular, the wish to please relevant national voter groups benefitting from such policies.

Some indicators do, in fact, point in this direction, notably the unwillingness of national policymakers to adopt EU-wide measures to implement these additional targets, instead insisting on national measures which allow them to control their distributional effects.

(1) Both absolutely and relatively to other world regions.

Also, policymakers typically do not use the official state budget to fund the measures derived from the second and the third of the 20-20-20- targets but rather special levies or regulation forced onto the energy consumers or energy suppliers.

5. Distortions and the role of the EU ETS

Because of the strategic position of Europe in the global energy arena "cost efficiency" is of particular significance to European policymakers. "Cost efficiency" typically requires absence of market distortions. The most relevant distortions in the European energy sector currently arise from non-neutrality of the state with respect to choice of technology or choice of location. Main issues are distorting taxes, levies, and subsidies, especially if they differ between EU member states. Apart from very heterogeneous tax systems across the EU member states, the two most important sources for such distortions are measures aimed at implementing the specific targets for energy efficiency and renewable energies discussed in the previous section. E.g., the RES surcharges levied on electric energy in Germany reduce the attractiveness of electricity relative to other energy carriers, and with respect to investments into demand flexibility, thus contradicting the overall visions of an energy world largely based on electricity generated by (intermittent) RES.

The EU internal market, in principle, should prevent such distortions from hampering intra-European competition. However, the current version of the European treaties and their recent application by the EU Commission indicate that member states still have significant leeway to create technology- or location-specific market conditions within their boundaries. Any reduction of these distortions would support the efficiency and competitiveness of the European energy sector.[1]

The EU emission trading system (EU ETS) is the prime example for a political intervention at the level of the EU 28 which is neutral with respect to technology and location. Within the sectors covered by the EU ETS, mitigation options compete across technologies and member states, leading to a cost efficient reduction of CO_2 emissions in Europe. Hence, as long as the EU maintains a mitigation commitment, the EU ETS deserves to be considered as the lead instrument for mitigation greenhouse gas emissions in the EU.[2]

(1) For a detailed discussion of the situation in the electricity sector cf. e.g. Bettzüge (2013).
(2) CO_2 taxes could, in principle, play an equivalent role. They would have certain advantages and disadvantages relative to EU ETS. None of these are critically in favour of taxes. In terms of implementation, however, the EU ETS is already established while the introduction of European CO_2 taxes would most likely face legal and political opposition by the member states. Furthermore externally, the EU ETS could provide a prime instrument to associate partnering countries e.g. in North-Africa and to facilitate transfer payments – which necessarily need to be part of any progress towards a global carbon agreement. Internationalisation of the European effort will be much harder to achieve with taxes rather than with the EU ETS.

The EU ETS' effectiveness could be greatly increased if additional action for promoting specific mitigation technologies, such as energy efficiency or renewable energies, were abolished or at least reduced. Relying on the EU ETS instead of technology-specific support mechanisms would, in particular, improve intertemporal efficiency. Currently, (Continental) Europe is faced with substantial overcapacity in the generation sector. Thus, encouraging investments into additional (renewable) generation capacity adds to the existing overcapacity. As capital cost matter, mitigation reduction could currently be achieved at much lower cost by shifting utilisation gradually towards more carbon efficient (existing) power stations. Based on CO_2-price signals market participants can already identify the optimal pathway for these adjustments. Hence, at present, renewable energy sources are not needed to achieve the target trajectory for the EU's CO_2 emissions.

Over the next one and a half decade, or so, however, the existing conventional fleet in Europe will be reduced due to end of lifetime. Under the EU ETS, replacement investments will then take the European CO_2-cap into account. Simulations consistently show that under the assumption of a strict European CO_2-cap, renewable energy investments would be entering the market anyway based on the price signals then sent by the EU ETS. Speeding up this process by government thus increases cost – both because of accelerated obsolescence of the existing fleet, and because the renewable investments undertaken in ten or fifteen years likely come at lower cost given the global technology learning curve.

Moreover, given the advantages of the system, the EU should even consider to extend its cap-and-trade-scheme from just one (politically convenient) sector to the heat and the transport sectors, instead of simultaneously inventing a plethora of specific (mostly national) interventions to mitigate emissions in these sectors. In this context, energy taxes, levies, and regulations should be carefully revised across all EU member states as to what extent they are contributing to the goal of cost efficient mitigation of carbon emissions, and then should be streamlined accordingly. In particular, it would be important to improve the intersection between the ETS sector and the Non-EU ETS sectors.

However, many observers including the EU Commission find the EU ETS to be flawed. The alleged problem is regularly described as "the CO_2 price being too low because of excess certificates from the past".

As for the first part of the sentence, such judgment typically means "too low" for a certain mitigation technology to be competitive, e.g. renewable energy or coal-to-gas switch. Hence, the argument masks technological non-neutrality. Moreover, a cap-and-trade scheme such as the EU ETS manages volumes, not prices. Hence, the statement would mean "the cap should be stricter" – but that has nothing to do with the EU ETS as a system but with the overall strategy of Europe towards global climate negotiations. Obviously, the EU is free to agree to a stricter unilateral target for the EU ETS sectors. And it could implement this stricter target either explicitly, by reducing the cap, or implicitly, by imposing a positive minimum price path for the certificates. But such measures would add to the EU ETS rather than correct an alleged failure.

The second part of the above statement, therefore, is more interesting. It concerns the intertemporal trading of CO_2-certificates, and it actually relates to the trading system as such. Policymakers (and the general public) generally think of emissions on a year-on-year basis, having a linear mitigation pathway in mind. The EU ETS, however, works in multi-annual trading periods, and it contains the option of banking certificates from one trading period into the next. Hence, market participants count on intertemporal liquidity of the certificates. Else, they would have to settle their positions within any given year, which would most likely induce CO_2 price signals with little meaning.[1] Thus, by construction, the EU ETS cannot serve to mitigate on a year-on-year basis but it can only cap the cumulative emissions over all trading periods which are connected via banking. Hence, whenever annual emissions undershoot the pre-defined trajectory, the EU ETS effectively lowers the restriction on the emissions in the subsequent years.

From a global perspective, this is not a problem. It does not matter whether Europe mitigates in 2015 or in 2018. From the point of view of the atmosphere, it is the cumulative emissions which count. Hence, from a mitigation perspective, the EU ETS set-up is perfectly fine. However, from a political perspective it is not: policymakers want to report ever decreasing absolute emissions back to their constituencies. Such continuous decreases, however, cannot be guaranteed by a mechanism like the intertemporal EU ETS.

This poses a dilemma: On the one hand policymakers are inclined to intervene if the intertemporal effects of the system run counter their intentions. Thus, latently, the system is always exposed to the risk of political ad-hoc intervention. On the other hand, symbolic values apart, intertemporal flexibility carries economic value. Next to the liquidity issue, intertemporal trade also serves on the macroeconomic side, reducing the CO_2 price in difficult economic conditions (such as now) and increasing it when the economy is booming.

Thus, an intertemporal restriction in the EU ETS such as the proposed Market Stability Reserve mechanism (MSR) is economically reasonable only if it improved upon this dilemma, i.e. if it increased policymakers' commitment not to intervene in case of market results they do not like, and if it did so at relatively little extra cost in terms of transparency and liquidity.

It is more than unclear, whether and how the current proposal by the Commission would improve upon the non-intervention commitment. The MSR would add an additional layer

(1) Cf. the experiences with the first trading period of the EU ETS (2005-2007) which did not allow banking into the second.

of (rather complex) regulation, which needs to be interpreted by market participants, and which – by introducing new concepts like "number of allowances in circulation" – would open up an entire new array of potential micro- interventions by policymakers. In fact, the MSR seems over-engineered for the purpose.

Looked at from the perspective of intertemporal flexibility and an improved non-intervention commitment, it might be much easier just to assign a depreciation rate to certificates from any given year (within certain pre-specified limits). This could be organised in an annual, transparent process involving the Commission, the Council, the European Parliament, and the stakeholders. Alternatively, a positive minimum (or maximum) price path could be implemented to make sure that intertemporal trading does not lead to excessively low (high) prices at certain times. Note, however, that any approach fiddling with the outstanding number of certificates implies a change on the unilateral mitigation commitment.

Thus, as a system the EU ETS is performing much better than public opinion has it. Higher ambitions for Europe's mitigation pathway should therefore not be advocated by twisting the mechanism but rather by openly declaring a stricter cap, either directly or indirectly via prices.

6. Improving the resilience of Europe's energy sector

Given Europe's high share of energy imports, and because of the threats often associated with energy dependence on foreign powers, any diplomatic effort to engage with energy producing countries in Europe's neighbourhood must be complemented by an improved resilience of the European energy sector.

The role of the state, i.e. the EU and the member states, in improving resilience should not concern the direct choice of primary energy sources, as policymakers (and a certain interpretation Art. 194 of the Lisbon treaty) regularly claim. As discussed above, this choice should be left to the market based on the relevant price signals and price expectations.

Obviously, policymakers will, and must, always have an indirect influence on the energy mix by the technical regulation (licensing) they impose on the use of indigenous fuels (e.g. for nuclear, or for shale gas). The stricter these regulations on indigenous fuels, the more energy dependent the European Union will be.

Therefore, member states' approaches to licensing have an indirect effect on the security of supply of all member states, and thus should be regularly compared and discussed on the European level. In particular, coal, lignite and indigenous gas which can all be securely provided to the European market should not be excluded from the energy mix by government fiat. As discussed above, technology-specific action against coal or certain production technologies for gas (so-called “fracturing”, or, colloquially, “fracking”) would be detrimental from the point of view of both efficient carbon mitigation and security of supply.

Apart from the issue of carefully balancing conflicting objectives in the licensing of certain technologies, another prominent role for policy lies in the provision of (redundant) infrastructure; only redundant infrastructure gives sufficient flexibility to counter short-term supply interruptions which are seen as the major threat.

Whether such threats actually exist, is a matter of dispute. Producing countries have a significant interest in providing security of supply to their customers. Therefore, problems encountered in the European gas supply over the past decade typically had (and have) to do with transit countries, rather than with producing countries. Hence, projects such as North Stream or (the original plan for) South Stream providing direct connection to a producing country, thus avoiding the transit through non-EU-members have obvious advantages with respect to an enhanced security of supply.

Moreover, due to suppressed gas demand in Europe a lot of Europe’s gas import infrastructure currently sits idle. Therefore, studies consistently show that under current circumstances it would take a rather substantial and long-lasting disruption of gas supplies to Europe to create immediate serious difficulties.

Still, improving resilience (and liquidity) by expanding the (regulated) European energy infrastructure is useful and can be attained at rather limited cost. Infrastructure expansion should take two major forms: expanding the grids physically, both within countries and cross-border, on the one hand, and enhancing flexibility e.g. by the use of ICT (in particular for power) or installing LNG terminals, storage capacities, or reverse-flow capacities (for gas) on the other hand.[1]

A critical question concerns the financing of such investments. They would provide redundancy to the market in the state of a potential crisis but which are underutilised under normal market conditions. As the benefits of insuring against supply interruptions are supposed to have European rather than national or local scope, the costs should not be imposed on national or local but rather on a European level. Such European reliability surcharge would have to be borne by the European power or gas consumer; this would be a helpful step towards further integration of grid regulation. Alternatively, the EU might also finance such redundancy cost from a public budget defined at the European level, and refinanced by the member states. Such an approach would render it easier to incorporate an asymmetric “burden sharing” between the member states.

(1) For gas, a recent analysis by EWI at the University of Cologne has shown, that redundant LNG terminals in the Baltic Sea and in the South-Eastern Mediterranean Sea would be the most important addition to the EU’s infrastructure.

A further important element of a resilient European energy sector is competition. Gas markets, in particular in certain Eastern European member states, do not yet show the level of competition associated with a functioning, and secure, gas market. While increasing reverse-flow infrastructure West-East might serve as an insurance for periods of short-term interruptions, it is most likely not reasonable to increase those capacities to the size required to fully integrate the Eastern European markets with the West – the natural logic of gas flows running counter this idea.

Instead, competition law could be invoked to increase the liquidity on Eastern European gas markets. In particular, measures to open up illiquid gas markets could include restrictions on importers' long-term retail contracts as well as gas release programmes forcing them to auction off some of their imported gas volumes.[1] EU competition law could provide a sufficient basis for such interventions into the market, and it would reduce market power of incumbent importers and their supplier. The idea of a "single European gas buyer" which has been floated in the context of the "Energy Union", constitutes the extreme version of a gas release programme. Obviously, this idea runs into many political and legal objections. Moreover, it would risk to reduce European competitiveness by reducing competition between the importers. A more targeted, selective gas release programme based on existing EU competition law seems to be a much less intrusive, and fully sufficient, alternative.

In summary, the challenge in terms of security of supply of competitive energy to Europe is not a challenge of fully avoiding certain countries or energy carriers, but rather a challenge of appropriately managing our continued energy dependence. Four priorities stand out: Keeping as many options for indigenous energy production open as possible; enhancing the resilience of the European energy sector through an expanded, and partially redundant, infrastructure and improved liquidity in the EU's energy markets; reducing the dependence on unreliable transit countries – either by increasing their reliability or by circumventing them; maintaining and building on an effective partnership with major producing countries in close proximity to the EU.

7. The single largest opportunity: unfettered European competition

Apart from its geographical proximity to important sources of energy, notably in Russia, the Middle East and North Africa, the EU's biggest assets in the global energy arena are its large internal market and its already well-developed energy infrastructure. Further improving the internal market and harnessing the forces of competition across the

(1) In Germany, such measures (imposed on E.ON Ruhrgas in the wake of the E.ON-Ruhrgas merger) have significantly contributed to the development of a liquid gas wholesale market.

28 member states still is most likely the single largest opportunity for Europe in the energy sector.

A no-regret option in this context is the expansion of physical interconnections at the relevant bottlenecks. Such interconnections come at relatively low economic cost, but they reduce the overall cost of the energy system, they dynamically improve competition within Europe and they contribute to an increased resilience of the sector.

Next to expanded interconnection, European competition can be enhanced by a large range of potential measures, in particular with respect to improving cross- border cooperation within Europe. With the exception of the EU ETS discussed in the following section, the regulatory framework and the corresponding institutions still have a markedly national flavour. While the EU sets general directives, implementation of these directives and oversight remains largely in the hands of national parliaments and regulatory authorities. Thus, there still is large heterogeneity in the institutional settings for the industry, and there are few examples of cross-border institutions that go beyond the coordinating roles played by ACER, CEER, ENTSO-E, or ENTSO-G.

With continued heterogeneity across the EU, it is obvious that a more detailed prescription of common European institutional and regulatory standards would contribute to a more integrated European market, and, thus, to more effective competition on the 28 national markets. Such improvements certainly still are possible even within the existing European treaties. E.g. it has been possible to effectively couple European wholesale markets; the important next step being an improved market coupling intra-day. In this context of gradual institutional improvement, the development of common and legally binding network codes for the entire European Union represents an important step towards more harmonized institutional settings. Also, adjusting the layout of bidding zones to correctly reflect existing bottlenecks would improve upon competition. National attempts to manage deep structural bottlenecks with regulatory short-cuts, such as e.g. in Germany,[1] distort wholesale market prices, and, as a consequence, lead to inefficient energy flows in Europe.

As TSOs play a central role in the political processes defining institutions and settings, cross-border mergers of TSOs might be an important catalyst for such developments. Merging French and German TSOs could generate particular momentum.[2] Moreover,

(1) The single German bidding zone, e.g., encourages French or Swiss power markets to import German electricity when there is strong wind in-feed in the Northern part of Germany and neighbouring countries. However, due to an internal bottleneck in Germany, this electricity can physically not be transported towards the Southern German borders. Thus, (extramarginal) Southern German power plants have to be re-ramped in order to supply the electricity for the export into France or Switzerland – at marginal cost at which the French or the Swiss market would not have procured it in the first place.
(2) Cf. e.g. Fondation Jean-Jaurés, Note 251(2015).

such cross-border mergers could also contribute to improving incentives for cross-border system optimisation, in particular with respect to effective and efficient grid expansion.

However, such a gradual approach most likely is bound to hit a structural barrier, a "glass-ceiling" for European market integration. This barrier arises because Europe lacks an effective mechanism for managing cross-border redistribution, e.g. for certain grid investments or other cost components surcharged on the energy consumer, e.g. cost for redispatch or for capacity reserves, or the like. Also, a full integration of balancing markets, which by necessity have a monopsonistic structure, seems rather difficult at present. The same is true for the geographical definition of bidding zones, or entry-exit-zones, within which wholesale prices and surcharges are "pooled", or for joint promotion schemes for e.g. renewable energies on the European level. In essence, any cross-border pooling would improve upon the existing institutions but it would also entail explicit cross-border financial flows, making it politically and legally challenging.

Therefore, any such initiatives would most likely also require cross-border regulatory authorities (in some way similar e.g. to the European Central Bank), which in turn need legitimacy from corresponding treaties and parliamentary acts on the national level. Given the current state of the European Union at large, it seems unlikely that substantial progress into this direction can be achieved at the level of the EU 28 in the near future. Instead, regional or even bilateral initiatives might provide a more realistic starting point into this direction. Iberia/France, France/BeNeLux, and France/Germany appear to be the most natural candidates for such efforts – provided that national policymakers are willing to seize the initiative.

Finally, there is one important element of the current debate about the role of policymakers in the electricity market which merits a more explicit discussion: the question of adequate generation capacity in the long-term. Pressure is imposed on policymakers to give binding insurance commitments to investors in order to reduce the risk of "underinvestment", i.e. exceedingly high electricity prices or even power rationing.[1]

Two aspects of this debate need to be carefully distinguished: The question of "missing money" due to explicit or implicit price caps on the one hand, and the question of a missing long-term market for power plant investments on the other hand.

As to the first aspect, this is a fictitious debate at present. Prices are nowhere near historical peaks, even in tight market conditions, both for spot markets and for existing balancing markets (which essentially procure short term capacity buffers). Moreover, projections into the future are notoriously difficult especially for lack of good estimates of the elasticity of demand. Therefore, it is far from clear whether critical price peaks will

(1) Such guarantees are contained e.g. in the commitments given to RES-investors in Germany or to nuclear investors in the UK, and, more generally, in the logic of capacity mechanisms such as the ones recently introduced in the UK.

emerge on a regular basis if policymakers did not come up with an additional intervention into the market. Note that if penalties for deviating from the nominated schedules are sufficiently high, market participants always have an interest to fully hedge their capacity. Thus, at any point in time, prices in spot and balancing market should correctly reflect scarcity of capacity in the system. Hence, if there were a problem related to price formation, increasing the penalties for deviations from the nominated schedule might be a rather simple remedy.[1]

As to the second aspect, policymakers do not know better about potential market developments than the market. Thus, they are unable to provide an efficient substitute for a missing long-term market.[2] In particular, they do not know better about the development of demand, thus they are always likely to insure a sub- optimal level of capacity, most likely on the high side. Governmental insurance does not make this demand risk disappear, rather, it leads to a re-distribution of the risk away from the investor to someone else. Typically, as e.g. in the cases of Germany and the UK, governments do not pay for the insurance premium themselves. Instead, they pass the cost onto the electricity consumer. As a side effect, this increases the likelihood that policymakers misuse the insurance to distribute political rents (as in the case of German RES state guarantees).

Strategic reserves are discussed an alternative mechanism to provide secure capacity in tight market conditions outside the distribution of market expectations. However, in order to be non-distorting, they need to be carefully crafted. In particular, the exercise rules warrant a lot of attention. In essence, the price trigger for the reserve acts like a price cap to the market.[3] Thus, if the trigger is chosen too low, introducing a strategic reserve might actually exacerbate the problem it is intended to solve. A slippery slope into larger and larger shares of the strategic reserve might be the consequence, especially since the state lacks relevant information for deciding about the appropriate size of the reserve.

Because of these problems with state-administered capacity control, some observers suggest "decentralized capacity control". In essence, such approaches suggest an obligatory trading of long-term capacity options. Such contracts can in principle also be

(1) This remedy forms part of the suggested "Anyway measures" proposed by the German government in its recent Green Book on electricity market design.
(2) Note that redundant generation has to be distinguished from redundant infrastructure which has been discussed in the previous section. Infrastructure exhibits features of a natural monopoly, and hence is regulated. Generation is a competitive activity, and is regulated only in the last minutes before physical fulfilment (typically, on one-sided balancing markets).
(3) If the call option on the strategic reserve is exercised based on a price trigger, then the reserve is directly linked to the market. However, it does not change the argument if the exercise rules are based on purely technical rather than commercial conditions, as e.g. in the right of German TSOs to redispatch certain power plants. Still, the positive probability that the strategic reserve will be exercised in some market conditions will distort the market, reducing the room for investments into non-reserve power plant capacity.

provided by the market on voluntary basis, and they are actually already being used.[1] Making such contracts obligatory will likely increase their liquidity, but it does incur additional administrative cost, especially for those consumers who do not need to have such price insurance. Whether or not there is an effect at all, mostly depends on the penalties for deviations from schedules.[2]

And even if there is an effect on capacity provision, the net effect on social welfare is unclear because of the transaction cost, and it strongly depends on the specific form of the obligations imposed on consumers.

An additional concern needs to be mentioned. Different from most other industries, there is a tangible additional risk for a long-term investor in the electricity sector: As the investment is sunk, policymakers might be inclined to expropriate parts of it (directly or indirectly) if the asset turns out to be very valuable (i.e. prices and margins are high). Thus, there is a commitment problem between the investor and the government. The market on its own will find it difficult to provide insurance for this problem. Payments guaranteed by the government might in deed overcome the issue if retroactive changes to these commitments are explicitly ruled out by the country's legal system.[3]

While such commitment problem might in fact exist, long-term capacity guarantees administered by the government are a possible but not the only solution, let alone the most efficient one. Other ways of overcoming the commitment problem are e.g. direct co-investments by the government. Also, constitutional rules on the national level, or binding international treaties on free trade, e.g. the European treaties, can serve to lower this specific political risk – if they are properly implemented and sanctioned.

In any case, current overcapacity (on the Continent) means that, even if it existed, the commitment problem is not an urgent issue for (Continental) European policymakers. Moreover, the abundant availability of investment options with short- term or medium-term amortization periods, e.g. gas engines, open cycle gas turbines, or investments into demand flexibility, further reduce the urgency of this issue. Therefore, in summary, the introduction of additional capacity mechanisms alongside existing balancing markets should be treated with a lot of caution.[4]

(1) Cf. e.g. the recent introduction of intraday-cap products by the EEX. Also, acquiring equity in power plants can serve as long-term hedge, cf. the so-called Mankala risk sharing structure derived from direct investment of energy intensive businesses into Finnish power plants.
(2) Essentially, the penalty for using more energy than scheduled serves as a back-stop price for capacity insurance. See above.
(3) This is, e.g., the case for the EEG commitments given in Germany. It was not the case for the subsidies to RES promised to investors in Spain, which the government reneged upon during the fiscal crisis.
(4) Cf. e.g. Bettzüge (2013) for a more extensive treatment of the issue.

Conclusion

European energy policy epitomizes the challenges of a European Union which is losing clout in the global arena faster than it can make progress in integrating the formerly independent nation states. More than for other sectors, national governments and parliaments regard energy policy as a domain they have to defend against European integration and harmonization, in particular with respect to energy taxes and to the electricity sector.

Also, public debate on European energy policy tends to greatly underestimate the degree to which Europe is dependent on global developments she cannot control (any more). No matter what European policymakers decide in the short-term, the EU will import fuels from external partners for a long time to come. And no matter how much the EU reduces its CO_2 emissions, it will depend on other countries to follow her if unabated global emission growth is to be avoided. Therefore, in particular, a general, candid, and fact-based public debate on the most effective way for Europe to contribute to the global fight against climate change should urgently be led.

Under the current, rather narrow political premises and restrictions, Europe should be careful not to overstretch with respect to the unilateral mitigation target. Moreover, Europe should aim to maximise the impact from her current emissions volume-oriented approach. In particular, member state governments need to be careful with implementing additional measures on the national level without taking into account the feed-back effects on the European level. In the end, the Rest of the World will not care at all whether Europe mitigates in Poland, in Spain, or in the UK. Viewed realistically, Europe cannot afford the luxury of 28 national climate and energy policies catering for 28 different and heterogeneous audiences.

Also, developments on the global fuel markets should be an important determinant for Europe's energy and climate strategy. Reduced fuel prices, e.g., make a unilateral mitigation strategy more expensive, and should therefore inform the European emission reduction target. No such feedback mechanism has so far been considered – European objectives for CO_2 reduction are defined without any reference to global developments

Overall, therefore, the EU seems well-advised to develop an energy strategy adapted to the global developments and to its structural position. An effective strategy would most likely be characterized by dexterity and flexibility, and it would try to eschew big political bets. Rather, the substantial uncertainty surrounding the energy environment for Europe should be reflected by gradualism and portfolio thinking. Furthermore, the need for increased cost efficiency would suggest a rethinking of subsidiarity in Europe, a reduction of political and regulatory risk, and a de-bureaucratization of the sector. Thus, such efforts would require substantial further harmonization and coordination within the EU – a difficult task given the general tendency for renationalization of policies. But the prize for Europe would be substantial.

On top, such a strategic view on energy policy would also encourage the EU to consider policies in other important domains – such as education, industrial policy, or defence – that are, or will be, directly impacted by the tectonic shifts in the world's energy architecture, and to generate a consistent perspective comprising all these areas. For example, there is no honest debate about the fact that retaining industrial activity in Europe requires competitive energy prices, and about ways to square this objectives of the multitude of initiatives increasing the energy cost burden of the European consumer. "Energy efficiency" as an answer is insufficient, because if industry has to pay for it, such efforts might turn out to add to the cost rather than to reduce it.

However, instead of developing a strategy which is robust against alternative scenarios of global development, European energy policy seems to be increasingly shaped by dogma. The dogmatic approach to European energy policy becomes most visible in the simplifying rhetoric which asserts that investments into renewable energy sources and technical energy efficiency will resolve all of Europe's energy challenges quickly and without substantial trade-offs. As a consequence, those challenges and trade-offs might not get the management attention they require. Instead, micro-management of investment choices opens up significant potential for political rent seeking (and thus, political risk).

Interestingly, intervention into the energy sector is not urgent at all – contrary to public perception. With sluggish demand, ample capacity, and an effective cap on the sector's CO_2 emissions European policymakers could, theoretically, leave the electricity sector alone for a while. For other sectors, much the same analysis holds except for introducing effective CO_2 mitigation by expanding the EU ETS to cover these sectors as well.

The very low capital cost in the short-term should not be wasted on inefficient investment projects, but on such investments that can generate increasing returns to scale for Europe. Most of such opportunities lie outside of the energy sector, in particular in the infrastructures for traffic and the digital economy, as well as in research and education. Within the energy sector, substantial social payback can only be expected for grid investments, particularly cross-border. Hence, public attention should shift from intervening in competitive decisions around generation (e.g. renewable energy sources) or demand (e.g. efficiency) to fostering regulated investments.

In general, the timing of Europe's efforts to develop its energy sector is an undervalued aspect of European energy policy. Ambitious objectives for the long- term do not need to be addressed by immediate, drastic action in the short-term, except for the European grid. Capacity thus freed up in the political institutions could then be used to address some of the fundamental governance challenges, e.g. for refining Europe's understanding of the meaning of Art. 194 of the Lisbon treaty, or for debating the best way to reap "double dividend" from energy taxes and the sale of CO_2 certificates.

In summary, a European energy strategy would think from today into a necessarily open future – rather than back-casting the present from closed "visions" of what the future will look like.[1] Open future thinking would start with the problems (e.g. greenhouse gas mitigation) rather than with potential solutions (e.g. certain renewable energy technologies). And such openness is warranted especially today – given the speed of technological development across the globe, partly driven by the digital revolution. The energy world of the 21st century has just started to emerge, and while one might guess some general directions, one should always be prepared for surprises.

Avoiding falling into the "closed-future"-trap, then, would require a fundamental rethinking of Europe's approach to energy policy. Over the past decade, Europe (as well as many a member state) has developed an inclination to set binding quantitative targets for certain descriptive dimensions of the energy sector. With the exception of the CO_2 cap for the EU ETS this is an ill-guided approach. Not only will the array of dimensions chosen be inconsistent and incomplete. Moreover, making many such specific targets binding necessarily leads into wasteful and ultimately unsuccessful "planification" policies – i.e. to the contrary of an open future-strategy. Thus, in particular, the additional targets for renewable energies and reduced energy demand should not be implemented as binding targets but rather be treated as indicative targets for a certain scenario of the CO_2 mitigation pathway.

The complexity of Europe's energy could be better captured by an "EU climate and energy scoreboard" encompassing a broad and relevant range of indicators. Such an approach would be similar to the sets of indicators for measuring the overall state of the economy which have been suggested e.g. by the Stiglitz-Fitoussi-Sen commission in France, or by the Enquête-commission "Growth, Wealth, and Quality of Life" of the German Bundestag.

Important dimensions for such a scoreboard would likely be cost (both within Europe and relative to the rest of the world), security of supply (both in terms of import dependency and reliability), ecologic footprint of energy supply (on the European as well as the local level), as well as descriptive statistics for energy demand. Within these dimensions, several essential indicators would have to be identified, a task which goes far beyond the scope of this paper.

(1) It might, e.g., be possible to compute the optimal path of energy demand relative to GDP in Europe for one specific scenario of future developments. But to fix e.g. the computed total energy demand for a given future year, say 2030, as a quantified target for the European economy, yet alone a binding one, does not seem to make a lot of economic sense, because it does not account at all for the enormous amount of uncertainty surrounding e.g. the development of technologies, of global fuel prices, or the well-being of the European economy in general.

The most important contribution of such a scoreboard would be to visualize the complexity of the energy challenge, and to allow for an explicit discussion of the trade-offs between political actions to “improve” any single one of these indicators. By doing so, the scoreboard might then also help Europe to slowly yet steadily change its energy policy from dogma to strategy.

TOWARD A SUSTAINABLE AND CONSISTENT EUROPEAN ENERGY AND CLIMATE POLICY

Fabien Roques[1]

Executive summary

In his opening statement in the European Parliament in July 2014, the new European Commission President Jean-Claude Juncker highlighted 10 key priorities for his mandate. One of these consists in "reform(ing) and reorganis(ing) Europe's energy policy into **a new European Energy Union"**.[2] Does this imply that this Energy Union will mark the beginning of a new approach toward European energy policy, or is it merely a reframing of the debate?

We argue in this paper that the new Energy Union will need a radically new approach to European energy and climate policy. A sound European energy and climate policy should be based on a set of well-defined objectives, and rely on well-articulated instruments to deliver in the most efficient way on these objectives. The current European energy and climate policy framework has major flaws on both fronts.

The paper does not aim to provide a comprehensive list of the issues at stake with European energy and climate policy, which would be a daunting task, and builds on previous work conducted for the for the Commissariat général à la stratégie et à la

(1) Associate Professor, University Paris Dauphine, Senior Vice President, Compass Lexecon. Contact details: Email: froques@compasslexecon.com, fabien.roques@cantab.net, Phone: +33 1 53 05 36 29.
The author would like to thank the French "Commissariat général à la stratégie et à la prospective" for its support in undertaking this study. The author is particularly grateful to Pr. Marc Oliver Bettzüge (EWI) and Pr. Dieter Helm (Oxford University) for very insightful exchanges during the course of the study. This paper was written in December 2014. The views expressed are those of the author alone. A shorter version of this paper is available in French on www.strategie.gouv.fr/publications/lunion-de-lenergie-0.
(2) Source: Jean-Claude Juncker's Political Guidelines for the New Commission, "A New Start for Europe: My Agenda for Jobs, Growth, Fairness and Democratic Change", 15 July 2014, available at: http://ec.europa.eu/priorities/docs/pg_en.pdf#page=6.

prospective (CGSP) in 2013.[1] Instead, **we focus on some key areas with the objective to make a series of concrete proposals for reform**. This paper takes a practitioners' perfective, recognizing that a "first best" economic approach is often not practical, and therefore putting forward policy recommendations which recognize the policy and institutional constraints that characterize European policy making.

We start by discussing issues with the European Commission (EC) energy and climate policy objectives, and then suggest some potential reforms to the regulatory framework to deliver on these objectives. We successively cover in session 2 and 3 the policy levers for decarbonization and for security of supply, before discussing the necessary changes to the power market framework. We conclude by discussing how the financing and governance challenges associated with these two key policy priorities can be handled.

1. The objectives of EU energy and climate policy

European energy and climate policy has often been described as searching to strike a balance between a "trilemma" of objectives: environment and climate policy, security of supply, and the creation of integrated and competitive electricity and gas markets. There has always been a working assumption that the different policy objectives reinforce each other. **However, in hindsight, the different pillars of Europe's energy policy do not seem as synergetic as often believed.** For instance, the relationship between liberalized power markets and security of supply is more complex than anticipated, as underinvestment and boom bust cycles seem to threaten security of electricity supply in a number of member states. In addition, Europe's green agenda has not been reconciled with Europe's objective to create competitive and integrated markets: the impact on energy costs and on Europe' competitiveness of the 2020 targets is becoming apparent today as many member states revisit their support policies for renewables, in order to contain costs for consumers.

RECOMMENDATION

In the context of the discussions on the policy and market framework to deliver on the 2030 targets, the EC should recognize the inherent conflicts between different policy objectives and define clear priorities. In particular the impact assessment should evaluate: the impact in terms of energy

(1) This paper follows on a first report written for the Commissariat général à la stratégie et à la prospective (CGSP) in 2013 which focused more specifically on the current issues in European electricity markets. See "European electricity markets in crisis: diagnostic and way forward", Fabien Roques, November 2013, contribution to CGSP report available at:
www.strategie.gouv.fr/sites/strategie.gouv.fr/files/archives/CGSP_Report_European_Electricity_System_030220141.pdf.

costs and industrial competitiveness of the different environmental targets; and the impact in terms of security of supply of deploying significant amounts of intermittent renewables.

The second major issue in the definition of Europe's energy and climate policy is that it is too much inward looking and based on contestable implicit or explicit assumptions about the future of global energy markets. Europe's strategy to lead on the fight against climate change has been based on the assumption that other countries would follow and define their own ambitious targets for emission reduction and clean technologies deployment. However, there has been very little progress on the international scene toward a global agreement to mitigate climate change since 2008. Moreover, current policies do not give any incentives to other countries to join Europe in the fight against climate change. Second, the conventional wisdom that underpinned Europe's commitment for decarbonization was that fossil fuel prices would increase steadily in the future. This assumption justified the support for low carbon technologies whose cost would reduce over time and converge with those of conventional fossil fuel technologies. This implied that the green agenda costs would remain affordable, and would in the long term yield positive benefits and save costs to European customers. However, the discovery and production of large quantities of shale hydrocarbons in the US, and the end of the "commodity super cycle" have largely changed the global energy market dynamics and call into question the affordability of Europe's climate targets.

RECOMMENDATION

The 2030 energy and environment policy framework should be stress tested against scenarios with a non-cooperative approach from Europe's commercial partners in the fight against climate change, and with lower fossil fuel prices than currently anticipated.

The policy debates in Brussels and in many countries are based on implicit or explicit assumptions about the costs of different technologies, as well as their evolution going forward. Often critical policy decisions are made on the basis of weak – or possibly even biased evidence – on the costs of different technologies. In the case of electricity generation, for instance, the comparison of the costs of different generation technologies is often based on the "levelised generation costs", and does not take into account the "external system costs" and/or the "subsidies" associated with the different technologies.

RECOMMENDATIONS

The principle of "cost reflective" prices should be instituted. All technologies should bear the cost associated with their external effect on the energy system and society at large.

A monitoring process should be put in place in all member states to track the evolution of the different types of energy system costs (including externalities) and subsidies over time.

2. Policies supporting decarbonization

The European Trading Scheme (ETS) was championed by the European Commission in the 2009 green energy legislative package as the centerpiece of European policy toward a decarbonized energy mix. But in practice **the ETS has become a** "**residual market" for carbon abatement, with most CO_2 reductions driven by targeted renewable support policies**.

RECOMMENDATIONS

The ETS needs a radical structural reform to provide a credible and bankable investment signal through a predictable minimum long term carbon price trajectory.

Whilst there are many ways in which a supply management mechanism can be put in place, a simple approach with cap and floor prices has many advantages.

Europe's support for clean technologies has been concentrated on the deployment of specific clean technologies which have received significant support in the past decade. This contrasts with the lack of funds available for research and development (R&D) in energy. Given the uncertainties on the costs and future progress of the different clean technologies, an optimal policy mix would need to be geared toward R&D and reduce spending on deployment. Instead of picking technology winners, the EU should invest in fundamental research and put in place a supportive framework for the demonstration and commercialization of innovation.

RECOMMENDATION

European countries need to scale up and coordinate better their R&D and innovation policies for clean technologies through a reform of the European Strategic Energy Technology plan.

The 20% / 27% renewables deployment targets could be replaced by a clean technologies R&D and deployment target, whereby countries could choose to support clean technologies through R&D and / or deployment.

Investment in clean technologies driven by support schemes displace thermal plants in the merit order, leading to lower power prices and revenues for thermal pants. By reducing power prices, policies supporting renewables create their own need as they prevent renewables to become competitive based on wholesale market revenues. **This "cannibalization effect" implies that there may be a structural and permanent need for subsidies for renewables if their cost reduction does not outweigh their depressive effect on power prices. Managing the pace of deployment of subsidized technologies is key both to control the costs**, and to provide investors with a long term perspective on the value of existing assets and potential new thermal plants.

RECOMMENDATIONS

Member states should define coordinated clean technologies roadmaps and a monitoring process to control the volumes of the different clean technologies added to the system.

In order to control the volumes of clean technologies, support schemes fixing a volume cap, or relying on auctions should be favored.

Policies to support renewables in Europe show a wide diversity of approaches, ranging from feed-in tariffs, premium schemes, and green certificate schemes. **The lack of coordination between the national approaches has led to suboptimal deployment of renewables, thereby increasing system costs for European consumers. Member states should improve the coordination of renewables support schemes and define solutions for cross border participation.**

RECOMMENDATIONS

Member states should improve the coordination of renewables support schemes by redesigning the existing cooperation mechanisms to remove the perceived barriers to their implementation.

The EC should also think of ways to create incentives for countries to participate in such cooperation mechanisms, e.g. by adding a financial or accounting bonus to projects involving cooperation across member states in the contribution toward the country 2020/2030 renewables targets.

Renewable support schemes in Europe are based on production as the level of subsidy received by the plant increases with production. This results in an

incentive to produce in hours where power prices are below avoidable costs, creating distortions in the merit order in the electricity market, and therefore increasing costs. The recently approved EU Guidelines on State Aid for Environmental Protection and Energy introduce a series of measures in order to promote the better integration of renewable energy into the market.

RECOMMENDATION

In order to remove distortions of power markets induced by clean technologies support schemes, Europe should eventually phase out production-based support schemes and instead concentrate support for renewables on investment, preferably through an auctioning process.

3. Policies supporting security of supply

Progress on building interconnection and other critical infrastructures supporting electricity and gas markets integration has been slow over the past two decades. However, there would be significant benefits in having more interconnected electricity and gas markets, estimated to range between €12.5 to €40bn/year in 2030 for electricity alone, or about €25 to €80bn savings per capita / year. However, this does not mean that all interconnection projects would be socially beneficial and the selection of projects receiving public support needs to be based on a cost benefit analysis.[1]

RECOMMENDATIONS

The EC should address permitting and licensing hurdles, through e.g. the creation of a one-stop-shop agency as part of ACER and/or regional transmission planning committees.

Greater engagement with local communities is needed to relieve local opposition, e.g. through benefit sharing mechanisms.

The regulation of Transmission System Operators (TSOs) should provide stronger incentives for TSOs to cooperate and to build interconnection capacity – e.g. by mandating that part of the congestion rents and cross border rents be channeled to investment in new lines.

Stronger coordination requires the implementation of regional transmission development agencies under joint ownership from TSOs. A more radical approach would consist in creating regional TSOs.

(1) Booz & Company (2013), “Benefits of an integrated European energy market”, 20 July. Prepared for: European Commission Directorate-General – Energy.

The recent Russian-Ukraine conflict and the associated dispute about Russian gas supplies have revived concerns about security of imported gas in Europe. In response, the European Commission released an EU energy security strategy on 28 May 2014. The mechanisms to enhance Europe's energy supply security are well known but relatively little progress has been made over the past decade.

RECOMMENDATIONS

In the short, term, the resilience of the EU gas system to supply disruptions requires: i) Developing more coordinated preventive planning through regional risk assessments, e.g. on a yearly basis; ii) Developing and regularly updating emergency preparedness procedures to deal with stress situations.

In the medium to long term, EU gas security can be improved by: i) Fostering the development of well-functioning and integrated gas markets; ii) Reducing energy demand though energy efficiency policies; iii) Fast-tracking the build-up of critical infrastructure; iv) Better coordination when negotiating with external energy suppliers, and strict application of EU energy and competition law, possibly coupled with the implementation of an internal regional aggregation mechanism for Eastern European countries to reduce discrimination against some of the most dependent member states; v) Diversification of gas supply sources and routes, and supporting security of supply in the EU's neighborhood (e.g. through the timely construction of the Trans Adriatic Pipeline (TAP) which will transport Caspian natural gas to Europe).

There is currently much worry that the current EU power market design is sending inadequate investment signals which may endanger security of electricity supply. Many countries have taken steps to introduce a capacity mechanism, using very different approaches. The result is a patchwork of mechanisms which could undermine the further integration of European electricity markets. The drivers of capacity mechanisms across Europe are different depending on the country considered, such that it is unlikely that a common approach at the Europe level will be practical or even suitable. But there would be merits in working toward some degree of coordination in order to minimize the potential distortions associated with different capacity mechanism approaches.

RECOMMENDATIONS

The EC should produce guidelines for the regional coordination of capacity mechanisms and ensure the possibility for cross border capacity participation.

TSOs need to cooperate on a regional basis to define common certification and verification procedures for plants and demand response, and to develop operational rules to deal with situations of system stress.

4. Toward a sustainable power market framework

European electricity market design needs to be reconciled with the new policy priorities in favor of renewables deployment in order to provide better scarcity signals as well as locational incentives. The historical approach for electricity market integration is incomplete as it is primarily focused on integrating day-ahead power markets, whilst the growth of intermittent renewables requires liquid and well integrated intraday and balancing markets to balance the system in real time. In particular, specific attention should be paid on ensuring that scarcity pricing allows appropriate remuneration of flexibility in short term markets. Besides, locational signals are lacking in current European power markets and hamper an efficient and coordinated development of generation, demand response, and the network.

RECOMMENDATIONS

The EU target model needs to be revised to fast track the integration of short term balancing through the implementation of cross border liquid intraday and balancing markets in order to enable the least cost integration of renewables in the system.

This will require to reprioritize the current Framework Guidelines and Network Codes process and to give ACER a stronger mandate in order to overcome some of the current blockages.

The redefinition of price zones and/or the introduction of location specific network charges would provide better locational signals and improve the coordination of network and generation investment.

In parallel to the reforms focused on short term markets, electricity market design needs to evolve to improve fixed cost (investment) recovery and facilitate investment in capital intensive technologies. Current electricity markets were designed in the 1990s and the recent development of renewables raises two fundamental questions. Whilst electricity was considered as a homogenous commodity, the introduction of intermittent renewables leads to a differentiation of the electricity produced from different generation technologies depending on a number of attributes: whether the production can be controlled, the degree of flexibility and predictability of the production, etc. Second, the change in the cost structure toward capital intensive technologies raises questions about possible ways to transfer some of the investment risk away from investors through e.g. long term contracts in order to reduce the cost of capital. The European Target Model will therefore need to evolve as the generation mix changes toward a dominant share of low variable cost technologies.

RECOMMENDATIONS

In the long term, electricity markets based on marginal cost pricing will need to be supplemented with some other mechanisms to foster fixed cost recovery and reduce the cost of capital. This can happen gradually through the ongoing reforms introducing capacity mechanisms.

A more radical approach would be a move to "hybrid power markets" with auctions of long term capacity contracts to ensure that there is competition "for the market", whilst the spot and intraday markets would ensure competition "in the market".

5. Governance and financing challenges

Significant investments are required to decarbonize Europe's energy sector and renew ageing infrastructure. The EC estimates that out of the EUR 200 billion needed for electricity and gas networks of European importance, EUR 100 billion should be delivered by the market unaided, whereas the other EUR 100 billion will require public action to leverage the necessary investments. In an increasingly global economy, fierce competition for capital means that the energy sector in Europe will have to compete to attract funding with other investment opportunities globally in a range of other sectors.

RECOMMENDATIONS

The EC and the European Investment Bank (EIB), together with the member states financial institutions, need to scale up the amount of public money lending and equity financing available to Trans-European Network projects and Projects of Common Interest (PCI).

In addition, alternative financing arrangements (such as public-private partnerships) and investment vehicles (such as project bonds and suitable investment funds) should be developed to leverage private capital.

Investments are hampered by perceived policy and regulatory uncertainty. A key source of policy uncertainty relates to the perceived disconnect between the long term policy targets, and the concrete short term policy instruments put in place to deliver on these targets. The inability of policy makers to credibly commit on a set of long term predictable policy objectives is a key issue that undermines the European energy policy framework.

RECOMMENDATIONS

The EC and the member states should develop detailed energy policy implementation roadmaps toward the 2030 objectives, to anticipate the necessary policy changes (e.g. carbon price evolution, timing for phase out of renewables support, etc.).

The process to elaborate these policy roadmaps should be coordinated regionally and open to a wide range of industry stakeholders, through a peer review at a national, regional, and European level.

A monitoring process to assess regularly progress against the policy roadmap and the 2030 objectives should be put in place.

As European energy markets have become increasingly interconnected, there is a growing disconnect with the national mandate of gas and power network operators, as well as regulators. The third Energy package created new institutions at the European level which play an important coordination role, namely the Agency for the Coordination of Energy Regulators (ACER) and the European Network of Transmission System Operators for electricity (ENTSO-E) and for gas (ENTSO-G). But some of the slow progress on market integration and critical infrastructure projects can be attributed to the limited mandates of ACER and the ENTSOs.

RECOMMENDATIONS

ACER and the ENTSOs should be empowered to coordinate and harmonize further national regulatory practices, e.g. to unlock some of the current blockages with the gas and power network codes.

Indicative planning led by ACER and the ENTSOs should be reinforced to improve the coordination of network and generation development, e.g. by broadening the scope of ENTSO's 10 year network development plans to assess the impact of different national energy transition plans.

Coordination at the regional level is a potential promising way forward to complement European integration. Taking into account country-specific circumstances and characteristics is difficult with 28 member states, and there is scope for closer energy policy cooperation of neighboring countries sharing some similar constraints. In addition, regional approaches may prove an opportunity for bottom up involvement of all key stakeholders to find practical solutions to implement EU policies. Policy coordination at the regional level can be either informal and rely on regional forums to disseminate information, or more structured processes through e.g. a formal peer review process and some form of institutionalisation.

RECOMMENDATIONS

Regional coordination groups involving all stakeholders (regulators, TSOs and DSOs, utilities, consumer associations, policy makers, etc.) should be set up with a mandate to explore potential opportunities for cooperation at the regional level on energy policy.

The objectives of such regional coordination groups could be by increasing level of ambition: i) To share information through a peer review process on investment plans; ii) To develop cooperation mechanisms on specific policy instruments, for instance a coordinated approach for cross border participation in renewables support schemes or capacity mechanisms; iii) To coordinate or develop joint policy initiatives at the regional level, for instance discussion on security of supply or on environmental target; iv) To develop joint policy instruments, e.g. common support scheme for renewables or a common capacity mechanism.

Local communities have a growing role to play in the design and implementation of energy and climate policies. The development of decentralized generation and active demand response increases the need for coordination at the local level. System optimization has become more complex and needs to incorporate the different levels of governance through a more "bottom up" process for policy making and stakeholders. Governance changes are needed to improve the coordination and consistency of energy and environment policies at the local, regional and European levels.

RECOMMENDATION

One challenge of Europe's energy policy going forward is to ensure the consistency of the multiple levels of decision and implementation of intertwined policies. The governance and regulation of local players such as Distribution System Operators (DSOs) and municipalities should ensure that all stakeholders have incentives to optimize the system.

Introduction

In his opening statement in the European Parliament in July 2014, the new European Commission President Jean-Claude Juncker highlighted 10 key priorities for his mandate. One of these consists in "reform(ing) and reorganis(ing) Europe's energy policy into **a new European Energy Union"**.[1]

Does this imply that this Energy Union will mark the beginning of a new approach toward European energy policy, or is it merely a reframing of the debate? **We argue in this paper that the new Energy Union will need a radically new approach to European energy and climate policy.**

The composition of the new European Commission that started his work late 2014 seems to comfort the ambition to fix some of the issues that contributed to mixed success on energy and environmental policies in the past. First, the unification of the former climate and energy directorates under a single Climate and Energy Commissioner Miguel Arias Cañete could help addressing the many conflicts and tradeoffs between energy and climate policy. Second, the creation of a Vice President position for the Energy Union, in the person of Maroš Šefčovič, demonstrates the ambition of the Commission to give a prominent role to energy policy in the coming years.

On 23rd October 2014, the European Council approved a set of 2030 targets for CO_2 emissions, renewables, and energy efficiency setting the objectives for the next fifteen years[2]. The new European Commission will be in charge of defining the supporting policies and regulatory framework to deliver on these environmental objectives, whilst maintaining security of supply and keeping costs affordable for consumers and preserving industrial competitiveness. It seems therefore timely to revisit the achievements of the previous Commission regarding the environmental targets for 2020 in the context of the wider European energy and climate policy. **Several lessons can be learnt from the past decade.**

First, a number of changes in context have led policy makers to revisit the relative priority of the different objectives characterizing the traditional trilemma of European energy policy: climate, security of supply and competition and competitiveness. The priorities evolved to put competitiveness and cost control on the top of the policy agenda, alongside security of supply as the Ukrainian crisis reminded policy makers of Europe's growing dependence on imported gas. This change of priorities has put under the

(1) Source: Jean Claude Juncker's Political Guidelines for the New Commission, "A New Start for Europe: My Agenda for Jobs, Growth, Fairness and Democratic Change", 15 July 2014. Available at: http://ec.europa.eu/priorities/docs/pg_en.pdf#page=6.
(2) Source: European Council (2014), Conclusions on 2030 Climate and Energy Policy Framework, 23 and 24 October. Available at: www.consilium.europa.eu/uedocs/cms_data/docs/pressdata/en/ec/145356.pdf.

spotlight some of the inherent tradeoffs between the different EU policy objectives which remain unresolved. In fact, Europe lacks a clear prioritization of the different EU energy and climate objectives.

Second, the policy tools that have been implemented in the different member states to deliver on the 2020 objectives do not only suffer from inconsistency, but have also been sometimes leading to unanticipated consequences. The EU European Trading Scheme (ETS) has largely failed to provide a robust carbon price signal to drive carbon abatement and a sound foundation for clean technologies investment. Uncontrolled growth of renewables and the use of support mechanisms based on production have contributed to destabilising power markets across Europe. Power prices have collapsed to historical low levels and large retirements of thermal plants threaten security of supply.

Unfortunately, the current European policy debate about the supportive policies to deliver on the 2030 objectives appears very much framed as a continuation of the 2020 approach and risks repeating the same mistakes. This paper argues that Europe energy and climate policy needs a major overhaul, as much in terms of objective setting as in terms of policy tools and levers to deliver on these objectives. In other words, the new Energy Union that President Juncker supports will need a radically new approach to European energy and climate policy.

This paper does not aim to provide a comprehensive list of the issues at stake with European energy and climate policy, which would be a daunting task. Instead, we focus on some key areas with the objective to make concrete proposals for reform. This paper takes a practitioners' perfective, recognizing that a "first best" economic approach is often not practical, and therefore putting forward policy recommendations which recognize the policy and institutional constraints that characterize European policy making.

The paper comprises five sections and makes a set of twelve concrete proposals for reform, both of the currently policy and regulatory framework, but also of the governance of Europe's energy policy. Section 1 discusses the objectives of EU energy and climate policy, whilst Sections 2 and 3 focus respectively on the policy tools and mechanisms for decarbonization and for security of supply. Section 4 reviews the necessary changes to the power market framework. We conclude in Section 5 by discussing how the financing and governance challenges associated with the policy priorities can be handled.

1. The objectives of EU energy and climate policy

1.1. The EU policy "Trilemma": an evolving hierarchy of objectives

European Energy policy has often been described as searching to strike a balance between a "trilemma" of objectives: environment and climate policy, security of supply, and the creation of integrated and competitive electricity and gas markets. The policy priorities of the European Commission (EC) and the member states have evolved over time, modifying the hierarchy between the different pillars of the energy policy trilemma.

In the late 1990s and early 2000s, policy efforts focused on creating the regulatory framework and common rules for the internal market in electricity, with the two key milestones being the December 1996 Directive (Directive 96/92/EC) and the June 2003 Directive (Directive 2003/54/EC). The continued drive to liberalize European electricity markets in the 2000s led to the implementation of the Third Energy package proposed by the EC in 2007 and finally adopted in July 2009. The package, among other things, dealt with unbundling of transmission networks and generation, and established National Regulatory Authorities in each member state and implemented an Agency for the Cooperation of Energy Regulators (ACER).

The focus of European energy policy in the mid-2000s turned onto the environment, as EU leaders set in March 2007 a set of targets for a low-carbon economy, which then was implemented through a set of Directives in 2009 often referred to as the “Climate and Energy Package”. These targets, known as the “20-20-20” targets, set three key objectives for 2020: i) A 20% reduction in EU greenhouse gas emissions from 1990 levels; ii) Raising the share of EU energy consumption produced from renewable resources to 20%; iii) A 20% improvement in the EU’s energy efficiency. As part of the 2011 discussions on a 2050 Roadmap, EU leaders committed to reducing Europe’s greenhouse gas emissions by 80-95% by 2050 compared to 1990 levels.

In recent years, however, security of supply has come back to the forefront of the European energy policy agenda. The Russian-Ukrainian gas crisis of January 2009 which led to supply disruptions in several member states reminded Europeans of their dependence on imported gas and revived discussions on both a common approach toward energy supplies from external countries and a strengthened set of criteria for ensuring security of energy supplies within the internal market. More recently, the 2014 Russian-Ukraine dispute and the discussions on gas supplies have revived concerns about security of imported gas supplies in Europe. In response to the political crisis in Ukraine, the European Commission released in May 2014 a communication defining a new EU energy security strategy.[1]

Since 2008, the economic crisis has also brought a new dimension into the European energy policy trilemma: policy scrutiny about the cost of some of the climate and green policies has intensified, and concerns have grown that the uncontrolled deployment of low carbon technologies could both undermine European’s economic competitiveness and raise concerns about security of supply. The Green Paper “A 2030 framework for

(1) European Commission Communication, “European Energy Security Strategy”, COM(2014) 330 final, Brussels, 28.5.2014.

climate and energy policies" (COM(2013) 169, 27/03/2013) represents an inflexion point in European energy policy that clearly heralds competitiveness and affordability as one of the key issues for the years to come.

1.2. Conflicting objectives call for priorization and tradeoffs to be addressed

Despite the evolving hierarchy of the three different pillars of Europe's energy policy, there has always been a working assumption that the different policy objectives are synergetic and reinforce each other. For instance, decarbonizing the European economy would support security of supplies in the sense that the deployment of low carbon technologies reduces Europe's dependence on imported fossil fuels. In addition, the pioneering role of Europe in deploying low carbon technologies is believed to yield positive economic benefits in a future in which fossil fuel prices would increase. Similarly, the integration of competitive wholesale power markets has been seen as a way to reduce prices and improve the competitiveness of the European economy, but also to improve the resilience of Europe's energy system to potential fossil fuel price shocks or supply disruptions.

However, in hindsight, the different pillars of Europe's energy policy do not seem as synergetic as often believed. First, the relationship between liberalized power markets and security of supply is more complex than anticipated: it is now largely recognized that the so called "energy only" markets do not provide adequate investment incentives, and cannot guarantee security of supply. In response, most European countries are currently implementing some form of capacity mechanism to ensure generation adequacy in the medium to long term. In addition, the synergies between liberalized power markets and competitiveness are increasingly being questioned as customers see electricity bills increasing. This is reinforced by the impact of environmental policies, in particular support policies for renewables which are driving electricity costs up for retail users in most countries.

In fact, Europe's green agenda has not been reconciled with Europe's objective to create competitive and integrated markets. The impact on energy costs and on Europe' competitiveness of the 2020 targets is becoming apparent today as many member states revisit their support policies for renewables, in order to contain costs for consumers. The integration of intermittent renewables into electricity systems also induces network reinforcement costs and raises new challenges for transmission system operators and distribution system operators to maintain security of supply.

One key lesson of the 2020 targets is that the inherent trade-offs between Europe's climate and environmental objectives, and its other competitiveness and security of supply objectives, have not been identified properly. A sound European energy policy needs to recognize that the three historical pillars of Europe's energy policy are not always synergetic, and address areas of overlap and potential contradiction. The identification of the tradeoffs involved between the different policy objectives is an important prerequisite that should be analyzed as part of the impact assessment of the 2030 objectives discussion.

This should naturally lead to a discussion on prioritization of the different policy objectives. Are there "primary" and "secondary" objectives within the European energy policy trilemma? Whilst maintaining security of supply and the fight against climate change seem to be clear primary objectives, the drive to liberalize and integrate European power and gas markets appears today rather as secondary objective, or an overarching constraint.

In this respect, it is noteworthy that creating integrated and liberalized markets seems to have evolved from being an objective in itself to a mean to an end, namely ensuring competitive access to energy for European citizens. The changing semantic over this third pillar of European energy policy illustrates this evolution: in the 1990s the policy impetus was for the creation of "liberalized integrated energy markets", whilst nowadays the third element of the trilemma is often described as ensuring "competitive and affordable" access to energy. For instance, the conclusions from the European Council on 26-27 June 2014 stated that "To ensure our energy future is under full control, we want to build an Energy Union aiming at affordable, secure and sustainable energy."

This change in policy priorities and the overarching competitiveness and affordability imperative are likely to have profound implications as this implies that creating a competitive liberalized internal market is not an end objective in itself anymore, but should instead serve the two other policy objectives – namely ensuring the safe and affordable supplied of energy to European citizens, and working towards the long term decarbonization objective. In other words, whilst the main objective of the previous directives on the internal energy market were to create a common market and to foster competition, the market design and regulatory structure will need to be rethought as a mean to an end – which will most likely lead to different types of arrangements. This issue is discussed further in Section IV.

As a conclusion, we make the following policy recommendations. First, the EC should in a more systematic way recognize the inherent conflicts between different policy objectives of the EU trilemma and address the tradeoffs. In particular, the EC should clarify the way in which the overarching competitiveness and affordability imperative affects the other decarbonization and security of supply policies. For instance, the impact assessment of the 2030 "green package" should provide a thorough assessment of the economic implications in terms of wealth and employment. In this perspective, significant progress has been made in the integrated modelling of energy-climate and the economy, with could usefully inform the policy debate. Similarly, the impact in terms of security of supply of the deployment of significant capacity of intermittent renewables should be assessed, and the costs associated with the network reinforcement and flexibility procurement identified.

1.3. Recasting EU energy policy to account for changes in global energy markets

Global energy market developments over the past decade and the economic crisis have challenged European energy policy, which seems in hindsight to have been too much inward looking and based on contestable implicit or explicit assumptions about the future of global energy markets and fossil fuel prices developments.

The drive for the "green agenda" has been based on two misguided assumptions. First, Europe's strategy to lead on the fight against climate change was based on the assumption that other countries would follow and define their own targets for emission reduction and clean technologies deployment. In the run up to the Copenhagen climate conference in 2008, the working assumption was that a global deal on climate change would legitimate Europe's strategy. However, there has been almost no progress on the international scene toward a global agreement to mitigate climate change since 2008. This has fired back on Europe's ambition to decarbonize its economy, as many doubts have been raised about such unilateral commitment and the costs that it would impose on the European economy, should other countries not follow suit with comparable engagements.

The second important assumption that underpinned Europe's commitment to fight climate change was that fossil fuel prices would increase steadily in the future.[1] This assumption justified the support for low carbon technologies whose cost would reduce over time and inevitably converge with those of conventional fossil fuel technologies. This implied that the "green agenda" costs would remain affordable, and would in the long term yield positive benefits and save costs to European customers.

However, the discovery and production of large quantities of shale hydrocarbons in the US has largely changed the global energy market dynamics over the past few years. Whilst the US natural gas production had been declining until 2008, and the US was anticipated to run into a large natural gas importer, the US is now foreseen to be self-sufficient by 2020.[2] The shale gas revolution in the US has had consequences on the European economy through the global energy markets nexus. The pressure on oil indexed gas supply contracts has led to renegotiations with Europeans suppliers, which brought natural gas prices purchased though long term contracts closer to market prices.

---

(1) European Commission staff working document SEC(2008) 85. "Impact assessment accompanying the Package of Implementation measures for the EU's objectives on climate change and renewable energy for 2020". Available at: http://ec.europa.eu/clima/policies/package/documentation_en.htm.
(2) International Energy Agency World Energy Outlook, 2012 edition.

The surplus of US coal production that is not being used anymore by power producers in the US has been exported and contributed to the downward spiral of international steam coal prices over the past few years – which explain the revival of coal fired generation in Europe. In addition, the recent decrease in the oil price as well as a number of other commodities marks the end of the "commodity supercycle", a period of sustained high commodity prices.

Moreover, the ramifications of the recent changes in the global commodity markets stretch into the broader issue of costs and competitiveness. By halving natural gas prices in the past five years in the US, shale gas has contributed to creating a significant cost advantage for locating some industries that are energy intensive or rely on natural gas as feedstock in the production process. The indirect effect on the price of electricity in the US versus Europe is also worth noting, as Europe has become much more expensive. Electricity and gas prices in Europe come at a significant premium to the prices in developing countries but also compared to other OECD countries, to the exception of Japan.

The 2030 Green Paper from the European Commission reckoned that the EC *"must reflect a number of important changes that have taken place since the original framework was agreed in 2008/9: the consequences of the on-going economic crisis; the budgetary problems of Member States and businesses (…); developments on EU and global energy markets, including in relation to renewables, unconventional gas and oil, and nuclear; concerns of households about the affordability of energy and of businesses with respect to competitiveness; and the varying levels of commitment and ambition of international partners in reducing GHG emissions."*[1]

As a conclusion, it seems important that Europe does not repeat the same mistakes as it discusses and develops its 2030 framework to fight against climate change. In particular, the impact assessment of the 2030 renewables, CO_2 and energy efficiency targets should consider scenarios with a non-cooperative approach from Europe commercial partners and with lower fossil fuel prices than currently anticipated. In addition to the current exceptions to some sectors at risk of carbon leakage, complementary policy measures such as the introduction of border tax adjustments should also be considered.

1.4. Informing policy debates with transparent data on system costs and subsidies for different technologies

The policy debates in Brussels and in many countries are based on implicit or explicit assumptions about the costs of different technologies, as well as their evolution going

(1) European Commission Green Paper (2013), "A 2030 framework for climate and energy policies", COM(2013) 169. Available at: http://ec.europa.eu/energy/green_paper_2030_en.htm.

forward. We argue that often critical policy decisions are made on the basis of weak – or possibly even biased evidence – on the costs of different technologies.

In the case of electricity generation, for instance, the comparison of the costs of different generation technologies is often based on the pure "technology internal costs", and does not factor the "external costs" or the "subsidies" associated with the different technologies. These broad cost categories can be defined as follows:

- Internal costs. These are the costs of generating a kWh of electricity borne by the firm that owns the power plant. These would include fuel, operation and maintenance and costs related with construction, siting and interconnection of the power plant;
- External costs. External costs are the costs of generating a kWh of electricity that are borne by the rest of the society. These external costs typically include the environmental damage such as the impact on climate change, acid rain, as well as the risk of accidents along the supply chain. The external costs also include the impact of a given generating technology on the costs of the delivering electricity from the rest of the electricity system, such as the backup costs in the case of intermittent renewables (system costs);
- Government subsidies (or taxes). Another type of external cost of electricity generation comes from subsidies, for example, a fuel subsidy. This subsidy reduces the internal cost of electricity production and the government compensates this reduction through the subsidy. The subsidy represents the cost to society, since it is funded either through higher revenues from other taxes or from foregoing other government expenditure. Taxes too can be incorporated into this framework by thinking of them as negative subsidies.

This implies that a priority of European energy policy should be to make the underlying assumptions about technology cost supporting energy policy targets explicit, and to ensure that a transparent and consistent methodology is used to assess and monitor the evolution of the cost and subsidies for different technologies. Interventions representing direct subsidies fall under state aid and are subject to European regulation on state aid, which was updated recently with the publication of the new EC Environment and Energy Aid Guidelines (EEAG).[1]

The European Commission (EC) launched a study on energy subsidies and costs in the European Union (EU) in January 2014. The objective of the EC study is to provide "a complete and consistent set of data on energy generation (electricity and heating) and

(1) European Commission (2014), "Guidelines on State aid for environmental protection and energy 2014-2020", 2014/C 200/01.

system costs and the historical and current state of externalities and subsidies in each Member State of the EU and for the EU overall."[1]

We would recommend that as a follow up from this study quantifying external costs and subsidies, a monitoring process be put in place in all member states to track and assess the evolution of the different costs over time. In addition, the creation of a level playing field will require a strict application of the European state aid guidelines policies in order to ensure that those policies are cost-effective for society and do not cause distortions of competition or a fragmentation of the Single Market.

Furthermore, we would recommend that the principle of "cost reflective" prices should be instituted as a core principle of tariff and taxes design, as well as more broadly of any policy impact assessment. In many member states, current end user prices do not reflect the addition of the different cost components, leading to subsidization, or cross subsidization of energy prices. This principle should also apply to external costs, in the sense that all technologies should bear the cost associated with their external effect on the electricity system or on society at large. This principle of cost reflectivity could be for instance enshrined in the Energy Taxation Directive.[2]

2. Policies supporting decarbonization

2.1. The need for a structural reform of the European carbon market

The European Trading Scheme (ETS) was championed by the European Commission in the 2009 green energy legislative package as the centerpiece of European policy toward a decarbonized energy mix.[3] However, carbon prices have been on a downward trend since 2009 and have been trading in the range of 5 to 7 €/tCO_2 for the past three years, which has triggered a policy debate about whether the ETS is working properly and about the need for reform.

The evidence is growing that the weak and volatile prices in the ETS are not effective in driving carbon emission abatement in the power sector. As a reference, the implied switching price between coal and gas fired generation ranges from 30 to 40€/tCO_2 with

(1) European Commission (2013), "A study on energy costs and subsidies in the European Union". See http://ec.europa.eu/dgs/energy/tenders/doc/2013/2013s_249_433934_specifications.pdf.

(2) The Energy Taxation Directive entered into force on 1st January 2004 sets minimum tax rates for energy products, including coal, natural gas and electricity. The aim is to reduce distortions of competition that currently exist between Member States as a result of divergent rates of tax on energy products; as well as to reduce distortions of competition between mineral oils and the other energy products; and increase incentives to use energy more efficiently. See: http://ec.europa.eu/taxation_customs/taxation/excise_duties/energy_products/legislation/index_en.htm.

(3) The European carbon Trading Scheme (ETS) currently covers close to half of the European Union's emissions of carbon dioxide (CO_2).

current gas and coal prices. In a longer term perspective, current ETS prices are also held to be well below the kind of carbon prices that are needed to make investment in clean technologies competitive.[1]

The ETS design is not to blame for the drop of prices, as the drop in carbon prices over the past few years can be explained by the growing oversupply of allowances for phase 2 and 3. The supply of allowances was fixed in 2007 for Phase 3 up to 2020, and since then a series of shocks affecting the supply and demand of ETS allowances have led to the current oversupply situation. The economic crisis that started in 2008 and the weak economic recovery that followed depressed industrial activity and reduced emissions compared to the expected emissions as defined by the cap for phase 3. On the supply side, a rush to register international offset projects and use the resulting credits ahead of quality controls that went into effect in 2013 also displaced ETS allowances demand and contributed to increasing the supply surplus.

The ETS is now oversupplied well into phase 3, and this is unlikely to be materially affected by the proposed ETS reform. The back loading of some 900 mt of CO_2 allowances until the end of the decade that was approved in late 2013 has not provided much support to prices. Moreover, the structural reform proposed by the European Commission in January 2014 does not seem to be ambitious enough to reverse this trend. The "market stability reserve" (MSR) proposed for the next compliance period (2021-2028) would gradually absorb the surplus of allowances, predicted to be over 2 billion in 2020, by reducing supply each year by an estimated 200 Mt until 2028, thus diminishing the surplus to a minimum volume of 500 Mt according to the impact assessment published by the Commission.[2] This seems too little too late, and some countries including the UK and Germany are now pushing for an early implementation of the MSR.

A range of analysts agree to question not only the efficiency of the MSR to provide some significant price support, but also its fundamental design and ambition.[3] A key issue that remains to be addressed by the reform is the overlap of the ETS with national policies in support of low carbon technologies and energy efficiency which have a significant effect on the demand for ETS allowances. In concrete terms, the issue is that the ETS has become a "residual market" for carbon abatement in the power sector.[4] Policies in

(1) Assuming a 140€/MWh cost of production for wind offshore and a 210€/MWh cost of production for solar PV, the implied carbon price that would equalize their long run generation costs with a combined cycle gas turbine (about 70 €/MWh) are respectively 240 €/tCO_2 and 430 €/tCO_2.
(2) European Commission Communication. Proposal for a market stability reserve, 22/01/2014 - COM(2014) 20. Available at: http://ec.europa.eu/clima/policies/ets/reform/documentation_en.htm.
(3) "The EU ETS' market stability reserve: a marginal long-term structural reform", Tendances carbone, April 2014, No. 90, www.cdcclimat.com/IMG//pdf/tc90_eng.pdf.
(4) See "The ETS: a residual market for carbon abatement in need of a structural reform", Fabien Roques, April 2012. Available at: www.cdcclimat.com/The-ETS-a-residual-market-for-carbon-abatement-in-need-of-a-structural- reform.html.

support of renewables or nuclear have been the prime drivers of power sector investments over the past decade in Europe.

As we argued in previous papers, the ETS needs a structural reform to provide some more credibility about a long term carbon price trajectory.[1] The ETS needs to evolve toward a hybrid “cap and trade system” with a price stabilization mechanism. This requires the implementation of a supply management mechanism more ambitious than the current MSR proposal. The MSR reform aims to provide a corridor for the allowance surplus, which is only an indirect way to absorb some of the existing surplus, but will not help in managing future shocks.

A supply management mechanism to maintain prices within a predetermined “politically acceptable” price range would rely on a “strategic reserve” of allowances which would manage the amount of credits auctioned each year to maintain ETS prices within a corridor. This can be either based on an improved MSR type mechanism, or delegated to an independent authority – e.g. a European carbon bank – which would have the mandate to adjust supply so as to maintain prices within a predetermined range. Our preference goes for a simple automatic approach with an auction reserve price, which would essentially require policy makers to agree on the trajectory for the price cap and floors, as relying on a new independent authority to manage the stock of allowances would seem to be unnecessarily complex to implement and would create a new source of policy uncertainty.

2.2. Too much focus on deploying technologies, not enough support for R&D

Europe’s support for clean technologies has been concentrated on the deployment of some technologies which have received significant support in the past decade. HIS CERA estimated that support costs for renewables in Europe have risen to €30 billon in 2012, and would reach €49 billion in 2020 based on current market trends. Based on current trends, annual renewables support costs would double across EU27 from €30 billion in 2012 to over €60 billion in 2035.[2]

This support for deployment of renewables contrasts with the lack of funds available for research and development (R&D) in energy. In real terms, public spending in Europe on energy remains well below the amounts spent in the 1980s, and this does contrast with the industrial policies of other countries such as the US or Japan, which focus a greater share of public spending on R&D.

(1) See “European electricity markets in crisis: diagnostic and way forward”, Fabien Roques, November 2012, contribution to CGSP report. Available at: www.strategie.gouv.fr/sites/strategie.gouv.fr/files/archives/CGSP_Report_European_Electricity_System_030220141.pdf.
(2) IHS CERA European Policy Dialogue 2012, Public Launch supporting Policy Memo.

Given the uncertainties on the costs and future progress of the different clean technologies, an optimal policy mix would need to be geared toward R&D and reduce spending on deployment. In 2007, the European Commission launched a Strategic Energy Technology Plan (SET-Plan) which aimed to accomplish four things: i) An improvement of coordination among existing research capacities in the EU; ii) Higher effectiveness of implementation of energy innovation; iii)Mobilization of additional resources; and iv) More and better international cooperation on energy technology development.[1]

The SET-Plan was endorsed by the European Council during the spring meeting of 2008. However, the Council did not indicate that it would mobilize additional funding for the initiative and the financing of the SET-Plan has remained a contentious issue. The difficulties of getting additional funding since then reveal both the desire to keep the development of new technologies with potential relevance for competitiveness under tight national control, but also an unwillingness to commit fresh money in times of tight national budgets.

Going forward, we would argue that Europe needs to develop a coordinated R&D and industrial policy for clean technologies through a wide-ranging reform of the SET-Plan. This would involve scaling up spending R&D and demonstration significantly, and a better coordination of the different national efforts to R&D. Instead of picking technology winners, the European Commission should invest in fundamental research and stimulate the development of collaborations between the public and private sector to stimulate and leverage private R&D.

An integrated European innovation policy should also focus on the funding and support for the demonstration and commercialization of innovation, an area where Europe lacks a supportive framework compared to e.g. the United States.

In practice, the renewables energy supply (RES) targets could be replaced with an equivalent RES R&D and deployment target, whereby countries could choose to support R&D on RES and get credit toward meeting their RES target. In other words, a system of RES credits could be put in place to ensure that the RES obligations of member states can to some extent be met through R&D efforts. This would require a certification and measurement process for R&D which would have the added benefit to contribute to rationalize and coordinate R&D spending across member states.

(1) Communication from the Commission of 10 January 2007 entitled: “Towards a European Strategic Energy Technology Plan”, COM(2006) 847 final.

2.3. Pace the deployment of clean technologies to manage the costs of the energy transition

Investment in renewable energy sources (RES) driven by feed in tariffs or other support schemes displace thermal plants in the merit order, and therefore have a significant effect on power prices dynamics and the revenues of thermal pants. This is known as the "merit order" effect, by which low marginal cost renewables technologies displace more expensive thermal plants. This effect is well documented and a literature review of econometric studies that have modelled the impact of the wind and solar PV deployment in Germany shows a depressive effect on average power prices ranging between 2 and 8 €/MWh.[1]

By modifying the generation mix policy makers change the distribution of revenues to the existing assets, reducing both the running hours of thermal plants and the expected power prices. This can lead to significant revenue transfers across technologies as the system adjusts the generation mix to reach a new equilibrium. The distributional effects depend on whether the revenues from the new RES plants are captured by the incumbent players operating the thermal plants which see their revenues reduced, or whether these go to different players.

The key issue to have a sustainable transition toward a low carbon generation mix is therefore the pace of deployment of subsidized technologies. If the transformation is so rapid and/or unpredictable as to radically alter the revenues of some units which are still in the amortization phase, it can lead to stranded costs and possibly endanger security of supply by amplifying boom and bust cycles. A number of European countries including Germany, Spain and Italy have recently reduced generous support schemes for renewables which led to spectacular – and sometimes uncontrolled – deployment of renewables, particularly solar photovoltaics (PV). Respectively, 7 GW and 5 GW of solar PV were installed on average per year in Germany and Italy over 2010-2012. This solar PV boom was triggered by generous feed in tariffs guaranteeing a comfortable rate of return for investors – but also locking in 15 to 20 years contracts an additional support costs to be paid by electricity consumers.

The key issue to have an affordable transition toward a low carbon generation mix is to manage the pace of deployment of subsidized technologies. This is both important to control the costs associated with subsidies for these technologies, and to provide a predictable pace of deployment so that the value of existing assets and potential new investments in thermal plants do not vary in an unanticipated or unpredictable way.

(1) Source: Öko-Institut (2013), "Proposal for a Revision of the Industry Exemption rules under the German EEG Towards a model that complies with European Laws and balances energy, industry and consumers".

We therefore recommend that member states define RES deployment roadmaps which would comprise among other things an anticipated trajectory for the volumes of the different technologies to be added into the system. In order to control the volumes of clean technologies, support schemes fixing a volume cap, or relying on auctions, should be favored to ensure some predictability of the trajectory for clean technologies deployment. For instance, the reform of the German Renewable Energy Act (German: Erneuerbare-Energien-Gesetz, EEG) sets an upper limit per year for the volumes installed of onshore wind (at 2.5 GW/year), offshore wind (6.5 GW to 2020), and solar PV (2.5 GW/year).[1]

2.4. Ensure greater coordination of national renewable support policies

Policies to support renewables in Europe show a wide diversity of approaches, ranging from feed-in tariffs guaranteeing a fixed price for energy amount fed into the grid, premium schemes under which RES producers receive the electricity market price and a fixed premium for producing renewable energy, and green certificate schemes relying on a renewable generation obligations imposed on suppliers, who can either produce "green electricity" or buy the equivalent in green certificates. There is a large academic literature and practitioner's evidence on the pro and cons of the different schemes.[2]

The lack of coordination between the national approaches has led to suboptimal deployment of renewables, with a strong build up in some regions that are not necessarily corresponding to the best endowed in terms of wind or solar resource, thereby increasing system costs for European consumers.[3]

In addition, these RES support schemes interact in a different way with electricity market dynamics. As a consequence, the lack of a coordinated approach across the different countries can lead to spreading distortions induced by RES support schemes across borders, such as negative prices. This is particularly true in regions which have implemented price-coupling, where a contagion effect for the effect of RES on electricity market price dynamics is likely to happen.

One priority of European policy should therefore be to work toward some coordination and eventually harmonization of RES support schemes. The EU Renewable Energy Directive 2009/28/EC encourages cooperation between Member States for the 2020

---

(1) Bundesministerium für Wirtschaft und Energie (2014): www.bmwi.de/DE/Themen/Energie/Erneuerbare-Energien/eeg-reform.html.
(2) See e.g. Hiroux, C., and Saguan, M. (2010), "Large-scale wind power in EU electricity markets: Time for revisiting supports and market designs?", *Energy Policy*, Vol. 38(7), July, pp. 3135-3145. Ragwitz, M., and Steinhilber, S. (2013), "Effectiveness and efficiency of support schemes for electricity from renewable energy sources", accepted for publication at WIREs Energy Environment.
(3) See e.g. Roques, F., Hiroux, C., and Saguan, M. (2010), "Optimal wind power deployment in Europe – A portfolio approach", *Energy Policy*, Elsevier, vol. 38(7), pp. 3245-3256, July.

target, and puts in place a number of cooperation mechanisms between member states and with third countries. Four types of cooperation mechanisms provide for different levels of cooperation between countries: Statistical transfer of renewable energy (Article 6); joint projects between Member States (Article 7); joint support schemes (Article 11); and joint projects with third countries (Article 9).

Although several Member States have started to assess the use of cooperation mechanisms and have approached potential cooperating states, only Sweden and Norway have so far engaged in a cooperation mechanism (joint support scheme). Member States interests to use cooperation mechanisms have so far been strongly linked to domestic target achievement, and there seems to be little awareness of the potential benefits of a joint approach. One key issue seems to be the practical design of cooperation mechanisms, which has been left to member states.

The potential benefits of cooperation are wide ranging and might include: i) closing a potential gap with the 2020 target and/or lowering the costs of reaching the national 2020 RES targets; ii) cooperation for technology development; and iii) long-term cooperation for market integration through electricity imports/exports. A recent study commissioned by the European Commission attempted to quantify the potential benefits of improved cooperation between member states for renewables deployment.[1] The study estimates that support expenditures that come along with dedicated RES support would decrease by 10.8% in the case of a strong use of cooperation mechanisms. This corresponds at EU level to cumulative savings of € 31 billion over the 2013 to 2020 period.

Looking ahead, the European Commission should as part of the discussions on the 2030 package work on the practical design of cooperation mechanism to remove the existing of perceived barriers to their implementation.[2] Going further, the EC should also think of ways to create incentives for countries to participate in such cooperation mechanisms, e.g. by adding a bonus in the accounting of renewables generation from projects involving cooperation across members states in their contribution toward the 2020 and 2030 targets.

2.5. Move away from production based renewables support schemes

Policies supporting RES can create distortions in power markets, which have led to a debate about how RES could be better integrated into power markets. For instance, the

(1) "Cooperation between EU Member States under the RES Directive", Task 1 report. By: Corinna Klessmann, Erika de Visser, Fabian Wigand, Malte Gephart, Ecofys, and Gustav Resch, Sebastian Busch, TU Vienna. 29 January 2014. A report compiled within the European project "Cooperation between EU MS under the Renewable Energy Directive and interaction with support schemes".
(2) The design features could include for instance the type of cooperation (e.g. number of involved parties), the scope of cooperation (e.g. technology and duration of support), the flow of support (e.g. determination of support level/transfer price) and the contractual arrangements (e.g. arrangements for noncompliance).

EC has recently noted that: "frequent occurrences of negative prices in many European markets signal the need for better integration of renewables into the power grid".[1]

The key issue lies in the design of RES support schemes. RES support schemes in Europe are based on production as the level of subsidy received by the plant increases with production.[2] This results in an incentive to produce in hours where power prices are below their avoidable costs, creating distortions in the merit order in the electricity market, and therefore increasing total generation costs to meet demand.[3] In markets which allow for negative prices (e.g. Germany or UK for balancing), these distortions can create artificial (and thus inefficient) negative prices.

The potential for dispatch distortion varies depending on the RES support scheme. The range of prices which lead to inefficient dispatch is greater the greater the size of the unitary support payment. The Feed-in-Tariffs (FiT) have therefore the greatest potential to distort dispatch, followed by Feed-in-Premiums (FiP) / Green Certificates /Contracts for Difference. The potential for distortion varies depending on the cost characteristics of the plant. The lower the avoidable variable costs the smaller the range of prices which lead to inefficient dispatch.

Ignoring the distortions to productive efficiency created by support schemes may lead to incorrect allocation of risk. Thus, while the risk for investors in technologies which receive a FiT may be lower vis-a-vis a FiP, a FiT increases certain risks for other generators and consumers.[4] In addition, the transfer of risk from RES producer's to other generators and consumers is inefficient as RES producers are best placed to handle these risks.

The recently approved European Commission Guidelines on State Aid for Environmental Protection and Energy introduce a series of measures, "in order to promote the better integration of renewable energy into the market". In particular, from 1 January 2016 all

(1) DG Energy: Market Observatory for Energy (2013), "Quarterly Report on European electricity Markets", Vol. 6(2), Second Quarter of 2013,
http://ec.europa.eu/energy/sites/ener/files/documents/20130814_q2_quarterly_report_on_european_electricity_markets.pdf.
(2) Some FiT and FiP schemes may set a maximum level of production allowed to receive support in a particular period with additional production receiving the market price without any subsidy.
(3) See Eurelectric's papers on State aid and RES integration:
www.eurelectric.org/media/127341/notion_of_state_aid_eurelectrics_response_14_march_final_correction-2014-2100-0007-01-e.pdf
www.eurelectric.org/media/77389/iem_comm_eur_response-2013-300-0001-01-e.pdf
www.eurelectric.org/media/26730/resap_report_20111026_high_quality-2011-133-0001-01-e.pdf.
(4) For instance, under a FiT there may be a higher risk for conventional generators of being inefficiently displaced in the merit order and prices being distorted below their competitive level. In addition, a FiT does not provide efficient signals for maintenance decisions or for the use of storage technologies (when available) and thus leads to a higher risk that production from plants will not be available when prices are higher. This increases security of supply risk for consumers.

new support schemes must ensure (for plants with installed capacity greater than 500 kW):[1]

- Aid is granted as a premium in addition to the market price (FiP) whereby the generators sell its electricity directly in the market.
- Beneficiaries are subject to standard balancing responsibilities (unless no liquid intra-day markets exist).
- Measures are put in place to ensure that generators have no incentive to generate electricity under negative prices.

The Guidelines seem to attempt to address the issue of distortions in the merit order by restricting the use of FiTs and ensuring that RES and CHP generators do not have incentives to produce at negative prices. However, this fails to generally address the inefficiency which can result from distorting price signals that generators use to decide when to produce. A more nuanced approach is appropriate depending on the cost structure and maturity of the technology.

Going further, regulated payments based on available capacity instead of production is the only approach that will fully eliminate the potential for dispatch distortion. Remunerating RES based on installed capacity rather than production can create some other issues as it does not provide any incentive to maximize the value of production. This can for instance lead to install the cheapest technologies, which would then deliver poor operational performance. These caveats can be addressed though e.g. requirements about minimum hours of production to be eligible for the capacity payment. Some countries such as Spain are already experimenting such new approach.[2]

We therefore recommend that the EC should consider the different maturity and cost structure of the technologies in a differentiated way when applying the recent state aid guidelines. We also suggest that the distortions in power market introduced by RES support schemes could be minimized by exploring a move away from production based support toward capacity based remuneration of renewables.

(1) European Commission, IP/14/400 09/04/2014, http://europa.eu/rapid/press-release_IP-14-400_en.htm.
(2) The recent reform of the Spanish support mechanisms of RDL 9/2013 implements a capacity based annual payment for the fixed costs of RES. In addition, the RDL 9/2013 involves an operating payment equal to the difference between the market price and the generator's variable cost. If the generator where to have a variable cost below the market price the operating payment will be zero. This is the case for instance for wind generators.

3. Policies supporting security of supply

3.1. Infrastructure: fast-tracking the build-up of interconnection

Progress on building interconnection and other critical infrastructures supporting market integration has been slow over the past two decades. This comes as a stark contrast to the ambition of the European Commission to step up the rhythm of interconnection build up as a critical facilitator of an affordable transition toward a low carbon electricity system.[1]

The progress of interconnection projects has been slowed down by a range of factors: primarily local opposition, as well as political and regulatory barriers. For instance, the French-Spanish interconnection extension across the Pyrenees, or the Austrian "Steiermarkleitung" projects have faced up to a 25 years of delays. In the past couple of years, about one third of the ENTSO-E "Projects of Pan-European Significance" have experienced delays, and five have been entirely cancelled. Most often the cause of the delays resides in authorization and permitting process and local opposition, as the coordination of different parties across borders is usually complex.

There would be significant benefits in having a more interconnected market across Europe. This does not mean that building interconnections should be an objective per se – a cost benefit assessment is required to evaluate the projects which should receive public support. A number of critical interconnection projects have been identified as part of the Priority Interconnection Plan (PIP).[2] The benefits of interconnection are greatest in some areas on the periphery of Europe which remain weakly connected to the European grid – for instance the Baltics or Balkan countries. Within continental Europe, some critical transmission line reinforcements would help to alleviate local network balancing constraints, such as the North–South constraint in Germany. More interconnection capacity could also allow tapping into the hydro reserves in the Nordics and in the Alps for the storage and balancing of electricity on a wider scale than just their immediate regional surroundings. Similarly, an offshore wind grid in the North Sea would allow harnessing the good wind resources of the area whilst integrating better the Nordic market with the CWE and UK markets.

Booz & Company modeled the potential gains by 2030 of a fully integrated market which would facilitate the short and long term trading of energy, renewables, balancing services and security of supply without regard to political boundaries. They found gains from integrating the energy markets that could reach €12.5 to €40 bn/year in 2030, or about

(1) ENTSO-E 10 year Investment Plan calls indeed for two- to threefold Increase in the rate of infrastructure investment, and anticipates €104 bn of investments in power grid infrastructure over 2012-22 (TK update).
(2) Source: TEN-E: http://ec.europa.eu/energy/infrastructure/tent_e/ten_e_en.htm;
PIP: http://europa.eu/legislation_summaries/energy/internal_energy_market/l27081_en.htm.

€25 to €80 savings per capita / year.[1] In addition, the benefits of the integration due to greater interconnection can be significant in some special circumstances. For instance, power prices in the Nordics can increase significantly in a dry year when the hydro reservoirs levels are low; similarly, power prices on the continent are sensitive in France to peak load variations in case of a cold spell because of the large share of electric heating, whilst prices in Germany will vary according to renewables production. As a consequence, new interconnection can be seen as insurance mechanisms against potential disruptions or events causing sudden price increases. This is reflected in the latest ENTSO-E 10 year plan, which identifies security of supply benefits integration as the key drivers of new interconnection lines in Europe.

Going forward, Europe needs to work on a set of measures to streamline and fast track the construction of critical infrastructure. The EC should work to remove some of the permitting and licensing hurdles, through e.g. the creation of a one-stop-shop agency as part of ACER and/or regional transmission planning committees for the approval of project. This could build and expand on the Regulation EC 347/2013 (the Energy Infrastructure Regulation) from April 2013 that organizes a new framework to foster transmission grid development in Europe; In addition, best practice should be applied to relieve local opposition, e.g. by working with local communities to create support for new projects through benefit sharing mechanisms. The German NABEG law, adopted in July 2013 could serve as a useful model here and be scaled up at the EC level. The NABEG law allows certain projects to follow a Federal permitting licensing process and to bypass the normal “Länder” process to accelerate the development of critical lines.[2] Financing could also be facilitated through the expansion of the current share of European funding for projects of Common Interest (PCI) projects, as well as scaling up some of the recent EU funding mechanisms such as the new project bonds initiative from the European Investment Bank (EIB) (see Section 5 of this report).

Finally, the EC should consider how the regulation of TSOs should evolve to put in place stronger incentives for TSOs to cooperate and to build interconnection capacity, subject to lines having a positive cost – benefit. This could be done e.g. by mandating that congestion rents and cross border rents be channeled to investment in new lines; and by putting in place regional transmission development agency under joint ownership from TSOs with a clear mandate to build a coordinated transmission expansion roadmap and to implement it.

(1) Booz & Company (2013), “Benefits of an integrated European energy market”, 20 July. Prepared for: European Commission Directorate-General – Energy.
(2) Bundesnetzagentur (2014): www.netzausbau.de/cln_1412/DE/Wissenswertes/Recht/Recht-node.html.

3.2. Toward a European gas security strategy

The recent Russian-Ukraine war and the associated dispute about Russian gas supplies have revived concerns about security of imported gas in Europe. In response, the European Commission released an EU energy security strategy on 28 May 2014.[1] The mechanisms to enhance Europe's energy supply security are well known and the new EC strategy builds on the existing regulation to improve security of gas supplies in the framework of the internal gas market adopted in July 2009[2] after the previous Russian-Ukraine gas crisis, as well as the September 2011 Communication on security of energy supply and international cooperation.[3]

Whilst there are divergences across member states on specific points, the UK and Polish Non papers in preparation of the April Energy Council summarize the key mechanisms to improve gas supply security in Europe.[4] In the short term, the resilience of European gas markets can be improved by:

- Fostering the development of well-functioning markets, supported by the build out of critical infrastructure to allow market integration. The implementation of the Third Energy Package should therefore be a key priority to ensure liquid and transparent energy markets.
- Developing integrated risk assessment and planning on a regional and European basis. In particular, Europe should develop coordinated preventive planning and emergency responses to potential supply disruption scenarios. This would involve regional security of supply plans based on regional risk assessments, as well as emergency response plans.

In the medium to long term, the security of gas supplies can be improved through the following measures:

- Reducing energy demand. This relies primarily on the reinforcement of energy efficiency policies. The revision of the Energy Efficiency Directive is the occasion to critically review the most efficient and cost effective approaches to support energy efficiency.
- Fast-track the build-up of critical infrastructure. The EU needs to accelerate the building of Projects of Common Interest (PCI) to improve the interconnectivity of the

(1) European Commission Communication, "European Energy Security Strategy", COM(2014) 330 final, Brussels, 28.5.2014.
(2) Regulation (EU) No. 994/2010 concerning measures to safeguard security of gas supply and repealing Council Directive 2004/67/EC.
(3) European Commission Communication, "The EU Energy Policy: Engaging with Partners beyond Our Borders", COM/2011/539.
(4) Polish Non paper, "Roadmap towards an Energy Union for Europe. Non-paper addressing the EU's energy dependency challenges", 15 April 2014. UK Non Paper, "Energy Security in the EU", 14 April 2014.

internal market with a particular focus on regions which are vulnerable to a high risk of external supplies disruptions.

- Better coordination when negotiating with external energy suppliers. Whilst the creation of an administered single buyer seems unrealistic, better coordination in the negotiation with external suppliers possibly coupled with the implementation of an internal regional aggregation mechanism for Eastern European countries could reduce discrimination against some of the most dependent member states. In addition, the implementation of EU energy and competition law provides strong tools to prevent the exercise of market power, and should be applied to all market players including suppliers from third countries.
- Diversification of energy supply sources and supply routes of energy. The development of liquefied natural gas (LNG) regasification facilities has a key role to play in diversifying European gas supplies, as well as continued support for the Southern Gas Corridor. Indigenous European energy production also has a key role to play through the development of existing as well as new energy supplies.
- Supporting security of supply in the EU's neighbourhood. The Energy Community treaty is a key mechanism to support the robustness of neighbouring eastern countries to gas supply disruptions. For instance, the Energy Community should develop liquid and transparent energy markets and implement the Second and Third Energy Packages.

3.3. Security of electricity supplies: toward a coordinated approach for capacity mechanisms

There is currently much debate about whether the lights will stay on in Europe without reform of the electricity market. Most countries have taken steps to introduce or reform a capacity mechanism, using very different approaches. The result is a patchwork of different national capacity mechanisms which could undermine the further integration of European electricity markets. As a result the European Commission has taken steps to ensure a minimum level of coordination and published on 9 April 2014 Guidelines on state aid in relation to capacity mechanisms.[1]

The drivers of capacity mechanisms across Europe are different depending on the country considered, such that it is unlikely that a common approach at the Europe level will be practical or even suitable. But there would be merits in working toward some degree of coordination in order to minimize the potential distortions associated with different capacity mechanism approaches. A number of preliminary steps can be

(1) Guidelines on State aid for environmental protection and energy 2014-2020: http://ec.europa.eu/competition/sectors/energy/eeag_en.pdf.

identified that would be necessary prerequisites before envisaging a coordination of the capacity mechanisms themselves.

A critical first step for a coordinated approach across European countries consists in defining explicit reliability standard criteria in each country and ensuring their consistency (e.g. loss of load expectation or target reserve margin). Many countries do not have an explicit security of supply standard, but rather rely on engineering principles to evaluate the necessary investments to upgrade or reinforce networks. These different security of supply criteria also imply that the issue of “capacity leakage”, i.e. cross subsidization predates the implementation of capacity mechanisms, in the sense that countries which have a system dimensioned to stricter security of supply standard actually cross subsidize countries with a lower security of supply standard.

Moreover, for countries which have an explicit security of supply criteria, the indicators used are different in nature (e.g. target reserve margin versus a target probability of lost load), raising the issue of the harmonization of the criteria and approaches used to derive them. European TSOs have been working as part of ENTSO-E to spread best practice in terms of forward adequacy assessments, using probabilistic rather than deterministic assessments. The ENTSO-E Ten Year Development Plan released every other years by ENTSO-E shows some convergence, but points toward the need for further work to define a common methodological framework for resource adequacy assessment.

Another important issue is the necessary collaboration of TSOs to define common certification and verification procedures for plants and DSM that will participate in capacity mechanisms across borders. This requires at minimum, a common registry of plants and other resources, as well as common approaches to certify and verify the availability of plants in line with the definition of the capacity product.

Most importantly, TSOs will need to develop on a regional basis a common coordination framework, including operational rules, to deal with situations of system stress. At time of capacity shortage in one or two countries, there need to be clear rules and corresponding operational practices in place to ensure the physical delivery of energy according to the commercial contracts that have been signed.

All these preliminary steps require close collaboration of TSOs and regulators, and a practical way forward would be to set up regional task forces. Whilst the EU-wide process led by ENTSO-E should continue, regional approaches have proven to be a successful way to find pragmatic solutions, and TSOs have a long history of working with their neighbors.

4. Toward a sustainable power market framework

4.1. Accelerating current market reforms: toward the Target model 2.0

Despite some steady progress toward integration, European electricity markets are currently at a crossroad. The key issue is not so much the imperfect or incomplete process of liberalization and integration of electricity markets, but rather the need to reconcile this process with the new policy priorities in favor of decarbonization and competitiveness.

Europe's target model for electricity market integration has indeed become obsolete before it is even implemented, as it failed to take into account the implications of the changes in context over the past decade. Confronted with the deficiencies of the European model, different countries have embarked in the past few years into national reforms which create additional distortions through e.g. the implementation of special mechanisms to guarantee security of supply (such as capacity mechanisms).

First, the current Target model is incomplete as it is primarily focused on integrating day ahead of power markets. In a previous study, Roques (2013) detailed how the sequence of electricity markets could be completed with the missing elements in both the short term and in the long term. With the growth of intermittent renewables, the short term balancing of the system will rely critically on the implementation of liquid and integrated intraday, balancing and reserve markets.[1] In addition, the implementation of capacity mechanisms in a coordinated way seems necessary to guarantee resource adequacy and security of supply in the long term. The design of electricity markets will also need to evolve to provide better locational signals so that production or demand response are located in nodes of the network where they are most needed.

4.2. The change of technology paradigm and the implications for power market design

The theory for electricity market liberalization was developed in the early 1980s in a very different context from today. In particular, a technology rupture – the combined cycle gas turbine – contributed to anchor the belief that electricity could be produced and traded as a commodity, and that therefore commodity markets could be used as a template to liberalize the electricity industry. Whilst electricity production had been characterized for decades by increasing returns to scale, the development of combined cycle gas turbines in the 1990s offered the prospect to develop competition based on a standardized and

(1) See "European electricity markets in crisis: diagnostic and way forward", Fabien Roques, November 2012, contribution to CGSP report. Available at: www.strategie.gouv.fr/sites/strategie.gouv.fr/files/archives/CGSP_Report_European_Electricity_System_030220141.pdf

modular technology, which would reduce barriers to entry and reduce the complexity of building and operating power plants.

Whilst CCGTs were the dominant technology of the 1990s and contributed to the development of competition in liberalized European power markets, the technology paradigm has dramatically changed in the past decade. Driven by the European climate and clean technologies targets, renewables have dominated investments in power generation in the past decade. In the past four years (from 2009 to 2012), more than 60% of the capacity additions in Europe (110 GW out of 174 GW) consisted in renewables or nuclear plant.

This change in technology paradigm imposes to revisit market arrangements and raises questions about the fundamental design of power markets. First, electricity markets have been designed on the principle that electricity is a homogenous commodity produced by a set of fairly similar technologies (conventional thermal plants). The introduction of intermittent renewables is leading to a differentiation of the electricity produced from different generation technologies depending on a number of attributes: whether the production can be controlled, the degree of flexibility and predictability of the production are valuable attributes which lead to the creating of separate markets to value these different attributes. For instance, capacity markets, and flexibility products are implemented in a number of countries to value respectively dependability and operating flexibility.

Beyond this growing complexity of electricity markets associated with the different attributes of renewables production technologies, the change in the cost structure of the dominant technologies raises questions about the fundamental principle of electricity markets. According to peak load pricing theory, in power markets participants bid their short run marginal costs (SRMC), and fixed cost are recovered through: i) inframarginal rents as technologies with higher SRMC clear the market and set the power price, and ii) scarcity rents when the market is tight and prices go beyond the SRMC of the technology clearing the market.

This market paradigm worked well to induce competition between technologies with significant variable costs, but will likely need to be adapted to reflect the recent changes in the technology costs structure of the generation mix. For all low carbon technologies – renewables, nuclear and carbon capture and storage – investment costs represent a large charge of the total generation costs.

In concrete terms, the European electricity industry is moving from an “OPEX world” into a “CAPEX world”. This has important implications for the evolution of the design of competitive power markets. Whilst in theory marginal cost pricing can still work with a part of the generation mix having zero or very low SRMCs, prices will likely become very volatile as the share of renewables increases and technologies with zero SRMC clear the market increasingly frequently. The risk is therefore that prices would be at or near zero (and could even be negative) for long periods of time, and fixed costs for thermal plants would therefore have to be recouped during few hours, therefore leading to extremely high prices.

The gradual increase of the share of renewables should be supported by reforms of the target model for electricity markets in Europe, reflecting the change of the industry cost structure. This implies that a transition to a market design that complements marginal pricing with some other mechanism to support fixed cost recovery will be needed. Alternative models of competition are possible for industries with a costs structure dominated by fixed costs. The key is to apply competitive pressure where it does matter, primarily on the investment decision. In other industries which are capital intensive, this is done through e.g. the auctioning of long term contracts.[1] In this respect, experience from Latin America provides alternative models of competitive arrangements, where periodic auctions are run for long term contracts of both thermal and renewables plants, and could constitute a useful learning case for Europe.

4.3. Long term power market design challenges: toward "hybrid models"

Beyond these well understood reforms of the European target model, a discussion needs to be initiated on the medium to long term model for electricity markets in Europe. Indeed, the evolution of the generation mix toward capital intensive technologies, combined with the intermittent nature of some renewables technologies, imply that electricity markets rooted in the principle of short term marginal cost pricing will likely not be appropriate in the medium to long term. In addition, the depressive effect of RES on power prices represents a structural issue as power prices will be on average lower than in the previous equilibrium, and with growing shares of renewables, will become more volatile. This might lead to an unstable market dynamic when renewables become the marginal technology for significant periods of time, where power prices would oscillate between extremes at short notice and in an unpredictable way.

Some exploratory work needs to be launched to study alternative models for the long term (post 2025). These alternative models will likely comprise a greater role for long term contracts to facilitate investment and financing of low carbon as well as thermal technologies. Long term contracts can be tendered to maintain competition and concentrate it on the investment decision, which is the most important cost factor for capital intensive technologies. A system of auctions for long term capacity contracts could supplement a liquid spot market which role would be confined to the short term dispatch optimization.

(1) See e.g. Finon, D., and Roques, F. (2008), "Financing Arrangements and Industrial Organisation for New Nuclear Build in Electricity Markets", Competition and Regulation in Network Industries, Intersentia, Vol. 9(3), pp. 247-282, September.

We therefore recommend that the European Commission considers the long term directions for reform of existing power markets. In particular, as the share of RES technologies with low variable costs increases, the role of marginal costs pricing as the pillar of electricity markets will have to be revised. This can happen gradually as additional remuneration sources through short term markets and capacity markets gradually provide new sources of revenues reflecting the growing importance of these products to the system. The long term destination may therefore be a market framework which would give a greater role for auctions of long term capacity contracts in order to ensure that there is competition "for the market" and a level playing field between low carbon and thermal plants, whilst the spot and intraday markets would ensure competition "in the market".[1]

5. Governance and financing challenges

5.1. Financing the energy transition: innovative instruments to scale up infrastructure investment

Significant investments are required in both the short and long term to decarbonize Europe's energy sector and renew ageing infrastructure. In the short term, the European Commission estimated that Europe's energy system would require investments of ca. EUR 1 trillion by 2020, out of which about EUR 200 billion needed for electricity and gas networks of European importance alone.[2] In the long term, Eurelectric estimated that the total investment in power generation over 2010-2050 would amount to €1.75 trillion (in 2005 money terms), whilst investment in power grids over the same time frame would amount to €1.5 trillion.[3] This corresponds to a range between 40 and 60 billion Euros per year of investment in the European power generation until 2050. The total energy costs are estimated to increase from about 10.5% of European GDP in 2010 to about 13% of European GDP in 2025.

There are concerns that financial constraints will require a significant contribution from public budgets of either member states or the European Commission to deliver on these ambitious infrastructure investment objectives. The European Commission states that *"The analysis carried out by the Commission services in preparation of the Connecting Europe Facility Regulation have shown that while the capital markets, the banking sector as well as national budgets are expected to play a major role in delivering the required infrastructures through appropriate investment and pricing mechanisms, some*

(1) For more discussion of these issues, see e.g. Finon, D., and Roques, F. (2013), "European Electricity Market Reforms: The 'Visible Hand' of Public Coordination", *Economics of Energy & Environmental Policy*, Vol. 2(2). Available at: www.ceem-dauphine.org/assets/wp/pdf/Finon_Roques_Visible_Hand1.pdf.
(2) Source: European Commission website, http://ec.europa.eu/economy_finance/financial_operations/investment/europe_2020/investment_needs_en.htm.
(3) Source: Eurelectric Power Choices Reloaded Study (2012).

investments in infrastructure will not take place or will be delayed far beyond 2020, if the EU does not take action. Therefore, there is a need for a significant contribution from the EU budget in the next Multi-Annual financial framework to ensure that EU infrastructure priorities are actually delivered"[1]. The European Commission estimates that out of the EUR 200 billion needed for electricity and gas networks of European importance, EUR 100 billion should be delivered by the market unaided, whereas the other EUR 100 billion will require public action to leverage the necessary investments.

In an increasingly global economy, fierce competition for capital means that the power sector in Europe will have to compete to attract funding with other investment opportunities globally in a range of other sectors. However, there are many claims that the current EU regulatory framework and market are not fit to attract the massive amounts of capital that are required to finance the transition to a low carbon economy. The profitability of the European power generation sector has fallen in recent years, and a growing share of European utilities' CAPEX is invested outside of Europe. European utilities are in a weak financial situation as they enter into a massive investment cycle: the total net debt position of the 10 largest European utilities nearly doubled over the past five years to reach about 280 billion Euros.[2] This implies that new sources of capital will be needed to finance Europe's ambitious energy infrastructure investment program.

A rethink of the regulatory framework is therefore needed to reduce risks for historical investors, but also to attract different sources of investors. One key new source of funding will come directly from domestic investments in renewables technologies: a large share of the solar PV investments across Europe has been financed directly by electricity consumers. However, utility scale investments will still be needed to finance the upgrade of transmission and distribution infrastructures, as well as of conventional generation. Financial players have shown a consistent interest in investing in the energy sector in Europe, and could be key players to facilitate the financing of utility scale infrastructure and generation investments going forward alongside utilities. Funds taking a long term perspective are particularly well suited, such as pension funds or sovereign wealth funds.

In order to attract large amount of equity investment into the power sector, financial players will need to be reassured about the technology and policy risks associated with investments in the European electricity sector. Funds that are ready to take on the lower ends returns on investment that have been typical of the utilities sector in Europe will also want a very secure risk profiles – which means that the key sources of risk on the regulatory, technology, and market side will have to be mitigated and/or transferred into other parties. European financial institutions have a key role to play in this respect.

---

(1) Source: European Commission website,
http://ec.europa.eu/economy_finance/financial_operations/investment/europe_2020/investment_needs_en.htm.
(2) Source: IHS CERA 2012 European Policy Dialogue final report.

The European Commission, the European Investment Bank (EIB) as well as the different member states financial institutions contribute already significantly toward the financing for critical energy infrastructure. The EIB lending activity for renewable energy reached for instance EUR 3.3bn in 2012. In addition to the direct lending activity of the EIB for clean technology investments, a number of joint initiatives supporting renewable energy have been put in place, including:

- The 2020 European Fund for Energy, Climate Change and Infrastructure – also known as the Marguerite Fund – which was launched jointly by the European Commission, the EIB, and other major long-term institutional investors provides finance for projects in the energy, climate change and transport sectors.
- ELENA (European Local Energy Assistance), which is managed by the EIB and funded by the Commission, provides technical assistance grants to local and regional authorities for the preparation of energy efficiency and renewable energy investment programmes in support of the EU's climate and energy policy objectives.
- The Energy Sustainability and Security of Supply Facility (ESF) is a multiannual EUR 3bn facility for financing projects in EU candidate and neighbourhood countries, African, Caribbean and Pacific (ACP) countries, South Africa, and Asia and Latin America.
- The NER 300 initiative (New Entrants Reserve of the EU emissions trading system) is a funding programme for carbon capture and storage demonstration projects and innovative renewable energy technologies.

In addition to the direct contribution to providing debt and equity for investment in clean technologies and energy infrastructure, the European Commission and the EIB have launched a "Project Bond Initiative" to facilitate the financing of critical infrastructure, which could in the future play a significant role to attract infrastructure finance into the European energy sector. The pilot phase of the EU-EIB Project Bond Initiative was launched in 2012, and aims to revive and expand capital markets to finance large European infrastructure projects in the fields of transport, energy and information technology.[1]

The aim is to attract institutional investors to the capital market financing of projects with stable and predictable cash flow generation potential by enhancing the credit quality of project bonds issued by private companies. The intention is to support capital market financing of projects as a form of finance to complement loans, not to replace other sources of financing, such as grants, nor to intervene in stages prior to financing, such as feasibility studies, assessments or procurement, where grants are also widely used. A

(1) The pilot phase of the EU-EIB Project Bond Initiative was established by Regulation No. 670/2012, published in the Official Journal L 204/1 of 31/07/2012.

recent EIB study discusses the contribution of private capital to the financing of infrastructure investment needs and how it could be increased.[1]

Going forward, we recommend that the European Commission and the EIB, together with the member states financial institutions, work together to scale up the amount of lending and equity financing available to Trans European Network and PCI projects. In addition, whilst the traditional ways of corporate and public) capital expenditure as well bank lending will continue to play a critical role, European will need to attract new sources of capital. Therefore, recognizing the limits of public funding at times of budget constraints, a major focus should be on exploring how the current regulatory framework can provide better incentives to private capital to the financing of infrastructure investment needs. There is scope for the development of alternative financing arrangements (such as public-private partnerships) and investment vehicles (such as project bonds and suitable investment funds). In this respect, scaling up the EU-EIB Project Bond Initiative could represent avenue to reduce risks and attract a growing amount of infrastructure investment funds.

5.2. Revisiting EU energy policy governance: local and regional challenges

Before the 1990s and the liberalization of European electricity and gas markets, energy policy in the different member states was largely determined through central planning exercises at a national level involving governments and the key stakeholders. The activity of electricity and gas supply was organized as national monopolies in most European member states, which were either state owned or regulated and therefore closely associated to the national energy policy. Often this resulted in a top-down and technocratic process to define energy policies, with little democratic involvement of the local communities and citizens.

The technologies dominating electricity production and transport, and well as gas distribution reinforced this centralized approach toward energy policy. Economies of scale associated with electricity production from the dominant technologies (hydro, then oil, nuclear and coal fired generation) as well as natural monopolies for the transport and distribution of electricity and gas led to a stable regulatory environment whereby natural monopolies and governments relied on central planning to define the long term energy policy directions.

In the past two decades, several elements combined to change the way energy policy is being made in Europe. A double dynamic has led both the local level and the European levels to become increasingly more important than the national level in shaping energy

(1) Private Infrastructure Finance and Investment in Europe, Georg Inderst, Inderst Advisory, EIB Working Papers 2013 / 02.

policy in Europe. The growing importance of both, the local level as well as regional and European levels in shaping energy policy in Europe, have increased considerably the complexity of policy making. One of the biggest challenges is to ensure the consistency of these multiple levels of decision and implementation of intertwined policies. Ensuring the optimization of the system technically and economically appears today much more challenging than in the past. This raises questions about whether the current governance mixing the national level with the local and regional/European level is optimal, and how it could be improved further to adapt to this new dynamic toward regionalization and Europeanization.

At the local level, local communities have become more engaged in the past few years in shaping energy policies. Whilst the role of municipalities varies greatly across member states, the development of decentralized generation on the one hand, and the more active outreach to energy consumers on the other side to stimulate demand response and active demand management have contributed to changing the perception of energy production and distribution. There is now much more interest from consumers and citizens to engage on energy issues, and municipalities or associations of consumers are gaining a prominent role in shaping energy policy at the local level.

Going forward, the role of distribution network operators (DSOs) will be central at the local level to coordinate and optimize the production and consumption of electricity at the local level. DSOs will also have a key role in the deployment and operation of smart grids and in providing access to the data that will be essential for suppliers to provide innovative services. This raises a number of questions regarding the governance and regulation of DSOs, which should be addressed by the Commission.[1]

As regard to the European level, the Third Energy Package created new institutions at the European level which play an important – albeit insufficient – coordination role, namely ACER and ENTSO-E and ENTSO-G. In addition informal discussion forums at the EU level include the Florence and Madrid Forums. Going forward, there is a need to reinforce the mandate of these European institutions to allow better coordination across network and generation expansion, as well as to assess the impact of different national energy transition plans on integrated power and gas markets.

5.3. Toward regional approaches as a practical way forward for policy cooperation

Coordination at the regional level is a potential promising way forward for further European energy coordination. Over the past few years, a bottom-up market integration

(1) See e.g. Ruester, S., Pérez-Arriaga, I., Schwenen, S., Battle C., and Glachant, J.-M. (2013), “From Distribution Networks to Smart Distribution Systems: Rethinking the Regulation of European Electricity DSOs”. Available at: http://fsr.eui.eu/Publications/POLICYbrief/Energy/2013/PB201305.aspx.

process has been at work through the creation of the Regional Initiatives (RIs) and other, independent regional integration projects.[1] These work streams have led to a number of successes in regional market integration. In particular, the implementation of market coupling on a regional basis has allowed some efficiency gains in the use of interconnections, and led to stronger price convergence between coupled markets.[2]

Going forward, regional initiatives yield some potential significant benefits compared to a more top- down European driven approach. First, taking into account country-specific circumstances and characteristics is difficult with 28 member states, and there is scope for closer energy policy cooperation of neighboring countries sharing some similar constraints – for instance countries sharing similar gas supply security issues. Second, some countries with joint interests and sharing similar policy orientations may way to move at a differentiated speed from the rest of the member states on some key issues, such as environmental policy. Third, regional approaches may prove an opportunity for bottom up involvement of all key stakeholders to find practical solutions to implement EU policies.

Several regional initiatives provide some useful lessons. These are wide ranging in their objectives and institutional setting. The Visegrad countries' V4 initiative (Poland, the Czech Republic, Slovakia and Hungary) aims for regional energy policy cooperation and market integration, and emerged from the Russia-Ukraine-EU gas crises of 2006 and 2009.[3] The Pentalateral Energy Forum (PF, which involves France, Germany, the Benelux countries, Switzerland and Austria) was created in 2005 in order to promote collaboration on cross-border exchange of electricity. The North Seas Countries Offshore Grid Initiative (NSCOGI, for ten nations bordering or close to the North Sea), as well as the Mediterranean Energy Forum are primarily driven by the joint interest in exploiting renewable resources – wind offshore in the first case and solar PV in the former case. De Jong and Egenhofer (2014) explore the potential for regional approaches, and assess lessons from existing initiatives, regional energy arrangements such as the Danube Energy Forum, the Mediterranean Energy Forum, the Pentalateral Energy Forum, the North Seas Countries' Offshore Grid Initiative and the Nordic Co- operation partnership.[4]

(1) "From Regional Markets to a Single European Market", Everis and Mercados, 2010.

(2) Market coupling in wholesale power markets uses implicit auctions in which players do not receive allocations of cross-border capacity themselves but bid for energy on their exchange. The exchanges then use the Available Transmission Capacity (ATC) to minimize the price differences between two or more areas. In so doing, market coupling optimizes the interconnection capacity and maximizes social welfare. This process increases price convergence between market areas, eliminates counter-flows. Price differentials send a price signal for investments in cross-border transmission capacities.

(3) See e.g. Kaderják, P., Selei, A., and Hum, A. (2013), "Energy Market Integration in Central Eastern Europe (CEE): Drivers, Early Lessons and the Way Forward", paper based on proceedings of a workshop, Regional Centre for Energy Policy and Research (REKK), Corvinus University, Budapest, 4 April.

(4) De Jong, J., and Egenhofer, C. (2014), Exploring a Regional Approach to EU Energy Policies. Clingendael', working paper No. 84 / April. See also De Jong, J., and Groot, K. (2013), "A Regional EU

Regional approaches could possibly play a growing role for governing EU renewables policy, which the European Commission has identified in the 2030 climate and energy framework as a new element for governance. The envisaged peer review process between countries on a regional basis and the European Commission could be a useful way forward to coordinate the pace of deployment of renewables and ensure that this deployment is optimized through e.g. regional support schemes. The Nordic countries precedent is a useful experience in this regard.

Policy coordination at the regional level can be either informal and rely on regional forums to disseminate information, or more structured processes through e.g. a formal peer review process and some form of institutionalisation. This would require some form of governance structure within the wider context of EU energy policy-making. One key objective of such governance structure should be to reconcile the work done at the regional level with the European policy directions and to ensure that these regional approaches do not lead to further fragmentation of the internal energy market.

Going forward, we recommend that Regional coordination groups involving all market stakeholders (regulators, TSOs and DSOs, utilities, consumer associations, policy makers) should be set up with a mandate to explore potential opportunities for cooperation at the regional level on energy policy. The objectives of such regional coordination groups could be by increasing level of ambition (see Leonie Meulman and colleagues (2012)[1] for a more detailed assessment of the potential for coordinated energy policy in north-western Europe):

- To share information on investment plans relevant for all fuels used in the power generation/distribution sector and for infrastructure improvements.
- To develop some cooperation mechanisms on specific policy instruments, for instance a coordinated approach for cross border participation in renewables support schemes or capacity mechanisms.
- To coordinate or develop joint policy initiatives at the regional level, for instance discussion on security of supply or on environmental targets.
- To develop joint policy instruments, e.g. a common support scheme for renewables or a common capacity mechanism.

Energy Policy?", CIEP Paper No. 2013/06, Clingendael International Energy Programme (based on workshops at the end of 2012), The Hague.
(1) Meulman, L., Boot, P., van der Linde, C., De Jong, J., and Werring, L. (2012), "Harvesting Transition? Energy Policy Cooperation or Competition around the North Sea", Clingendael International Energy Programme, The Hague, January.

5.4. From policy targets to instruments: Toward peer reviewed policy roadmaps and progress monitoring

The inability of policy makers to credibly commit on a set of long term predictable policy objectives is a key issue that undermines European energy policy. Ensuring inter-temporal consistency is always difficult for policy makers who are elected for a few years and make long term commitments. In order to demonstrate the bi partisan support for fighting climate change in the long term, the UK has for instance amended its constitution to include an emission reduction target.

In practice, governments can also rely on long term contracts which can be enforced by tribunals to create some form of long term commitments. In this respect, long term contracts in the form of FiT or Contracts for Difference (CFDs) have a role to play in reducing policy uncertainty in the long term. Whilst long term contracts can have negative effects on competition and care needs to be given to ensuring that they comply with European State Aid guidelines, they could play a growing role in reducing policy and regulatory risk relating to climate policy. As we argued in section 2, long term carbon contracts could for instance play a critical role to reduce the long term commitment to a rising carbon price and the lack of confidence in the ETS and support investment in clean technologies.[1]

Another source of policy uncertainty relates to the perceived disconnect between the long term policy targets, and the concrete short term policy instruments put in place to deliver on these targets. For instance, the European Commission 2050 roadmap sets an ambitious 2050 target to reduce CO_2 emission by 80% to 95% in Europe, which does not appear consistent with the current ETS design as the current annual emission reduction factor seems largely insufficient to deliver such emission reductions (see section 2).

In order to ensure that policy instruments in the short term are consistent with medium to long term policy objectives, and in turn reinforce the credibility of these engagements, we suggest that the Commission and the different member states should develop energy policy roadmaps. These policy roadmaps would provide a forward looking view of the required policy changes needed (e.g. carbon price evolution, timing for phase out of renewables support, etc.).

The process to elaborate these roadmaps should be largely consultative and open to a wide range of industry stakeholders, first at a national level, then at a regional level, and finally at the European level. Through a peer review process between member states at the regional and European level, inconsistencies could be picked up early and resolve

(1) See Carbon Contracts and Energy Policy: An Outline Proposal, Dieter Helm and Cameron Hepburn October 2005. Available at: www.dieterhelm.co.uk/sites/default/files/CarbonContractsOct05.pdf.

early, ensuring greater confidence and credibility of the stated energy policy objectives. Last but not least, a process to assess regularly progress against the policy roadmap should be put in place. This would rely on a set of indicators, which would be periodically reviewed.

Director of publication:
Jean Pisani-Ferry, Commissioner General
Editorial director:
Selma Mahfouz, Deputy Commissioner General
Editors:
Olivier de Broca, Sylvie Chasseloup
Press contact:
Jean-Michel Roullé, Head of publications and communication unit,
+33 (0)1 42 75 61 37, jean-michel.roulle@strategie.gouv.fr

FIND THE LATEST NEWS CONCERNING
FRANCE STRATÉGIE AT:

www.strategie.gouv.fr

francestrategie

@Strategie_Gouv

FRANCE STRATÉGIE

France Stratégie is a policy advisory body for the Prime Minister's Office. Beyond assessing different policy options and making recommendations to the government, it anticipates future trends affecting the economy and society by serving as a forum for debating topical issues and providing a strategic vision for the country as a whole. Combining breadth with depth, its research covers four main fields: employment, sustainable development, economics and social issues.

FRANCE STRATÉGIE - 18, RUE DE MARTIGNAC - 75700 PARIS SP 07 - TÉL. +33 (0)1 42 75 60 00