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STRENGTHENING THE EUROPEAN ELECTRICITY MARKET THROUGH IMPROVED FRANCO-GERMAN COOPERATION

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SUMMARY

European as well as national energy and climate legislations have ringed in the transformation of the EU energy system. One major objective is the emergence of a sustainable, truly common internal energy and electricity market in order to support a low carbon economy. **Although energy policy convergence has taken place in some areas**, such as the need to incentivise the affordable deployment of renewable energy sources (RES), and EU member state electrical systems have become increasingly interdependent, **policy divergence has taken place in other sectors**. National energy mixes remain very distinct while market designs and spending on all forms of energy differ widely as do ambitions to transform member states' energy systems. **These divergences have prevented states from being able to reap the benefits of a smoothly interlinked continental electricity system. Member states instead react to shared challenges with disconnected domestic policies:** generation adequacy is assured on a purely national level, weakly connected markets lack sufficient volume or competition, and opportunities for shared infrastructure investments are lost.

But instead of fearing interdependence and privileging national solutions, resources could be used in a more complementary and optimised way, paving the way for the more flexible electricity system that will be required to handle increasing amounts of electricity produced from RES. Cooperative multinational investments make economic sense in all sectors of the energy system, from research and development efforts to infrastructure upgrades. Besides improving generation adequacy, network stability and energy security, a more collaborative approach to European energy policy will prove less costly and more efficient, a non-negligible factor in times of bleak economic performance.

A common European energy policy and a truly common electricity market has yet to emerge due to the lack of cooperation between member states and the deficiency of shared governance mechanisms to guide the European energy transition. **This Policy paper**, with no claim to completeness, **analyses in depth the bilateral energy relationship between France and Germany, with a focus on the electricity sector, to illustrate this shortcoming and identify opportunities for improved energy cooperation.**

The Policy paper first **shows how the energy policies of France and Germany have developed significant similarities in the last decade, but still retain immense differences** (Chapter 1). It assesses the ambitions for, and positions of each country as they intensify their energy transition. In France, this has most recently been galvanised by the new energy transition law, years after the introduction of the German *Energiewende*. **The Policy paper then sheds light on the challenges ahead in France, Germany and in the rest of the EU on the path towards a transformed and fully integrated market** (Chapter 2). Chapter 3 **proposes some strategies for how to overcome the purely national approach to energy policies and re-frame the energy transitions in France, Germany and across Europe.** The last chapter **makes concrete proposals on how bilateral cooperation between France and Germany could be extended to regional and European levels in order to advance a better, common energy policy.**

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INTRODUCTION

National energy landscapes in Europe are changing quickly, driven by increasingly global energy markets (the shale gas boom in the US, rising fossil fuel demand in Asia) and by European energy policy decisions. In addition to strengthening the internal EU energy market, member states have agreed at the EU level to transform their energy systems. Based on EU treaty provisions for […] preserving, protecting and improving the quality of the environment" (Article 191 TFEU), a key objective of European policy has been to move towards a low carbon economy. For such a sustainable economy to emerge, the EU has since 2008 adopted a number of rules and regulations as part of the 1st Climate and Energy Package[1] with goals for 2020: The reduction of greenhouse gas (GHG) emissions by 20% compared to 1990, the increase of renewable energy sources (RES) to 20% in final energy consumption and an increase in energy efficiency of 20% (the 20-20-20 goals).[2]

This framework linked European energy policies and member state energy strategies together in providing both guiding principles and mandatory objectives. At the same time, progress on the internal energy and electricity market has interconnected countries on commercial and physical levels.

However, this interdependency of policies and markets at the continental level has been followed by neither increased political will to cooperate among EU countries nor by adequate structures of governance for such cooperation to emerge. Yet it is more apparent than ever that the interplay of national and European energy policies creates the need for enhanced cooperation between EU member states. Policy decisions taken in one country may affect energy systems in another country, an issue likely to become more important as the transformation of the EU energy system towards a low carbon economy will necessitate huge financial, political and technological changes. Those efforts can be less costly and more effective when faced in the spirit of mutual solidarity. Enhanced cooperation, common energy governance, and mutual solidarity are also needed between the EU member states in perspective of the new Climate and Energy Package 2030, adopted by the European Council in October 2014.

Two countries are particularly suited to provide the impetus for enhanced cooperation: France and Germany, the driving forces behind European integration and the development of EU energy policies. Both countries are overhauling their energy systems; in Germany, the *Energiewende* (energy turnaround)[3] is well under way while the French *transition énergétique* has recently been invigorated by a new legal framework (*loi sur la transition énergétique*).[4] Nevertheless, for a variety of historic, economic and even cultural reasons, national approaches to these turnarounds diverge in some sectors while converging and becoming increasingly interdependent in others. This makes enhanced cooperation absolutely necessary.

This Policy paper will flesh out some of those divergences and convergences and describe the challenges for developing a more sustainable, low carbon energy system. The Policy paper tries to show how increased Franco-German cooperation could not only work for the advantage of the two countries, but for the EU as a whole, on its way to a truly common European energy policy. This Policy paper will focus on the electricity sector and the common European electricity market, with emphasis on the integration of renewable energy sources (RES), although other problematic areas will be touched upon.

1. Although common EU climate change policies date at least back to the 1990s the legal package with the three times 20 objectives commonly referred to as 1st Energy and Climate package.
2. For more information on European energy policy, see Philipp Offenberg, "Taking stock of German energy policy in a European context", Policy Paper No. 116, Jacques Delors Institut – Berlin, August 2014.
3. Even though the German term *Energiewende* is often translated with "energy transition" the word "turnaround" is the more correct translation as it signifies the envisioned comprehensive overhaul of the German energy system.
4. However, at the time of the publication of this Policy paper, the law had still not been officially adopted.

1. French and German energy profiles: convergence and divergence

1.1. Convergences

European energy policies and objectives have linked national and European energy strategies, fostering convergence between some aspects of different countries' energy landscapes. France and Germany are no exception to this trend, pursuing convergence in several areas.

1.1.1. RES deployment

First of all, the decision to transform both countries' energy systems to support the emergence of a low carbon economy has led to the increasing deployment of renewable energy sources (RES). RES development has proceeded well in both countries, though French RES development has been dwarfed by the rapid deployment of German solar and wind facilities. In 2012, Germany boasted the largest installed wind power capacity in Europe (29% of total installed European capacity or 31 GW)[5] while France has a long hydro power tradition (about 25 GW, or 18% of European installed capacity)[6]. Together, they account for more than half of EU solar photovoltaic (solar PV) capacity (Germany 32.7 GW, France 4 GW) and are the two largest biomass producers in the EU. Moreover, they employ a large number of people in the RES sector: as of 2012, 45% of jobs in the European wind industry are occupied by either a German or a French national (roughly 130,000 people) along with 50% of solar PV jobs (126,700 employees).[7]

1.1.2. Electricity market integration

France and Germany have become increasingly interconnected via the integrated European electricity market. French and German power markets are amongst the biggest in Europe in terms of liquidity and attract traders from more than 20 European countries. The net transfer capacity of electricity across the Rhine is one of Europe's highest, standing at roughly 3000 MW[8] and since 2010 Germany is coupled to the French and Benelux markets, seen as a key achievement of European internal energy market policies[9]. Coupling markets together is expected to render the continental electricity system more competitive and more efficient in allocating generation capacities. Coupling limits the underutilisation of resources and enhances network security as failure of one important source of electricity in one country could be balanced by power generation from another country.[10]

Thanks to this increasing integration, electricity trade volumes between France and Germany increased by 48% between 2008 and 2012.[11] In 2012, France and Germany exchanged around 3% of their total domestic electricity production, with Germany exporting 14 TWh to France and France exporting 5.2 TWh to Germany. However, challenges remain, as will be explained in chapter 2.

1.1.3. "Europeanisation" of the energy industry

Increasing RES deployment and electricity market convergence have also fostered stronger connections between French and German energy players, which are amongst the biggest companies in Europe. The German market is dominated by E.ON (53 GW installed capacity) and RWE (52 GW), together accounting for roughly € 177 billion in sales in 2013. France is dominated by GDF Suez (49 GW installed capacity in Europe)[12]

5. Observ'er (ed.), "État des énergies renouvelables en Europe. 13e Bilan EurObserv'ER", 2013.
6. Eurelectric (ed.), "Hydro in Europe: Powering Renewables Synposis Report", September 2011 and France Hydro Electricité Website, "Chiffres clés".
7. As a frame of reference, the European RES industry employs roughly half as much people as the European fossil fuel industry. See: Cambridge Econometrics (ed.), "Employment Effects of selected scenarios from the energy roadmap 2050", October 2013.
8. Cambridge Economics, 2013
9. France and Germany are now part of the Central Western Europe (CWE) market which links them to the Benelux and Danish markets.
10. Böckers, V. et. al., "Benefits of an integrated European electricity market", DICE Discussion Paper No 109, 2013.
11. Acer/CEER (ed.), "Annual Report on the Results of monitoring the internal electricity and natural gas markets in 2012", 2013.
12. GDF Suez, "Registration Document", 2013 and EDF.

and EDF (100 GW in France)[13] who together generate around € 156 billion of revenues in 2013. Increasing market liberalisation has led these national champions to invest in other countries in energy production, distribution and refining sectors. For example, E.ON owns 2.8 GW installed capacity in France while GDF Suez has 2.4 GW installed capacity in Germany. RWE operates 14 hydro power stations in France while French EDF co-owns the hydro power plant Iffezheim. On a more local level, German Distribution System Operators (DSOs) are delivering electricity to French clients (like E.ON in France) while French energy companies like Veolia retain shares in several German *Stadtwerke*.[14]

1.1.4. Research & development

Paris and Berlin have also intensified their cooperation in energy research & development (R&D). Germany's Fraunhofer Institute works with France's Institut national de l'énergie solaire (INES) on solar PV modules in the framework of the SOL-ION project and with the French institute CEA-LETI on micro electronic appliances research. Recently, Fraunhofer, INES and the Swiss Centre for Electronics and Microtechnology launched a partnership to scrutinise the economic factors and opportunities to construct a large scale solar PV manufacturing plant. Baptised X-GW, the plant aims to produce large solar PV panels by 2017. Common research activities have been furthermore bundled with the foundation of the European Institute for energy research in Karlsruhe – a cooperation between the local technical university (KIT) and Électricité de France (EDF) or with the founding of the French-German Institute for environmental research (DFIU). Moreover, special student exchange programmes between the two countries exist in the technical studies domain. However, large scale research projects have yet to be developed in the fields of energy.

1.1.5. Governance

Germany and France have clearly converged on many levels. This trend has also led to increasing cooperation on governance, though it is developing modestly and belatedly compared to the rapidity of developments on energy markets. Nevertheless, some gains have been made.

> "A DETERMINED APPROACH IS IMPORTANT IF THE EU WANTS TO REMAIN LEADER IN CLIMATE PROTECTION AND SUSTAINABLE DEVELOPMENT"

On a European level, France and Germany have been the driving forces behind the EU Energy & Climate Package which established the 20-20-20 goals. Both countries were also amongst the more ambitious member states during the negotiations leading up to a new 2030 framework and supported a tougher emissions reduction target as well as a binding RES objective.[15] Paris and Berlin also seem to believe that a determined approach is important if the EU wants to remain leader in climate protection and sustainable development.[16] These issues will grow in relevance, particularly for France, the host of the 21st UNFCCC conference in late 2015 which is supposed to bring about a new climate protection agreement.

Regionally, Germany and France participate in several governance initiatives such as the Pentalateral Energy Forum and the North Seas Countries' Offshore Grid Initiative (NSCOGI). Furthermore, both countries are part of the Central-South and Central West cluster of the Council of European Energy Regulators (CEER) regional initiatives.

13. EDF, "Activity Report 2013".
14. Stadtwerke are a distinct form of German (and Austrian) municipal governance. Those "city plants "are usually charged with providing public services in domains such as electricity production and distribution, waste management, water distribution or public transport.
15. Euractiv (ed.), "Un enjeu de calendrier reflète les divisions de l'UE sur le climat", 2014 and Euractiv (ed.), "Huit pays de l'UE lancent un appel en faveur des énergies renouvelables", 2014.
16. Thanks to high German RES and high French nuclear power production, Europe is indeed the only economy worldwide that powers its economy with almost 50% close to zero carbon emissions technologies. The share of low carbon technologies in the electricity mix of the USA hovers around 30% while this share is even lower in China, namely 12%. Source: IEA and EIA.

BOX 1 ► Some regional cooperation initiatives with Franco-German participation

The Pentalateral Energy Forum, established in 2007, unites experts, regulating authorities, Transmission System Operators (TSOs) and ministers from Germany, France, Austria, Switzerland and the Benelux countries to facilitate electricity market integration. The energy ministers play the role of coordinators and are supported by a secretariat in Brussels.[17] The Forum tackles issues such as electricity market designs and the alignment of network codes. The efforts of the Pentalateral Energy Forum (PEF) led to the aforementioned market coupling between France, Benelux and Germany/Austria in 2010 and can be considered a success[18] even though challenges remain *(see chapter 3)*.
The North Seas Countries' Offshore Grid Initiative (NSCOGI) unites energy ministers of 10 states on the North and Irish Seas[19], representatives from the European Commission (EC), and concerned country TSOs, regulatory bodies and energy stakeholders. The objective of NSCOGI is to facilitate the large scale deployment of offshore wind energy. Different work streams have been implemented on questions such as grid design, interconnection options and market integration.
The Council of European Energy Regulators (CEER) does similar work to the Pentalateral Energy Forum with a focus on regulatory affairs and the goal of speeding up integration of national energy markets. In the same vein, regional groups are organised within the EU Projects of Common Interest (PCI)[20] framework, an EU financing and regulatory instrument created to speed up the implementation of key energy infrastructure to enhance security of supply.

France and Germany are also members of other regional groupings such as the Baltic Sea Region Energy Cooperation (Germany) and the MEDREG initiative (France), an association of EU and North African energy regulators.[21] Interestingly, while Germany is also part of the International Grid Control Cooperation (IGCC) which groups Transmission System Operators (TSOs) from Germany, Austria, Belgium, the Netherlands, Denmark, the Czech Republic and Switzerland on regional balancing issues, France is not.

On a bilateral level, Paris and Berlin have also established fora and institutions for dialogue. In June 2014, the German BMWI (Federal Ministry of Economy and Energy) and the French Direction Générale de l'énergie et du climat (General Directory of Energy and Climate) inaugurated a high level inter-ministerial working group. This step towards better governance was buttressed when German DENA (German Energy Agency) and French ADEME (French Environment and Energy Management Agency) signed an inter-institutional agreement the same month. In the same vein, the Office franco-allemand pour les énergies renouvelables (French-German renewable energies office) has been working since 2006 to bring together RES stakeholders from both sides of the Rhine.

These convergences on governance issues are increasingly necessary as more RES deployment, market integration and mutual investment activities interlink German and French energy policies. It is noteworthy, however that these bilateral governance initiatives generally follow technical and economic convergences instead of framing them. While their energy systems have been intertwining rapidly in recent years, it was only in 2014 that an inter-ministerial working group was established. And although convergence has taken place even without strong bilateral governance initiatives in some areas, such lack of governance has also led to the divergence in the electricity sector in other areas.

1.2. Divergences

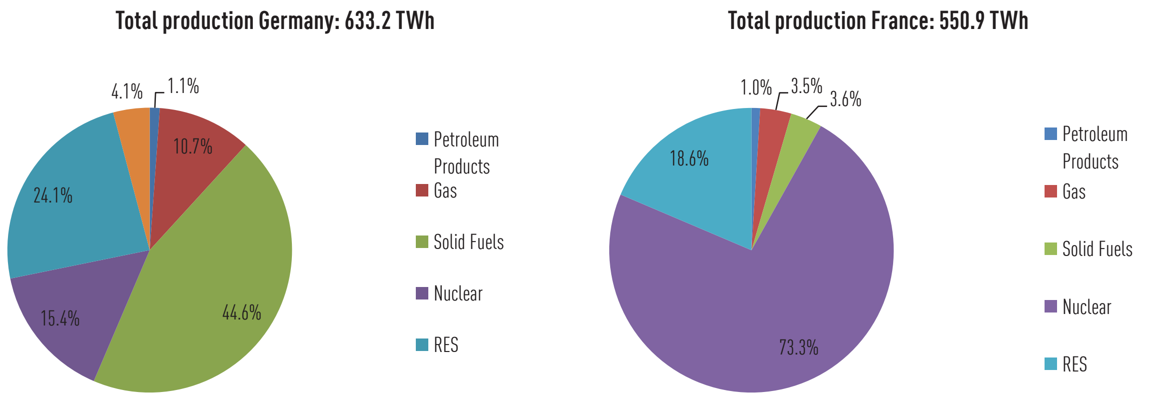
France and Germany diverge significantly on a variety of energy and electricity topics as seen in their very different electricity profiles developed separately in response to different political, economic and cultural pressures.

17. De Jong, J. et. al., "A regional EU energy policy?", CIEP Paper 6/2013.
18. *Ibid*.
19. Belgium, Denmark, France, Germany, Ireland, Luxembourg, The Netherlands, Norway, Sweden and the UK.
20. See chapter 3, point 3.3.
21. The MEDREG initiative covers a variety of non EU countries in the Middle East and North African (MENA) region. As it goes beyond the scope of this Policy paper it won't be further analysed.

1.2.1. Energy profiles and ambitions

National energy mixes vary widely across the EU,[22] and between Germany and France. 45% of German power comes from solid fuels (mainly coal), while nuclear power accounts for almost 74% of French electricity generation.

FIGURE 1 ► Electricity mix, 2013 in percentage of total production



Source: RTE, AG Energiebilanzen e.v.

Even though both France[23] and Germany have a long nuclear tradition, nuclear policies have diverged significantly in recent years. While Germany decided to phase out all of its nuclear reactors by 2022 in the wake of the 2011 Fukushima-Daiichi incident, the new French *loi sur la transition énergétique* has confirmed the key role of nuclear energy. Even though the government initially foresaw a reduction of nuclear energy from 75% to 50% in the electricity mix, the nuclear capacity will most likely be capped at 64.85 GW. Also, it remains to be seen whether the time frame of 2025 will be maintained.[24] This fundamental divergence on the role of nuclear energy will likely remain for the foreseeable future as will the subsequent difference in energy and electricity mixes: The role of coal in German electricity production will most likely remain high following the increase in coal use between 2010 and 2013 partly to compensate for the reduced nuclear production.[25] At the same time, nuclear energy will continue to play a major role in France thus creating very different environmental challenges.

Furthermore, different ambitions on how far to proceed with the transformation of the electricity and energy systems suggests a likely endurance of this electricity mix divergence. The German government foresees RES as 50% of the electricity mix by 2030[26] whereas France aims at having RES contribute 32% of gross final energy consumption by the same year, though with non-mandatory targets for electricity production. While those objectives might be interpreted as being quite similar, it is informative to look closer at past achievements in RES deployment, reductions in energy consumption and CO2 emissions cuts to assess the probability of those objectives to be met.

22. For example, Italy powers its economy mainly with gas while Austria, taking advantage of geographical conditions, sources its electricity to 68% from renewable hydro power. Coal use is intense in Eastern Europe with Poland generating almost 90% of its electricity from coal.
23. Nuclear energy is particularly important in France where roughly 125,000 people are directly employed in the industry and companies such as Areva (revenues of € 9.2 billion in 2013) are international players in the extraction, treatment and commercialisation of uranium and nuclear fuels. See: Areva Website, "Que représente le nucléaire dans l'économie française" and "Chiffres clés 2013".
24. When this Policy paper was published, the "*loi sur la transition énergétique*" was still debated in the French Sénat.
25. Fraunhofer ISE (ed.) "Kohlenverstromung zu Zeiten niedriger Börsenstrompreise – Kurzstudie", 2013.
26. Bundesregierung website.

1.2.2. Past achievements

From 2004 to 2013, the share of RES in the German electricity mix surged from 9.8% to 24.1%. Beneficial weather conditions have led occasionally to significantly higher results; on August 17th 2014, renewable electricity delivered 75% of Germany's electricity demand.[27] Progress in France has been more modest with the share of RES rising from 13.8% of the electricity mix in 2004 to 18.6% in 2013.[28] One of the reasons for this divergence has been the different legal frameworks: Germany adopted one law in 2002, the *Erneuerbare-Energien-Gesetz* or EEG (renewable energies law) and despite regular amendments since 2002 the main provisions were left intact, guaranteeing much needed investment stability. France, on the other hand, changed its legal RES support several times between 2001 and 2010, creating uncertainty amongst RES stakeholders and hindering effective deployment. The pace of solar PV installation actually fell between 2010 and 2013, before increasing again in 2014 but the question remains, whether this trend is set to continue as some analysts observe stagnating new solar PV installations in France.[29] Moreover, the new legal proposal framing the French energy transition was long delayed and is still not officially adopted.[30] It remains to be seen whether the French government will live up to its ambitions and be supported by a strong societal consensus for RES deployment as in Germany[31] as similar objectives don't automatically make for similar results.

With regards to past success in reducing final energy consumption, another divergence appears. Even though both countries have subscribed to the -20% reduction objective, results since 1990 could not be more different. While Germany managed to decrease its final energy consumption by roughly 10% from 228.9 million tonnes of oil equivalent (mtoe) in 1990 to 213.1 mtoe in 2012, France during the same period increased its energy consumption by 10% to 151 mtoe.[32]

Berlin also reduced its overall GHG emissions by 23.4% to 964.6 mt CO2e between 1990 and 2012 while Paris achieved a more modest decrease of 11.8% to 506.4 mt CO2e. However, several nuances have to be made: First, lowering GHG emissions is more complex for France which already has a comparatively low carbon intensity economy thanks to nuclear energy. Second, Germany is still by far the largest GHG emitter in the EU while the French power sector emitted roughly 29 million tonnes of CO2 in 2012[33], German power generation blew a staggering 318 million tonnes into the air.

FIGURE 2 ► German CO2 emissions from power generation

Federal Environment Agency, *own estimates

Source: Agora Energiewende

27. Wirtschaftswoche Green Edition (ed.), "Energiewende: Erneuerbare decken mehr als 70% des Strombedarfs", 2014. Challenges related to this large range of renewable electricity production will be discussed in chapter 2.
28. It is interesting to note that about 2/3 of RES electricity in France comes from hydro power. In Germany, only 20% of all electricity based on RES came from hydro in 2012.
29. Cals, Guilain. „Photovoltaique: un courant à relancer", Alternatives économiques, No. 340, 2014.
30. When this Policy paper was published, the "loi sur la transition énergétique" was still debated in the French Sénat.
31. Although under criticism recently due to high energy prices, the Energiewende in Germany enjoys a large political and societal consensus across all mainstream parties and layers of society.
32. Eurostat.
33. RTE (ed.), "Bilan électrique 2013".

Third, as illustrated by this figure, Germany seems to suffer from an energy transition dilemma. Even though renewable energies boom, emissions have been on the rise in recent years. It is therefore doubtful whether Germany will meet its 2020 emissions reduction target of 40% (compared to 1990) even though recent policy developments suggest that Berlin is taking this potential failure seriously.[34] French emissions from electricity have also been rising since 2011.[35] Reasons for this increase include low price on carbon emissions, the low price for coal on world markets and the decreasing profitability of gas fired power-plants as well as the (slow) economic recovery. This problem of gas plant profitability is linked to the question of generation adequacy which merits not only a brief description but represents also a point of divergence between Germany and France.

1.2.3. Assuring generation adequacy

The rapid changing of the energy world has had unforeseen consequences for the electricity grid in France, Germany and across the EU notably on its capacity to provide electricity 7 days per week, 24 hours per day. Over recent decades, the system was built on reliable fossil fuel-based electricity production where input materials (coal and gas), even though rising constantly in costs, were easily calculated and attributed to well known demand curves. However, the increasing deployment of electricity based on RES has changed this pattern of production – wind does not always blow and sun does not always shine. If production from RES is low, other plants, mostly fossil fuel powered ones, have to step in to assure that enough electricity is produced. Because this is easier in theory than in practice, as market forces and infrastructure constraints do not provide for the needed flexibility *(see chapters 2 and 3)* different mechanisms have been tested to ensure power availability. One option has been to use fixed payments to power generators to make generation capacity available at all times – a strategic reserve. Another option is to organise a fully fledged capacity market where electricity producers bid at auctions to guarantee to supply power in times of need. Again, France and Germany are diverging on that matter. In Germany, deliberations are still ongoing with some experts suggesting that the German energy market is functioning well and guarantees full generation adequacy. The French *loi sur la transition énergétique*, on the other hand, already foresees the implementation of a national capacity market by 2016. This divergence has the potential to drive a wedge between the two countries, especially considering their very different electricity market designs.

1.2.4. Market design and market management

France and Germany have both liberalised their markets, but to very different degrees. Germany allows for free market pricing while French consumers still benefit from regulated electricity tariffs – more than 90% of French customers pay government-capped prices.[36] This is true for industrial as well as household clients though regulated tariffs for large business consumers are to be phased out until 2016. Moreover, market concentration is much higher in France than in Germany. In 2011, the largest French electricity generator, EDF, had a market share of 86% while German national champion E.ON accounted for only 28.4% of the German market in 2010.[37]

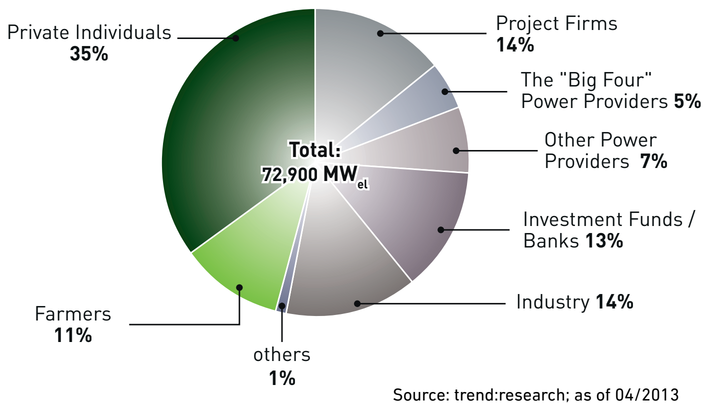
"AT THE END OF 2013, 46% OF THE ROUGHLY 73 GW OF INSTALLED RES CAPACITY IN GERMANY IS OWNED BY PRIVATE INDIVIDUALS, CITIZENS' INITIATIVES AND FARMERS"

The same picture emerges in the retail segment where Germany has more than 1,000 companies delivering electricity to its final consumers whereas France has only 183.[38] Ownership structures also differ, especially in the renewables sector. At the end of 2013, 46% of the roughly 73 GW of installed RES capacity in Germany is owned by private individuals, citizens' initiatives and farmers.[39] In France, RES deployment remains largely in the hand of big utilities; private (citizen) ownership cannot be compared with the success this

34. DPA (ed.), "Wie Deutschland sein Klimaziel doch noch schaffen soll", Hamburger Abendblatt, 13.11.2014.
35. RTE (ed.), "Bilan électrique 2013",.
36. Acer/CEER (ed.), "Annual Report on the Results of monitoring the internal electricity and natural gas markets in 2012", 2013, p. 54.
37. No available data for Germany in 2011 on Eurostat.
38. Eurostat.
39. German Renewables Agency (ed.), "Renewable Energies – a success story".

bottom up approach enjoys in Germany.[40] This certainly impacts the future of RES capacity additions, as big utilities are getting under pressure from decentralised power generation.

FIGURE 3 ► German RES capacity, by ownership



Source: German Renewables Agency

The transmission business is also organised differently in the two countries. In France, one TSO, Réseau de Transport d'Électricité (RTE – 100% owned by EDF), manages the French grid while the German grid is maintained by 4 separate TSOs, 2 of them owned by other European actors. TenneT is controlled by the Dutch TennetT Holding B.V. (100% state owned) while the Belgian firm Elia holds the majority of 50Hertz. This different market design is an important factor in explaining the differences in energy investment programs and in electricity prices between France and Germany.

1.2.5. RES spending and electricity prices

Until recently, Berlin and Paris had decided to use feed-in tariffs (FiTs)[41] to support RES development. But this instrument has been criticised for the rising costs it brings, particularly in Germany. While France spent less than € 4 billion, Berlin spent roughly € 17.5 billion in 2012; costs related to FiT instruments have been rising constantly in Germany and are expected to near the € 20 billion level in 2014.[42] These cost pressures led the German government to amend the renewable energies law in summer 2014 in accordance with the new state aid guidelines provided for by the European Commission.[43] Table 1 gives a comparative view of RES and fossil fuel support and the boost this support generated in the solar photovoltaic (solar PV) and wind sector.

40. According to Mr. Johann Margulies, Energy & Climate Policy Director, Ville de Sevran, France.
41. FiTs guarantee RES producers a certain amount of money per kWh of RES electricity produced for a defined time frame (sometimes 20+ years). Given the fact that RES electricity enjoys grid priority in Germany (and in several other EU countries due to Directive 2009/28/EC) it has to be fed into the grid even when demand is low. This can contribute to negative electricity prices, which in turn widens the gap between the amount TSOs earn and the amount they have to pay RES electricity producers because of the FiT provisions. These additional costs are usually passed through to the consumer via a levy.
42. Fraunhofer ISE (ed.),"Kurzstudie zur Entwicklung der EEG Umlage", 2014.
43. In Germany, RES facilities installed after August 1st, 2014 are subject to a new support scheme. While the FiT for wind power was reduced, changes are particularly pronounced in the solar PV sector: Installations above 500 kW size will have to sell their electricity directly on the market and will received a premium on top of the market price. In France, the new law also foresees the implementation of premium schemes instead of FiTs thus following the European Commission' guidelines on "state aid for environmental protection and energy" (2014/C 200/01) which calls for a complete phase out of FiTs by 2016. See: Assemblée nationale website.

TABLE 1 ► Different spending – Different success

COUNTRY	RES SUPPORT 2007 (€ BN)*	RES SUPPORT 2012 (€ BN)**	FOSSIL FUEL SUBSIDIES 2011 (€ BN)***	PV CAPACITY (GW)****		WIND CAPACITY (GW)	
				2007	2012	2007	2012
France	<0.2	< 4	2.7	0.05	4	2.5	7.4
Germany	3.5	17.5	5	3.8	32.7	22	31.1

Source : Ecofys, OECD, Eurobserv'ER

* Ecofys (ed.), "Financing Renewable Energy in the European Energy Market – Final Study", 2011.
** Ecofys (ed.), "Subsidies and costs of EU energy. An interim report", 2014.
*** OECD (ed.), "Inventory of estimated budgetary support and tax expenditures for fossil fuels 2013", 2013.
**** All data from ObservER, 2013.

This rather unequal spending on RES support influences electricity prices for industrial and household consumers in France and Germany, which have been rising in both countries for the past six years, due to the passing through of support costs onto the consumer. Table 2 gives an overview of electricity price evolution for household and industrial consumers between 2007 and 2013.

TABLE 2 ► Evolution of electricity prices, in € cents/kWh

COUNTRY	DOMESTIC CONSUMERS 2007		DOMESTIC CONSUMERS 2013	
	BASE PRICE	INCL. TAXES AND LEVIES	BASE PRICE	INCL. TAXES AND LEVIES
France	9.2	12.2	11	15.8
Germany	12.8	21.5	14.9	29.2
EU 28	11.6	15.6	13.8	20.1
COUNTRY	INDUSTRIAL CONSUMERS 2007		INDUSTRIAL CONSUMERS 2013	
	BASE PRICE	INCL. TAXES AND LEVIES	BASE PRICE	INCL. LEVIES AND TAXES
France	5.2	6.8	6.6	11.6
Germany	8.9	13.5	9.5	20.7
EU 28	8.5	11.5	9.3	14.7

Source: Eurostat

While one can see that support of RES via levies such as FiTs does play a role in increasing the electricity prices for German and French customers, other factors affect prices as well.

First and foremost, fuel prices have, on average, been rising over the last decades thus making fossil fuel based electricity production more expensive with coal prices taking a significant plunge only recently (and oil prices only at the end of 2014), also due to the US shale gas boom. Second, different forms of energy have different production costs. While the input and operational costs of fossil fuel power plants are high, RES are low on operational costs but necessitate high amounts of up-front investment. Also, the fully amortised French nuclear park is able to provide low cost electricity (having been heavily subsidised in the past) while less mature technologies such as offshore wind need higher prices to run profitable. Third, policy decisions such as those related to industrial policy also contribute to electricity price increases. This is the case in Germany where concerns about competitiveness have led to the exemption of many German industrial players from paying their full share of financing the *Energiewende*. In 2013, more than 1,500 industrial actors paid 0.05 cents/kWh to support renewable energies whereas the average household paid 5.27 cents/kWh via the famous renewables surcharge. At the same time, some German industries still enjoy long term delivery contracts based on wholesale electricity prices which have been falling in recent years due to RES injection and general installed overcapacity. Therefore, German industrial players benefit from the *Energiewende* while some suggest those actors could pay more to distribute the costs more evenly.

As we have seen in this chapter, France and Germany converge in some sectors of their energy policies while diverging in other sectors. Different legal approaches have led to different results on the way to achieving national and European objectives, while the markets of the two countries remain organised in very different manners. Barriers related to the transformation of both countries' energy systems are becoming more apparent and political governance to do away with them has largely been insufficient until recently. The next chapter will take a closer look at these barriers and challenges and analyse how the lack of cooperation and governance aggravate certain challenges.

2. Main challenges for the Franco-German and the European electricity system

Challenges to the French and German grids are manifold. Generation adequacy must be assured while managing the interdependency of electricity networks and planning sufficient investments to bring the aging electricity network up to speed. Since investments will most likely yield different returns for different stakeholders on opposite sides of the Rhine, this chapter also tries to show how all those issues are intrinsically related and need to be addressed by a comprehensive cooperation effort.

2.1. Generation adequacy

France and Germany have different approaches to ensuring generation adequacy while handling unanticipated market developments. Increasing RES injection on wholesale markets has contributed to a general overcapacity, decreasing wholesale electricity prices and making it more difficult for conventional electricity producers to run profitably. Furthermore, with the prices for carbon emissions and coal both very low since a few years, it has been cheaper in both countries to burn coal than gas, making it more expensive to produce electricity from gas, even using modern combined cycle gas (CCG) plants. In 2013, GDF Suez mothballed more than 1.5 GW of gas fired capacity in France[44] while Germany's RWE froze more than 12 GW of capacity since the beginning of 2013.[45] Nevertheless, reliable power is still needed to meet peak demand gaps and provide electricity when the sun is not shining and wind is not blowing. France has decided to alleviate these concerns by implementing a capacity market by 2016 while Germany is still discussing whether an extensive backup capacity mechanism is needed. But creating unilateral, poorly coordinated and strictly national capacity mechanisms will further exacerbate the generation adequacy challenge and could have detrimental effects on the objectives of the European electricity market.

> "A PURELY NATIONAL APPROACH MIGHT FURTHER CEMENT THE FRAGMENTATION OF THE EUROPEAN INTERNAL ELECTRICITY MARKET"

First, a purely national approach might further cement the fragmentation of the European internal electricity market which should be based on the principle of electricity exchange between member states and not on 28 autarkic national energy markets. Moreover, focusing on national solutions to transnational problems could lead to the peculiar situation where France mothballs reliable generation capacity while, Germany suffers from a shortage.

44. GDF Suez (ed.), "Document de Référence 2013".
45. Balser, M. et. al., "RWE könnte weitere Kraftwerke stilllegen", Süddeutsche Zeitung Online.

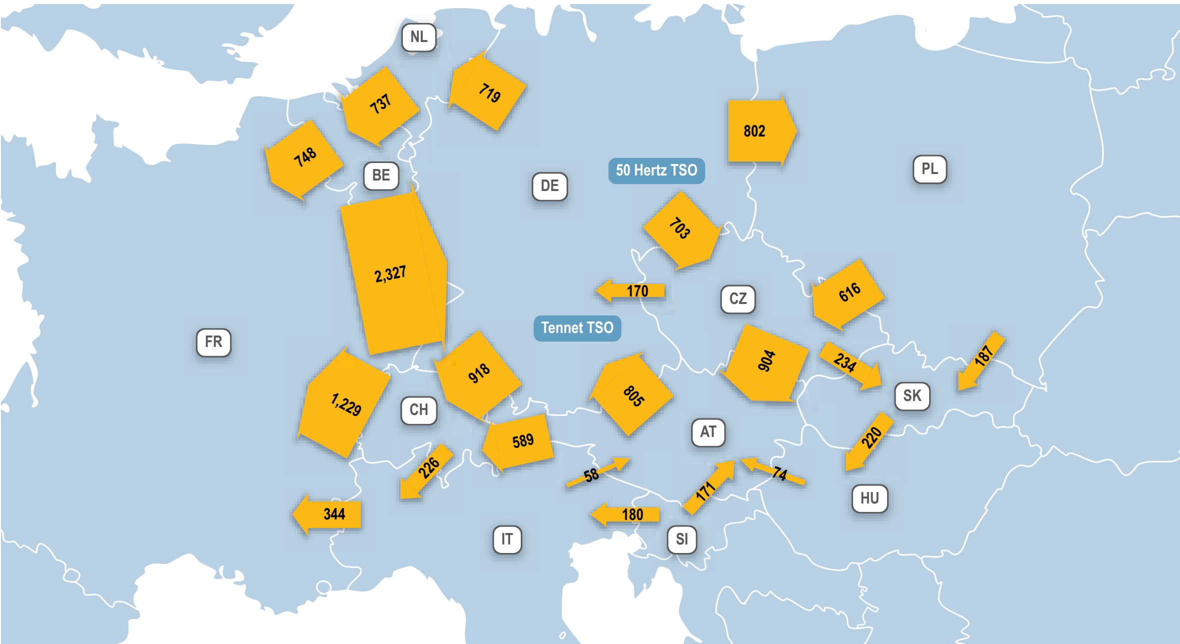
Second, a badly designed capacity scheme could disincentivise companies to decarbonise by allowing power generators to access revenue streams even without investing in low carbon technologies. Third, the creation of multiple parallel markets complicates an already complex continental system which is already haunted by distortive barriers to price finding such as high market concentration. Distorted price signals already pose significant challenges to both countries' electricity grids such as the emergence of loop flows.

2.2. Interdependency of electricity networks: loop flows & price signals

As illustrated above, the electricity systems between France and Germany are increasingly interlinked on commercial and physical levels. One of the most prominent challenges related to this interdependency is the issue of loop- and transit flows[46] of electricity. Those are unscheduled and unwanted electricity flows that occur when demand and production are not matched. Since electricity grids require stability to avoid black-outs, any overproduction of electricity must flow, and does so according to laws of physics and not necessarily according to market schedules.[47]

These flows are particularly tricky to handle in and out of Germany. At one point in 2012, unscheduled flows between Germany and France took up 60% of their cross border transmission capacity, leaving only 40% of the capacity commercially available. The welfare loss for both countries due to this inefficient use of interconnections strained by loop flows was estimated by ACER to stand at € 50 million in 2012.[48] In addition, costs linked to re-dispatching and counterbalancing those unscheduled flows are not negligible, with German TSOs spending € 130 million and the French TSO spending € 1.3 million in 2012.[49] This difference might be explained by the fact that just German loop flows have destabilised grids for countries further east, it is French unscheduled flows which strain the German grid as Figure 4 shows:

FIGURE 4 ► Average unscheduled flows, 2013 (MW)[50]



Source: ACER/CEER

46. For the sake of simplification, and since both phenomena are caused by the same shortcomings and cause similar problems, both terms are used interchangeably in this paper. See: Thema Consulting Group (ed.), "Loop flows – Final Advice", October 2013.
47. Ibid.
48. Acer/CEER Report 2013, p. 105.
49. Acer/CEER Report 2013, p. 203.
50. Acer/CEER Report 2014.

Rapid RES deployment, and the grid priority those sources enjoy in Germany and other EU member states due to Directive 2009/28/EC, are often said to be the culprit for such unscheduled flows. In times of high wind generation, more RES power is fed into the grid than demand requires. Since transmission capacity within Germany is limited *(see 2.3)* this might lead to the unscheduled flow of electricity across borders where it poses challenges to the other countries' grids.[51] However, researchers have found that unscheduled flows occur between Germany and its neighbours even at times when electricity generation from wind power was virtually negligible.[52]

Therefore, other factors might also contribute to the occurrence of loop flows such as inefficient price signals. The European electricity market has not reached a fully integrated state so distortions such as regulated prices remain, affecting the efficiency of the market. This in turn contributes to an increase in loop flows, particularly in Germany where on multiple occasions imports from neighbouring countries were incentivised into one German market zone even though production there was already sufficient.[53]

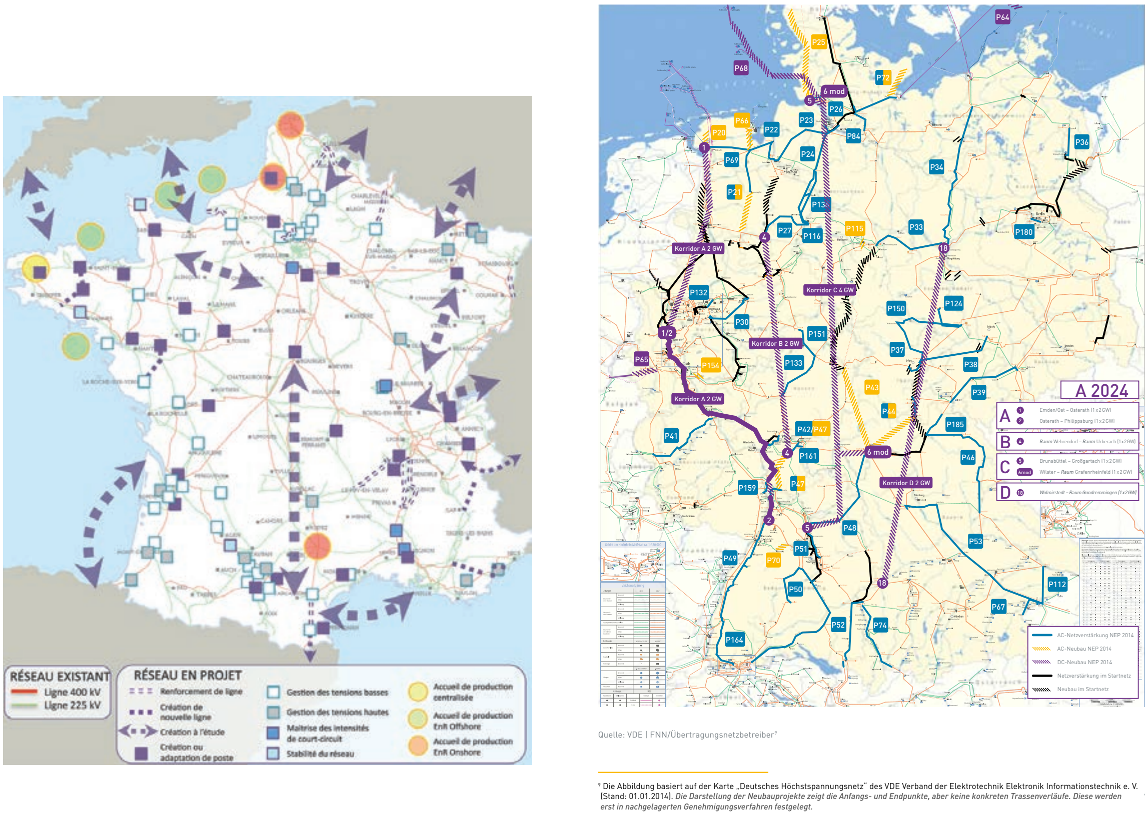
But inefficient price signals and market flaws are also due to the fact that the French, German and European electricity infrastructure is not ready yet to accommodate changing power production patterns. Adaptation will necessitate significant investments in the coming years.

2.3. Infrastructure

This increasing exchange of electricity between France and Germany requires important investment in electricity infrastructure. In Germany, one of the main challenge lies with bringing RES power generated in the north to the centres of demand in the south. However, existing high voltage electricity lines are deemed insufficient. The German Federal Network Agency (Bundesnetzagentur) opines that bringing the electricity infrastructure up to speed (i.e.: new high voltage lines, better interconnections between the *Länder*) would require between € 22 and € 26 billion in investments in the coming ten years according to newest estimates.[54] France faces similar challenges. While the Commission de Régulation de l'énergie (CRE) indicates that France spent more than € 1 billion per year on electricity infrastructure investment between 2009 and 2012,[55] the RTE prospective report foresees a need for € 35 to € 50 billion in additional infrastructure investment before 2030.[56] Priority regions are the Bretagne and the Provence-Alpes-Côte d'Azur. Figure 5 gives an overview of planned investment in both countries:

51. De Jong, J. "A regional EU energy policy ?", Clingendael International Energy Programme (ed.), CIEP Paper 2013/06, 2013.
52. Loreck, C. et. al., "Impacts of Germany's nuclear phase-out on electricity imports and exports", Öko Institut (ed.), 2013.
53. Ibid.
54. Bundesnetzagentur (ed), "Netzentwicklungsplan 2014, Factsheet".
55. Commission de régulation de l'énergie website.
56. RTE (ed.), "Schéma décennal 2012 de développement du réseau de transport d'électricité", 2012.

FIGURE 5 ► **Planned investments in French and German electricity infrastructure**



Source: RTE, Bundesnetzagentur (Scenario A 2024)

This investment effort is necessary to mitigate congestion and allow for better use of both markets. Much of this investment is needed to improve system flexibility in order to better integrate RES. However, it has to be carefully scrutinised how much investment is absolutely essential and what money could be saved by simply managing electricity markets better and providing them with a more flexible design. While we will get back to that point in chapter 3, it is important to note that increased investment and better cross-border market integration will likely yield different benefits for Berlin and Paris, another main challenge.

2.4. Winners & losers

As we have seen, electricity prices diverge between France and Germany for several reasons such as different market design, market concentration and primary energy sources. But we have also seen how infrastructure shortcomings, within national markets as well as cross-border hinder bilateral electricity trade and therefore price convergence. However, if infrastructure bottlenecks are alleviated by new investment in transmission capacity, economic theory suggests that the two countries will not benefit equally. As Germany is a high price country, increasing exchange of electricity will probably drive down prices for German consumers while the French consumers are likely to see their bills rise. German producers of electricity would likely lose out to lower-priced French production.[57]

57. Jacottet, A. "Cross-border electricity interconnections for a well-functioning EU Internal Electricity Market", Oxford Institute for Energy Studies (ed.), 2012.

Furthermore, TSOs might be reluctant to invest in additional infrastructure if it was to lower their congestion rent[58] and if costs were to outweigh the benefits.[59] For now, TSOs are compensated for losses incurred when making capacity available for cross border flows via the Intra TSO compensation mechanism (ITCM) (Regulation 838/2010) but there is still no effective cost-sharing mechanism to incentivise infrastructure investments.[60] This issue of unevenly distributed costs and benefits is indeed key as it touches upon two fundamental issues: increased coordination and increasing "Europeanisation" of both countries' electricity systems.

2.5. The benefits of political cooperation

First, increasing market integration and the electrical system interdependency should be followed by both an increasing coordination effort and closer cooperation. Increased coordination is necessary to allow both countries to alert each other of major energy policy decisions and allow concerns to be voiced before a given policy is adopted. Closer cooperation is then needed to see how diverging view points and different priorities could be accommodated in a mutually beneficial energy strategy. France is currently in a critical phase of implementing its own energy transition. Since Germany has had a head start in RES deployment and gained significant experience in handling its challenges, a more profound cooperation between the two countries could be especially beneficial for France in order to avoid policy shortcomings. It is however important to note that this concertation process does not mean a harmonisation of energy policies. Art. 194 of the Treaty of the Functioning of the European Union (TFEU) allows each member state to use whatever energy sources. However, it also states that EU energy policy shall be conducted "in the spirit of solidarity". Therefore, stronger cooperation is not only necessary due to increasing convergence on some matters (and harmful divergence on others) but also clearly sanctioned by European law.

> "STRENGTHENED FRANCO-GERMAN COOPERATION IS EVEN MORE BENEFICIAL WHEN EMBEDDED IN A EUROPEAN CONTEXT"

Second, strengthened Franco-German cooperation is even more beneficial when embedded in a European context, especially since the aforementioned challenges are heavily interlinked: too little cooperation can lead to network instability and generation inadequacy, which is exacerbated by the lack of investment and a suboptimal market design. This, in turn, is blocking the way to a more renewable based energy system. Moreover, those shortcomings exist in other EU member states: Loop flows occur between Germany and its eastern neighbours; while infrastructure bottlenecks hinder electricity exchange between France and Spain. Investment is needed everywhere in Europe[61] and RES grid integration is a challenge every country will face as soon as RES reach a certain share of the country's electricity production.

Moreover, investment challenges become more affordable when faced together. A more European perspective also enlarges the circle of potential investors. Consulting company Booz & Co estimates that in the electricity market alone, € 2.5 to € 4 billion a year could be saved if European electricity markets were fully integrated instead of member states providing only for national solutions.[62] A study of the Technical University of Berlin came to a similar conclusion, finding that a coordinated approach in expanding electricity grids, RES use and back up capacity could lead to € 23 billion in welfare gains compared to purely national approaches over the coming 26 years.[63] While cost-benefit analysis and modelling exercises are always difficult and need to be interpreted with care, this amount represents almost 1/4 of the money necessary to guarantee system stability and adequacy of the European electricity infrastructure by 2020 according to ENTSO-E development plans.[64]

58. Congestion rent occurs when prices in one market area are bigger than export capacity from that area. This price differential creates ownerless income on the spot market and is distributed, depending on the market design, mostly to TSOs.
59. Frontier Economics London Ltd. (ed.), "Improving incentives for investment in electricity transmission infrastructure", 2008.
60. Gerbaulet, C. et. al., "Regional cooperation potentials in the European context: Survey and Case Study evidence from the Alpine region", Economics of Energy & Environmental Policy No.3/2, 2014.
61. ENTSO-E (ed.), "Ten Year Network Development Plan 2012", 2012.
62. Booz & Co (ed.), "Benefits of an integrated European Energy Market", 2013.
63. Rechlitz, J. et. al., "Development Scenarios for the Electricity Sector. National Policies versus Regional Coordination", Technische Universität Berlin, WIP Working Paper No. 2014-01, 2014.
64. ENTSO-E (ed.), "Ten Year Network Development Plan 2012", 2012.

But how is it possible to achieve more intensified cooperation? Besides stronger governance *(see chapter 4)* enhanced cooperation would need an objective, a leitmotiv to organise and direct this communal effort. An objective that could fit this need is the optimisation of resources and energy systems.

3. The way forward: optimising the energy systems in France, Germany and the EU

German and French energy policies are driven to a certain extent by the EU's 20-20-20 objectives. While these objectives are necessary in order to tackle climate change, the way of doing so has recently come under criticism. Discomfort with rising costs related to RES deployment has been growing (even in Germany) while aforementioned challenges to the French, German and European grid have raised concerns over system stability. Moreover, European economic competitiveness and security of energy supply are also on the agenda, as seen in recent negotiations over the 2030 Climate and Energy Package which showed a growing division between member states on how ambitious the EU could afford to be in fighting global warming. This suggests that a new leitmotiv of cooperation, palatable to every member state, is needed. Taking the example of energy system optimisation, this chapter will try to show in which areas optimisation is essential, and likely to provide significant benefits, and how this optimisation should not be limited to France and Germany but is best extended to other regions and the whole EU.

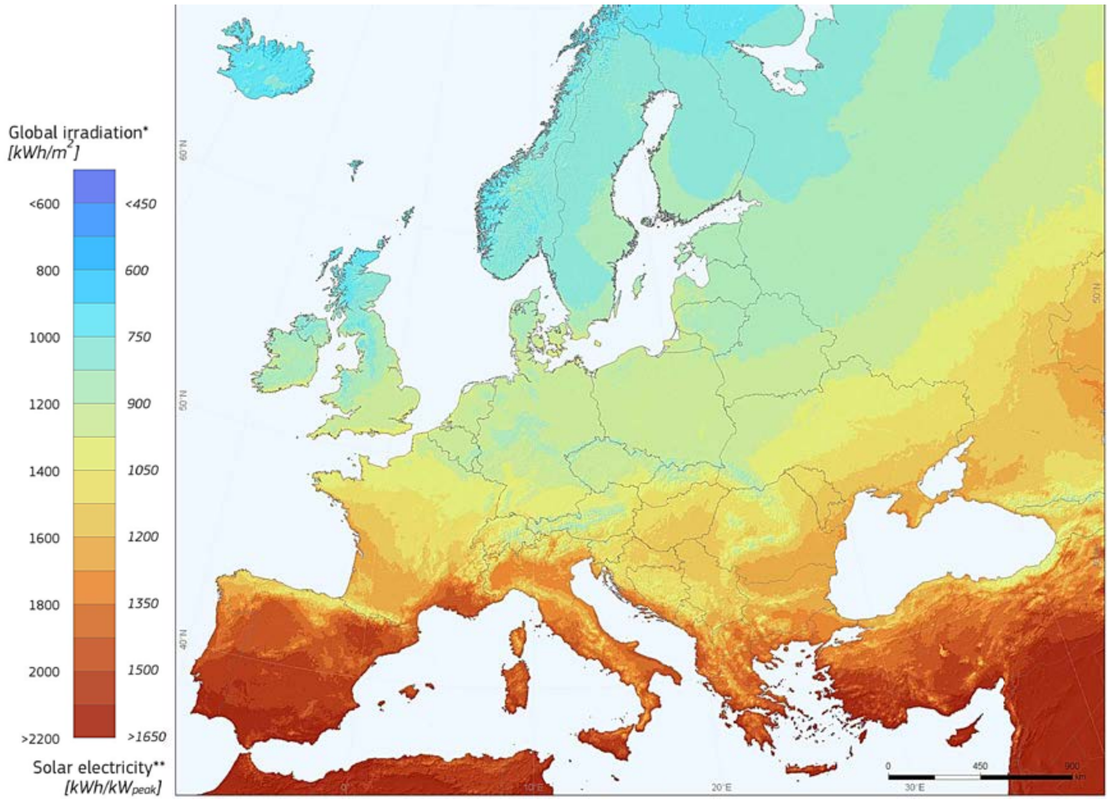
3.1. Energy profiles: taking advantage of complementarities

The very different energy profiles of France and Germany should be seen as an advantage in strengthening both grid stability and security of supply.

For instance, mean solar irradiation is higher in France (~1400 kWh/ m2) than in Germany (~1200 kWh/m2), so it would be more efficient to install solar PVs in southern France than in northern Germany. While German R&D efforts (and Chinese mass production) have helped to lower the price for solar panels by a factor of three in the past five years[65] taking a purely national approach in deploying panels foregoes potential efficiency gains.[66] While every country remains free to choose its energy sources, capitalising on national comparative advantages and making those benefits available to all European consumers via the internal EU electricity market might be prudent, especially in times of economic crisis. Figure 6 shows solar potential in France and Germany.

65. Cals, Guilain. "Photovoltaique: un courant à relancer", Alternatives économiques, No. 340, 2014.
66. On the other hand, guaranteed FiTs, even though costly, have helped to create much appreciated investment stability thus helping the rapid deployment of RES in Germany.

FIGURE 6 ► Solar power potential in Europe



Source: European Commission Joint Research Center, the more red the better the potential with the region around Marseille, France having a potential of 2000 kwh/m2

This "communitisation" of optimised resources via the internal electricity market would be especially useful for hydro power, which could play a key role in balancing RES production. As one of the main issues with intermittent RES production is storage, hydro power offers the cheapest way to store electricity in the form of potential kinetic energy. Hydro power can also be activated within minutes if other power sources fail. In a resource optimised system German and French RES generation could be balanced by French nuclear power given the fact that nuclear energy will continue to play an important role in the French electricity mix. Furthermore, both countries' hydro capacities could play a vital role in storing excess RES electricity.

However, both France and Germany are traditionally net exporters of electricity. Therefore it might become necessary to extend this optimisation to a regional and subsequently European level. Solar power is produced more cheaply in the south of Europe (Spain, Portugal), offshore wind is deployed more easily off the coast of the UK (due to geological and meteorological conditions), and there is still a large untapped hydro potential in eastern Europe.

Capitalising on comparative energy advantages can also help strengthen continental generation adequacy and distributing the risks of network failure. It would therefore be important to pursue optimisation beyond the national level to ensure that advantages in one country are made available to other countries. But to reap the benefits of optimisation, the current market design needs to be adapted.

3.1. Market design: more flexibility

Flexibility is a key feature of an optimised market design; especially with regards to increasing RES deployment. As RES become increasingly cost competitive, more will be demanded of RES producers to stabilise and balance markets across the continent.

Yet cross border capacities between France and Germany are currently allocated a maximum 45 minutes prior to delivery on intra-day markets.[67] Even though a new flow-based calculation model will be introduced in the first half of 2015, thus making the allocation and utilisation of cross border capacities more efficient, the 45 minutes time frame might not be enough to integrate RES electricity effectively into the market. Moreover, liquidity on intra-day markets could be higher and cross border utilisation is not organised in an optimal way thus hindering the exchange of electricity.[68] Once intra-day market tools and instruments are reinforced and optimised, developing a cross border balancing market would be the next step in market integration between Germany and France as welfare gains are expected to be substantial.[69] However, balancing agreements are currently only adopted bilaterally between stakeholders (TSOs) thus ignoring a European perspective. Regulations for managing balances also differ across the EU, forming barriers to real time cross border trade. Different tradable wholesale electricity products and varying commercial time frames can cause the inefficient allocation of resources and can play a detrimental role in integrating RES production further into the market. Doing away with these barriers to cross border electricity trade should be a primary objective of enhanced Franco-German energy cooperation in order to capitalise on their complementary energy profiles.

Both countries are also part of a larger, regional market, the Central Western European market (CWE). Therefore, further integration between French and German markets should be developed in a way that allows them to be extended subsequently to the CWE region and eventually to the whole EU. The adoption of the Capacity Allocation and Congestion Management (CACM) network codes to increase cross border utilisation efficiency (developed jointly by ACER, ENTSO-E and the European Commission and expected in 2015 will be a step into the right direction, but more is required.

> "DEMAND SIDE MANAGEMENT IS SUPPOSED TO HELP CONSUMERS BECOME MORE ACTIVE"

Designing markets to provide flexibility must be done with awareness of the needs of French, German and European energy consumers via demand side management. Demand side management is supposed to help consumers become more active, providing them the opportunity to adapt consumption patterns to dynamic prices. If prices were based on the real cost of electricity (for example higher prices in times of peak demand), consumers could be incentivised to switch off some household appliances during a high price period. This would help even out the demand curve, making it more elastic and increasing the stability of the network. However, although demand side management is seen as a key instrument for more flexibility, few regions (the Harz Landkreis region in Germany or the Nice region in France with its REFLEXE project) have measures to increase energy system flexibility such as smart metering and near real time pricing. On this issue, optimisation potential is large and stronger efforts might be made in order to boost demand side flexibility. France and Germany both might benefit from increasing cooperation with the Nordic member states and Norway, where smart metering and "smart pricing" are more advanced than on the continent.

But providing for more flexibility via demand side management or a different market design to do away with problems such as loop flows or to better integrate RES electricity is only one side of the coin. Another area where more work has to be done is the optimisation of investment in the French, German and European energy infrastructure.

3.2. Optimising infrastructure investment

As indicated in chapter 2, French and German electricity grids will require significant investment in the years to come. In addition to grid stability or affordability, optimal investments must also take into consideration the evolution of national energy systems. In Germany, RES deployment is increasingly taking place in a decentralised manner, which raises the question of how private citizens should participate in financing

67. Mahuet, A. (Presentation) "Case example on Power Exchanges: Market Coupling and Cross-Border Trading", Florence School of Regulation (ed.), 2012.
68. Pöyry (ed.), "Proposition pour une nouvelle architecture du marché de l'électricité – Rapport pour France Énergie Éolienne", September 2014.
69. Vandezande, L. et. al., "Assessment of the implementation of cross-border balancing trade between Belgium and the Netherlands", University of Leuven (ed.), 2009.

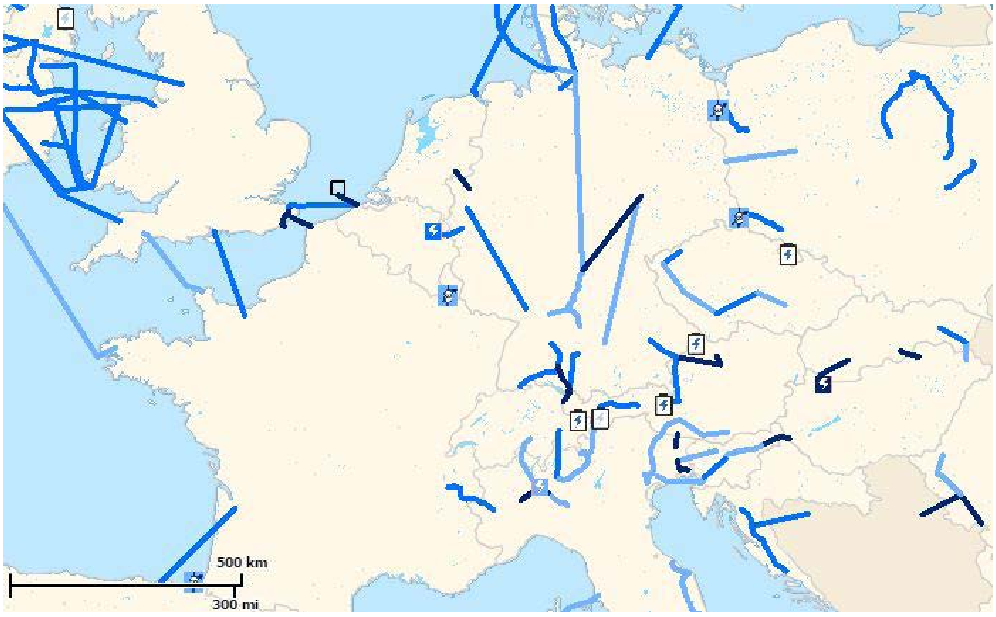
the infrastructure that they still need in times when their home solar panels do not produce enough electricity. Germany also needs significant investments in large scale infrastructure projects like the German North-South corridor, which might necessitate a more centralised approach to grid planning. Optimising investment strategies will require adapting them to this dichotomy of centralised vs. decentralised approaches. While this issue is less pronounced in France, increasing cooperation would still be beneficial. The French electricity system will most likely become more regionalised in the medium and long term due to increasingly cheap, small scale RES solutions for private homes such as solar PV and heat pumps. Therefore, Germany could offer some valuable lessons learnt on how to deal with this decentralisation.

But the optimisation of infrastructure investment can yield greater gains if it is pursued beyond the national level, and taking the best advantage of complementary energy profiles will require careful scrutiny of how much investment in cross border transmission capacity is needed. In the case of France and Germany, the difference in spot market electricity prices suggests the need for more cross border investment[70] though utilising existing capacity to the fullest might render some investment unnecessary. But if additional investment should be necessary, one barrier is the uneven distribution of benefits. Current investment decisions across the border are implemented according the principle that each party pays for the costs arising on its territory.[71] Yet, benefits and actual investment costs might differ widely. For example, a new transmission line between Sweden and Norway was built predominantly (75%) on Swedish territory, but short term benefits have been largely reaped by Norway.[72] Therefore, improved cooperation becomes necessary to draw up a bilateral investment plan based on thorough cost-benefit analysis leading to an efficient allocation of new cross border capacity. A compensation mechanism might be devised which compensates TSOs not only for congestion rent lost due to new investments made.

Again, these issues apply not only to Germany and France. The EU has recently taken the initiative to foster a more collaborative approach to investment in infrastructure by adopting a list of "projects of common interest (PCI)" based on Regulation 347/EU/2013. Those PCI serve specific strategic purposes like strengthening the Union's energy security, boosting the internal energy market and/or reducing CO2 emissions. However, those projects can also be seen as an attempt to optimise investment by employing a regional or European prism when looking at spending. Institutions such as the EU Agency for the Cooperation of Energy Regulators (ACER) and the Council of European Energy Regulators (CEER) are already developing codes and best practice examples to optimise and to speed up investments in PCIs. Figure 7 gives an overview of PCIs in the electricity sector to be realised by 2022.

70. Averaged during 2013, base prices differed almost by 6 Euros on the respective day-ahead markets. However, electricity prices vary significantly from hour to hour and from year to year. However, trends can still be discerned. EPEX Spot Website.
71. Meeus, L. et. al., "Guidance for project promoters and regulators for the cross-border cost allocation of projects of common interest", Florence School of Regulation (ed.), 2014.
72. Meeus, 2014.

FIGURE 7 ► Projects of common interest in the European electricity sector[73]



Source: European Commission; dark blue indicates projects supposed to be finished before the end of 2017

But when developing an optimised, more flexible electricity system with appropriate infrastructure, France, Germany and other European member states should base this transformation on sound scientific reasoning. Only a clear understanding of the challenges, and concrete propositions on how to overcome these challenges, could lead to an optimised, low carbon energy system.

3.3. Boosting research and development to facilitate the energy transition

Optimisation efforts should also address research & development. First, R&D efforts could enhance the complementary energy profiles of France and Germany by providing improvements in existing energy technologies such as solar panels or solutions to challenges such as electricity storage. Electricity storage is of significant interest to both countries as storage needs will likely increase with continuous RES deployment. While conventional storage facilities such as hydro reservoirs are widely accepted, other technologies might be scrutinised for their suitability to deliver energy storage without driving up costs significantly. One potential technology could be "power to gas".[74] Even though this technology is still in its infancy,[75] research cooperation has the potential to lead to some significant breakthroughs. Currently, there are experimental power to gas facilities in Germany (Prenzlau, Falkenhagen and Stuttgart) and France (Dunkerque) involving E.ON, ENERTRAG, GDF Suez and AREVA.[76] Bundling research efforts through joint ventures might yield some of those expected breakthroughs.

A second area of research cooperation could be focused on improving electricity system flexibility to better integrate RES and to avoid threats to network stability. National regulators and TSOs might forge stronger partnerships with national research institutions within each country, as each party offers a different perspective on the issues at stake. With stronger intra-national links between stakeholders, this collaboration effort should be connected across the Rhine. Again, differences between France and Germany (larger share

73. Several projects remain confined within a national territory. However, they have a positive impact on the European grid as a whole since the status of national infrastructures influences cross border electricity flows. If national electricity lines are congested, national TSOs could be incentivized to curtail cross border trade to stabilise the national grid. Therefore, a more fluid internal electricity system also facilitates the trade across borders and subsequently the optimal deployment of resources.
74. "Power to gas" is one possibility to store electricity. In times of overproduction, electricity is used to split water into oxygen and hydrogen by means of the electrolysis process. Different methods exist but the hydrogen could be fed directly into the European gas network, used in transportation or later on for electricity generation. Unfortunately, the efficiency of this technology is still very low and the process is expensive. Furthermore, it is not clear whether this method would be the most advantageous form of electricity storage. However, confirming or falsifying this assumption is exactly one objective of experimental research
75. Hermann, H. et. al., "Prüfung der klimapolitischen Konsistenz und der Kosten von Methanisierungsstrategien", Öko Institut (ed.), March 2014.
76. SIA partners (ed.), "Power-to-gas: état des lieux des projets réalisés, en cours ou programmés visant à préparer l'industrialisation du procédé".

of intermittent RES in Germany vs. a remaining status quo of nuclear power in France) should not be seen as a barrier to an enhanced R&D cooperation but as advantage. Different systems lead to different experiences which might lead to different policies. But conclusions drawn from these policies might not be mutually exclusive but could form the base to build a stronger, more collaborative energy policy.

Third, infrastructure adaptation and investment is also a promising area where research efforts could be bundled. This is particularly true when touching upon the subject of unequal distribution of benefits. Questions on how to invest in cross border capacity with fairly shared costs and benefits clearly goes beyond the national context. A closer cooperation of stakeholders is therefore not only a political vision but an economic necessity if the cross-border market integration is to yield its full benefits.

However, it has to be kept in mind that overcoming the challenges evoked in chapter 2 by optimising the electricity systems of both countries has to be thought in a European context as several benefits are likely to materialise.

3.4. Optimisation in a European context

Pursuing resource optimisation (i.e. the efficient and as sustainable as possible use of energy sources) while taking into consideration the needs of neighbouring countries would help maximise overall welfare gains in providing the most efficient energy solution to European customers via the internal electricity market. Facing challenges together is less costly than purely national approaches because economies of scale could be put to work for investing in targeted, mutually beneficial infrastructure projects. Moreover, optimised and interconnected energy systems are likely to increase the security of supply as failure of one significant energy source in one country is more easily mitigated if it is part of a larger network of interconnected countries.

“INCREASED COOPERATION IS NOT A THREAT BUT AN OPPORTUNITY NOT TO BE MISSED ON OUR WAY TOWARDS A MORE SUSTAINABLE, LOW CARBON ECONOMY”

Stronger cooperation in finalising the EU internal electricity market will also lead to increasing interdependency amongst member states. However, instead of fearing this interdependency and trying to fend off challenges linked to the evolution of the whole energy system relying on a purely national perspective, Germany, France and the rest of the Europe have to realise that increased cooperation is not a threat but an opportunity not to be missed on our way towards a more sustainable, low carbon economy.

A more collaborative approach between member states offers significant gains. However, experience show that besides the lack of motivation to increase the cooperation efforts, the current governance structures in order to facilitate a stronger cooperation are for the time being insufficient. The last chapter will flesh out some propositions, how the governance instruments of France, Germany and the EU could be enhanced in order to allow for increasing cooperation which in fine is set to lead to a true European Energy Union.

BOX 2 ► A European Energy Union

The concept of an Energy Union was first proposed by former European Commission president Jacques Delors and former president of the European Parliament Jerzy Buzek. As the energy systems of member states are increasingly interdependent through the internal energy market and defined by common goals, such as the EU 2020 and 2030 targets, member states can find strength in unity. Instead of pursuing only national strategies, a more united, European approach could save money, increase stability of the energy system and accelerate the transition to a low carbon economy. The Energy Union concept goes beyond the scope of this Policy paper and covers also the external aspect of European energy policies. As the recent Ukrainian crisis reminds us, European energy challenges can only be solved by keeping in mind the international context and developments on global energy markets. Unity vis-à-vis external energy partners such as Russia strengthens European energy security. Instead of pursuing individual deals with Russian companies such as Gazprom – thus driving a wedge between member states, European efforts could be bundled in order to pursue a common goal like the diversification of resources. Past gas delivery crises involving Russia and Ukraine (2007, 2009 and 2012) pushed member states towards more cooperation, with the benefits already becoming apparent: Due to a common approach based on solidarity (and enshrined in Regulation 994/2010), gas pipelines have become bidirectional in several member states, allowing for the reversal of flows and the delivery of gas volumes to member states in distress. Increasing cooperation and coordination between regulators and competent authorities has led to the elaboration of emergency plans, while storage provisions have added resilience to the system. This was confirmed by the European Commission' stress tests of the European gas system (COM (2014) 654 final) revealed to be less vulnerable than years ago even though there is still a long way to go. Furthermore, inquiries of the European Commission concerning the conformity of the Gazprom proposed pipeline South Stream with EU regulations (the Commission found the project to be not conform) has certainly played a role in Gazprom shelving the project for the time being. Thus, the Southern Gas Corridor has been kept open for other partners than Moscow. However, it was only due to a crisis situation that European leaders decided to act and to adopt energy policies fostering solidarity. European energy policy, however, is still characterised by fragmented, *ad hoc* and *ex post* approaches instead of ambitious, common *ex ante* energy policies. Harnessing the economic and diplomatic power of European unity is therefore one major objective of the European Energy Union.

4. Managing optimisation – strengthening bilateral, regional & European energy governance

A more collaborative approach between member states offers significant gains, but existing governance structures are not designed to facilitate closer cooperation. This last chapter will discuss how the governance instruments of France, Germany and the EU could be enhanced in order to allow for increasing cooperation and lead to a true European Energy Union.

4.1. Bilateral cooperation: key priorities and enhanced governance

As shown in the preceding chapters, the challenges linked to the transformation of the French and German energy systems to help the emergence of a low carbon economy are significant. Several priority areas have been identified where increasing Franco-German cooperation is not only beneficial but necessary:

- Generation adequacy has to be assured, giving preference to solutions developed bilaterally rather than nationally, and building on progress towards a common European electricity market.
- A more flexible market design is needed to mitigate threats to system stability and assure the better integration of renewable energies.
- Infrastructure investment in a timely and efficient manner should be assured especially across borders in order to assure a fair distribution of costs and benefits.
- Those efforts should lead to increasing optimisation of both countries electricity systems, particularly if buttressed by an enhanced common research effort.

As discussed in chapter 1, initiatives to increase the governance of those issues have been implemented but more has to be done.

On a political level, inter-ministerial meetings should be held regularly, as stipulated in the agreement of June 2014, followed by a roadmap with concrete objectives to be realised by the next meeting. Those objectives could then be taken up by institutions such as the Agence de l'environnement et de la maîtrise de l'énergie (ADEME) and the Deutsche Energieagentur (DENA). Their role could be to implement some of the objectives of the road map while enriching the debate with technical know-how concerning the priority areas outlined above. This institutional setting could function as guiding framework to support a new governance instrument on a more technical level.

For example, a kind of permanent bilateral forum or council could be established where different stakeholders from both countries come together in different configurations depending on the subject matter discussed thus establishing several committees with specific tasks: Questions of generation adequacy could be addressed by a committee comprised of both countries TSOs, French and German energy regulators and representatives of each country's energy industries. That way, national adequacy assessments could be shared and discussed in order to achieve a comprehensive strategy which tackles adequacy issues not from a purely national point of view but from a bilateral perspective. Should the question of market design be discussed, another committee could have a more research focused agenda with research institutions participating in the meetings to provide for their input. Independent of the number and configuration of each committee, this forum could be under the patronage of both countries' energy agencies (DENA & ADEME) so that information flows smoothly from the bottom up but also from the top (ministerial level) down.

The design as well as the configuration of such a forum or council might vary but the important factor is that both countries allow for a regular exchange of viewpoints, research and strategies, at best under the inclusion of a large variety of stake holders. However, enhanced governance does not require stronger harmonisation, but can lead to better optimisation of complementary resources. It is nevertheless necessary to embed this optimisation of the respective countries' energy systems (resources, markets, investment and infrastructure) in a regional context not only because other countries have been connected with the Franco-German energy systems such as the Benelux countries and Austria but also because optimisation potential is significant in other regions.

4.2. Reaching out to the regional level: the Franco-German engine

Regional cooperation and governance mechanisms with Franco-German participation are already in existence, such as the Pentalateral Energy Forum and the North Seas Countries' Offshore Grid Initiative (NSCOGI). Other regional groupings exist further east, like the Visegrad Four Group but without German and French participation. Several regional cooperation instruments have been launched with a more continental view, such as the regional cluster initiatives of the Council of European Energy Regulators (CEER) or the regional groups working to facilitate the implementation of Projects of Common Interest (PCI).[77] It is therefore important to think on how each of those initiatives could provide value added while avoiding the doubling of efforts.

The Pentalateral Energy Forum can be regarded as success in bringing concerned stakeholders together and in fostering cooperation on important measures such as stronger market integration. It has been one of the main drivers of the Central Western European market coupling procedure[78] but momentum has been lost recently. It would therefore be time to revive and to reinforce the capacities of the forum. Helpful steps would include replacing the 2013 working programme with a longer term agenda that includes concrete milestones for the coming 5 years, setting up working groups dedicated to the challenges of RES integration and making the work of the Forum more publicly visible to create an exchange with other stakeholders.

> "FRANCE AND GERMANY COULD PLAY A KEY ROLE, ESP. CONCERNING RES DEPLOYMENT, IN SHARING LESSONS LEARNT AND BEST PRACTICE EXAMPLES WITH OTHER MEMBERS"

France and Germany could play a key role, especially concerning RES deployment, in sharing lessons learnt and best practice examples with other members. France might draw some additional benefits from exchanges with key actors from other countries as the rebooted French energy transition seeks to avoid shortcomings of past energy policies in its neighbourhood. This enhanced work on RES integration could be complementary to other regional initiatives, such as the NSCOGI, which could serve as a concrete case study of issues deliberated in the Pentalateral Energy Forum, especially those concerning the integration of large scale offshore wind farms, ranging from interconnection modalities to the market design.

77. Regional groups within the PCI framework in the electricity sector include the Northern Seas Offshore Grid, the North Sea Infrastructure (NSI)-West Electricity, NSI-East Electricity, the Baltic Energy Market Interconnector Plan (BEMIP). See: De Jong, J. et. al., "Exploring a regional approach to EU Energy Policies", CEPS (ed.), 2014.
78. De Jong, J., 2013.

Revitalising NSCOGI would also be beneficial and high level meetings should be reintroduced to set an ambitious yet realistic agenda with small scale objectives to be realised in the near future. As the new Climate and Energy Package 2030 does not have binding individual RES targets, increasing regional cooperation on those matters could send a strong signal to other member states, especially if large economies such France and Germany take RES issues seriously. Moreover, common subsidy schemes for RES electricity could be scrutinised, an area where Sweden and Norway do have expertise to share thanks to their common RES support instruments.

Regional cooperation should also be pursued towards the east, including with the Visegrad Four Group – bringing together Poland, the Czech Republic, Slovakia and Hungary, which has an energy expert group. Since unscheduled flows between Germany, Poland and the Czech Republic are a matter of concern it would be prudent to include German stakeholders in the group's deliberation process. An information exchange mechanism between the Pentalateral Energy Forum, NSCOGI and the Visegrad Four could be envisioned with representatives of each forum participating reciprocally in meetings, work stream sessions and conferences.

However, France, Germany and other member states must be careful not to double existing instruments of governance. Other regional initiatives and European associations, like the CEER, also work on regional electricity markets issues (although with a strong regulatory focus) as do EU agencies such as ACER. In addition, the recent implementation of regional groupings within the PCI framework further adds complexity, most notably as one regional PCI group, the Northern Seas Offshore Grid is very similar to the NSCOGI framework.[79] This is exactly where the shoe pinches. Regional initiatives are more than welcome, especially when they may break a deadlock on a higher European level, thus working in favour of the subsidiarity principle.[80] However, uncontrolled regional initiatives might further complicate the already complex energy governance system of the EU and may even run counter to efforts to coordinate member states energy policies.

4.3. Strengthening EU energy policy

> "IMPROVED GRID STABILITY, INFRASTRUCTURE INVESTMENT AND RES INTEGRATION REQUIRE A TRULY EUROPEAN APPROACH"

Challenges to the European electricity system are not very different from challenges on regional or member state levels, as the EU has adopted its own objectives to transform its energy system. Member states decided to integrate their respective energy systems and to make them more sustainable. This increasing interdependency puts the challenges evoked in chapter 2 in a European context: improved grid stability, infrastructure investment and RES integration require a truly European approach. This seems all the more clear as the heads of states agreed in October 2014 to further integrate the European energy markets by boosting the interconnection target to 15%.[81] It is therefore important to dovetail stronger bilateral and regional cooperation into the European governance framework. This can help facilitate the emergence of a truly common energy policy based on the spirit of solidarity. The renewal of the European institutions in fall 2014 provides for an outstanding opportunity to do so.

The Council conclusions concerning the new Energy and Climate Package for 2030 clearly state the need to develop a "reliable and transparent governance system" to assure that the EU meets its energy policy goals and the 2015 working programme of the European Commission explicitly mentions the goal of establishing an energy union under sub-point three.[82] However, it is not yet clear how this governance system will look like.

A first step could be to capitalise on existing infrastructure and to streamline their functioning. The proposition to harmonise reporting standards, as called for in the Council Conclusions of October 24rd 2014, seems to be a good starting point. Currently, each 2020 objective (emissions reduction, RES, energy efficiency) needs

79. De Jong, 2014.
80. Ibid.
81. By 2030, member states are supposed to guarantee that 15% of their electricity capacity installed could be transferred across borders according to the European Council Conclusions of October 24 2014.
82. European Commission (ed.), "Commission Work Programme 2015 – A new start", COM (2014), 910 final.

its own national action plan which has to be sent to the European Commission. Combining those different strands into one comprehensive 2030 framework report on all three objectives might be more effective.[83]

Existing EU institutions and regional initiatives could also be linked together in a more comprehensive manner. ACER is already competent to monitor regional cooperation activities on regulatory issues by virtue of Art 6.9 of Regulation 713/2009.[84] This function should be reinforced. ACER representatives could also be a part of the PEF (Pentalateral Energy Forum). ACER is already involved in the NSCOGI and could provide those and other regional initiatives with guidance and expertise where necessary. Other EU institutions such as the European Commission (EC) or the European Parliament should participate more actively in regional fora. The EC could provide guidance documents for regional initiatives to assure that deliberations on a regional level meet EU energy objectives and EU legislation standards. These propositions must not be understood as usurpation of those regional cooperation initiatives but as an increase of communication between different levels of governance. A stronger communication effort is necessary to streamline their functioning and to assure that they interact smoothly.

It might be prudent, as a second step, to enlarge the competencies of existing institutions. ACER does not have the power to issue binding network codes but only to give advisory opinions on network codes developed by the ENTSO-E, and to issue framework guidelines on which ENTSO-E network codes should be based. However, granting ACER the power to issue binding codes could facilitate the energy trade across borders. While a stronger mandate for ACER should focus on the technical details such as new network codes, individual member state TSOs could also endow ENTSO-E with more competencies, especially concerning cross-border investment decisions. A special fund could be implemented and ENTSO-E might be entrusted with more control over the real time electricity flows on the European grid. This increase in competency, however, has to be supplemented by a boost in transparency within ENTSO-E ranks, to guarantee actions in the interest of the European consumer.[85] Moreover, it could be beneficial to supplement ACER or ENTSO-E with additional administrative personnel in order to fulfil those new functions efficiently. Regional offices could be created which would work closely with aforementioned already existing regional initiatives as well as with the European Commission.

Last but not least, the current period might be favourable to provide current administrative infrastructures with an enhanced governance structure. As the new EC took office, the nomination of a Commission vice president in charge of the "Energy Union" was a promising first step. In the mission letter to the designated commissioner Maroš Šefčovič, Jean-Claude Juncker specifically reasons that the new commissioner should be "engaging with regulators and stakeholders at national and European level in order to improve, reinforce and fully apply EU legislation in this area." Furthermore, he is supposed to manage and organise the representation of the Commission in "[…] national Parliaments and other institutional settings as well as at international level", which gives a clear mandate to the Energy Union commissioner to play the role of a coordinator and facilitator.[86] Therefore, European policy makers could envision implementing a focal point between regional initiatives and EU institutions. This focal point could be directly under the supervision of the Energy Union commissioner and would assure not only the representation of EC personnel in fora such as PEF, NSCOGI or the Visegrad group but would also relate information back to other EU agencies and institutions while at the same time providing guidance based on EC's recommendations.

"INCREASING INTERDEPENDENCY BETWEEN THE MEMBER STATES HAS MADE INCREASING COOPERATION A POLITICAL NECESSITY"

This would help the EU strengthen the key shortcoming of European energy policy (also observable on regional and bilateral levels): the lack of communication, and cooperation, which in turn hinders the emergence of a truly common energy policy and an Energy Union. Increasing cooperation efforts to optimise the European energy system and to surmount the challenges analysed in chapter 2 (generation adequacy, loop flows, investments

83. Duwe, M., "Challenges and potential of a new governance framework for the EU's climate and energy policy for 2030", Ecologic Institute (ed.),Research Draft June 2014
84. Regulation 713/EC/2009.
85. Brüning, A. "Towards a green internal electricity market", Institute for International Political Economy Berlin (ed), Working Paper 31/2014.
86. Juncker, J.-C., "Mission letter to Maroš Šefčovič", 15 October 2014.

necessary, winners and losers) are not meant to deprive member states of their right to choose the energy policies. Rather, increasing interdependency between the member states has made increasing cooperation not only a noble philosophical vision but a political necessity for a secure, stable and sustainable energy system.

CONCLUSION

European energy policy is at a turning point. The new EU 2030 Energy and Climate Package furthers the transformation of the European energy system and is another step towards a common energy market. France and Germany – the traditional drivers of EU energy policy – have adopted their own ambitious legislation packages to pave the way for energy transitions that exceed EU ambitions. But while their electricity systems became increasingly interdependent and they have developed similar goals in areas such as RES deployment and emission reduction efforts, insufficient bilateral governance of their energy transitions has led to divergences and challenges in other areas. Their market designs are radically different, potential threats to system stability remain unaddressed, generation adequacy has suffered, RES integration remains problematic and investments need to be made urgently.

These challenges must be faced by Germany and France, but also by the rest of the EU member states seeking to build low carbon energy systems. Insufficient levels of coordination, cooperation and governance on energy issues not only make it difficult to address these challenges, but are actually the cause of some of them, as member states still view their energy policies through largely national prisms. The increasing interdependency of energy systems makes this prioritisation of national perspectives a very short-sighted one.

As the detrimental effects of a non-cooperative approach on energy issues become more apparent, including loop flows and threatened generation adequacy, France and Germany have begun to strengthen their bilateral governance on energy issues. While this is a welcome step forward, efforts should be intensified using existing but also creating new governance structure in order to yield concrete results. As progress is gradually achieved on a bilateral level, Franco-German bilateral governance initiatives should be extended to existing regional fora. France and Germany are part of a larger electricity market and vital building blocks of the European internal energy market. As the new European Commission starts its work, the time seems ripe to sign on to a truly common European energy policy that can address current challenges, prevent future crises, and make the transformation of the European energy system a success.

The transformation of European electricity systems could certainly be achieved more quickly, and at a lower cost, if member states were to strengthen a common governance of energy issues by optimising their resource use, allowing for more flexibility especially concerning the integration of RES and by pooling their intellectual and financial resources. Besides lower costs a move toward more cooperatively developed and jointly implemented energy policies would facilitate the planning that leads to increased system stability and better security of supply.

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