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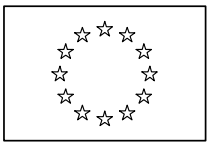

EUROPEAN COMMISSION

Brussels, 6.6.2011
SEC(2011) 755 final

COMMISSION STAFF WORKING PAPER

Energy infrastructure investment needs and financing requirements

Introduction

Major efforts are needed to modernise and expand Europe's energy infrastructure and to interconnect networks across borders to meet the Union's core energy policy objectives of competitiveness, sustainability and security of supply. This is crucial to ensure that solidarity between Member States will become operational, that the internal energy market is completed by 2014 and isolated regions are linked by 2015, that alternative supply/transit routes and sources of energy will materialise and that renewables will develop and compete with traditional sources, as highlighted by the 4th of February 2011 European Council. In its conclusions, the European Council furthermore underlined the importance to streamline and improve authorisation procedures and to promote a regulatory framework attractive to investment, while recognising that some projects may require some limited public finance to leverage private funding. The European Council also requested the Commission "*to report by June 2011 to the Council on figures on the investments likely to be needed, on suggestions on how to respond to financing requirements and on how to address possible obstacles to infrastructure investment.*"

This Staff Working paper answers the Council's request by presenting the Commission's analysis with regard to (1) the investment needs of European relevance in electricity and gas infrastructures for the period up to 2020, (2) the investments at risk of not being delivered due to various obstacles, and (3) the measures proposed to respond to the financing requirements and overcome the obstacles identified. These measures are intended to be formalised in a legislative proposal foreseen for October 2011.

(1) Priority corridors to be implemented by 2020

In the Communication[1] on "*Energy infrastructure priorities for 2020 and beyond – a Blueprint for an integrated European energy network"* (hereinafter the "Commission Communication"), adopted in November 2010, the Commission identified a limited number of priority corridors, which are necessary to allow the EU to meet its ambitious energy and climate targets by 2020 on completing the internal energy market, ensuring security of supply and enabling the integration of renewable sources of energy. They also prepare the networks for further decarbonisation of the energy system in the longer term.

These priority corridors concern mainly electricity and gas, which are regulated under the internal energy market legislation and covered under the trans-European network policy and financing framework. In addition, priority corridors/actions were also identified in sectors, which are not regulated (oil networks) or where the framework still needs to be further developed (electricity highways and carbon capture, transport and storage infrastructure).

In its conclusions the TTE Council on 28 February 2011 endorsed these corridors as priorities for Europe.

(2) Investment needs in electricity and gas

In the Commission Communication the overall investment needs in electricity and gas infrastructure are estimated to amount to more than 200 billion euros (bn €) for the decade up to 2020.

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[1] COM(2010)677

This assessment was based on an evaluation of the infrastructure needed to allow Europe to meet the overarching policy objectives of completing the internal energy market, ensuring security of supply and enabling the integration of renewable sources of energy, using EU-wide modelling tools combined with various scenario analyses prepared by the industry and other stakeholders. The assessment took notably account of the future evolution of energy demand, notably in the transport sector, interdependencies between the electricity and gas systems of all Member States and the need to address the remaining infrastructure bottlenecks to obtain a fully integrated European network (see maps in Annex 2).

The identified investment needs are composed of:

– About 140 bn € for high voltage electricity transmission systems of European significance, both onshore (70 bn €) and offshore (30 bn €), including storage and smart grid applications at transmission and distribution level (40 bn €);

– About 70 bn € for high pressure gas transmission pipelines (coming into the EU and between EU Member states), storage, liquefied/compressed natural gas (LNG/CNG) terminals and reverse flow infrastructure[2].

These estimations neither take account of maintenance, refurbishment or new investment expenses for national transmission networks without European significance or for distribution networks, nor do they comprehensively reflect investment needs to enhance the climate resilience of existing and new infrastructure[3].

These estimates have in the meantime been confirmed or even exceeded both by national regulators and transmission system operators:

- According to a survey carried out by the Council of European Energy Regulators (CEER) among national regulatory authorities (NRAs) in February/March 2011, total investment needs in national electricity transmission for the same period were confirmed and estimated as being in the range of 96 to 143 bn €, of which 25-55 bn € for offshore grids. Under the current work ongoing for the preparation of the 2012 10-year network development plan (TYNDP), the European Network of Transmission System Operators in Electricity (ENTSO-E) sees roughly 100 bn € of investment needs for the period up to 2020, excluding investments for offshore grids and maintenance and refurbishment of ageing assets. Nor does this number reflect the specific investment needs for smart grids at both transmission and distribution level and electricity storage, which could exceed 40 bn €[4].

- In gas, in the latest 10-year network development plan (TYNDP), published in March 2011, the European Network of Transmission System Operators in Gas (ENTSOG) foresees investments of at least 89 bn € until 2020, including projects for

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2 See SEC(2010)1395 for more detail.

3 Impacts of climate change and extreme weather events have shown to disrupt energy services (with significant costs to the economy). About half of the system faults in electricity grids are caused by weather effects. Adapting energy infrastructure, including transmission lines, to these effects could, according to the literature available to date, entail significant costs (see for example Vattenfall Europe 2006; Van Ierland, E.C. et al. (2007)). The relevance of this issue for transmission infrastructure will be assessed more thoroughly in the context of the Impact Assessment related to the legislative proposal.

4 SEC(2010)1395.

which the Final Investment Decision (FID) has been taken[5] and projects for which the FID has not been taken, although they are considered necessary for diversification of supply routes/sources and security of supply inside EU. This is considerably more than the results of the CEER survey among its members, according to which total investment needs in transmission, LNG and storage[6] infrastructure are estimated between 51 and 59 bn € (about 40 for transmission, 8 for LNG, 5-10 for storage). It should be noted that the CEER survey covers only investments on EU territory.

Furthermore, according to a study commissioned by the Commission and prepared by Roland Berger (2011, forthcoming), investment volumes for the 2010-2020 period will, based on forecasts by transmission system operators (TSOs), increase by 30% for gas and 70% for electricity compared to current levels. This confirms the Commission's assessment that in electricity, annual investment will even have to double, compared to investment over the period 2000-2010[7].

(3) Investments at risk of not being delivered by 2020

This analysis highlights not only the **step change due to the significant increase in investment volumes compared to past trends**, but also the **urgency to build the necessary infrastructure**, without which cost-effectively reaching the EU's 2020 energy and climate targets will be impossible, while keeping in mind the major uncertainties surrounding the future of the energy sector. Already the 2006 inquiry into the European Gas and Electricity Sectors[8] had highlighted the underinvestment in energy networks in some Member States and a general lack of transparency on past and future network investments among TSOs. Also, with the increasing integration of national electricity and gas transmission systems, the impacts of new infrastructure built in one or two Member States on the surrounding Member States become increasingly important.

Acknowledging these challenges, the Commission analysed the obstacles, which would – under business-as-usual assumptions – prevent these investments from taking place or delay them far beyond the 2020 deadline. Its 2010 impact assessment[9] identified **two major categories of obstacles related to permit granting and regulation and financing** and provided a top-down estimation of the value of projects, amounting to approximately 100 bn €, subject to these obstacles and therefore at risk of not being delivered (also called "investment gap").

To further assess the relevance of the obstacles for the implementation of the necessary investments by 2020, the Commission has organised a conference with the Hungarian Presidency of the Council and different dedicated workshops with Member States, the

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5 The gas TYNDP produced by ENTSOG in February 2011 does not put costs on the various investment projects but gives only an overall cost estimate on investments on the basis of a non-exhaustive list of about 200 investment projects as collected from its members.

6 The numbers for storage do not include investments for France and Germany.

7 The 2006 inquiry into the European Gas and Electricity Sectors underlined that "Amounts invested in cross-border infrastructure in Europe appear dramatically low. Only 200 million € yearly is invested in electricity grids with as main driver the increase of cross-border transmission capacity."

8 COM(2006)851

9 SEC(2010)1395

European associations of transmission system operators, individual national operators, regulators, banks, investors, academia and other stakeholders between January and June 2011.

CEER's survey also examined the investment gap identified in the Commission Communication. It concluded on the basis of national estimates that the investment volume at risk due to permit granting obstacles could exceed Commission estimations, while the obstacles related to regulation and financing could be more limited. However, it should be noted that only a limited number of survey respondents gave quantified estimations on the extent, to which problems translate into investment amounts at risk. CEER also underlined that the survey results contain a high degree of uncertainty and that problems could arise for future projects.

Investors, such as public banks or investment funds, confirmed that TSOs have largely exploited their ability to raise debt capital and that future investments will require large equity injections by private investors or the State (in case of publicly owned TSOs). Higher investments will translate into significant increases in the regulated asset base (RAB) – up to about 20% per year – and have a small but long-term impact network tariffs. National regulators need to take into account the actual cost of capital in the market for TSO investments, which will at the same time make such investments more attractive for investors. At the same time, TSOs could face challenges raising sufficient amounts of debt at reasonable cost, especially because of borrowing ceilings or the absence of or insufficient investment grade ratings. Moreover, regulators will also have to take into account the often limited capacity of national consumers to bear tariff increases.

The uncertainty on the delivery of key investments, the high number of non-FID projects, in particular in gas, and the potential constraints on the supply chain, in particular in electricity, will increase the need for a framework appropriately incentivising investments, notably to ensure the inflow of capital from new investors, in particular those looking for stable long-term returns, such as pension funds. But it will also require management and financing efforts from TSOs to deliver them, as well as a cooperative attitude of all authorities (notably national administrations, regulators and other authorities involved in the permit granting process) concerned.

(a) Delays due to lengthy and complex consultation and permit granting procedures

Projects falling under this category would be realised, but much later than necessary to meet the 2020 energy and climate objectives.

It is widely acknowledged that lengthy and ineffective permit granting procedures, along with public opposition, are amongst the major reasons impeding the timely implementation of energy infrastructure projects, in particular electricity overhead lines[10]. The time between the start of the process until the final commissioning of a power line takes frequently more than ten years, and the commissioning of a project which faces substantial public opposition can even take longer (e.g. about 40 years for the interconnector between France and Spain). The 2005 "*TEN Energy Invest*" study concluded that the ratio performed investments/scheduled investments could be as low as 60% for certain electricity TSOs[11]. The enormous efforts

[10] Some Member States such as Germany, Ireland, the Netherlands or the United Kingdom have already introduced legislation to facilitate procedures. Germany is currently preparing more measures to further streamline its processes.

[11] SEC(2010)1395.

associated with the permitting procedure can exceed 10% of total project costs[12], thereby also increasing the investment and the overall electricity system cost and binding resources, which could be used more efficiently for the actual investments necessary in grid infrastructure.

The Commission estimated that projects worth about 40 billion euros (out of a total of 200 billion), mainly in the field of electricity, would be subject to such delays beyond 2020. According to analysis from national regulators, the value of these projects could even be higher, in absence of change in the required procedures.

(b) Difficulties related to the existing regulatory and/or financing framework

Investments in the priority corridors as outlined by the Commission Communication generally provide large socio-economic benefits at regional[13] and EU level, but are not necessarily viable from an investor perspective. Furthermore, the focus of the national tariff setting frameworks on national networks and consumers as well as the pressure to keep grid tariffs as low as possible in a context of low acceptability of structurally rising energy prices does not incentivise operators to invest in these projects. In particular, they have one or several of the following main features:

- They provide **higher regional than national benefits**, making the identification of benefits and allocation of costs a long and complex process with uncertain outcome. Examples of this type could be electricity cables or gas pipelines crossing a Member State bringing benefits to the neighbouring Member States or projects involving two or more Member States with asymmetric allocation of costs and benefits, as well as gas storage or LNG terminals serving more than one Member State.

- They use **innovative technologies involving higher risks and/or uncertainties** that are necessary for building the grid in an optimal and cost-effective way. Examples of this type could be Northern Seas offshore grid investments using direct current technologies, large-scale electricity storage or smart grids projects. As of today, such innovative investments are made difficult or impossible due to lack of adequate regulation, risk mitigation and financing instruments.

- They provide **externalities not taken into account by market demand**. Examples of such externalities are notably the following:

  – the regional or Union-wide gas security of supply provided by increased flexibility of the gas transmission network;

  – the regional or Union-wide benefits of integrating shared resources, like large-scale renewable sources, and linking the EU to diversified supply sources from third countries;

  – the reduction of electricity loop flows through transit countries made possible by reinforcing networks in the transit countries or increasing interconnection capacities on the direct route between a generator and a consumer;

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12 This estimation is based on empirical data provided by various transmission system operators.

13 i.e. concerning two or more Member States.

– the advanced capacity provided for by "oversizing" gas pipelines or offshore electricity hubs compared to the short-term demand they cover;

– the increased market competition created by new or additional electricity or gas interconnection capacities.

The Commission estimated that projects worth 60 billion euros would be subject to the difficulties identified above, with most projects being in the electricity sector.

In summary, **the relevance of these obstacles has been confirmed by all stakeholders and there is broad consensus in that the existing financing and regulatory framework does not allow addressing these issues properly**, because of difficulties to quantify the benefits and costs and allocate them accordingly.

Regional examples

Electricity

Concerning the **Northern Seas offshore grid** in particular, it is estimated that about 20% of the wind farms to be developed between today and 2020 should be connected via hubs to shore or via T-connections to international interconnectors, in view of developing an optimised meshed offshore grid. This represents investment costs of about 10 bn €, out of a total investment of about 30 bn €. These projects will however be technologically more risky and most likely require "oversizing" of the assets.

North-South electricity connections in Central Eastern Europe: The interconnection investment volumes in Bulgaria, Czech Republic, Poland and Slovakia for the period up to 2020 will increase by about 70% compared to the period 2005-2010. According to TSO analysis, investment will total 7.8 bn €, out of which between 20-50% could need financial support to be realised by 2020.

Gas

The development of the **Southern Gas Corridor** aims at opening a fourth gas supply corridor to the EU that is able to link Europe to gas supplies from the Caspian Sea and Middle East Basin (90.6 trillion cubic metres of proven reserves). This diversification would provide new gas imports in the range of 10% of total imports by 2030. The implementation of the Southern Gas Corridor requires close co-operation between several Member States and at European level, as no country individually requires the incremental gas volumes (new gas) sufficient to underpin the investment in gas infrastructure currently estimated at around 22 bn €.

In order to link the isolated Baltic region to the European gas market, thus enhancing security of supply, ending single supplier dependency and increasing diversification by supplies for Norway, the **Baltic Energy Market Interconnection Plan (BEMIP)** identified key gas infrastructure investments, including a regional LNG terminal, of around 950 million € in the East Baltic alone for the period 2011-2015. For the West Baltic, the specific investment needs are currently examined in a new action plan under implementation, which would require at least 1 bn € for overcoming important bottlenecks in the region and providing diversification.

(4) Summary of measures to be proposed to facilitate the implementation and to remove the obstacles identified

The Commission has pursued the analysis of the main infrastructure bottlenecks along the identified priority corridors in view of identifying and agreeing on the priority actions needed. The TTE Council of 28 February 2011 requested the Commission *"to develop, in close cooperation with Member States and all the relevant stakeholders, a comprehensive analysis for each of these priorities, identifying obstacles to project completion, taking into account bottlenecks with cross border impacts and where appropriate suggesting action plans for their completion."*

There is broad agreement by the different stakeholders on the projects that must be implemented urgently to complete the internal energy market by 2014 and to end the isolation of energy islands by 2015, as agreed by European Council on 4th February 2011. These investment needs are presented in the Annex 1 for each of the four electricity and three gas priority corridors. The corresponding analysis must be regularly repeated to identify the

bottlenecks beyond the short term 2014/2015 horizon and to take account of changes in demand, the future mix and location (centralised vs. decentralised) of new generation, progress in energy efficiency measures, technological breakthroughs as well as possible climate risks and adaptation options between today and 2020 and beyond.

The legislative proposal planned for October 2011 is envisaged to take a holistic approach for a new energy infrastructure policy, aiming at creating a facilitating environment for private and public investments in energy infrastructure that Europe needs by 2020 by:

- Proposing a **new method to identify concrete projects** (declared as projects of common European interest) necessary to implement the identified priority corridors, on the basis of regional cooperation, transparent, measurable criteria and socio-economic cost-benefit analysis. The **selection process** is planned to be detailed in the upcoming legislative proposal and include the following steps, as outlined already in the Commission Communication:

  – Identification of potential projects of common European interest necessary to implement the identified priorities: Member States, TSOs and other project promoters will be invited to propose individual projects fulfilling the criteria to the yearly/bi-annual selection process, using the TYNDP as reference input.

  – Common methodology to assess benefits: project promoters should apply a common methodology to assess the impacts of the proposed projects (socio-economic cost/benefit analysis, notably taking into account cross-border effects, environmental and climate impacts etc.).

  – Compilation of regional lists of projects of common interest: Verification of the proposed projects against the agreed and transparent criteria leading to the identification of a first project list within regional groups, which bring together regulators, transmission system operators, Member States and other stakeholders. Existing frameworks such as the Regional Initiatives may be used for this.

  – Control and labelling of projects of common interest for all regions at the EU level: the Commission in collaboration with ACER and the ENTSOs – to ensure consistency across the priorities and regions and feedback to the regional setting where relevant.

  – Inclusion of the labelled projects into the Union-wide and national TYNDPs with adequate priority and timing.

- **Shortening permit granting** while ensuring the respect of EU environmental legislation, in particular by simplifying national administrative procedures in terms of complexity and fragmentation of the process, upfront planning and coordination, and requirements for stakeholders to work along clearly established time lines, along with sufficient political support; and by fostering public acceptance and consensus through provision of clear information on the costs and benefits of a project and early and active involvement of stakeholders and the public in the process.

- Creating a sound and stable regulatory framework for infrastructure investment, notably for cross-border projects, by

– providing sufficient regulatory and financial incentives allowing TSOs to deliver the necessary investments by 2020: These incentives will have to address both the outlined equity and debt constraints and will need to be reflected in the rules governing the regulated asset base and tariffs due to stepped up investment volumes.

– improving the rules for cost allocation concerning certain complex projects with cross-border impact: While Member States with existing well-developed regulatory systems have successfully increased the efficiency of TSOs and delivered investment so far, many future investments with complex cross-border impacts will require new rules for identifying the beneficiaries, quantifying the benefits and allocating costs accordingly. In the light of the huge investment needs identified, national regulators will have to include long-term signals for network investments to their existing focus on the efficiency of TSOs.

For the sector of regulated gas and electricity networks, the regulatory framework is the main underlying factor for investment decisions, as confirmed by CEER, investors and TSOs. If the two main measures for enhancing the regulatory framework can be achieved, a significant share of projects identified can be delivered.

Market-based support instruments and, where necessary, direct EU funding, will be needed. Even assuming full implementation of the internal energy market legislation and appropriate regulatory change, the Commission, regulators and TSOs agree that there will be certain projects, for which regulatory measures alone will not be sufficient or not be the most effective means to ensure on-time delivery. In these limited cases, an appropriate combination of innovative financial instruments and grants will be proposed with the aim to mitigate risks, ease access to financing and leverage private and public funding.

The European Energy Programme for Recovery (EEPR) has played an important role as driver and facilitator for project implementation as acknowledged on several occasions[14] by mobilising infrastructure projects and mitigating disruptions of supply with negative effects on citizens and the European economy.

This would in particular apply to the following project types to address obstacles, mitigate the risks and remove the externalities presented above:

– projects in gas and, to a lesser extent, electricity contributing to regional and EU-wide security of supply or solidarity (e.g. regional storage and LNG terminals serving two or more countries and the connecting pipelines);

– complex transmission projects with cross-border impacts in electricity and gas, notably projects that provide higher regional than national benefits (e.g. interconnectors, internal lines addressing bottlenecks relevant for cross-border flows);

– innovative projects notably in electricity, concerning in particular offshore transmission, storage and smart grids, with a particular view to the long-term decarbonisation of the power sector (see COM (2011)112).

[14] COM/2011/0217 final.

The cost of not realising these investments or not doing them under EU-wide coordination would be huge, as demonstrated by offshore wind development, where purely national radial connection solutions could be 20% more expensive. Thanks to the leverage effect of the new instruments proposed (e.g. equity participation, loan guarantees), the need for EU support will be only a small fraction of the identified overall investment needs.

Annex 1

Priority corridors – identified bottlenecks and investment needs

1. Offshore electricity grid in the Northern Seas and connections to Northern as well as Central Europe

- integrate and connect energy production capacities in the Northern Seas with consumption centres in Northern and Central Europe and hydro storage facilities in the Alpine region and in Nordic countries;
- develop adequate interconnections, notably within Germany and Poland, to connect new, including renewable, generation capacities in or close to the North Sea, to the demand centres in Southern Germany and to pumped storage power plants to be developed in Austria and Switzerland.

2. Electricity interconnections in South Western Europe

- develop interconnections in the region and accommodate the existing national networks to those new projects. An interconnection capacity of at least 4,000 MW between the Iberian Peninsula and France will be needed by 2020;
- concerning connections with third countries, the realisation of the Tunisia-Italy interconnection, the expansion of the Spain-Morocco interconnector, the reinforcement, where necessary, of South-South interconnections in North African neighbour countries and preparatory studies for additional North-South interconnections to be developed after 2020.

3. Electricity connections in Central Eastern and South Eastern Europe

- strengthen the regional network in North-South and East-West power flow directions, in order to assist market and renewables integration, including connections to storage capacities and integration of energy islands;
- internal relief of congestion through investments to increase cross-border capacity while also accommodating new generation in particular from renewables;
- new tie-lines between Germany and Poland and new interconnections with the Baltic States (in particular the Poland-Lithuania interconnection);
- develop Italy's connections with countries of the Energy Community (notably Montenegro, but also Albania and Croatia);
- in a second step, increase transfer capacities between South East European countries, including those of the Energy Community Treaty, in view of their further integration with Central European electricity markets.

4. Completion of the BEMIP (Baltic Energy Market Interconnection Plan) both in electricity and gas in view of full integration of the Baltic States into the European market

– reinforcement of the internal electricity networks of the Baltic States and strengthening of interconnections with Finland, Sweden and Poland (in particular LitPol);

– reinforcement of the Polish internal electricity grid and interconnections east and westward;

– end the isolation and single-source dependency of the region there is urgent need to develop gas pipeline connections between the Eastern Baltic Member States and to the rest of the EU in particular through the Polish-Lithuanian gas link as well as to construct a regional LNG terminal serving all the countries concerned.

5. Southern Gas Corridor to further diversify sources at the EU level and to bring gas from the Caspian Basin, Central Asia and the Middle East to the EU

– The development of the Southern Gas Corridor aims at opening a fourth gas supply corridor to the EU that is able to link Europe to gas supplies from the Caspian Sea and Middle East Basin (90.6 trillion cubic metres of proven reserves). This diversification would provide new gas imports in the range of 10% of total imports by 2030.

6. North-South gas connections in Central Eastern and South East Europe

– Development of the gas connection between the Baltic Sea region and the Adriatic and Aegean Seas and further to the Black Sea covering the following EU Member States (Poland, the Czech Republic, Slovakia, Hungary, Romania, and possibly Austria) and Croatia;

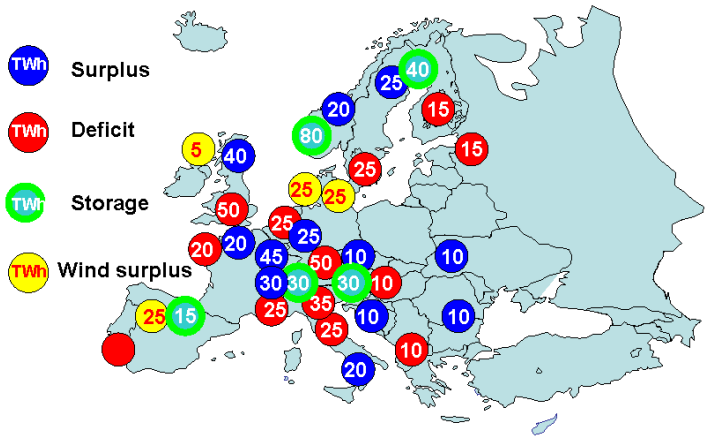
– In a second step, this integration process will have to be extended to the non EU member countries of the Energy Community Treaty through adequate interconnection capacity.

7. North-South gas corridor in Western Europe to remove internal bottlenecks and increase short-term deliverability, thus making full use of possible alternative external supplies, including from Africa, and optimising the existing infrastructure, notably existing LNG plants and storage facilities

– Investments in new interconnections on the North-South axis in Western Europe will better interconnect the Mediterranean area with the North-West gas region. By overcoming important infrastructure bottlenecks, the Iberian Peninsula and Italy will be able to provide for further diversification and competition to the whole area and will allow consumers to access all supplies from Africa and the Northern supply Corridor (Norway and Russia).

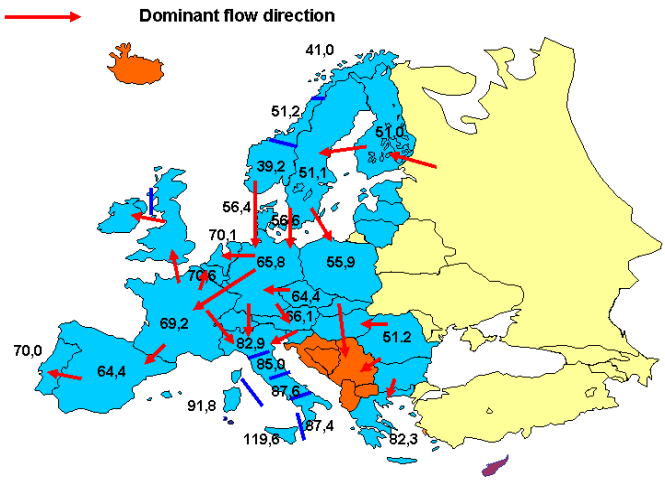
Annex 2

Electricity surplus and deficit areas (2008)



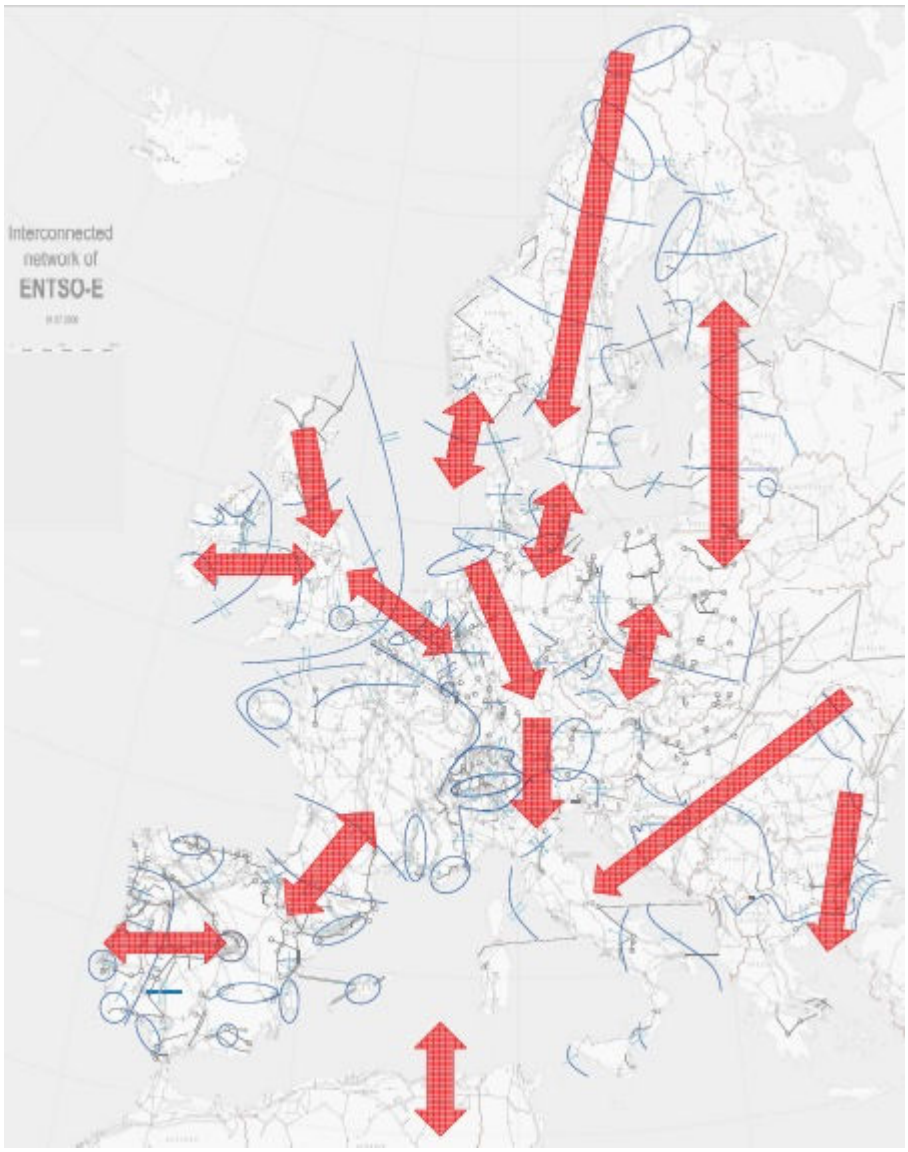
Source: Matti Supponen, "Influence of national and company interests on European electricity transmission investments", PhD thesis for the Helsinki University of Technology (draft May 2011)

Electricity prices and power flows in €/MWh (2008)



Source: Matti Supponen, "Influence of national and company interests on European electricity transmission investments", PhD thesis for the Helsinki University of Technology (draft May 2011)

Preliminary analysis of main electricity transmission bottlenecks up to 2020



Source: ENTSO-E

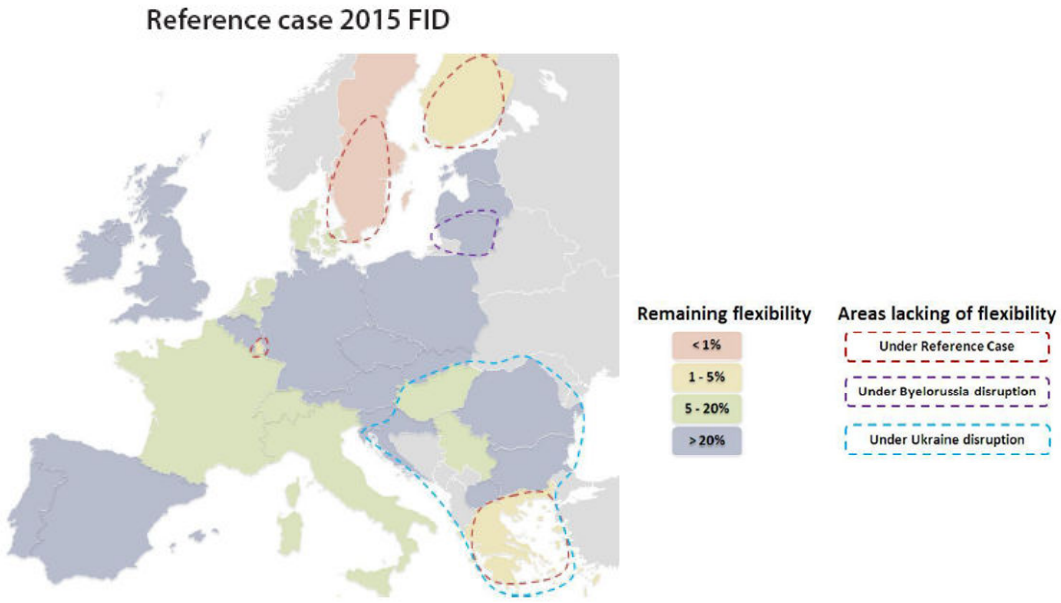
NB.: Arrows do not represent any projects, but only show the direction of main power flows.

Main gas transmission capacity reinforcement needs

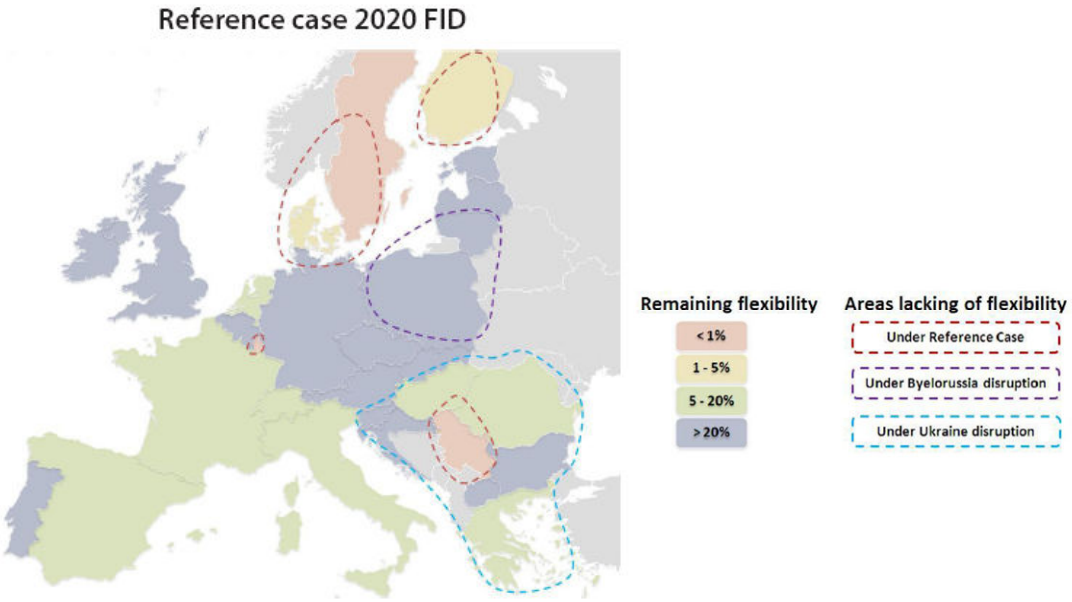
NB.: Forms on the map do not represent any projects, but only show the main corridors.

Main gas transmission capacity reinforcement needs for 2015 and 2020

(scenario analysis "security of supply")



Source: ENTSO-G, TYNDP 2011



Source: ENTSO-G, TYNDP 2011