Europe's Energy Infrastructure

The European Commission's plan for an integrated European energy network

Götz Reichert & Jan Voßwinkel | **Updated energy infrastructure, an integrated internal energy market, more reliable supplies, diversified imports, and lower carbon counts: the goals set out by the European Commission in its "Blueprint for an integrated European energy network" are ambitious. But are they realistic? An analysis.**

The backbone of European energy supply is the energy infrastructure, the variety and vulnerability of which has been demonstrated by three events in recent years. First, on the evening of November 4, 2006, when a high-voltage cable in Emsland, Germany was turned off to allow a cruise ship to transfer from the Papenburg shipyard to the North Sea. As a result, due to an overload in a transmission cable, more power lines collapsed "in a cascade" from north to south all over Europe, as the German Federal Network Agency reported. Over 15 million Europeans in Germany, France, Belgium, Italy, and Spain were without power for up to an hour and a half.

In a second case, in January 2009 Russian natural gas deliveries to Europe were cut off for some two weeks because Russia and Ukraine could not agree on conditions for Ukrainian natural gas imports and transit fees for Russian natural gas exports to Europe. Some Eastern European countries experienced serious supply shortfalls.

Finally, there was a stormy weekend in Germany in early October 2009. Pushed by blustering winds, wind turbines produced large amounts of energy and took priority in feeding the energy grid, creating an oversupply that could not be compensated within the grid due to a lack of storage capacity and lines to consumption centers. The surprising consequence: temporary "negative energy prices" at the Leipzig energy exchange EEX, so that energy suppliers had to pay to discharge energy.

These examples illustrate the various challenges confronting the energy infrastructure in the European Union. "Energy infrastructure" refers comprehensively to the technical and organizational mechanisms necessary for the production, transmission, and storage of energy of the most varied types—electricity, natural gas, crude oil, or district heating. Europe's current energy infrastructure, built largely in the early decades after World War II, is antiquated and must be overhauled and modernized in the coming years. Added to this need for modernization are new demands—especially due to the intended creation of a European single market for energy—for improving the security of energy supplies by diversifying energy imports, and "decarbonizing" Europe's energy supply.

The European Union wants to create a European "Single Energy Market," in which energy could be traded unimpeded across state borders. For this purpose, a gradual liberalization of the energy market should replace mono- and oligopolistic energy supplier structures, so as to lower energy prices through intensified competition. The ability to trade energy Europe-wide effectively requires a corresponding network for the energy infrastructure. However, the number of necessary connecting lines, especially between national partial markets (so-called "interconnectors"), is still too low for both electricity and gas.

The European energy infrastructure is antiquated and must be overhauled.

Secure supplies and import diversification are other central priorities. The European Union's dependence on imports of fossil fuels (2009: 54 percent) is high for coal (2009: 62 percent) and crude oil (2009: 83.5 percent), and is predicted to rise steeply for natural gas (2009: 64 percent; 2020: approximately 73-79 percent; 2030: approximately 81-89 percent).[1] Among other things, natural gas will be used increasingly as back-up fuel to compensate for fluctuations in the electricity grid, especially due to the use of renewable energy. Nevertheless, to increase the security of the energy supply, the EU hopes to at least reduce its dependence on individual suppliers by more heavily diversifying both supply sources and delivery channels. For this purpose, it aims, for example, to construct additional natural gas pipelines like the Nabucco project, which will tap natural gas sources in the Caspian Sea, bypassing imports from Russia and transiting through Ukraine.

Finally, climate change concerns impact Europe's energy goals. To both reduce dependence on the import of fossil fuels and protect the climate, the European Union is seeking a long term transition to a low carbon energy system. For this purpose, the European Council decided in March 2007 (in the "20-20-20 Decision") that the EU would reduce its greenhouse gas emissions in the medium-term by at least 20 percent by 2020, with 1990 levels as the benchmark. In addition, member states are to increase their energy efficiency in order to reach the legally non-binding goal of cutting 20 percent of EU energy usage, compared to prognoses for 2020, by that year. Finally, by 2020 the share of renewable energy must make up 20 percent of the EU's entire energy consumption. Through this "decarbonization" of the European energy system, by 2050 greenhouse

[1] Eurostat, chart on "Energy," data on energy dependence (code: tsdcc310; updated on May 20, 2011); European Commission, "Energy infrastructure priorities for 2020 and beyond—A blueprint for an integrated European energy network," Commission Communication, November 17, 2010, p. 21.

gas emissions should be reduced by 85 to 90 percent (from 1990 levels).[2]

To achieve these ambitious goals, the European Commission has stressed that urgent investment in the EU's antiquated and badly interconnected energy infrastructure is essential. A "fully integrated" energy infrastructure based on smart and low carbon technologies is, according to the Commission, a requirement for creating a well-functioning single energy market, increasing reliability of supply, integrating renewable energy into the energy system, and raising energy efficiency. The Commission demands a "new EU energy infrastructure policy" in order to coordinate and optimize the creation of an energy infrastructure "on a continental scale." For this purpose, in November 2010 the Commission submitted a "Blueprint for an Integrated European Energy Network,"[3] in which it listed the priorities for modernizing the European energy infrastructure by 2020 and beyond, and suggested a new method for planning infrastructure projects "of European interest."

Planning Infrastructure Projects

To promote the connectivity and interoperability of individual states' energy grids as well as grid access, the European Union can already contribute to the creation and development of "trans-European networks" in the area of energy infrastructure (TEN-E). In particular, insular, self-contained, marginal regions should be connected to the central areas of the European Union. For this purpose, since the 1990s a TEN-E policy has been developed which initially concentrated on cross-border projects to develop electricity and gas networks to establish a European single energy market. Beyond this original, purely single-market oriented approach, the EU has also had the authority, since the entry into force of the Lisbon Treaty in December 2009, to promote the general "interconnection" of energy grids. At present, the TEN-E policy aims at (1) supporting the creation of a single energy market, (2) reducing the isolation of disadvantaged and island regions, (3) securing and diversifying European energy supply, and (4) contributing to sustainable development and environmental protection.

The EU's energy and climate goals cannot be achieved under the current policy.

According to a Commission report from May 4, 2010, however, the TEN-E policy, with its approximately 550 eligible projects, has not yet been effective enough to develop the energy infrastructure necessary to attain the EU's energy and climate goals. Therefore, the Commission intends to replace the current procedure with a "new method of strategic planning." In its "Blueprint," the Commission proposes a multi-stage procedure.

First, an "energy infrastructure map" will be developed for a "smart European supergrid" that will connect grids all over Europe.

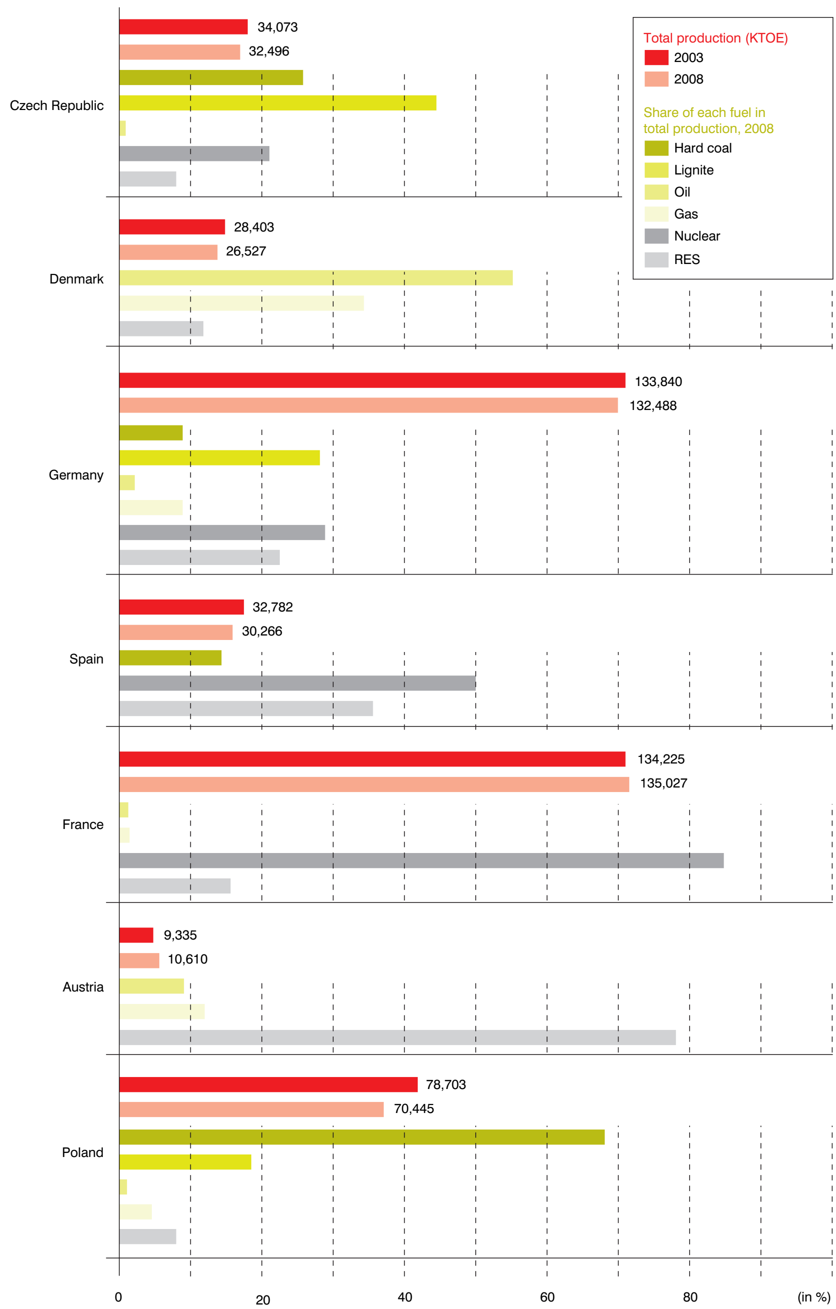
---

[2] European Council, conclusions on the "Energy Summit," February 4, 2011.

[3] European Commission, "Energy infrastructure priorities for 2020 and beyond—A blueprint for an integrated European energy network," Commission Communication, November 17, 2010, p. 9 et seq.

Energy Production, by fuel type

IP | 4/11



Source: Eurostat

Gross Inland Consumption, by fuel type

IP|4/11

Source: Eurostat

Second, measures at the European level to develop infrastructure would concentrate on a limited number of "European infrastructure priorities" that must be completed by 2020.

Finally, the concrete "projects of European interest" necessary to achieve these priorities will be established on the basis of a uniform method and transparent criteria. In the future, the intention is to proceed more flexibly and use regional cooperation as a basis in order to take account of changing market conditions and technological developments. The implementation of projects of European interest will be supported by new instruments such as increased regional cooperation, streamlined permit procedures, better information for decision makers and citizens, and easier financing opportunities.

In the future, projects of European interest will build on regional cooperation.

Seeking an Electricity Supergrid

In the electricity field, fragmented partial markets currently dominate the European Union. In its network development plan for 2010 to 2020, the European Network of Transmission System Operators for Electricity (ENTSO-E) provides for the development of an electricity grid totalling 42,200 km of new (35,300) or restored lines (6,900). That is, more or less, the circumference of the globe. The electricity grid in the ENTSO-E area comprises some 300,000 km, so that 14 percent of the existing network is to be either newly laid (12 percent) or overhauled (2 percent).

To better integrate the electricity generated in northern and southern Europe from renewable energy into the overall European electricity grid, EU measures for network development will concentrate until 2020 on certain "priority corridors for electricity." Thus, for example, an offshore network in the northern seas will be developed so as to connect electricity from offshore wind parks with consumer centers in northern and Central Europe and with hydrostorage facilities in Scandinavia and the Alpine countries. Similarly comprehensive are the plans to develop transmission lines to Southwestern Europe, which will aid in long-range transport of electricity from solar and wind energy from Spain and North Africa (for example, through the Desertec initiative) via France to Central Europe. Finally, the Baltic states, whose electricity grids are isolated from the other EU states, will be integrated into the European Union's electricity market through the building of transmission lines to Finland, Sweden, and Poland as part of the "Baltic Energy Market Interconnection Plan" (BEMIP).

In addition to strengthening network connectivity through additional transmission lines, the lines themselves will be made more efficient. In the long term, the European Commission aims to construct "European electricity highways," which will have greater capacity than existing high-voltage lines in terms of both the amount and distance of transmission. Such "electricity highways" will one day integrate the electricity produced from renewable energy sources in the northern seas, the Baltic region, eastern and southern Europe, and North Africa into Europe's electricity grid. They will connect these new electricity generating capacities with large electricity storage facilities in Scandinavia and the Alpine countries, as well as with the major consumption centers in Central Europe. In this way, the increasingly flexible and decentralized electricity supply will be managed. To build such electricity highways, however, new technologies must be developed to make possible, in particular, electricity transmission through direct current and voltage over 400 kilovolts.

Finally, the electricity grid is to become "smarter." Especially through the use of information and communication technologies, "smart grids" can "cost efficiently integrate the behavior and actions of all users connected to it—generators, consumers, and those that do both—in order to ensure an economically efficient, sustainable power system with low losses and high quality and security of supply and safety."[4] The Commission wants to provide incentives for rapid investment in "smart grids" in order to make possible the emergence of a competitive electricity retail market and the integration of renewable energy and decentralized energy generation into the electricity grid, as well as to support "new types" of energy demand (such as electric cars).

Gas Pipes Plus

To increase the security of gas supply, the European Commission proposes that the EU develop the most comprehensive and flexible natural gas network possible, which could receive diversified gas supplies from various suppliers and distribute gas within the European Union. Bidirectional pipelines, larger storage capacity, and diversification of supply sources—including liquified natural gas (LNG) and compressed natural gas (CNG)—are needed. The aim is to develop the infrastructure for a European single gas market, in which natural gas can be traded anywhere in the EU, regardless of its origin or of national boundaries.

The development of such an infrastructure will concentrate, until 2020, on a few "priority corridors for gas." These include the "Southern Corridor" for gas imports from the Caspian Basin, Central Asia, and the Middle East, as well as the linking of the Baltic Sea, Black Sea, Adriatic and Aegean Seas through the implementation of the "Baltic Energy Market Interconnection Plan" (BEMIP) and the "North-South Corridor" in Central-Eastern and Southeastern Europe. The "North-South Corridor" in western Europe will eliminate internal bottlenecks on gas transport and make possible external supply from Africa, among other places.

The electricity grid will be "smarter" through the use of new information and communication technologies.

"Projects of European Interest"

To implement these infrastructure priorities, a list of "projects of European interest" is to be drawn up in 2012, to be updated every two years. These projects will be chosen according to their contribution toward better electricity or gas infrastructure.

Specifically in terms of electricity, projects should make a contribution

[4] European Smart Grid Task Force's definition of "smart grid," cf. European Commission, "Smart grids: from innovation to deployment," Commission Communication, April 12, 2011.

in terms of security of electricity supply; capacity to integrate energy and transmit it to major consumption and storage centers; increase in market integration and competition; energy efficiency and smart electricity use.

In terms of gas infrastructure, the EU is looking to diversify energy sources, suppliers, and delivery routes; increase competition through greater interconnectivity; and increase market integration and reduce market concentration.

An estimated one trillion euros will be needed to remake the entire EU energy system.

Cutting the Red Tape

A significant obstacle to the development of the European energy infrastructure is represented by lengthy permit procedures with uncertain outcomes. Often ten years can pass between the start of planning and a plant going into operation. If the achievement of even a purely national plan is already difficult, cross-border projects provoke additional resistance because they are often seen as mere transmission connections without any local benefit.

Against this background, national permit procedures for "projects of European interest" are to be streamlined and better coordinated. According to the Commission's preliminary plan, in the member states one authority will coordinate the permit procedure among project developers and national, regional, and local authorities as a "one-stop shop," while member states will remain responsible for allocating decision-making power. For cross-border projects, the Commission suggests coordinated or joint procedures between the affected member states. Permit procedures should be completed within a specified time limit of no more than five years.

The European Commission rightly sees that this sort of "streamlining" of permit procedures for infrastructure projects of European interest could collide with the legally-assured participation rights of those affected, which are anchored in European law and based especially on the international Aarhus Convention. Accordingly, the Commission wants to ensure transparency and facilitate public participation in the decision-making process. It hopes that open debate will ultimately increase acceptance of the projects. In addition, the Commission considers possible financial incentives for regions or member states that facilitate timely authorization of projects to be of European interest. At present, the European Commission is investigating and comparing the member states' various permit procedures in order to submit a legislative proposal on the matter in 2011.

Who Foots the Bill?

The European Commission estimates that a one trillion euro investment will be needed by 2020 for the entire EU energy system (including network expansion, promotion of renewable energies, and measures to increase energy efficiency).[5] Of this, around 500 billion euros would go to the network itself (energy transmission net-

[5] "Energy infrastructure priorities for 2020 and beyond—A blueprint for an integrated European energy network," Commission Communication, November 17, 2010.

works, electricity and gas storage, "smart grids"). And, in turn, approximately 200 billion euros of this would be necessary just to build new energy transmission networks. According to the Commission, only half of this 200 billion could be raised from the market, while the remaining 100 billion euros would remain as a gap in financing. Even if the suggested planning methods and new implementation instruments were to be applied, in the Commission's estimation there would still be an "investment gap" of 60 billion euros in 2020, so that private funding would have to be mobilized.

At the "Energy Summit" of the European Council on February 4, 2011, EU member states made clear that a large amount of the necessary financing would have to be provided by the market. At most, "some projects that would be justified from a security of supply/solidarity perspective, but are unable to attract enough market-based finance," could "require some limited public finance." This could, for example, be the case for the connection of the Baltic states to the European electricity grid.

To this extent, member states and the European Commission generally agree that financing must come from private investors. In this connection, the Commission emphasizes that the electricity and gas infrastructures will continue to be "primarily" financed through regulated tariffs from users ("user pays principle"). However, according to the Commission, the tariff levels set by national regulation authorities do not sufficiently take into account Europe-wide (cross-border) priorities. In 2011, it will therefore put forward guidelines or a legislative proposal with tariff and investment rules for cost allocation for large or cross-border projects.

Even if it is principally possible for private investors to earn back the investment costs through user fees, investment risks present a problem. For infrastructure projects, definite high investment costs typically coexist with uncertain profits distributed over a long period of time (several decades). In principle, this risk can be insured by a bond insurer (so called monoliner). However, according to the European Commission, this business model has stalled since the outbreak of the financial and economic crisis. To nevertheless offer private investors the opportunity to transfer part of the risk, the Commission considered "project bonds" that are guaranteed by the European Investment Bank (EIB). A project company that finances, implements, and operates an infrastructure project would, under this model, issue a project bond to finance a specific infrastructure plan on the capital market. The EIB would grant a payment guarantee covering the entire term of the project bond. The sum guaranteed must not exceed 20 percent of the investment sum. This guarantee would be structured to ensure that the bond would be rated according to "investment grade," "ideally around A or higher."[6] In place of such guarantees,

A large amount of the financing will need to be provided by the market.

[6] European Commission, "The Europe 2020 Project Bond Initiative," Stakeholder Consultation Paper, February 28, 2011, p. 7.

the EIB could also grant the project company loans of up to 20 percent of the investment sum.

Funding infrastructure primarily with private funds and refinancing through user fees reduces incentives for expensive, poorly planned, or unnecessary infrastructure projects and increases the chance that infrastructure projects will follow economic rather than political criteria. The costs of this expansion should principally be borne by users alone, who will profit from greater security of supply or lower energy prices. A crucial prerequisite for this is the development of appropriate common principles for cost allocation, especially for cross-border infrastructure projects.

The question of public guarantees (or loans) to finance infrastructure projects requires a nuanced assessment. For one, as a result of the current debt crisis in many member states, project companies have become more attractive to investors since even government bonds seem insecure. And investors, as a rule, distribute their risks among various infrastructure projects, out of their own self-interest, and thus protect themselves against possible loss of payment. Both the relative attractiveness of the projects and their diversity militate against the need for EIB guarantees. However, minimum requirements for insurance and pension funds (sometimes even legally fixed) can prevent investment in project bonds that have anything below an "A" rating. In this case, public guarantees (or loans) that lead to an A rating or "investment grade status," may draw private investors to project bonds. This is inherently preferable to public financing.

Unless there is an honest cost comparison, a rational strategy for European energy will not be possible.

EIB guarantees (or loans) should only be used for infrastructure projects as part of the trans-European network, not for projects limited to one member state.

However, by taking on guarantees for project bonds, the EIB becomes a kind of bond insurer. This becomes problematic if the existing insurers' weakness is only temporary because the EIB then makes their re-entry into the market more difficult by competing with them using public funds. The extent of this possible market distortion can, however, be reduced through the size of the risk premium that the project company must pay to the EIB: the closer the size of the risk premium is oriented toward a reduction in outside financing costs, resulting from better ratings from the EIB guarantee, the closer it will correspond to the "market price" of a guarantee, and the smaller the possible competitive distortion. This procedure would also tend to prevent too much clouding of risk awareness as a result of EIB guarantees.

Financing through tax revenues should only be considered in narrowly defined exceptional cases as envisaged by the Commission and the member states. This involves infrastructure that cannot be financed through user fees, but which are necessary to achieve a networked single energy market and ensure a secure energy supply.

A considerable portion of investment in energy infrastructure is necessary as a result of the expansion of electricity generation through renewable energies. We must be careful to attribute costs accurately to the respective generation technologies. Only in this way can we honestly compare the economics of various options for the expansion of renewable energy. For example, a forced expansion of renewable energy in places where energy exploitation is highest—such as wind energy on the northern European coast or solar energy in southern Europe and North Africa—requires different infrastructure projects with different costs than decentralized expansion with smaller energy sources but possibly lower infrastructure costs. Without an honest cost comparison, a rational European energy strategy is not possible.

No Way But Forward

The energy infrastructure in the European Union, in terms of both transporting and storing energy, is confronted with a variety of challenges. It should help to create a European single energy market, contribute to the security of the energy supply through diversification of import sources and delivery routes, and make possible a transition to a low carbon energy system. In its most recent proposals for a multi-stage planning method for infrastructure projects, the European Commission has rightly and courageously chosen a European approach with clear priorities. Nevertheless, questions remain. The timeline in particular, which aims for implementation of infrastructure projects "of European interest" by 2020, seems far too ambitious. The still-open questions in regard to restructuring permit processes and financing infrastructure projects especially illustrate the dimensions of the challenge. Given the significance of the energy infrastructure for energy supply, Europe must face up to this challenge.

GÖTZ REICHERT
is a law policy analyst for environment, energy, and climate protection at the Centrum für Europäische Politik.

JAN VOẞWINKEL
is an economic policy analyst for environment, energy, and climate protection at the Centrum für Europäische Politik.