Public Participation and Transparency in Power Grid Planning

Recommendations from the BESTGRID Project

Handbook – Part 1

BEST GRID

GERMANWATCH

BESTGRID PARTNERS

Transmission System Operator (TSO) Partners

50Hertz Transmission GmbH
www.50hertz.com

Dr Dirk Manthey, dirk.manthey@50hertz.com
Phone: +49 (0) 30 5150 3419
Eichenstr. 3A, D-12435 Berlin

Elia System Operator NV
www.stevin.be

Jeroen Mentens (Stevin project)
jeroen.mentens@elia.be
Phone: +32 (0) 2 546 7957

Christophe Coq (Waterloo-Braine l'Alleud project)
christophe.coq@elia.be
Phone: +32 (0) 2 382 2334
Leon Monnoyerkaai 3, B-1000 Brussels

National Grid
www.nemo-link.com

Phil Pryor, phil.pryor@nationalgrid.com
Phone: +44 (0)7795 641 431
Warwick Technology Park, Gallows Hill, Warwick,
UK-CV346DA

TenneT TSO GmbH
www.suedlink.tennet.eu

Marius Strecker, marius.strecker@tennet.eu
Phone: +49 (0) 921 50740 4094
Bernecker Str. 70, D-Bayreuth

Terna Rete Italia SpA
www.terna.it

Fiorenza Roghi, fiorenza.roghi@terna.it
Phone: +39 (0) 683139042
Viale Egidio Galbani, 70, IT-00156 Rome

NGO and Science Partners

Bond Beter Leefmilieu
www.bondbeterleefmilieu.be

Erik Grietens (BBL; Stevin project), erik.grietens@bblv.be
Phone: +32 (0) 2 282 1734
Tweekerkenstraat 47, B-1000 Brussels

Fédération Inter-Environnement Wallonie (IEW)
www.iewonline.be

Valérie Xhonneux (Waterloo-Braine l'Alleud project)
v.xhonneux@iewonline.be
Phone: +32 (0) 81 390 763
98 rue Nanon, B-5000 Namur

Natagora asbl
www.natagora.be

Julien Taymans (Waterloo-Braine l'Alleud project)
julien.taymans@natagora.be
Phone: +32 (0) 81 390 720
98 rue Nanon, B-5000 Namur

German Environment Aid (DUH)
www.duh.de

Liv Becker (Suedlink / Bertikow-Pasewalk)
becker@duh.de
Phone: +49 (0) 30 2400 867 98
Hackescher Markt 4, D-10178 Berlin

Germanwatch e.V.
www.germanwatch.org

Rotraud Hänlein, haenlein@germanwatch.org
Phone: +49 (0) 30 2888 356 83
Stresemannstr. 72, D-10963 Berlin

International Institute for Applied Systems Analysis (IIASA)
www.iiasa.ac.at

Joanne Linnerooth-Bayer, bayer@iiasa.ac.at

Dr Nadejda Komendantova, komendan@iiasa.ac.at
Phone: +43 (0) 676 83 807 285
Schlossplatz 1, A-2361 Laxenburg

Naturschutzbund Deutschland (NABU)
www.nabu.de

Eric Neuling, eric.neuling@nabu.de
Phone: +49 (0) 30 2849 84-1812
Charitéstraße 3, D-10117 Berlin

Elke Meier, elke.meier@nabu-niedersachsen.de
Phone: +49 (0) 511 91105 24
Alleestrasse 36, D-30167 Hannover

Renewables Grid Initiative (RGI)
www.renewables-grid.eu

Antina Sander, antina@renewables-grid.eu
Phone: +49 (0) 30 7677 194 58
Neue Promenade 6, D-10178 Berlin

BirdLife Europe
www.birdlife.org

Willem Van den Bossche
willem.vandenbossche@birdlife.org
Phone: +32 (0) 2 541 07 82
Avenue de la Toison d'Or 67, B-1060 Brussels

The Royal Society for the Protection of Birds
www.rspb.org.uk

Dr Ivan Scrase, ivan.scrase@rspb.org.uk
Phone: +44 (0) 1767 693486
The Lodge, Sandy, Beds SG19 2DL, UK


Christoph Bals


Rotraud Hänlein


Alexander El Alaoui

Electricity is everywhere in our daily lives. And although many of us are ever-more dependent on power-intensive technologies, we often do not appreciate the value of it.

Power generation systems in Europe are undergoing fundamental change towards a low-carbon power system based on renewables. As governments make the transition towards low-carbon energy systems, we must ensure that power grids throughout Europe keep pace with demand – as well as with the changing nature of power generation.

In this changing environment, power supply systems must be reliable and capable of providing the energy required for households and industry alike. Power generation sourced from solar and wind is increasingly being generated at a great distance from our large consumption areas and is dependent on weather and time of the day. We see more and more evidence that a power system based on renewable sources can provide a secure, low-carbon power supply even in a highly industrialised Europe.

Power grids form an integral part of energy transition in Europe and have an important role to play in any future large-scale power system for Europe. They are cost and energy efficient compared to other infrastructure options such as storage technology. More and smarter power grids can help balance fluctuations in renewable energy supplies. Therefore, the upgrade of European power grids is an important part of restructuring our energy system.

In the context of this ongoing transition, we are facing both technical and social challenges. Often, when large transmission lines are being planned or constructed there are protests. But those conflicts can be alleviated if handled appropriately. Often, the right way to address complex and emotive issues – one of which is the conflict surrounding power grid planning – is through early and meaningful participation by affected communities and other stakeholders.

BESTGRID, an EU-funded project, sets out to provide information and guidance for organisations engaged in power grid planning. BESTGRID acts as focal point for the exchange of best-practice approaches to early and transparent stakeholder participation in power grid planning implemented by transmission system operators (TSOs) from Belgium, the UK, Germany and Italy. These approaches to early participation have been developed jointly with nature conservation and non-governmental organisations (NGOs).

Germanwatch, a German environment and development organisation, has been closely following the work of the BESTGRID pilot projects and has compiled its findings in this handbook. This handbook highlights improvements in participation and transparency that have been achieved by the TSOs and provides answers to the following questions:

- Who is responsible for power grid planning, and how can I participate in the decision-making process?
- Where do I find information on power line projects planned in my area?
- What conflicts might arise during the different phases of the planning process?
- What lessons can be learned from the BESTGRID pilot projects?

This handbook provides food for thought for those concerned with power grid projects in their areas. It invites local stakeholders to contribute their experience and expertise in support of energy transition and the much needed power grid transformation. It also provides TSOs with examples of good practice in formal and informal stakeholder engagement and encourages the exchange of experience between them.

Christoph Bals, Rotraud Hänlein and Alexander El Alaoui
Germanwatch e.V.

CONTENTS

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Stresemannstr. 72
D-10963 Berlin

info@germanwatch.org
Phone +49 (0)30 / 28 88 356-0

www.germanwatch.org

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Authors:

Rotraud Hänlein
Alexander El Alaoui

Editing:

Paula McDiarmid

Design:

Natalie Muth
Alexander Bernhard
www.siebentage.net

Pictures:

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LIST OF ABBREVIATIONS

AC	alternating current
BBL	Bond Beter Leefmilieu
DC	direct current
DNO	distribution network operator
DUH	Deutsche Umwelthilfe (German Environmental Aid)
EHV	extra high voltage
EMF	electromagnetic field
ENTSO-E	European Network of Transmission System Operators for Electricity
EU	European Union
EU COM	European Commission
kV	kilovolt
NABEG	Netzausbaubeschleunigungsgesetz (German Power Grid Extension Acceleration Act)
NABU	Naturschutzbund Deutschland (Bird Life Germany)
NGO	non-governmental organisation
PCI	Project of Common Interest
RES	renewable energy sources
RSPB	The Royal Society for the Protection of Birds
TSO	transmission system operator
TYNDP	Ten-Year Network Development Plan
UK	United Kingdom
V	volt

FUTURE RENEWABLE ELECTRICITY

Our current consumption of resource-depleting and climate-damaging energy sources is not sustainable. However, as a society, we are rising to this challenge and have been taking steps towards a turnaround in energy policy – a turnaround widely known as 'energy transition'. We know that if we are to limit global warming to less than two degrees centigrade compared to pre-industrial levels, we must facilitate the transition of our heating, transportation and power systems towards a low-carbon economy. This endeavour, however, faces various constraints – one of which is time.

Power grids of the future

Clean energy generation, which forms the backbone of the energy transition, requires a significant overhaul of the power grid infrastructure – across all of Europe. One reason for this, is that future power grids will increasingly convey electricity sourced from wind and solar power plants located in remote areas, unlike the fossil fuel-based or nuclear power plants we have been relying on in recent decades. Furthermore, renewable energy may not be in steady supply throughout the day and often depends on weather conditions.

The challenge is to make use of renewable and decentralised energy, which may vary or be interrupted at times, without impairing the stability of the power networks that convey the energy. Furthermore, power grid planning will need to improve connectivity between power grids across countries and markets in order to make a renewables-based European power system as a whole more resilient and more efficient. The more those power grids are connected, the better power generation dependent on weather conditions can be balanced at a Europe-wide scale.

Lastly, further issues need to be addressed over the decades to come. One of these is the necessary redesign of the economic framework for a needs-based and flexible low-carbon electricity system to supplement the future renewables-based system. Other issues include energy efficiency measures, the development of market mechanisms to enhance flexibility options for the electricity markets (eg, demand-side management/demand-side response), and the development and implementation of new storage capacities.

Recommendations for local stakeholders

- **European power grid:** Make sure you keep up to date with developments:
  - What infrastructure is needed for a future electricity system based on renewable energy sources (RES)?
  - What are the advantages or disadvantages of a trans-European grid?
  - How will your area or district be affected by new power lines or RES generation?
  - How can people in your region benefit from RES generation and/or a new infrastructure?
- **Local debate on power grids for a European energy transition:** Share your experience and findings within your municipality or district.

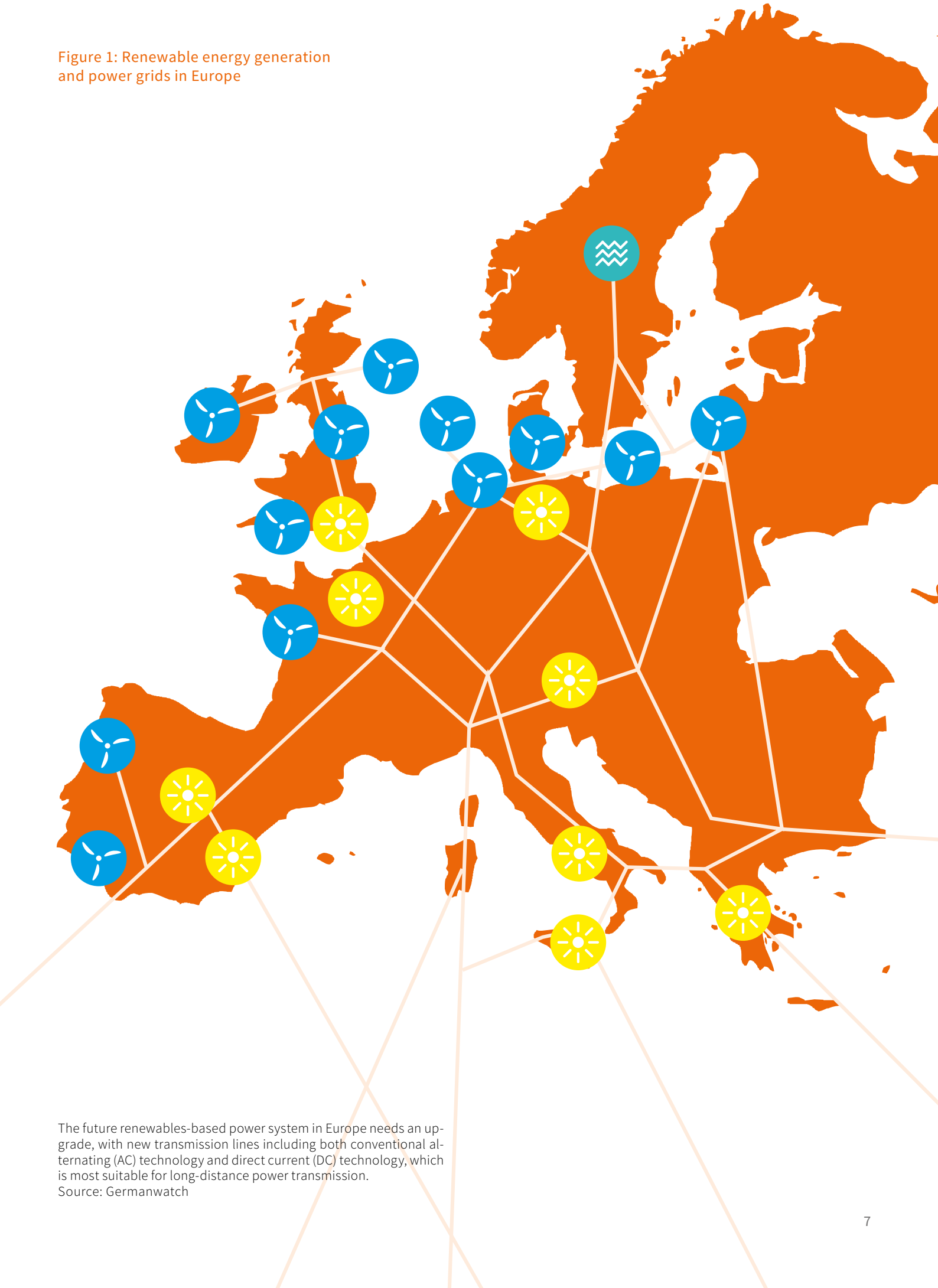
Recommendations for TSOs

- **Transparency:** Share with various groups of stakeholders your expertise and assumptions about the need for new and upgraded power lines that will support the energy transition.
- **Roles:** Explain various roles and tasks in energy policy and power grid planning. Co-operate with politicians, mayors, local civil society and local industry associations, ie, in regional discussion forums on the need for power grids.

Weblinks: European long-term power grid planning

- KEMA study on behalf of the European Commission (2014): Integration of Renewable Energy in Europe
  https://ec.europa.eu/energy/sites/ener/files/documents/201406_report_renewables_integration_europe.pdf
- Different long-term scenarios on the development of European power generation and infrastructure across Europe predict a substantial need for new transmission lines throughout Europe within the next decades. Since 2010, the Organisation of European Transmission Grid Operators has been developing a biennial Ten-Year Network Development Plan (TYNDP). The 2014 TYNDP predicts a need for about 50,000km of new transmission lines throughout Europe by 2030.
  www.entsoe.eu/major-projects/ten-year-network-development-plan/Pages/default.aspx
- Information on long-term national infrastructure development and projects is available on the websites of national transmission system operators and/or the regulatory agency:
  - for a list of European transmission system operators, go to:
    www.entsoe.eu/about-entso-e/inside-entso-e/member-companies/Pages/default.aspx
  - for links to the websites of European regulating agencies, go to:
    www.acer.europa.eu/The_agency/Organisation/Board_of_Regulators/Pages/BoR-Members.aspx

Figure 1: Renewable energy generation and power grids in Europe



The future renewables-based power system in Europe needs an upgrade, with new transmission lines including both conventional alternating (AC) technology and direct current (DC) technology, which is most suitable for long-distance power transmission.
Source: Germanwatch

POWER GRID PLANNING

The power grid planning process is fairly complex. It follows the rules of the respective national planning legislation and involves a number of different stakeholders at different levels. A key condition of an open, transparent planning process is for all concerned to know who is involved in the process and what their roles and interests are.

In several European countries, the planning process around the extension or upgrade of additional high and high-voltage transmission lines is basically **a two-level** process. At the first level, grid operators and planning authorities assess the need for new transmission lines in coming years or decades.

This **needs assessment** often includes a scenario framework, which in some countries is subject to public consultation, as well as a national power grid plan, which should be consistent with the European grid plan and based on various scenarios developed by the grid operator.

The needs assessment is followed by the **corridor and route planning process**. The grid operators develop a proposal for a specific corridor and route, or route alternatives, for a specific grid project; in some countries, this may follow on from a two-step formal planning procedure consisting of the spatial planning procedure and the permission or plan approval procedure.

Table 1: Planning procedure for transmission lines

Needs assessment Level 1		Corridor/route planning Level 2 (a two-step procedure in some countries)		Construction and operation
Scenarios	**Grid development plan**	**Corridors**	**Detailed routes**	**Construction and operation**
Scenario development EU / national	Grid or network development plans EU (TYNDP) / national	Corridors	Detailed determination of routes	
What are the likely future developments of electricity generation and demand?	What projects are needed?	In which corridor should the power line be built?	Which route should be determined in detail? Where will pylons (or cables) be built?	
		Spatial planning	Corridor and route planning	

Source: Germanwatch, based on BNetzA 2015[1]

Table 2: Stakeholders with legal planning responsibility in power grid planning

Stakeholder	Task	Interest
Transmission system operator (TSO)	Responsibility for security of supply and power grid extension In some countries: preparation of possible future electricity supply and demand scenarios and long-term grid development planning	Operation of a stable power grid, security of supply, fulfil legal task of power grid planning and realisation
Planning authority	Thorough examination of TSO project plans; plan approval at the end of formal procedure, legally binding decision	Consideration of principles and targets of spatial planning Weighing up of all legal interests
Regulator	Cost regulation of power grid development	Minimisation of costs
EU COM / ENTSO-E	European power grid planning (TYNDP) Determination of important European grid projects (projects of common interest, PCI)	European security of supply European social welfare by enhancing electricity interconnectors EU climate and energy targets
National politicians	In some countries, ie, Germany: Need definition by national power grid plan or law	Security of supply, tackle climate change, provision of good conditions for the national economy, re-election

Stakeholder interests

The key players in the grid planning process are:

» the grid operators who assess the need for and plan power grid upgrades and develop the corridor or route alternatives
» the planning authorities that approve power grid plans after a thorough consideration of all relevant legal implications and the completed impact assessments.

A range of other, mostly local, stakeholders who may be directly or indirectly affected by the project might also be involved in the grid planning process. The legitimate, yet sometimes conflicting, interests and arguments of those stakeholders need to be taken into account and carefully balanced during the planning process. Table 3 presents an overview of stakeholders and their interests relevant to the grid planning process.

Table 3: Other stakeholders in power grid planning[2]

Stakeholder	Interest
State, region, province, local politicians	Representation of national, regional, local interests
National NGOs, global justice, climate change, nature conservation, mobility, landscape, health	Realisation of transition to renewable energy in a short time, bird and protected species protection, high standard of nature and/or landscape conservation, health protection
Local NGOs, nature conservation, landscape conservation	Protection of local environment, landscape, decentralised electricity production, health protection
Industry, including local economy, households, public institutions and services, society	Security of supply, low energy prices
Farmers	Agriculture without disturbance from pylons and low-hanging power lines, reduced usability of agricultural areas due to construction works or operation of underground cables, compensation
Power generators	Unlimited grid access
Renewable power generators	Unlimited grid access, no feed-in restrictions to avoid financial losses
Consumers, households	Reasonable electricity prices, financial participation in energy transition, sustainable energy
Tourism	Beautiful landscape, recreational offers, good tourism infrastructure combined with reduced visibility of industrial infrastructure
Land and property owners	No loss of value of property, comfortable living area
Residents' and citizens' action groups	Protection of residential areas and landscape

In most countries, several statutory stakeholders are legally entitled to participate in the formal planning procedure, including local authorities, land owners and nature conservation associations. However, in some other countries, only those who are directly affected by the planned power line can fully participate in the planning procedure. For the other stakeholders, participation is limited to public dialogues organised by the grid operators or local authorities.

General recommendation for all stakeholders

» **Roles and attitudes:** Keep in mind that a significant number of stakeholders with differing interests may be involved in power grid planning. They all have legitimate interests. Respect the interests, constraints and obligations of all stakeholders in the participatory process.

PARTICIPATION AND TRANSPARENCY

Transmission system operators wishing to develop an innovative and participatory approach to power grid planning will ask themselves at an early stage of the process: Who should be involved, when and how? What level of participation is appropriate and feasible at which stages of the planning process?

To answer these questions, the two planning levels – **needs assessment and corridor and route planning**, as shown in Table 1 – should be analysed separately from each other. Although there are some general guidelines for effective and inclusive participation, TSOs will also need to develop strategies that relate specifically to the interests expressed by stakeholders concerned with their particular plans.

At both planning levels, public participation might follow a five-step approach:

1. A thorough and diligent stakeholder analysis ('stakeholder mapping')
2. A tailor-made and transparent public participation strategy to be used during the needs assessment or for a specific project
3. Sound implementation and execution of the participation strategy
4. Presentation and discussion of the outcome of public consultations, including room for feedback of the stakeholders concerned
5. Evaluation of the public participation strategy[3]

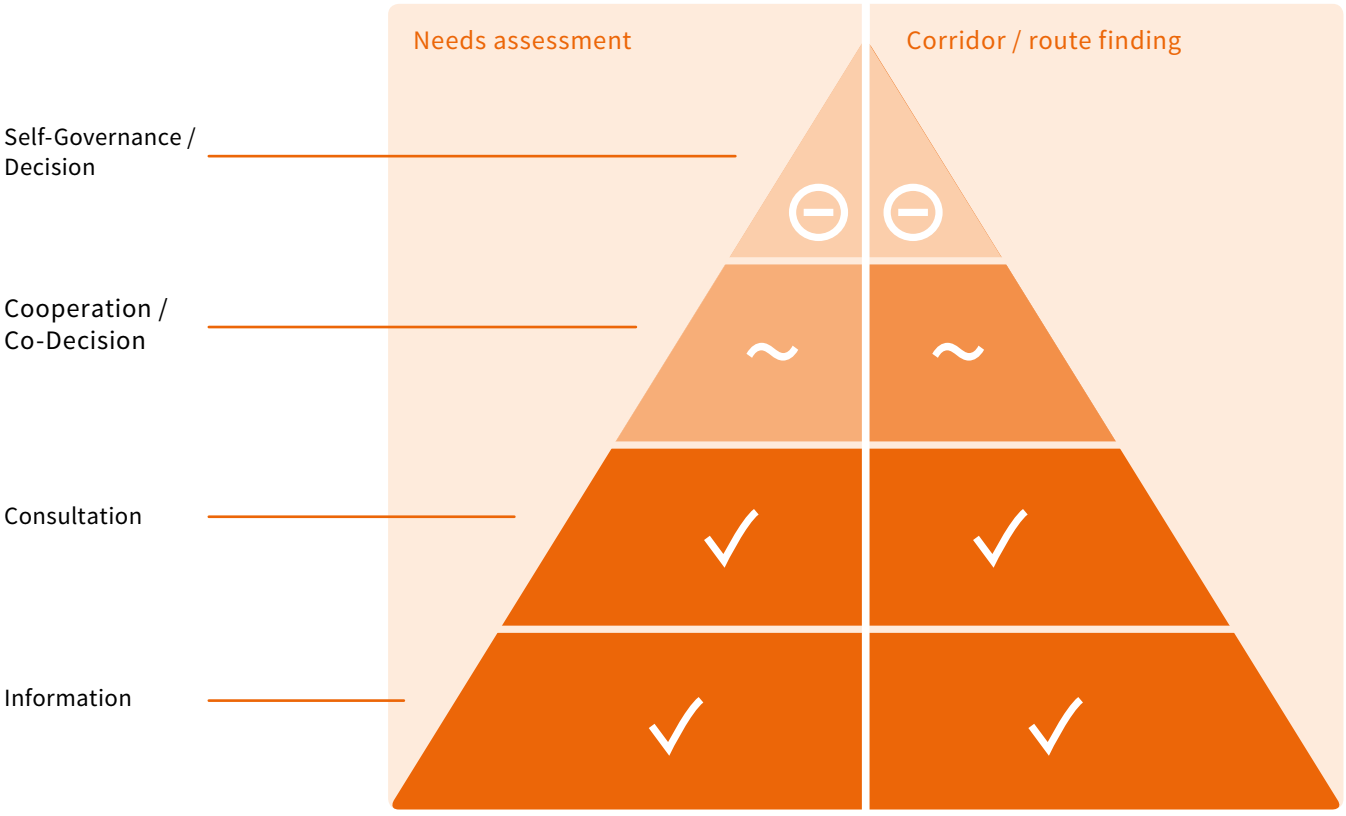
Options for and limits to public participation in power grid planning

Stakeholders engaging in planning processes often have high expectations about the outcome. To avoid disappointment, grid planers and operators need to clearly explain what they mean by participation.

Sociologists suggest that public participation can be divided into four levels, ranging from pure information to self-governance[4]. Up until now, public participation in the grid planning process has usually been limited to the first two levels of participation. This is due to the fact that planning a power grid is highly complex and requires expert knowledge in a range of fields, including energy economics, electrical engineering, planning law and nature protection law – to name just a few.

Thus, power grid and energy experts will be taking the final decisions related to the needs assessment. These experts might include 'trusted experts' from different stakeholder groups. Apart from this, local knowledge should be taken into account by those experts. However, public participation may go further in the corridor planning process and involve some form of co-decision-making (3rd step on the 'ladder of participation' shown in Figure 2 below). A successful example of co-operation at the 'need level' is the recent German grid planning exercise, when the country's energy and climate targets were integrated as basic assumptions into the scenario-setting and power grid modelling that had been a key demand of several groups of stakeholders during the preceding public consultations.

Figure 2: Public participation levels in power grid planning



There may be even more opportunities for co-decisive participation at the level of route finding, where local stakeholders, with their regional knowledge, may be very helpful in identifying the best possible route option. Hence, stakeholders and grid operators should co-operate early on to identify corridor or route alternatives for a project.

Transparency

Planning a power grid is highly complex, making it difficult for TSOs to provide clear and useful background information. Most people would not want to read long reports or consult numerous studies and other documents. Also, different stakeholders will want different information: experts might want to know about complex technical issues while non-expert local residents might want easily understood information that is relevant to their communities.

The relevant authorities, as well as the TSOs, must take responsibility for providing information early in the planning process to experts and others interested in being consulted. Those responsible for grid planning should make use of all means of communication to reach broader audiences and provide different types of information. It is crucial that the results of consultations are communicated widely, clearly explaining which arguments or concerns led to changes, which ones didn't and why.

The BESTGRID project partners have come to realise that public participation is a matter of continuously improving the communication methods they use. They are fully aware that they are only at the beginning of a long but important and fruitful process of establishing a regular public dialogue on the future of the European energy system. The dialogue is seen as a joint learning process, not as 'push and accept' strategy.

There are good opportunities for public participation in power grid planning at the level of information and consultation. Public participation can be extended to the level of co-decision, especially concerning the determination of corridors and routes.

Source: Germanwatch, based on Arnstein (1969) and Rau et al (2012)[5]

Recommendations for local stakeholders

» **Formal and informal planning procedure:** Find out how the formal planning procedure works, if and when you have the right to participate, and whether and how you can make a difference. Having a formal role may depend on whether you are a private person or belong to a public agency or registered interest association.
» **Early engagement:** Get involved early and ask for informal discussions, either preceding or accompanying the formal procedure.
» **Different interests:** Stand up for local interests but keep in mind that other stakeholders may have different interests that are equally legitimate. Bear in mind that your suggestions, if agreed, could affect other interests – so use your arguments responsibly.

Recommendations for TSOs and planning authorities

» **Co-operation:** Involve civil society stakeholders early on in the planning process. Informal consultation before the beginning of the formal procedure often makes sense. Provide opportunities for increased public participation both in the formal procedure and in informal offers based on thorough stakeholder analyses.
» **Transparency:** Take seriously the legitimate needs of different stakeholder groups for transparent information and plan your dialogue and information offers accordingly.

Weblink:

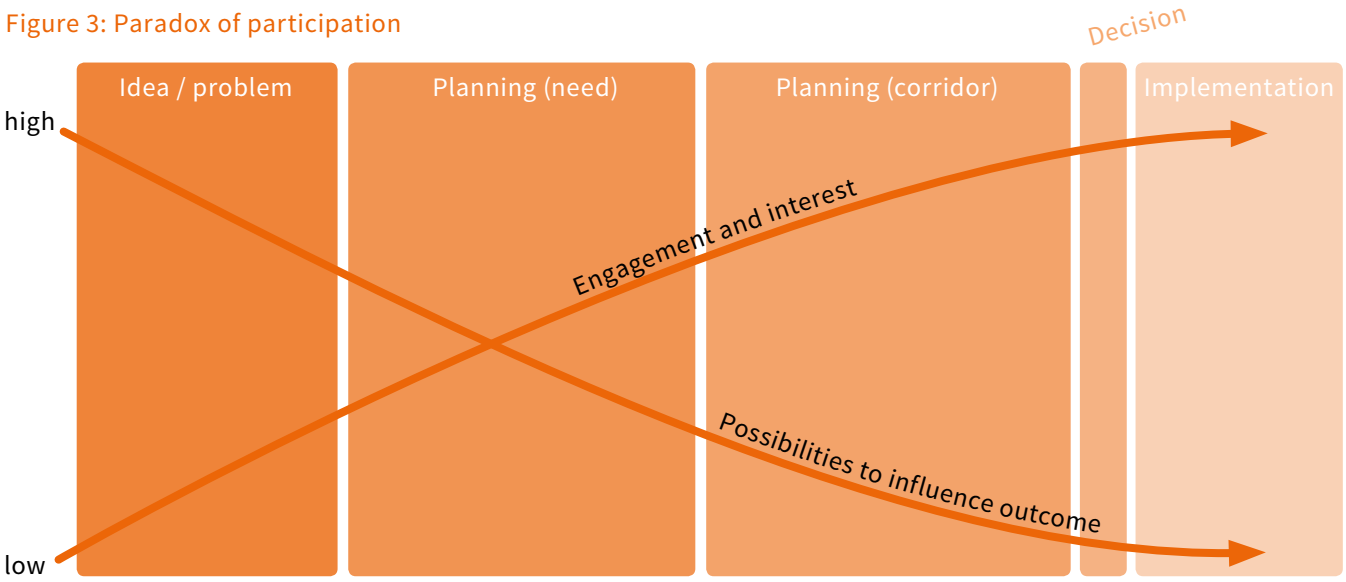
The Grid Infrastructure Communications Toolkit (EU-Commission, DG Energy / Roland Berger) provides a detailed overview on power grid related stakeholders and their roles and interests:
www.grid-communications-toolkit.eu

PLANNING LEVEL I: NEEDS ASSESSMENT

Whenever people feel affected – in one way or another – by an infrastructure project planned in their area they will want to have their voices heard and their concerns taken into account. Project planners increasingly have come to realise that early participation is key to avoiding social conflicts and helps making best use of local expertise relevant to the project.

There are many opportunities for stakeholders to engage in consultation with grid operators and planning authorities – both at European and in most countries at national level. However, scope and degree of stakeholder participation may vary considerably depending on formal requirements (when and how), on the willingness of authorities and TSOs to include different stakeholders early on, and on the level of expertise each stakeholder can contribute.

Figure 3: Paradox of participation



Source: Germanwatch

There are, however, constraints as to the scope of early participation, often referred to as the 'paradox of participation'. There is a useful window of opportunity for meaningful participation early in the process, when many decisions regarding the need for a power line and its design are yet to be taken. However, this is less the case further along in the process and often people only get involved at a later stage when the planning is already well advanced, or designs have already been started or are almost completed.

When the planning process has just begun, and when many elements are still vague or relevant information on the planning is not yet publicly available, people might not realise that they could be affected by the project in the future. If the results of earlier discussions on a proposed power grid – including pro and con arguments – have not been well documented or are hard to find, stakeholders becoming involved in later planning stages will be asking questions that were already asked and answered.

Those who want to effectively participate in the planning process need to distinguish between the two different levels of the planning process, as described above:

1. **Needs assessment:** scenario framework/European and national power grid development
2. **Corridor/route finding:** formal planning procedure
   In some countries there is a two-step formal planning procedure: ie, spatial planning to identify a corridor and decide on the most favourable option, and the approval procedure for a proposed route

Those responsible for the planning procedures should continuously improve their efforts on stakeholder engagement in order to further develop a process where arguments are discussed and documented in a transparent way. The legitimate, yet sometimes conflicting, interests and arguments of stakeholders all need to be taken into account, and decisions should be based on arguments that carefully balance those different interests.

Stakeholder engagement with needs assessment

One lesson from the BESTGRID project is that the question of whether a power line is needed often turns out to be highly controversial in the area where the project is to be realised. While it is challenging to address issues of energy politics, such as scenario planning and overall grid development, during public dialogues aimed at finding the best route for the project, stakeholder engagement on the level of the needs assessment may contribute to achieving a higher legitimacy of the determined need. It is crucial to raise awareness among local representatives and regional stakeholders about their options to participate in the debate on the need for new power grids at the very beginning of the grid planning procedure.

Each stakeholder – experts and non-experts equally – can ask relevant questions and contribute sound arguments. It is important to have a thorough overview of the assumptions on which the reports and studies defining the need for future power grids are based. Due to the interconnectedness of power grids, one could argue that the new or consolidated power line at a specific location might not be required or may be neces-

sary only for some future use. However, it might be that overall, the power line may well be necessary and crucial to energy transition.

Local stakeholders can apply their knowledge of local circumstances, landscape and bio-diversity as well as contribute to discussions around corridor alternatives. They may also contribute their views on possible technology options, eg, overhead lines versus (partial) underground cabling, at an early stage of planning, as in some countries – for example in Germany – technology options are determined at national level at an early stage of the planning process.

In order to engage effectively in the needs assessment process, it is of great advantage for stakeholders to have a good understanding of the technical and economic conditions for power grid planning as well as of European and national energy policy and legislation. Therefore, it may be worthwhile for regional stakeholders to co-operate with other actors with specific knowledge in the fields of planning legislation, electrical engineering, transmission technologies, geography and environmental assessment.

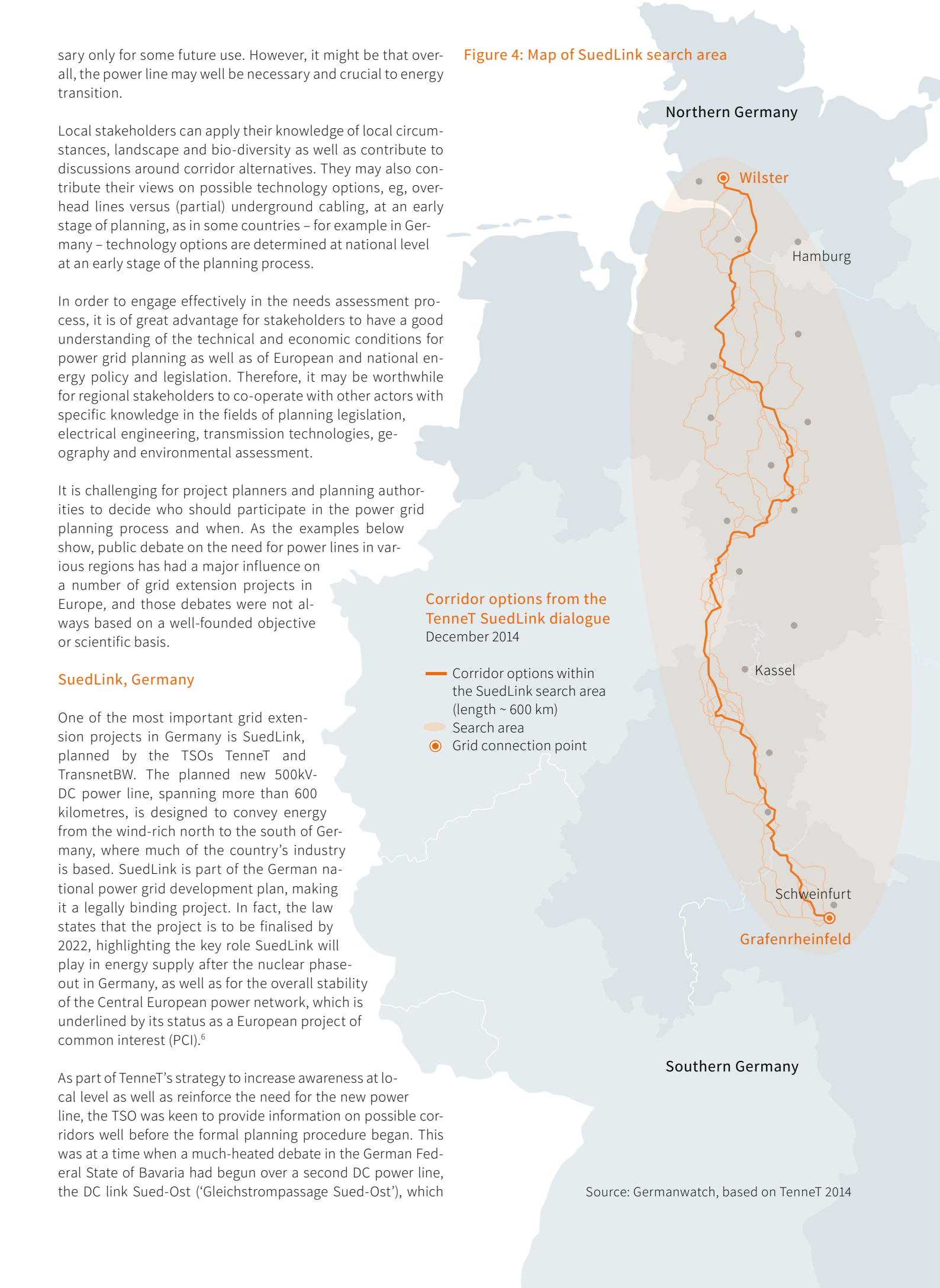
It is challenging for project planners and planning authorities to decide who should participate in the power grid planning process and when. As the examples below show, public debate on the need for power lines in various regions has had a major influence on a number of grid extension projects in Europe, and those debates were not always based on a well-founded objective or scientific basis.

SuedLink, Germany

One of the most important grid extension projects in Germany is SuedLink, planned by the TSOs TenneT and TransnetBW. The planned new 500kV-DC power line, spanning more than 600 kilometres, is designed to convey energy from the wind-rich north to the south of Germany, where much of the country's industry is based. SuedLink is part of the German national power grid development plan, making it a legally binding project. In fact, the law states that the project is to be finalised by 2022, highlighting the key role SuedLink will play in energy supply after the nuclear phase-out in Germany, as well as for the overall stability of the Central European power network, which is underlined by its status as a European project of common interest (PCI).[6]

As part of TenneT's strategy to increase awareness at local level as well as reinforce the need for the new power line, the TSO was keen to provide information on possible corridors well before the formal planning procedure began. This was at a time when a much-heated debate in the German Federal State of Bavaria had begun over a second DC power line, the DC link Sued-Ost ('Gleichstrompassage Sued-Ost'), which

Figure 4: Map of SuedLink search area



Source: Germanwatch, based on TenneT 2014

despite the previous federal government's approval had again been brought up for public discussion. The Bavarian state government even went so far as to call for a moratorium on any new planning of transmission lines that pass through its state. While this intervention met with criticism, it created an atmosphere in which TenneT found itself constrained to switch strategy, from primarily discussing route alternatives to also engaging with local stakeholders on the issue of needs assessment.

This example shows that in spite of apparent political consensus at national level concerning the merit of grid extension, local politicians often have a totally different view on the need for grids. Communication between national politicians and local stakeholders about the need for new transmission should be enhanced in order to reach a common understanding of the reasons for the overall grid planning. This requires great effort on the part of the stakeholders at both national and local levels: national politicians should emphasise dialogue with regional stakeholders about possible local impacts of national plans, while local stakeholders interested in general issues of the power grid planning ('whether or why a line is needed') should engage with the first planning level ('needs assessment').

Waterloo-Braine l'Alleud, Belgium

Another example that shows why early engagement with the assessment of need for new power lines may be useful is the former 150kV-underground cable project Waterloo-Braine l'Alleud. At 5 kilometres in length, the project was planned to meet a number of needs.

First, the local distribution system operator (DSO) Ores identified a need for more energy to be supplied to the Waterloo substation. Its estimates, which were confirmed by models created by the TSO Elia, showed that by 2018 the existing facilities would no longer be able to cope with the needs of the population, due to a rise in demand from residential customers and business customers. Second, the TSO Elia needed to increase the density of its grid and optimise transmission of energy generated by the growing number of local renewable sources (such as wind farms and photovoltaic facilities). Lastly, it was intended that this project would help make the grid more secure by ensuring a reliable supply for everyone.

Elia, the Belgian TSO, has co-operated with IEW, a Walloon environmental umbrella association, on a number of issues, one of which was identifying and engaging with relevant local stakeholders. For IEW, working with a TSO was new venture, but the organisation felt it could benefit from the co-operation as it helped to enhance transparency in grid planning. Therefore, they jointly set up several roundtable discussions where local residents and environmental groups could raise questions and submit proposals for alternative routes for the line.

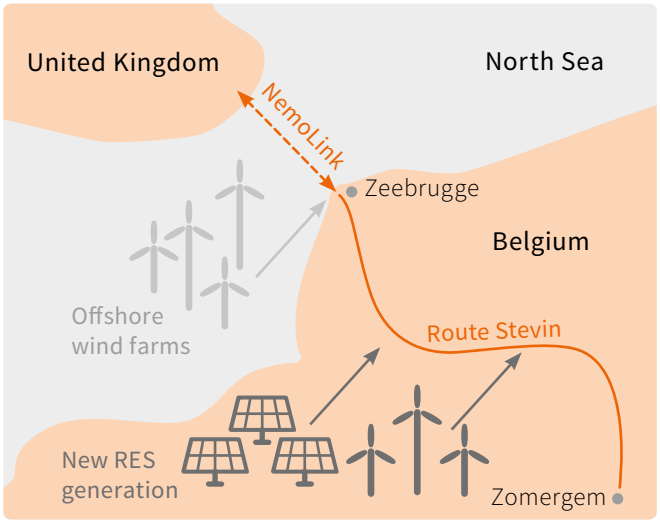
One concern that was often put forward, and also raised by IEW member organisations, was whether the line was needed at all. Several stakeholders felt that the need for the line had not been sufficiently addressed at the beginning of the process. When it later transpired that the underground cable was no longer deemed necessary – because the power demand forecast had changed – stakeholders asked IEW for more information. The lesson for IEW was that it needed to place more emphasis on stakeholder engagement and on providing information on the issue of the needs assessment in any future venture.

Stevin, Belgium

A second example from Belgium is Stevin, one of the country's largest extra-high voltage projects developed by Elia. The new 380kV-AC power line spans more than 47 kilometres, of which 10 kilometres will be underground. It is designed to convey energy from a substation in Zeebrugge to a substation near Zomergem. According to Elia, the Stevin project addresses multiple needs, including enabling new offshore wind power to be fed into the electricity network and building new interconnection capacity between Belgium and the UK via the planned subsea connection cable NemoLink. The line will start operating in 2017. If the project had already been realised it might have prevented bottlenecks in Belgian power grids in the winter of 2014/15 when several Belgian nuclear power plants were switched off due to modifications and – in one case – to sabotage and Elia had to develop a black-out prevention plan.

Elia co-operates with BBL, a 150-member organisation strong Flemish environmental umbrella association, on the issue of stakeholder engagement. Together they have been setting up a number of round tables and focus groups to discuss with government representatives and other local authorities best practices for stakeholder engagement and to identify opportunities for improvement of grid planning processes. During the course of those discussions, it became apparent that even some staff from the planning authorities were not fully aware of the scale and scope of the Belgian National Grid Development Plan. They too raised concerns about the overall need of new power lines. What can be learned from this particular experience is that politicians and TSOs may increase their efforts to stress clearly the implications of national grid development plans and seek further exchanges with planning authorities.

Figure 5: Stevin project, Belgium



Source: Germanwatch, based on Elia 2014

Recommendations for local stakeholders

» **Planning responsibility:** Identify who is responsible for power grid planning in your country – TSOs, the government or a planning authority?
» **Information:** Request information on the scenario setting and needs assessment of new power lines from the relevant planning authority and find out how you can participate.
» **Early engagement:** Take part in public consultations on the need for new or upgraded power lines right from the beginning of the decision-making process. Consider co-operating with other actors such as energy research institutes or regional/national NGOs to achieve the greatest impact.
» **Conferences:** Invite national experts and politicians to discuss national grid planning and energy politics at conferences in your area.

Weblinks: Public consultations on power grid development plans

If you want to contribute to power grid planning in your country or at European level, you'll find information here:

EU: European Ten-Year Network Development Plan (TYNDP): Information and Public Consultation: www.entsoe.eu/major-projects/ten-year-network-development-plan/tyndp-2014/stakeholder-interaction/Pages/default.aspx
After registering to receive the ENTSO-E newsletter, you'll get information on upcoming consultations on the TYNDP: www.entsoe.eu/news-events/news-subscription/Pages/default.aspx
Projects of Common Interest (PCI, a list of gas and electricity projects which are of very high importance for the European energy market): http://ec.europa.eu/energy/infrastructure/pci/pci_en.html
Public consultations are published here: http://ec.europa.eu/energy/en/consultations
Belgium: www.elia.be/en/grid-data/grid-development/investment-plan (consultation in spring 2015)
Germany: www.netzentwicklungsplan.de; www.netzausbau.de; www.netzausbau.de/europa
Italy: www.terna.it/default/home_en/electric_system/grid_development_plan/grid_development_plan_summary.aspx
United Kingdom: http://www.talkingnetworkstx.com/electricityplan/

Recommendations for grid operators (TSOs) and grid planners

» **Information:** Provide early and transparent information for stakeholders with different backgrounds. Include an explanation on how their arguments have been considered within the planning process.
» **Reduce complexity:** Explain why the new lines are needed. Clearly describe which power lines are needed in all relevant scenarios. Identify ways to reduce complexity in the need planning process. Refer to the reality of people's lives when you are telling the story.
» **Stakeholder mapping:** Address a broad range of stakeholders and invite them to make their voices heard in the national power grid planning process at an early stage when they can have an impact. Develop a specific approach for different groups of stakeholders.
» **Political support:** Co-operate with other stakeholders with respect to the dialogue about the necessity of building new power lines supporting the energy transition, ie, politicians, mayors, local civil society, local industry associations.
» **Involve civil society:** Involve stakeholders such as local representatives or NGOs early in the informal and formal grid planning procedure and explain transparently the need for a plan or a project.
» **Knowledge transfer:** Help close the knowledge gap between local stakeholders, national politicians and energy experts. Provide background information on the national power grid planning process.
» **Transparent planning:** Explain the legal framework, legal boundaries and fixed planning schemes. Explain clearly which issues have been decided and which ones are open for discussion. Offer dialogue forums open to all relevant stakeholders and provide tailor-made information.

PLANNING LEVEL II: CORRIDOR AND ROUTE PLANNING

Stakeholder engagement in identifying the 'right' corridor

Once the needs assessment has been finalised, the power grid operator starts identifying, comparing and evaluating possible routes or corridors through which the power lines may eventually pass. The criteria applied during that process must be in line with legal requirements as set out in the spatial planning law, energy and planning law, nature conservation legislation and/or emission control regulations.

In most EU member states, grid operators follow a two-step formal planning procedure. First, the spatial planning authority identifies the best corridor option (spatial planning). Second, the plan is approved by the relevant authority, which identifies the exact route of the power line within that corridor. At all times, the authority must remain mindful of the different interests and views that may come into play, and weigh them thoroughly against each other.

Table 4: Corridor and route planning of transmission lines: formal procedure in two steps

Corridor and route planning	
Corridors	Detailed routes
Corridors	Detailed determination of routes
Spatial planning	Corridor and route planning

Source: Germanwatch

Stakeholder engagement in the legally required formal planning procedure may in some countries (such as Germany) be restricted by rules regarding entitlement to participation and relevant deadlines for participation. Thus, those interested in being involved in the planning process should examine those restrictions to determine whether they qualify for participation.[7]

Environmental impact assessment forms an integral part of the planning procedure and takes place at various levels. While the environmental impacts of large-scale corridor alternatives are assessed[8] as part of the spatial planning process, impact assessment[9] of small-scale routes is part of the approval procedure. Environmental groups are involved in those assessments, but such opportunities can be increased, as the BESTGRID project has shown.[10]

TSOs, politicians and public authorities have gone beyond the formal restrictions and extended their scope of engagement by organising informal information and dialogue events at an early stage of the planning. There are various reasons for their actions: first, early engagement may contribute to finding more suitable planning options. Second, identifying the concerns and needs of local and environmental stakeholders at an early stage helps determine local mitigating measures more effectively. Finally, various stakeholder groups have expressed their dissatisfaction with the fact that legally required planning procedures do not take their interests into account sufficiently.

To help overcome these problems, ways should be sought to incorporate the conclusions of informal dialogues, in which concerns raised by locals and other relevant stakeholders are discussed, into the formal planning procedure.[11]

SuedLink, Germany

In spring and summer 2014, months before TenneT intended to submit its application for the SuedLink project to the national competent planning authority, the organisation made huge efforts to provide information to local stakeholders. Before the formal planning procedure began, TenneT organised a series of 22 public consultation events, so-called 'info-markets' or 'info-marts' along the corridor prioritised by the TSO, in early 2014. During the info-markets, the TenneT team displayed maps and detailed information on possible corridor options and on the criteria for the selection of a priority corridor for the SuedLink project. A team of several TenneT staff, accompanied by staff from the planning authority, explained the planning procedure and asked local stakeholders for their comments and suggestions on the proposed corridor and possible alternatives. This proved to be very challenging, as the huge Suedlink project will affect a very large number of stakeholders.

Following these dialogue events, TenneT received about 3,000 suggestions, including proposals for corridor alternatives. After thoroughly assessing each of the submitted proposals, the TSO made numerous amendments to the original application and identified three small-scale corridor alternatives as preferable.

TenneT info market 2014 / Photo: TenneT

TenneT also co-operated with environmental groups during the course of 2014. As part of this co-operation, a local branch of BirdLife Germany (NABU Lower Saxony), a German nature conservation association, set up and ran two round-table events on how new power lines could be constructed in mountainous regions in central Germany in an environmentally friendly way, using the SuedLink project as a model.

Later in 2014, still before the legal planning procedure had started, TenneT organised a second series of info-markets where the conclusions of the earlier dialogues were presented. In total, almost 300 public information and dialogue events were held by TenneT in 2014. The second series of info-markets was supported by Deutsche Umwelthilfe (DUH), a German environmental organisation, which helped organise and moderate several of the above mentioned info-markets. While some stakeholders reacted positively to these opportunities for early engagement, others criticised the TSO for its pre-selection of a priority corridor in their region. Accordingly, a group of representatives of German districts published a joint declaration calling for openness in the process of corridor assessment and asking the TSO and the planning authority to seriously consider alternative route options as well as alternative technologies such as underground cabling.[12]

The SuedLink dialogue in 2014 shows clearly that local stakeholders are highly interested in being involved in the corridor and route finding procedure. They rightly demand a transparent explanation of the criteria for choosing one or several route alternatives. However, early stakeholder engagement per se does not of course mean that all concerns can be dispelled. Even the best participatory approach cannot provide a generally accepted solution, bearing in mind that a broad range of differing interests is affected by large transmission grid projects such as the SuedLink. Those who live near the power line may, understandably, reject the project as such and will not be satisfied even by a procedure that follows good practice. But a transparent and participative approach may result in a better and more legitimate final decision reflecting the concerns, suggestions and interests of a broader range of stakeholders.

Bertikow-Pasewalk, Germany

Bertikow-Pasewalk is a grid extension project in East Germany planned by 50Hertz. The new 380kV-overhead line, spanning over 30 kilometres, will replace the old 220kV-power line that passes through the two federal states of Brandenburg and Mecklenburg-Vorpommern. The upgrade will ensure reliable energy supply, with a higher proportion of wind energy. The need for the Bertikow-Pasewalk power line has been laid down by law.[13] Another German law on power grid extension[14] has improved provisions for public participation, setting a clear framework for the timely provision of information to the public and stipulating possibilities for public participation at all stages of the planning process.

In addition to these formal requirements, project developers have engaged in informal dialogue with the public to support the formal procedure. In co-operation with German environmental groups Naturschutzbund Deutschland (NABU) and DUH, as part of the BESTGRID project, 50Hertz organised a number of public events, including a mobile bus tour, to provide information to local communities on the planning process for the new line between the two substations Bertikow and Pasewalk, on possible corridors, on electromagnetic fields as well as on environmental impacts.

Six months before the start of the formal planning procedure, 50Hertz hosted two information events for public authorities and concerned citizens and held numerous discussions with local and regional stakeholders. Furthermore, right before the start of the formal planning procedure 50Hertz organised a roundtable event where residents and other local stakeholders were invited to raise questions and discuss the environmental impacts of the corridors proposed and corridor alternatives. Surprisingly, unlike most other public consultations on power grid extensions, none of those present raised the question as to why the power line upgrade was necessary. The most contested topics were environmental impacts such as bird collision risks, forest dissection and the role of electromagnetic fields (EMFs).

Despite the efforts of the TSO and its partners at NABU and DUH to attract the interest of the wider public, very few attended the roundtable event. There are different possible explanations: it might be that it is difficult to address local stakeholders at an early stage of the planning procedure when they might not yet realise how they will be affected by the planning. Another explanation might be that the Bertikow-Pasewalk was less controversial than other power grid projects – possibly because wind energy plays a relevant role in this economically weak area. However, in a certain respect the event may well be considered a success. After attending the roundtable meeting, a representative of a local public authority approached 50Hertz and expressed her willingness to co-operate with the TSO by publishing information on future public events in the town council's official journal.

In October 2014, 50Hertz organised a 10-day tour of the Bertikow-Pasewalk project with a mobile info bus, visiting two villages per day. The 50Hertz 'info-mobil' was well attended by local authorities, politicians and residents and received much coverage in the local press. The mobile info bus allowed residents to get in touch with staff of the TSO, learn about the planned corridor, and raise questions and concerns related to environmental and health impacts of the upgraded power lines. To this end, the TSO invited experts to join the tour and perform on-site measurements of the electromagnetic fields (EMFs) underneath existing 220kVlines and to then compare the acquired data with the expected values of the future upgraded 380kV power line. Furthermore, the experts explained the effects of EMF by using various household appliances in the mobile bus. Such demonstrations helped to alleviate fears and misunderstandings regarding EMFs.

50Hertz mobile info bus, 2014 / Photo: 50Hertz

PLANNING LEVEL II: CORRIDOR AND ROUTE PLANNING

NemoLink, Great Britain and Belgium

NemoLink is an interconnector project that will consist of subsea and underground cables connecting converter and substations in England – built on the site of a former fossil fuel power park – and in Belgium. The AC/DC project, operated by TSOs National Grid and Elia, will allow offshore wind energy to be fed into the grid and help to integrate increasing renewable electricity generation in both countries. Construction work will begin in 2015 and is scheduled for completion by 2019.[15]

The NemoLink operators face challenges that are quite different to the ones discussed earlier, mainly due to the different legal systems that come into play and the use of various technologies such as AC, DC, underground cabling, and others. What is more, the transnational character of the project adds to the difficulty of building and maintaining relationships between the relevant stakeholders and making sure that everyone involved is provided with the necessary information regarding the planning process.

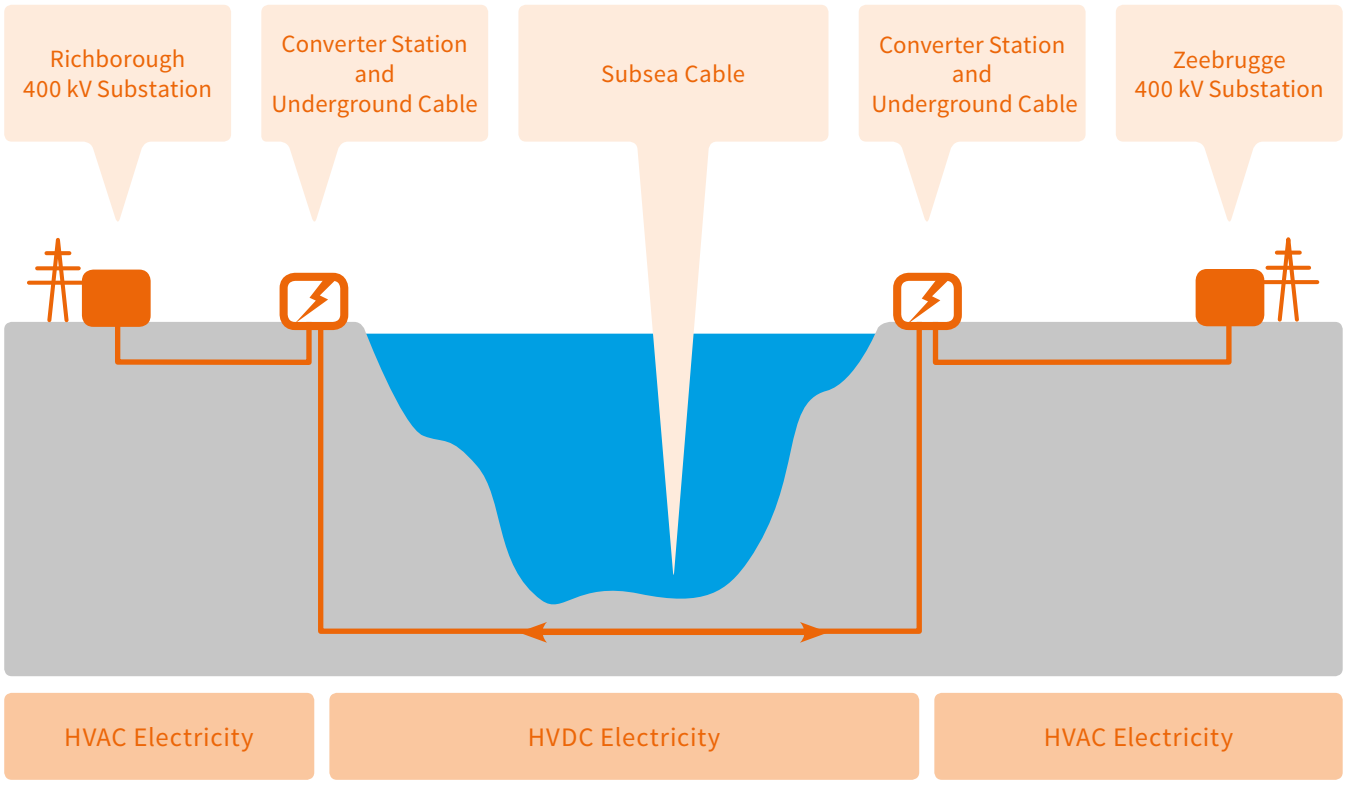
National Grid's role in BESTGRID was to analyse the approval procedure and to organise stakeholder workshops. Staff from local authorities in England and Belgium, as well as representatives from civil society, including the Fishermen Association and other environmental groups, were invited to put forward ideas on how to speed up the approval process and improve stakeholder engagement. As a result, National Grid is drafting a 'Marine Best Practice Action Plan', a manual on stakeholder engagement and environmental impact assessment in transnational marine power cable projects.[16]

Stevin, Belgium

The route planning process for the Stevin power line began in June 2008 and took about four years. The process started with an informal, administrative guidance group, with representatives of various administrations participating. The purpose of the guidance group was to identify possible bottlenecks for the route finding at an early stage of the procedure and to examine possible route alternatives for the strategic environmental assessment (SEA). The official procedure for the SEA started at the end of 2009 with a public inquiry. During this phase of public consultation, citizens, NGOs and local authorities proposed alternative routes to be investigated in the SEA. The TSO Elia organised information sessions in the municipalities concerned and meetings with NGOs, including Greenpeace and the Flemish NGO BBL.

In the SEA, finalised in mid-2011, six main routes and 15 variations were explored and the most environmentally friendly alternatives were defined. After that, the procedure for the legally binding land use plan began at the end of 2011. The land use plan determines the exact route of the power line and is the legal basis for the building permit. Stakeholders consider the land use plan to be the most important step in the procedure for the power line. Accompanying the procedure, Elia

Figure 6: NemoLink subsea cable connecting southeast England and Belgium



Source: Germanwatch, based on NemoLink

organised five info-markets in the municipalities concerned. During the public inquiry, about 1,700 objections were submitted, many of them demanding that the entire power line be put underground or suggesting additional alternative routes. When the Flemish government announced its final decision on the route, it stated that a 10km section of the 47km route would be put underground.

Despite intense preparations, various legal public inquiries and many non-mandatory initiatives by Elia, the procedure met with opposition and protest. Various municipalities voted on motions to reject the project, citizen protest groups were formed, and legal proceedings against the decision of the Flemish government were started with the Council of State. This caused a lot of delay and even threatened to send the project back to start. However, Elia managed to agree on the legal procedures, and construction work was able to start in 2015.

One of the most important findings of the workshops and interviews conducted by BBL to evaluate the procedure was that informal participation in decision-making for a new power line route should start before the start of the formal process. This participation should start with joint fact-finding, so everyone is aware of each other's interests and concerns. By engaging stakeholders earlier in the process, before the legal public inquiry, concerns can be handled in a positive way. The decision about which routes need to be examined in the strategic environmental assessment should be the result of a transparent, participatory process. Many participants in the interviews and workshops run by BBL in late 2014 and early 2015 complained that new route alternatives proposed by the public were dismissed without clear reasons given, and that decisions on the final route had already been made. They argued that routes that are technically not feasible (eg, a cable in a canal) or economically not feasible (eg, the whole route underground) should be publicly discussed – otherwise civil society may see a decision on the route as a fait accompli.

In addition, people wanted clear feedback on their objections. Most citizens do not know where they can find answers to their objections. This causes a lot of frustration and encourages people to go to court. It is therefore important that citizens are informed about the authority's response to their objections in an easy-to-understand way.

Good practice exchange, Italy

Learning from other stakeholders and other countries is fundamental to addressing new challenges, preventing obstacles and facilitating collaboration. As part of the BESTGRID project, Terna, the Italian TSO, applied a two-pronged evaluation tool for the exchange of good practice:

» A list of best practice share and exchange tools commented by BESTGRID partners and external stakeholders
» Practical tools: an internal smartphone chat (with a group of BESTGRID partners), various public discussion formats (eg, speed-dating, pitches, info-market): a professional networking group on an internet platform

From that evaluation Terna learned that many actors strongly agree that sharing and exchanging good practice experience through different formats has an important value. They concluded that this is worth an investment in time and resources. NGOs seem to be the most experienced exchange partners, and they need to be supported to guarantee their valuable contribution to these activities.

Transfer of BESTGRID experience to other countries

The TSO Terna also tried another approach. It assessed whether and how specific actions implemented in the BESTGRID pilot projects could be transferred to other countries. Terna projected three good practice approaches in the Italian context. From the Renewables Grid Initiative (RGI) experience, Terna knew that all of the European TSOs are facing the same general issues and obstacles in transmission grid development, but there are also differences linked to the legislation of each government and to special cultural and local conditions. Due to these differences, it is important to discuss the feasibility, the impacts and the outcomes of certain experiences with stakeholders of another region.

Terna selected three activities from BESTGRID pilot projects as workshop issues:

» community dialogue with info-markets along the SuedLink project by the TSO Tennet
» EMF measurements by the TSO 50Hertz within the Bertikow-Pasewalk project
» collaboration between the bird protection NGO NABU and the TSO 50Hertz on nature conservation.

These were discussed during three one-day workshops at the beginning of 2015 with different Italian stakeholder groups (maximum ten participants each):

» Terna employees from different departments (technicians, communication and public affairs) and representatives from authorities (ministries, Italian municipalities association)
» Italian NGO representatives
» associations (consumers, renewable energy, environment, industry) as representatives of the general public.

Terna asked workshop participants to analyse the extent to which they consider these actions applicable and useful in the Italian context. Participants in all three workshops were very interested in the actions that had been implemented and were willing to discuss further options for strategic co-operation between TSO and NGO and to help improve procedures in Italy. They felt there is a need for adjustments due to different laws, organisational structures, competent authorities and local bodies. It also emerged in the dialogue that cultural differences between Italy and Germany need to be taken into account. Hence, a successful transfer of a good practice to another country includes the need to adapt the approach not only to the other country's legislation but also to its culture and other specific conditions.

PLANNING LEVEL II: CORRIDOR AND ROUTE PLANNING

Recommendations for local stakeholders

- **Formal planning procedure:** Find out if you or other groups have the right to participate or object in the formal planning procedure and act accordingly. Try to co-ordinate with other stakeholders. Be aware there are strict deadlines for objections and comments during the formal planning process.
- **Informal stakeholder engagement:** Ask for additional dialogue events accompanying the formal planning process. If you are given the opportunity to participate early, you should seize it. Fundamental opposition later on in the process is unlikely to stop a grid from being built as the need will already have been decided. Thus, finding ways to influence where exactly and how the connection will be built early on may be more beneficial than avoidance strategies.
- **Keep in touch with TSO:** Get in touch with the planning TSO, if possible as a group, ask for a contact person and a regular update on the planning procedure and ask the TSO to come along to information-sharing events. If you believe the 'offer for interaction' made by the TSO is insufficient, share this concern with the TSO. Provide relevant regional planning data to the TSO.
- **Engagement on route alternatives:** Get in touch with the TSO, public authorities, politicians and other stakeholders in your area and engage in the debate about the route finding. Comment on the proposal submitted by the TSO. Identify the criteria along which the proposal has been drafted and suggest further criteria or aspects that have not been considered. Ask clear questions and express your expectation that responses to your arguments will be documented and available to the public.
- **Organise local interests:** Bundle regional interests early on in a working group or local stakeholders' interest group and use the group's potential for learning and interacting with the project planners and authorities. Co-operate with regional NGOs and / or local civil associations and councils.
- **Direct dialogue on the ground:** If you live in a scarcely populated area, encourage the TSO to come to your area using more appropriate methods, as an info bus instead of organising events in towns that are far away and difficult to get to.
- **Level of participation:** Differentiate engagement in the 'need debate' from your engagement in local planning and adjust your activities to the appropriate level of the planning process.

Recommendations for TSOs

- **Stakeholder mapping:** Perform a thorough and diligent stakeholder analysis and indicate which local stakeholders should be involved in the planning process and at what stage. Be open to including additional relevant stakeholders.
- **Tailor-made communication strategy:** Prioritise creating a tailor-made communication and dialogue strategy. Consider various means of communication. Provide detailed information to experts. Provide simple information to local residents and the wider public. Provide documentation of previous discussions on the internet and explain how you responded to different arguments. Adapt your communication strategy to local circumstances, political developments and different target groups, i,e, using social media channels to communicate with younger people.
- **Co-operation with civil society and local stakeholders:** Both TSOs and NGOs should consider co-operating with civil society early on in the planning process. Do not wait until it is too late.
- **Opportunities and limits for participation:** Explain to stakeholders why they are being consulted. Clearly communicate the limits of stakeholder engagement at the respective planning level.
- **Corridor alternatives:** Put forward one or more corridor alternatives for discussion and give a clear explanation of the criteria used if you are planning a power line in a new corridor or route. Inform municipalities of additional corridor alternatives identified in public dialogue forums.
- **Contact person:** Provide contact information for local stakeholders so they can keep in touch with the right person during the process.
- **Direct dialogue:** Get in touch with the community. Don't wait for them in a 'stakeholder information office' but provide direct dialogue on the ground. Spend time and staff on developing and exploring methods of direct communication.

» **Participation tools:** Choose participation tools appropriate for your purpose, depending on local circumstances and on the planning level. The following tools have proven successful:
  › **Info-markets:** TSOs such as Elia and TenneT have shown that info-markets are well suited for introducing grid extension plans to a broader public. Their success relies on well-trained dedicated staff as well as on the information provided.
  › **Mobile bus tour:** 50Hertz found that mobile info buses create access to information and make it easy for local residents to get in touch with grid planners and operators. Useful equipment for the mobile info bus would be:
    • display maps to provide a visualisation of the (priority) corridor/route and its alternatives
    • use computer simulations and other visual material to help residents understand if and how the power line (upgrade) will affect them.
  › **Roundtables:** All TSOs involved in BESTGRID have found that stakeholder workshops or roundtable discussions, depending on the topic for discussion, can help to address and, in some cases, to minimise public concerns.
» **Share experiences with peers:** Evaluate your public participation strategy at all stages of the process and promote the dissemination of knowledge both in-house and among peers.
» **Best-practice:** Share your best-practice experience, ie, by applying for a best practice award.[17]

Marine projects such as NemoLink: Recommendations for planning and local public authorities, and TSOs

» **Approval procedure:** Intensify exchange on transparent project planning. Making the project pipeline more transparent helps authorities allocate their resources more effectively.
» **Stakeholder engagement:** Early involvement and regular updating on the environmental impact assessment while it is being developed helps speed up the approval procedure significantly.
» **Co-operation and exchange:** Promoting regular and personal exchange between the project planners and planning authorities involved helps allocate resources more efficiently.
» **Additional staff:** Marine stakeholders may provide valuable input to the planning of marine projects. TSOs may want to employ staff dedicated solely to building and maintaining relationships with these stakeholders and to improve in-house communication on these issues.

Electricity can be transmitted by two different systems – alternating current (AC) and direct current (DC). Today, the most widely used transmission technology in Europe is a so-called meshed AC system, which means AC electricity is transmitted and distributed at different voltage levels between the generating power plants to the customers. AC technology allows for changing the voltage via transformers, making it the preferred current nowadays.

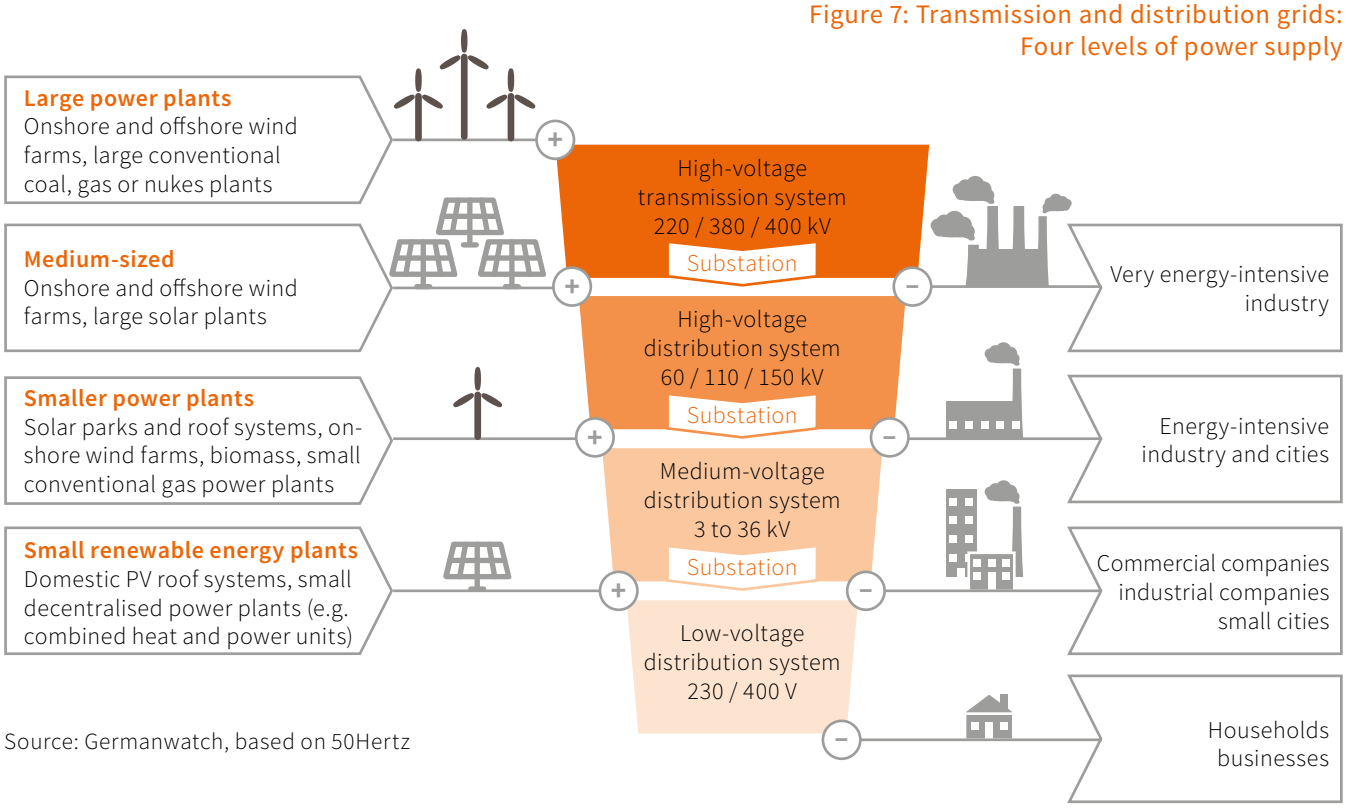
However, DC power lines have the advantage of taking up higher voltages and lower electric loss, which explains the planned use of DC lines on long distances. For this reason, DC technology is used for long-distance connections of offshore wind farms to the grid, for energy transmission via long-distance subsea cables, and for complementing existing AC power systems, which are vital for the development of the grid infrastructure and its feed-in-capacity.

AC power lines can take up different voltages. Transmission grids (see below) are operated by TSOs, grids with lower voltages are operated by DNOs.

Use of cable technology depends on voltage level

The costs for both technologies (overhead lines and underground cables) are about the same at the low- and medium-voltage level. At high voltage level, power grid operators calculate about double the costs for underground cable sections, while at the extra-high voltage level (EHV), further technical restrictions and risks – especially within the AC technology – as well as the substantially increased costs explain why overhead technology is the world's most commonly used technology. In addition, overhead lines and underground cables are very different with respect to their environmental impacts. While overhead lines may have serious impacts on the avifauna, underground cables affect soil conditions and species living near ground.[18]

Figure 7: Transmission and distribution grids: Four levels of power supply



Source: Germanwatch, based on 50Hertz

Overhead line or underground cable

Faced with the upgrade or construction of new power lines, many affected communities have been requesting that grid operators use underground cabling instead of overhead power lines. However, there are compelling economic and technical reasons to do otherwise.

In general, the voltage at which electricity is transmitted or distributed determines the technology applied. In various European countries, grid operators use underground cabling for a large part of the low- and medium-voltage network. For extra-high voltage lines in the transmission grid, this is very rarely the case. This is due to several technical and economic constraints for underground cable technology at higher voltage levels, especially in the AC transmission system.

However, 'partial undergrounding' has become prominent in some parts of Europe. Underground cables in AC technology at the extra-high voltage level are sometimes used for small sections (mostly about 3 to 5 and up to 10km length) of the transmission grid in densely populated areas. Several small-scale projects have been implemented, one of the largest being the Dutch Randstad 400kV AC cable, spanning over 10km, laid near Rotterdam and operated by TenneT. Other such projects are planned in Denmark, Belgium and Germany.

In some parts of Europe, the existing AC transmission grid will be complemented by long-distance EHV transmission lines in DC technology. DC transmission minimises the loss of power in long-distance power transmission. As there are fewer technical restrictions on underground technology within DC EHV systems, some of these DC projects are planned using (partial) underground technology. The world's longest DC onshore underground cable (300kV) is currently being built in Sweden where the South West Link project will connect central Sweden to the south over a distance of 190km.

However, there is no common legal framework for the use of underground cable technology in the transmission grids in place. While in the UK partial undergrounding may be considered following a case-by-case assessment by the regulators and the TSO, in Germany legal rules set out which projects can use underground cabling.

The question of which technology should be chosen for a new power line is often raised in debates about new transmission grid projects. Many questions remain unanswered about AC underground technology at the high- and extra-high voltage level: what are the technical impacts of an increasing combination of overhead lines and partial undergrounding, how are the costs of specific projects developed, and does a specific technology option contribute to public acceptance?

Due to technical challenges and economic restrictions, the underground cable technology will presumably not prove to be an easy solution for the upcoming transmission grid projects. But it may in some cases contribute to acceptable solutions for some projects. The use of underground cables should be based on the development of comprehensible criteria developed in a transparent procedure. This requires consultation with a broad range of stakeholders. The feasibility of different technology options needs to be addressed and communicated in public consultations. This includes an open and honest dialogue about the feasibility, restrictions, disadvantages and advantages of different technology options.

Recommendations for local stakeholders

» **Overhead line and underground cabling:** Find out which technology options are technically feasible and legally applicable to the project of your concern and why. Request information on the various technical, economic and environmental impacts of the different technologies.
» **Information and dialogue:** Request an explanation of the reasons for the use of either overhead or (partial) underground cable technology and enquire about public events to discuss technology options with the grid operator, regulatory authorities, politicians, environmental NGO staff and other experts. Note: the technology option may be determined by national law in your country.

Recommendations to TSOs

» **Information:** Explain clearly the reasons for the technology option(s) you choose.
» **Technology development:** Contribute to the development of transparent criteria for the use of underground cable technology in co-operation with political and civil society stakeholders.

Literature

» ENTSO-E / EuropaCable position papers on transmission technologies:
http://www.europacable.com/home/energy-cables/documents.html
» RGI database providing an overview on European underground cable projects on the extra-high voltage level:
http://renewables-grid.eu/activities/learning-groups/project-database.html
» Information on the Swedish onshore South-West-Link EHV project, a combination of AC overhead technology and long-distance DC underground cable technology:
http://www.svk.se/en/grid-development/Development-projects/the-south-west-link/

ELECTROMAGNETIC FIELDS (EMF)

Concerns related to the health and environmental impacts of power lines have been at the centre of public debate for a long time. Such fears are particularly widespread in areas where new power lines are planned in close proximity to houses and farms and where affected residents fear adverse effects from exposure to electromagnetic fields (EMFs) surrounding power lines.

EMFs are everywhere around us. Their frequency varies greatly, from very high (sunlight +/- 10^{15} or 10.000.000.000.000.000 Hz), to high (micro wave ovens +/- 10^{10} Hz, cell phones +/-10^{9} Hz, radio waves +/- 10^{6} Hz), to extremely low (power circuits 50 Hz). Extremely low-frequency EMFs surround all power circuits, not just high-voltage lines, and they surround our domestic appliances such as cookers, hair dryers and alarm clocks, as well as medical devices such as magnetic resonance scanners. The latter are said to have the strongest magnetic fields, while the strongest electric fields ordinarily encountered in the environment are beneath high-voltage transmission lines. Unlike electric fields, magnetic fields at 50Hz cannot be blocked by walls. However, while electromagnetic fields are strong near power lines, their strength is rapidly reduced with distance. The size of magnetic fields also depends on the technology in use, ie, overhead power line or underground cable and alternating or direct current. While the general question of whether EMFs are harmful for humans is the subject of ongoing research, it is a well-known fact that the potential health effects vary significantly depending on the frequency and intensity of, and exposure to, the fields.

Exposure limits, prevention and public concerns

New grid extension plans have led to increasing public concerns about the health effects of EMFs. Above certain levels, EMFs can have adverse effects on human health. EU member states have introduced national standards, based on guidelines determining the maximum levels of exposure to EMFs, which grid operators in Europe comply to. Those guidelines are set by the International Commission on Non-Ionizing Radiation Protection (ICNIRP). They recommend that the maximum exposure levels typical for everyday life conditions should be far below the guideline limits including a large safety margin and suggest a limit of 200µT.[19]

In spite of national exposure limits based on scientific knowledge, public concern about the negative health impacts of magnetic fields surrounding power lines have not been sufficiently overcome. Certain health issues remain a concern. For one, the question whether EMF exposure might cause childhood leukaemia has not been satisfactorily addressed. Second, on a more general level, people are uncomfortable with the invisibility of EMF, which they feel is not addressed satisfactorily either. Politicians, planners and regulators have come to realise that in order to gain public support for grid extension projects, they need to take these fears more seriously. As a result, the World Health Organization (WHO) has launched an International EMF Project, which aims to provide scientifically sound and objective answers to public concerns over low-level electromagnetic fields.[20] Furthermore, several EU countries have introduced additional preventive policies, recommending stricter, though non-binding, exposure limits for sensitive areas or prohibiting the construction of transmission lines over residential buildings.[21]

Recommendations for local stakeholders

- **Information:** Research and compile information about EMFs provided by international research organisations and/or national authorities. Sound, scientific information is vital for forming your own judgement on the potential health risks of EMFs. Note the frequency of the EMF when comparing the field sources.
- **Communication:** Request information on EMFs from the grid operator.
- **Concerns and risks:** If you are concerned about EMFs, find out as much as you can about them. There is a lot of research and data available, and people's initial concerns are often dispelled once they understand where fields are strong and where they are not.
- **EMF measurements:** Ask the grid operator to perform EMF measurements under existing lines and/or in the homes of local residents in order to explain and compare values.
- **Planning:** Ask the grid operator for information on ways to reduce exposure to EMFs. Ask for public consultation on this matter also, including route planning.

Recommendations to TSOs

- **Potential risks:** Take health-related issues seriously. Provide detailed information on the potential impacts of electromagnetic fields. However, those issues should not be the only ones raised during information events, which are essentially to inform citizens about the corridor planning process.
- **EMF measures:** Enter into dialogue with concerned residents on the issue of EMFs and arrange visits to carry out on-site EMF measurements where applicable. Ask for support from independent experts, such as from universities or research institutes.

Weblinks

For an explanation of electromagnetic fields:
- http://www.who.int/peh-emf/about/WhatisEMF/en/index5.html

For an overview of health effects:
- http://www.who.int/peh-emf/about/WhatisEMF/en/index1.html
- International Commission on Non-Ionizing Radiation Protection: http://www.icnirp.org/
- EMF-Portal RWTH Aachen University: www.emf-portal.de/?l=e
- SAGE (Stakeholder Advisory Group on EMF), a UK group set up in 2004 to consider possible precautionary measures in relation to EMFs: sagedialogue.org.uk/

If disadvantages for relevant stakeholders cannot be fully eliminated, then compensatory legal measures to mitigate the potential adverse effects of power grid extensions should be considered. In general, there are different types of compensatory measures, including:

» **Financial compensation for land, forest or property owners:** Property owners are compensated according to national law when the approving authority obliges them to accept a pylon being built on their property or spanning a line over their property.

» **Compensation for communities:** In some countries, for example in Germany, transmission system operators pay compensation for the construction of new transmission lines on municipal territory. Compensatory measures for communities can also include non-financial measures reducing negative impacts of other local projects.

» **Compensatory measures for environmental impacts:** If environmental impacts cannot be avoided, then compensation must be awarded according to European and national nature conservation legislation. This would be the case if there were significant impacts on Natura 2000 areas, an EU-wide network of protected conservation sites. For example, a grid operator may be obliged to invest in a local re-forestation project or pay for bird protection measures related to other existing overhead power lines.

Compensation as a matter of fairness

It is sometimes challenging to explain the necessity of new power lines as well as their benefits to those potentially affected by the grid extension project. This is particularly true when disadvantages for locals cannot be fully eliminated, for example when the property of residents or landowners is directly affected.

In fact, public objections to a grid extension project might remain in many cases despite efforts to reduce impacts, as some power lines will need to cross private property, particularly in densely populated areas. In such cases, however, compensation should be considered. A good example is the Elia Stevin project: home-owners whose houses will be under the conductors of the new transmission line receive compensation and a purchase offer for their property.

Recommendations for local stakeholders

» **Compensation for municipalities:** If applicable, enquire about the possibility of the TSO paying financial compensation.
» **Compensation for individuals:** Negotiate agreements between property owners and TSOs before the date on which the TSO is obliged to pay compensation, as this has proven to be more successful.
» **Environmental mitigation measures:** Co-operate with the grid operator on the best measures for your area or the affected protection site.

Recommendations for TSOs

» **Compensation for individuals:** Negotiate agreements with land and property owners before the date on which you are obliged to pay compensation.
» **Environmental compensatory measures:** Increase co-operation with municipalities to put in place mitigation measures that will be best for the area and possibly help to achieve local nature conservation goals.

LANDSCAPE AND NATURE

Power grid extension projects, which form part of the energy transition, have impacts on the landscape and the natural environment that can lead to local conflicts. New power lines and new power generating facilities, like wind turbines, change the appearance of familiar landscapes. As a local resident, a tourist or a person who loves a particular landscape, you may feel strongly about your area and thus may oppose a project you feel will negatively impact on the environment, landscape or residential areas. Concerns about impacts on landscapes and nature may add to public pressure that aims to prevent projects going ahead.

Overhead lines: danger to birds

Power lines do not only change the landscape, they also have impacts on the environment. For birds there is a risk of collision with power lines, especially for species such as migratory or nocturnal birds. The collision risk is highest for the high-hanging lines, called 'earth wires'. Those earth wires, used for lightning conduction, are thin and least visible. One way to deal with this problem (among other options such as alternative routing or partial undergrounding) is to apply markers attached to the earth wires so as to increase the visibility of the power lines and reduce the risk of collision. Some grid operators are already making use of bird protection markers in particularly sensitive areas.

Early environmental assessment

Environmental impact assessment plays an important role in the planning procedure. The EU Environmental Impact Assessment Directive and nature conservation directives determine common, high environmental standards that are applied in grid development. There is considerable scope for advancing good practice in complying with these regulations and in other areas of nature protection and enhancement. These have been explored through the BESTGRID project, and recommendations are provided in Part 2 of this handbook, Protecting Wildlife and Nature in Power Grid Planning, published by BirdLife Europe (www.bestgrid.eu).

Cope with a changing landscape

Grid operators often struggle with addressing the interests and heightened emotions of concerned residents during the corridor planning process. They have to take account of various legitimate and legally protected goods and interests, including property law, nature and conservation regulation, and emission control legislation. Landscape protection is, in some countries, part of nature conservation law, but in general, does not sufficiently protect the legitimate interests of stakeholders such as tourist associations and local residents. As a result, little or no attention is paid to their concerns about protecting their surrounding landscapes during the formal planning procedure. Similarly, no regulation has been enacted to require that power lines be built far from residential areas. Any such attempt, however, might prove challenging given that within such a legal framework no new power line could be built in densely populated countries, eg, Belgium.

Better planning options

There are, however, planning tools at hand, including technical, forestry and design options, that power grid planners might apply to minimise the impacts of transmission lines on landscape and residential areas. One is partial undergrounding, which – if economically, environmentally, technically and legally feasible – may in some cases boost public acceptance of new power lines. Another design option is bundling power lines with different voltages and merging them into an integrated pylon, which would reduce the number of power lines used for transmitting electricity. While an integrated pylon system might be subject to approval by the national authority, this option would serve the usually widely varying interests of tourist associations, bird protectionists and landscape conservationists. Another option would be to use new design options for power pylons to meet the needs of regional tourism, bird protection or landscape preservation. Furthermore, the visibility of new power lines could be reduced by forestation, thus reducing local discomfort with grid extension.

T-pylon / Photo: National Grid

Recommendations for local stakeholders

- **Reduce impact:** Get involved in the informal and/or formal planning procedure and help identify the most convenient corridor and route alternative.
- **Bundling power lines:** Enquire about the possibility and feasibility of merging old and new or high and extra-high voltage power lines into an integrated pylon system in order to lessen the negative visual impact of grid expansion projects.
- **Partial undergrounding:** Ask about the possibility and feasibility of partial undergrounding in your area and discuss technology options with grid operators and authorities.
- **Design and visual impacts:** Enquire about the possibility of forestation measures and discuss pylon design options with grid operators and authorities.

Recommendations for TSOs

- » **Bundling power lines:** Look into the possibility of merging old and new or high and extra-high voltage power lines into an integrated pylon system in order to reduce the negative visual impact of grid expansion projects.
- » **Technology:** If technically, economically, environmentally and legally feasible, use (partial) underground technology where necessary to reduce visual and environmental impacts.
- » **Design and visual impacts:** Investigate whether, and how, new pylon design options could be used in future projects.
- » **3D visualisation:** Check how 3D visualisation tools could improve the planning and help stakeholders to get a cleared idea of the project.

[1] Bundesnetzagentur (2015) Mitreden beim Stromnetzausbau. www.netzausbau.de/SharedDocs/Downloads/DE/2015/FAQ-Konsultation.pdf?__blob=publicationFile

[2] The list is not exhaustive; note that national planning legislation may differ significantly.

[3] See detailed description of the presented five-step approach: Rottmann, Katja (2012) Recommendations on Transparency and Public Participation in the Context of Electricity Transmission Lines

[4] Arnstein, Sherry R, 'A Ladder of Citizen Participation', JAIP, Vol. 35, No. 4, July 1969, pp 216-224, or: www.lithgow-schmidt.dk/sherry-arnstein/ladder-of-citizen-participation.html; Rau, Irina/Schweizer-Ries, Petra/Hildebrand, Jan (2012) 'Participation Strategies: the Silver Bullet for Public Acceptance?' In: Kabisch, S et al: Vulnerability, Risk and Complexity: Impacts of Global Change on Human Habitats, Leipzig, pp 177-192.

[5] Ibid.

[6] According to Regulation (EU) 347/2013, Projects of Common Interest (PCIs) are European electricity projects that have significant benefits for at least two European member states. They should contribute to market integration and further competition, enhance security of supply and reduce CO2 emissions. To be recognised as a PCI, projects must be included in the preceding TYNDP developed by the European Network of Transmission System Operators (ENTSO-E). However; the assessment process to include a project in the PCI list is the responsibility of the European Commission. The PCIs benefit from faster and more efficient permit-granting procedures, improved regulatory treatment and possible access to financial support. For more information and a PCI list, go to: http://ec.europa.eu/energy/infrastructure/pci/pci_en.html

[7] Roland Berger (2011) Permitting procedures for energy infrastructure projects in the EU: evaluation and legal recommendations,

[8] On the level of spatial planning, environmental impacts are assessed within a 'strategic environmental assessment' (SEA).

[9] On the level of route planning, environmental impacts are assessed by an 'environmental impacts assessment' (EIA) following national law.

[10] More information on the assessment of environmental impacts during the different stages of the planning procedure is provided in Part 2 of this handbook: "Protecting Wildlife and Nature in Power Grid Planning. Recommendations from the BESTGRID Project" published by the BESTGRID partner Royal Society for Bird Protection RSPB (www.birdlife.eu).

[11] Further information on the options for participation within formal and informal planning procedures in European, German and UK legislation can be found in Harrison K, Verheyen R (2015) Opportunities and Restrictions for Public Participation in European Transmission Grid Projects (www.germanwatch.org).

[12] www.hamelner-erklaerung.de

[13] Project no. 11 as part of German law defining the need for transmission grid projects: Bundesbedarfsplangesetz (BBPlG)

[14] German Grid Expansion Acceleration Act (NABEG)

[15] Project information and timeline: http://www.nemo-link.com/timeline/

[16] www.bestgrid.eu

[17] The Renewables Grid Initiative (RGI) provides a 'Good Practice of the Year Award', which you might apply for: http://renewables-grid.eu/activities/good-practice-of-the-year-award.html

[18] See part 2 of this handbook: "Protecting Wildlife and Nature in Power Grid Planning. Recommendations from the BESTGRID Project" published by the BESTGRID partner Royal Society for Bird Protection RSPB (www.birdlife.eu).

[19] See http://www.icnirp.org/cms/upload/publications/ICNIRPFactSheetLF.pdf

[20] For more information, visit www.who.int/peh-emf/about/WhatisEMF/en/index1.html

[21] www.who.int/peh-emf/about/WhatisEMF/en/index5.html

BESTGRID pilot projects at a glance

UK/Belgium NemoLink project, AC cable from 400kV Richborough substation in south-east England to DC converter station on the coast, DC undersea cable between DC converter stations on English and Belgian coasts, length: ~ 120km, AC cable from DC converter station on the Belgian coast to Zeebrugge substation (National Grid NemoLink and Elia). Expected start of operation: 2018

Belgium Stevin project, 380kV AC line/cable, length: 47km, out of which 12km new overhead line, 10km underground cable, 25km upgrade of existing 220kV line (TSO Elia). Expected start of operation: 2017

Belgium 150kV AC underground cable project Waterloo-Braine-l'Alleud in a densely populated area near Brussels (TSO Elia); length: 5km. Project put on hold in 2014

Germany SuedLink project, a 500kV DC transmission line from northern to southern Germany (TSOs TenneT and Transnet BW), length: 600/800km. Expected start of operation: 2022

Germany Project Bertikow-Pasewalk, upgrade of an existing 220kV line by a new 380kV overhead power line in north-east Germany (TSO 50Hertz Transmission), length: 30km. Expected start of operation: 2017

Italy Test of communication tools for sharing good practice (TSO Terna)

BEST GRID

GERMANWATCH