Protecting Nature in Power Grid Planning

Recommendations from the BESTGRID Project

Handbook – Part 2

BEST GRID

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EUROPE AND CENTRAL ASIA

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For Part 1 of this handbook, on Public Participation and Transparency in Power Grid Planning, visit http://www.bestgrid.eu

This handbook is for anyone who would like to help ensure transmission grid development contributes to protecting wildlife and nature, and to sustainable development of our energy systems. It shows how grid development and nature protection interests can work together to achieve common goals for society.

The BESTGRID project has been hugely valuable for the non-governmental organisations (NGOs) involved. It has provided an opportunity to work with electricity transmission system operator (TSO) partners to help develop and test better practices and to increase understanding of each other's perspectives and the challenges we face.

When working with grid operators, it rapidly becomes clear that the natural environment is a key consideration in the way projects are approached, in terms of route and technology choices and in efforts to engage with local stakeholders.

Many grid operators express support for environmental protection policies, such as the creation of protected areas for wildlife. These help to identify sensitive routes and thus avoid unnecessary harm to nature. Minimising legal objections or public protests based on legitimate environmental concerns is also an important consideration for TSOs: these objections, if not avoided, may add arguments and voices to local opposition regarding the impact on landscapes and residential areas.

BESTGRID and its partners have taken a broad view on what kinds of 'better practices' to test, but the approach is one informed by a vision and broad understanding of what more sustainable and acceptable development involves. The project partners all recognise and support the role of power networks in enabling clean renewable energy. They also see the urgency with which some developments are needed to prevent inadequate grid infrastructure becoming a serious bottleneck, holding back transition to new energy systems. But the climate change challenge is not where 'the environment' or sustainability stops. BESTGRID puts affected people and nature centre stage as a way to increase sustainability and acceptability, showing ways to improve projects, build support and enable swifter delivery.

Grid operators and conservation stakeholders, such as environmental NGOs and authorities, face great challenges in getting the interests of nature protection heard before commitments are difficult to reverse. BESTGRID provides one solution, where NGOs have been invited to help develop project plans that do more to engage with environmental stakeholders. We also need better awareness and implementation of nature protection legislation and for its objectives to be embedded across energy policy and planning at all levels. To make grid development as a whole really sustainable, there is a long way to go to ensure all investments really are positive for both the climate and for today's nature and wildlife.

This handbook builds on lessons from the BESTGRID project and on BirdLife's experiences engaging with grid policy and projects to suggest ways that nature conservation interests and environmental NGOs can get involved. By engaging early and working together with governments and industry on solutions, nature conservationists and supporters can help enable grid development to become really sustainable. This can be done from the highest levels of policy, down to decisions on details such as the design and location of 'diverters' that help birds avoid colliding with power lines.

This Handbook suggests constructive ways in which NGOs and their supporters can contribute and ways in which TSOs and policy makers can work with environmentalists to achieve sustainable development in power transmission.

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LIST OF ABBREVIATIONS

AC	Alternating current
BBL	Bond Beter Leefmilieu (a Belgian NGO umbrella group)
DC	Direct current
DOPPS	BirdLife's Partner in Slovenia
EIA	Environmental impact assessment (of projects)
ENTSO-E	European Network of Transmission System Operators for Electricity
EU	European Union
GIS	Geographical information system
GW	Gigawatt
HVDC	High voltage direct current
kV	Kilovolts
LOD	Lithuanian Ornithological Society (BirdLife in Lithuania)
NABU	Nature and Biodiversity Conservation Union (BirdLife in Germany)
Natura 2000	A Europe-wide network of areas protected under the EU Birds and Habitats Directives
NGO	Non-governmental organisation (used here to refer to NGOs with an environmental/nature conservation remit)
PCI	'Project of common interest', designated as a priority under EU legislation
RSPB	The Royal Society for the Protection of Birds (BirdLife in the UK)
SAC	Special area of conservation designated under the EU Habitats Directive
SEA	Strategic environmental assessment (of plans and programmes)
SOR	Romanian Ornithological Society (BirdLife in Romania)
SPA	Special protection area for birds designated under the EU Birds Directive
TSO	Electricity transmission system operator
TYNDP	Ten Year Network Development Plan
WWF	World Wide Fund for Nature

1. WHY IS SUSTAINABLE GRID DEVELOPMENT A NATURE CONSERVATION ISSUE? AND VICE VERSA?

Protecting nature is the main objective for nature conservation NGOs and many environmental groups. It is also an important objective for grid developers and a routine part of their work in planning power line developments. The BESTGRID project recognised these common interests, objectives and expertise and brought together environmental NGO experts and grid operators to explore better practices in sustainable development of our energy systems.

Europe's biodiversity is already in decline because of (i) habitat loss and fragmentation, (ii) unsustainable land use and (iii) the impacts of invasive non-native species. Climate change has been described as a fourth ecological 'horseman of the apocalypse'. There is a risk we will see dangerous levels of global warming this century, which would drive a significant proportion of species to extinction.

This growing risk of climate change to biodiversity, and is implications, are discussed in Section 2 of this report below. Section 3 covers habitat modifications associated with transmission lines, and with their construction, principally in forested areas. Section 4 focuses on bird protection, which is an important consideration in the routing of new power lines. Discussion of stakeholder engagement and grid planning procedures, such as environmental assessments, are integrated into Sections 3 and 4 using boxed case studies.

1.1 Sustainable grid development

Environmentalists are deeply concerned about climate change. They are aware of the huge challenges it poses and of the need to develop further energy infrastructure to make sure renewables can play their part in solving the problem. At the same time, they are also deeply concerned about biodiversity, which is in an alarming state in the European Union (EU) and globally.

Overhead power lines can be a significant risk for some bird species and may result in habitat changes in power line corridors, particularly in forested areas. This sometimes leads to opposition by environmentalists to overhead power lines. This adds to (almost inevitable) local opposition based on possible health impacts, negative effects on the appearance and character of the landscape or residential areas and related effects on property values. In some cases, the likely ecological effects of power line proposals have resulted in legal action by environmentalists, leading to long and protracted procedures, with high costs for both sides.

So grid development is clearly a nature conservation issue for reasons relating to local impacts and also because of wider, systemic concerns such as resource use and climate change. Grid developers care about nature and the risks of climate change too, and are legally required to factor these concerns into their decision making. Engaging with stakeholders and avoiding unnecessary local impacts in order to avoid late objections and protests is an important consideration. So clearly nature conservation is also a grid development issue.

It is therefore important that we find the best solutions for sustainable grid developments (Box 1) that contribute to tackling climate change in harmony with nature. The bigger picture, of truly sustainable grid development, urgently needs to become embedded in the way the industry develops and environmental stakeholders engage.

1.2 Implications for TSOs and NGOs

Climate change threatens to become a major cause of extinction of wild plants and animals (see Section 2 below). This means conservation organisations and their supporters increasingly have to factor climate change into their thinking and to understand what they can do to benefit nature when getting involved in debates about infrastructure development.

The best solution for nature in the short term (e.g. putting all new power lines underground) might make tackling climate change impossible in economic terms, doing much greater harm to nature in coming decades. Conversely, a solution that fights climate change might be a disaster for nature, if it unnecessarily damages a very rare habitat or adds to extinction risk for an endangered species.

Resisting the most damaging projects is a legitimate aim for conservation organisations and their supporters. Yet the scale of investments needed for energy transition means environmental NGOs will never have the resources to protect nature by reacting to developments individually at a late stage. If it is not well considered, the conflict such a stance entails may be in no-one's interest. It potentially adds to delays in tackling climate change and to the perception that environmentalists (and environmental protection laws) are obstructive and out of touch with social needs.

However, there is a lot that people who love nature can do to help ensure projects are selected and planned in a better way and that the overall benefit for nature and the environment is positive. This Handbook illustrates how proactive approaches can be developed through engagement with TSOs, for example in joint projects and in grid planning procedures. This can help to resolve the apparent tension between grid development and nature protection, by helping to avoid problems and delays from the outset.

In BESTGRID the emphasis is on earlier and more constructive engagement between environmental NGOs and grid operators at the planning stage. This Handbook draws on experiences and wider lessons to suggest what more can be done to make grid planning work for climate *and* nature and to build public support for well-planned grid development. BESTGRID shows NGOs and TSOs are ready to learn, share knowledge and work together to improve projects. They're also ready to understand the multiple interests and stakeholder groups that grid planning has to serve (Box 2). BESTGRID also shows that it is possible to go beyond legal requirements and standard practice and even to make grids beneficial for nature.

1. SUSTAINABLE DEVELOPMENT?

'Sustainable development' is clearly a reasonable aspiration, so it is an uncontroversial objective. However, differences arise among stakeholders about what the term means, or should mean, when applied in a specific sector. Sustainable grid development cannot be discussed without thinking about wider energy system development and related policies.

Environmental goals, such as dealing with 'acid rain', air pollution and the depletion of finite fossil fuel resources, have long been part of the energy policy 'trilemma' – the triple challenge of maintaining affordable, secure and environmentally acceptable energy supply. In recent years, however, the 'environmental' (or 'sustainability') element has, in practice, been limited to climate change considerations, rather than considering a wider set of environmental protection issues, such as resource use and preventing further loss of global biodiversity.

Moreover, 'sustainable development' in the eyes of many energy specialists is a process leading to investments that contribute, *on balance*, to social, economic and environmental goals. It is all too easy to go from this to saying energy development is *already* sustainable or that specific policies or investments that are a disaster in climate or nature protection terms are 'sustainable' *on balance*, because the economic and social gains are so great.

Environmental NGOs fear the impact climate change could have on society and nature and also want cuts in greenhouse gas emissions to be at the heart of all energy policy and planning. However, there are perhaps three major differences in how these NGOs would see the challenge of sustainable energy development.

Firstly, NGOs take a less positive view of how close to 'sustainable development' we already are. Climate and energy targets are commonplace, but real and robust national goals and plans to develop clean energy systems (such as Germany's plans to phase out nuclear power and develop renewables) remain the exception. Political and financial support for continued fossil energy extraction and use creates inertia that is holding back energy transitions across Europe and the world.

In the absence of credible long-term plans for decarbonisation, confidence that support for investments in fossil energy supplies and related infrastructure can be 'sustainable' is heavily undermined. Further, global biodiversity continues to be in crisis and decline, despite global agreements and targets. The EU has a target to halt its loss of biodiversity by 2020, having failed to meet a similar target by 2010. In 2015, mostly due to human activity, 17% of birds, 39% of freshwater fish and 22% of amphibians in the EU are threatened with extinction, according to BirdLife's mid-term assessment of progress towards the EU's 2020 target[1]. Species extinctions are set to accelerate dramatically due to climate change if deep cuts in emissions are not achieved in coming decades.

Secondly, environmental NGOs see sustainable development as a necessary correction to 'unsustainable' development driven solely by economic and social considerations, at the expense of the environment and the world's poorest. This was how sustainable development was defined by the Brundtland Commission[2] way back in 1987, when the term came into wide use. In this view, the challenge is not to 'balance' the three objectives in the energy trilemma, but to make sure the environment and social needs are brought more fully into the heart of decision making so that development *becomes* sustainable.

Thirdly, most environmentalists are concerned not just about climate impacts in future, but also about conserving and enhancing the natural environments we have today. This is needed to stop further loss of biodiversity. In addition to other important services nature provides to society, such as enabling food production, healthy ecosystems are also an important part of the solution to climate risks. Soils, forests and oceans in good condition lock up carbon and nature-rich areas are needed as refuges to enable species to adapt to warming conditions.

That means we have to think not just about how energy policies affect greenhouse gas emissions, but also how the resulting investments might impact on nature. Promoting renewable power, and the grid infrastructure it needs, clearly adds to sustainability in that it helps cut greenhouse gas emissions. It can also help to conserve finite resources and to reduce the health impacts of air pollution.

However, promoting the *right kinds* of renewables and grid development in safe locations (from a biodiversity perspective) does even more to help bring the environment into the heart of energy decision making, making grid development more sustainable.

2. BIRDLIFE PARTNERS WORKSHOPS AND ROUNDTABLES ON GRID DEVELOPMENT

BirdLife International is a global partnership of national bird and nature conservation NGOs, each with its own membership base. In Europe, BirdLife has a Partner NGO in every EU member state, with a collective membership of more than 2 million people and more than 4,100 wildlife sites. In addition to its direct conservation work, the partnership undertakes world class scientific research and works with industries and governments to help protect and enhance the natural environment.

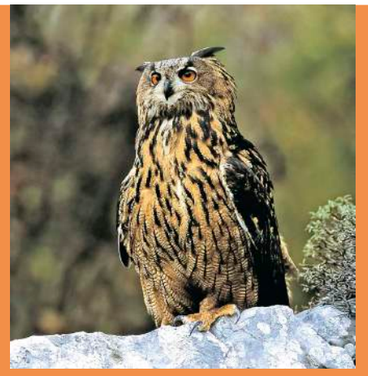
In the BESTGRID project BirdLife Europe's Partners organised a series of roundtables on grid development and nature, bringing together grid operators, NGOs and government officials responsible for energy and the environment. These provided forums to share knowledge and experiences and to identify opportunities to work together for common aims. The roundtables were held in Lithuania, Romania and Slovenia. Each explored practices that should help planning and delivery of power lines, in particular EU priority projects, while protecting nature and improving public support. The Romania workshop is described further below in Box 7.

The Lithuanian Ornithological Society (LOD - BirdLife in Lithuania), organised a roundtable in Vilnius in April 2015, with a focus on how the 'LitPol' power interconnector with Poland was planned. This project has been identified as a priority for the European Union. As an EU 'project of common interest' (PCI), EU funds are available for studies and permitting is 'streamlined' to meet time limits.

The roundtable was a valuable opportunity to bring together first hand experiences from work in both Poland and in Lithuania and experts from both industry and NGOs. Independent wildlife experts and NGOs were directly involved in environmental assessments on both sides of the border, for example providing data on wildlife and advising on routing options and mitigation measures.

These experts were satisfied that the proposed project has been well planned to serve society's needs without unnecessary impacts on nature, despite considerable challenges. Nevertheless, the project faced public opposition on both sides of the border. Attempts to delay or stop the project, while not apparently motivated by concern for nature, have included legal claims that the developers failed to follow rules on the assessment of impacts on wildlife. Grid projects very often attract public opposition and action groups will often take legal action to try to delay or stop projects, including by using laws that aim to protect nature. The issues were debated at length in the roundtable, with many expressing doubts that stopping the project, or re-doing environmental assessments, would really benefit nature or the people of Poland and Lithuania.

DOPPS (BirdLife Slovenia) organised a roundtable in May 2015. Slovenia is heavily forested and has very rich biodiversity including bears and eagle owls. Because of the European importance of its wildlife, it has many Natura 2000 sites. This rich natural heritage is a great asset to be proud of, but it undoubtedly adds to the challenges of environmentally sensitive grid development. These challenges were explained by representatives of the Ministry of Environment and Spatial Planning and by the national transmission system operator (TSO), ELES, which hosted the roundtable. NGOs and independent wildlife experts provided detailed advice on bird



Eagle owls breed in Slovenia's forests

protection issues and related these to specific projects in Slovenia. The roundtable prompted all parties to consider the others' perspectives and priorities and created a strong basis for further dialogue and cooperation.

In addition to the three national roundtables, BirdLife Europe organised two workshops, principally for NGOs, to consider how we engage with grid planning. The first, in the UK in May 2015, brought together 12 national BirdLife Partner NGOs and representatives of National Grid from the UK and Elia from Belgium. Experiences and lessons from the BESTGRID project and beyond were shared, for example highlighting the importance of early engagement in planning by environmental stakeholders. A representative of BirdLife International, which works around the world, attended the workshop. She has already been applying lessons on the value of joint project working and early engagement in plans and projects in her work with BirdLife's Partners in Africa, the Middle East and the Mediterranean.

A final workshop, in Brussels in June 2015, brought together representatives of European NGOs, such as the umbrella organisations European Environmental Bureau and Climate Action Network Europe. Here the focus was on ways in which NGOs can do more to make grid development help tackle climate change and to protect nature. Ideas for initiatives were developed for working with industry, influencing policies and supporting other NGOs to work in this area.

QUESTIONS FOR NATURE CONSERVATIONISTS AND SUPPORTERS

Local wildlife matters and it needs protection! But is it possible to do more about immediate pressures and also about the longer term?

What does the need for action on climate change imply for grid development?

- Can everyone afford to generate all his or her own electricity? Would you be happy with an unreliable electricity supply at home or work?
- What does this mean for how you and your organisation engage with grid development?
- Is it possible to identify and support grid development that is positive for nature and climate protection?

RECOMMENDATIONS FOR TSOs AND ENVIRONMENTAL AUTHORITIES

Many concerned citizens look to environmental NGOs for guidance about the acceptability of local infrastructure plans. Environmental and conservation NGOs are very concerned about climate change. Increasingly they can see the consequent need for grid development if it clearly helps the growth of renewable energy and impacts on the environment are avoided and minimised.

Explain the climate rationale for projects honestly and clearly.

- Take time to understand NGOs' concerns, to communicate with them and engage them in constructive ways.
- Contact the Renewables Grid Initiative for ideas about collaboration with environmental NGOs 'upstream' in the planning process and about better practices in stakeholder engagement and nature protection.

WEBLINKS

NGO statements on the need for grid development

- The European Grid Declaration, signed by 15 NGOs and 9 TSOs, supports environmentally sensitive grid development for renewables:
  http://renewables-grid.eu/documents/eu-grid-declaration.html
- BirdLife Europe's recommendations on developing priority power lines in the EU:
  http://www.birdlife.org/sites/default/files/attachments/20141007_EnergyInfrastructure_report.pdf
- Greenpeace's analysis of the need for renewable energy and grid development in Europe:
  http://www.greenpeace.org/international/en/campaigns/climate-change/energyrevolution
  http://www.greenpeace.org.uk/media/reports/power-2030-european-grid-3/4-renewable-energy-2030
- Joint action by WWF, Deutsche Umwelthilfe and Germanwatch:
  http://www.wwf.de/2014/februar/ohne-neue-stromtrassen-scheitert-die-energiewende (*in German*)
- Deutsche Umwelthilfe's "Plan N" for sustainable grid development in Germany:
  http://www.duh.de/uploads/media/PLAN_N_2-0_Gesamtansicht_01.pdf (*in German*)

Good practice guidance for grid developers

- For Part 1 of this Handbook, on public participation and transparency in grid planning, by BESTGRID Partner Germanwatch:
  http://www.bestgrid.eu/uploads/media/D8.2_Guidelines__22Public_Participation_and_Transparency_22.pdf
- For lessons on good practice in grid planning from across Europe:
  http://renewables-grid.eu/documents/eu-grid-report.html
- For a better understanding of stakeholders groups and their priorities, see the EU Grid communication toolkit:
  https://webgate.ec.europa.eu/multisite/gridcommunicationstoolkit/en

2. CLIMATE RISKS TO NATURE AND THE ROLE OF POWER NETWORKS

2.1 What are the issues?

Climate change is already affecting wildlife. Many species are moving towards the poles and to higher altitudes as global temperatures increase. Biodiversity is being affected by the earlier arrival of spring, by unseasonal weather events and by the knock-on effects through food webs.

A few species may stand to gain as their 'climatic envelope' or 'thermal range' increases and where they are able to exploit new areas of suitable habitat. However, far more species will find that areas of their current habitats can no longer support them and that alternative habitats are more restricted, unavailable or in too poor ecological condition to support them, leading to population declines and even increased risk of extinction.

Increasing evidence suggests that some species are already failing to adapt to climate change. For example, recent research[3] has found that bumblebees in the northern hemisphere are dying out at the southern edges of their ranges, with some species retreating by as much as 300km northwards since 1974. At the same time, they are failing to colonise areas further north. The crops and wild plants that bumblebees pollinate will likely suffer where these species are lost.

Other studies show that the rate of change of species movement is already lagging behind that of climate. A synthesis report on 'the accelerating extinction risk from climate change' published in *Science* in 2015[4] found that 5.2% of all species face extinction risk with 2ºC warming, 8.5% with 3ºC and 16% under a 'business as usual' warming scenario of 4.3ºC. Endemic species with smaller ranges and certain taxa, such as invertebrates, amphibians and reptiles, are predicted to face the greatest extinction risk.

This study also emphasises that other species that are not threatened directly by extinction could experience substantial changes in population and distribution and how they interact with other species. This in turn would affect ecosystems and the services they provide to society, such as enabling food production.

A Climatic Atlas of European Breeding Birds[5], published by the Cambridge and Durham Universities and the Royal Society for the Protection of Birds (RSPB), found that under a 3ºC warming scenario there is an overall average shift in the suitable climate conditions for Europe's breeding birds of some 550km to the north-east. The extent of suitable climate conditions reduces in size by 20%. For some species there is no overlap between the current and future breeding areas under this scenario. For a few species, no future potential range remains in Europe.

These stark projections underline the need for deep cuts in greenhouse gas emissions to keep warming to below 2ºC. For this to be possible, global emissions need to peak by 2020 and then be reduced by at least 50% by mid-century. Renewable energy is central to the solution, supported by energy saving, to limit overall infrastructure needs. Given the high cost, risks and technical challenges of the other low carbon electricity options, renewable energy can be expected to have a very large role to play, requiring massive investment. See Part 1 of this Handbook for an explanation of why transmission grid development is an essential precondition for this shift to a sustainable energy system, alongside energy saving through smart demand management, building-scale renewables and greater energy efficiency.

The vulnerability of nature to climate change also underlines the need to do more to protect the species and habitats we have today. To be able to adapt to warming conditions, wildlife populations need to be strong and healthy. We need to assist the relocation of animals and plants by increasing ecological connectivity across landscapes and, in some cases, by physically relocating species. Our existing protected areas need to be in good condition with healthy wildlife populations in order to (i) produce dispersing individuals to colonise new areas (ii) provide conditions to welcome new arrivals and (iii) retain species at southern limit of their ranges.

Seabirds are particularly sensitive to climate change

Renewables are needed to protect nature from climate change

Healthy ecosystems are also needed for climate change mitigation, with soils, wetlands, forests and oceans locking up vast reserves of carbon. Where habitats, such as forests and peat lands, are lost or degraded they release their carbon, adding further to climate change and the risks it brings to both natural and human communities.

2.2 How are the issues factored into decision making?

The European Union recognises the huge threat climate change represents and has committed to reducing its emissions by at least 80% by 2050. This is reflected in EU and national targets for the use of renewable energy and for energy saving. The German Government's plan, for example, is for renewable energy to meet at least 80 per cent of the country's electricity demand by 2050. In the UK, the government's advisory Committee on Climate Change says a fully decarbonised electricity system is needed by 2030.

In order to predict the national and international need for new transmission power lines, grid planners develop scenarios about future electricity demand and supply. These scenarios are used to identify future bottlenecks in electricity transmission and to estimate the future economic costs and benefits of grid developments to deal with them. In Germany, again, renewables capacity is being developed primarily in the north, whereas large consumer centres are situated in the south of Germany.

The gap between the electricity supply and demand will continue to widen if further nuclear power stations in Bavaria and Baden-Württemberg are phased out. This north-south gap may endanger supply security in Germany if the necessary infrastructure is not provided in time, unless energy is imported from elsewhere (which would likely be more expensive and less 'green'). According to Germany's *Grid Development Plan 2013*[6], a total of 3,600km of new transmission lines must be built over the next ten years. This includes the SuedLink project (see Box 5), which is one of the projects in the Plan which must be built under a law passed in 2013.

However, this kind of legally binding requirement to develop particular transmission capacity is the exception rather than the rule in Europe. Future electricity supply and demand usually has to be estimated, since firm EU and national commitments are not in place over the relevant time horizon for long-lived investments like transmission lines. Many nations, such as the UK, do not develop binding national energy or grid plans, preferring to leave detailed investment decisions to industry. For modelling future energy system development, typically three or four scenarios will be developed and then examined when deciding on the need for grid development and assessing the economic case for specific investments. See Part 1 of this Handbook for more detail on how the need for grid development is assessed at EU and national levels.

Predicting future electricity demand and supply is inevitably uncertain where renewable energy and wider energy system development plans are non-binding, i.e. they do not require any particular investments. The European Network of Transmission System Operators (ENTSO-E) develops EU-wide grid plans under a Ten Year Network Development Plan[7] (TYNDP). This is developed based on scenarios, most of which fail to meet EU climate and energy goals, and is itself non-binding.

The highest priority power lines for the EU, 'projects of common interest' (PCIs), are selected from the TYNDP. PCIs[8] benefit from 'streamlined' permitting and environmental assessment procedures and access to additional EU funds. However, PCI status does not make a project into a binding commitment. Under current procedures it is not possible for independent stakeholders to verify that the PCIs selected are really the most necessary ones to meet Europe's needs, nor is there any mechanism to ensure newly identified transmission bottlenecks are addressed by the PCI selection process.

Where key elements of future energy system development are uncertain, such as the future share of renewable electricity and level of energy saving, grid operators cannot assume that climate and energy targets will be achieved. In fulfilling their duty to maintain secure electricity supplies they have to also consider scenarios in which greenhouse gas emissions and use of renewables are not on track to avoiding dangerous levels of global warming. However, by making these targets just one consideration and while also planning for scenarios in which they are *not* achieved, they may also be seen as 'planning for failure', risking a continuation of our unsustainable energy systems.

2.3 What more can TSOs and environmental stakeholders do?

2.3.1 Plan and build what's needed for the energy transition

Long range national-level energy system planning and the selection and promotion of transmission projects should no longer 'plan for failure' in tackling the threat of climate change. Where credible plans for decarbonising energy systems are not in place, grid operators are required to maintain energy security in the face of uncertain future demand and supply. TSOs are legally required to accommodate whatever electricity supplies become available. This does not, however, mean that TSOs cannot express opinions and preferences about energy scenarios and system development.

Renewable electricity supply in Europe took off in countries like Germany and Denmark in the 1990s and then across the EU in the last six years as a result of the introduction of nationally binding targets in the 2009 Renewable Energy Directive. Before this many energy experts considered that transmission systems would not be able to maintain reliable supplies with more than a very small share of variable (weather dependent) renewables on the system. This pessimism has proven unfounded, but it undoubtedly made national governments more cautious about the prospects for switching to high shares of wind and solar power for a long time.

Now that wind and solar are widely used - on some days providing more than half of the electricity generated in nations such as Germany, Spain and Denmark - grid operators have found these supplies may be variable but not unpredictable and that they can in fact integrate large shares into their systems reliably. With additional efforts to make grids smarter, technical challenges to renewables integration will be reduced further. This, coupled with the need for more investment, security and certainty in long term planning, has led some TSOs, such as those involved in BESTGRID, to actively support a strong shift to a renewables-based future.

By expressing confidence in renewables and the grid's ability to evolve, TSOs send a strong signal to decision makers that tackling climate change does not have to entail risks to energy security. The next step is to ensure the scenarios upon which grid planning is based all assume that the EU and its member states will take the necessary steps to develop renewables and manage demand so that emissions fall.

RECOMMENDATIONS FOR NATURE CONSERVATIONISTS AND SUPPORTERS

- Join a campaign for ambitious climate and energy targets in your country and for these to be built into a credible long-term plan for the future of the energy system.
- Find out when the next round of national grid scenario building and planning will begin in your country: contact your TSO and ask to be alerted and consulted.

RECOMMENDATIONS FOR TSOs AND ENVIRONMENTAL AUTHORITIES

- Plan grid development at EU and national levels based on the assumption we will not fail to tackle climate change.
- Being non-discriminatory with regard to generation sources does not mean TSOs have to be neutral about climate change and the energy system development needed to tackle it.
- TSOs are influential: for the sake of future generations and the natural world, dare to take a position supporting the transition to renewable energy. Clear targets for renewables reduce investment risks and help to explain the need for grid development. Enabling renewables development improves support for grid development with many stakeholders.

WEBLINKS

- A synthesis of research on the extinction risks created by climate change: http://www.sciencemag.org/content/348/6234/571.full
- Research on the contracting range of bumblebees: http://www.sciencemag.org/content/349/6244/177.abstract
- The scientific consensus on the likely impacts of climate change from the Intergovernmental Panel on Climate Change: https://ipcc-wg2.gov/AR5/report/full-report
- Grid planning links – see Part 1 of this Handbook: http://www.bestgrid.eu/uploads/media/D8.2_Guidelines__22Public_Participation_and_Transparency_22.pdf

3. HABITAT MODIFICATION

In this Section the main focus is on measures to enhance, or avoid damaging, biodiversity in new and existing power line corridors in forests. Wetlands are also considered. In these areas both underground and overhead cables may present significant challenges from a nature conservation perspective, leaving alternative routing as the most acceptable solution. The lessons are also relevant in other habitat types, such as peat lands, which may be particularly susceptible to damage and/or may present opportunities for restoration and ecological enhancement.

3.1 What are the issues?

Traditionally, tall trees have not been allowed to grow underneath or close to overhead power lines, with a c. 50-70m wide area normally kept clear beneath transmission lines. This swathe of land is logged and then kept without tall trees through repeated clearance using heavy machinery.

This is clearly undesirable in forested areas that have high biodiversity value, such as ancient woodlands. It may be possible in such forests to build higher pylons to prevent the need to manage the vegetation below, but risks to birds may remain. If forests with high biodiversity value cannot be avoided, this may be a better option than undergrounding, which requires extensive vegetation clearance to prevent tree roots damaging the cabling (Box 3).

However, in many parts of Europe dense non-native plantations of little natural value have been created. The lack of diversity in vegetation and habitat types in such forests can make them like deserts for plants, insects, birds and other wildlife, perhaps with small, but poorly connected oases of biodiversity. Existing and new power line routes through this kind of forest may provide opportunities to create improved habitats for wildlife.

3.2 How are the issues factored into decision making?

When new transmission lines are developed, forested areas and wetlands are among the land use types that have to be considered in terms of the constraints or opportunities they may offer. Sophisticated geographical information system (GIS) land use mapping systems are sometimes used to classify all parcels of land according to their suitability for grid development. They also help identify routes with the lowest social and environmental impacts. See Box 4 for an example of a system of this kind used by the Italian TSO, Terna. The challenges of finding an acceptable route for a new power line are addressed in more detail in Part 1 of this Handbook and in the discussion of bird protection in Section 4 below.

3.3 What more can TSOs and environmental stakeholders do?

When considering options for new power line routes it is important to avoid causing fragmentation of high nature value forests. However, there may be opportunities to create more diverse and better-connected habitats for wildlife in some forested areas. This approach should be informed by ecologists with a deep understanding of the opportunities and risks for species and habitats in the area concerned. Where existing lines pass through forests, local ecologists can also help advise on how to manage land beneath the lines in ways that benefit nature.

3.3.1 Understand risks and opportunities for nature in forests

Where power lines are planned that may cross forests with low nature value, there is great value in understanding how routing can benefit nature by creating more forest edge habitats and open habitat that can be colonised by flora and fauna. Power line corridors managed in this way can also help connect any pockets of higher biodiversity value, such as protected areas or nature reserves. See Box 5 for an example of a study undertaken by the Lower Saxony branch of the German BirdLife partner, NABU, as part of the BESTGRID project.

3.3.2 Ecological enhancement in existing forested power line corridors

Where power lines already pass through forests, it can be much better for nature to stop clearing vegetation every few years, and instead grow shrubs and small trees or use grazing animals. The NGOs Solon and CARAH have worked with grid operators since 2011, creating rich habitats for nature in the immediate vicinity of more than 155km of power line routes in Belgium and on seven different sites in France. This not only benefits nature, but also saves grid operators money (Box 6).

3. COMPARING THE IMPACTS OF OVERHEAD AND UNDERGROUND TRANSMISSION LINES

Today many low and medium voltage power lines are placed underground. This helps avoid visual impacts in populated areas and valued landscapes and eliminates collision and electrocution risks for birds. However, putting high voltage transmission lines underground is technically challenging and is more expensive than overhead technology. The challenges are reduced where high voltage direct current (HVDC) technology is used, compared to alternating current (AC). In either case, impacts on the natural environment may be more severe than with overhead lines, especially during construction. For these reasons, undergrounding has rarely been used for stretches longer than a few kilometres. This may change as HVDC technology develops, with plans for its greater use in long distance transmission in Germany and elsewhere.

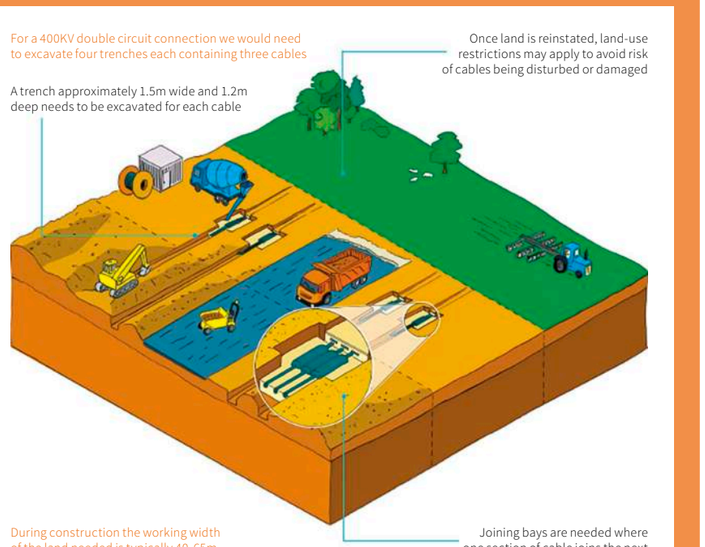


FIGURE 1 DIRECT BURIED CABLE INSTALLATION[11]

A 2012 study[9] estimated the lifetime cost of underground transmission lines is at least twice as expensive as overhead technology and sometimes much more so (GBP£10.2 - 24.1m per km for underground cables, compared to GBP£2.2 - 4.2m per km for overhead transmission lines[10]). With greater use, costs can be expected to fall. Nevertheless, it would likely raise the cost of tackling climate change considerably if all transmission lines needed for energy system development in Europe were placed underground. Therefore it is important from a nature conservation perspective to consider carefully the long term implications of demanding more undergrounding, as well as understanding local impacts.

The main ecological impacts of overhead lines relate to (i) vegetation clearance and management in forested corridors and (ii) bird collision and electrocution risks during operation (see Section 4 below). In many agricultural areas farming continues beneath overhead power lines and their development may make little difference to the nature value of the area provided it does not create additional risks for vulnerable birds.

Underground cables also require clearance and management of vegetation, to ensure plant roots do not damage the cable. According to the UK TSO, National Grid, as many as 12 cables in four trenches may be needed to match the performance of a 400kV AC double circuit overhead line, creating a work area as wide as 65m. In addition, large concrete lined 'joint bays' have to be constructed every 500-1000m and these are wider than the trenches (Figure 1). These major earthworks could damage, for example, the habitats for rare plants, amphibians and reptiles. Cable maintenance can also be challenging, with risks of further soil disturbance.

Soil compaction and damage to soil-based biodiversity is likely during construction. Heating of the soil may also be an issue, but this can be limited depending on the technology used. It is important to avoid heating the soil's upper layer, which is most important for biodiversity, so that soil biota can recover as far as possible.

Undergrounding may be extremely technically challenging in rocky and mountainous areas. Hydrological conditions must also be considered. Wetlands should be avoided when planning underground cables as these may suffer severe or irreparable harm. Alternative routing may be the only option, since many wetland birds are vulnerable to collision with overhead lines. Undergrounding may also be unsuitable in forested areas, due to the need to clear vegetation and prevent the re-growth of trees. Grazing and annual crops, such as wheat, can still be grown above the cable, but deep rooted crops such as vines cannot be grown and construction of housing or other buildings is not possible.

4. GIS MAPPING OF LAND USE CONSTRAINTS AND OPPORTUNITIES AT TERNA

Every year Terna updates its national electricity transmission grid Development Plan, which looks ahead over the next 10 years. Corridor alternatives are identified using a sophisticated GIS database that gives a score to each parcel of land according to a set of criteria, relating to technical, social and environmental considerations. This mapping is then one part of a strategic environmental assessment (SEA – see Section 4.2.2 below) of the development plan, which is a requirement under national legislation implementing the SEA Directive[12].

Four sets of criteria are applied to each parcel of land, labelled 'exclusion', 'repulsion', 'problem' and 'attraction' (referred to by Terna as ERPA criteria). Airports and military areas are classified as 'exclusion' areas for grid development. Existing infrastructure corridors, such as power lines and roads, and locations where impacts on the landscape are lowest, are marked as areas of 'attraction' in the GIS system. However, they become areas of 'repulsion' if they include urban areas, heritage sites, national parks, protected areas for wildlife and mixed woodlands. 'Problem' areas have particular characteristics that require further investigation before they are assigned to one of the other criteria. Figure 2 illustrates how broad corridor alternatives, about 2km across, are identified using the resulting maps.

Terna then discusses these broad corridor alternatives with an environmental NGO, WWF Italy. The decision on which broad corridor alternative to adopt is made by government ministries. The SEA process helps to integrate environmental objectives into the development plan. It does this by applying a set of environmental objectives and criteria to the evaluation of the alternative corridors and 'feasibility routes' (about 400m wide) within those corridors. Environmental objectives include 'minimising interference with vegetation, flora and fauna' and others such as 'respecting cultural landmarks and the landscape'. Though the SEA Directive does not require it, Terna follows a common practice in SEA of also looking at other 'sustainability' objectives and criteria, including social, economic and technical considerations. Further details can be found in the *European Grid Report* (see links below).

The SEA and the plan are developed in parallel, so that environmental (and wider sustainability) considerations are built into the plan. A national SEA group, made up of Terna, national ministries and regional governments, develops the SEA methodology and assesses the sustainability of the plan. Regional SEA groups, involving Terna, regional authorities and local authorities in each Italian region, feed into the process. The final draft plan and SEA environmental report are then open to public consultation for 60 days. Results of the SEA report and the consultation are then taken into account by the government in agreeing the final plan.

The public consultation on the SEA report and plan is an opportunity for NGOs and other nature conservation stakeholders to find out what grid projects are planned in Italy and what their impacts on nature might be. The process is designed to avoid impacts on nature, among other objectives. However, if concerns about potential impacts on nature remain, then stakeholders have the opportunity through the SEA process to raise these with the relevant decision makers and to influence decisions made in finalising the plan.

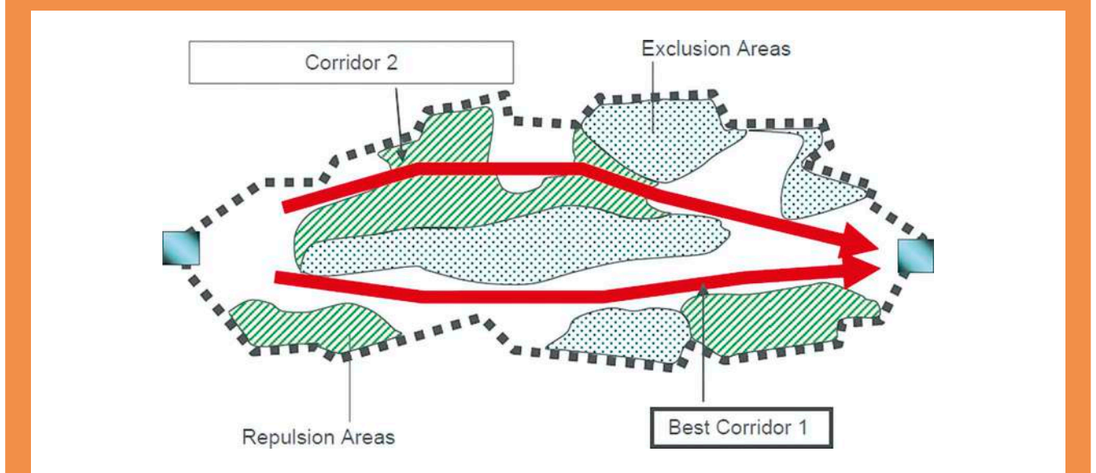


FIGURE 2 IDENTIFICATION OF CORRIDOR ALTERNATIVES IN ITALY USING GIS MAPPING

5. NATURE AND POWER LINE ROUTING IN A MOUNTAINOUS, FORESTED REGION OF GERMANY

SuedLink is the largest infrastructure project in the German energy transition. It is an 800km central 500kV HVDC connection from north to south. With a transmission capacity of 4 GW, it will create the urgently needed link between the wind power generated in the north and the consumer centres in the south of Germany.

The investigation area for possible route corridors was approximately 100,000km², one quarter of Germany's total size. As obliged by German law, one of the TSOs responsible, TenneT, developed an initial working proposal for a single 1km-wide possible corridor as a basis for discussion. Before the formal approval process had begun, TenneT presented it to the public and published it online and a comprehensive project dialogue was initiated. Local info-marts were the central element of this project dialogue. See Part 1 of this Handbook for more details.

Planning at this time was based on the prioritisation of overhead lines rather than underground cabling and, wherever possible, following the same route as existing power lines and other infrastructures, such as railways and roads. In Germany there are no statutory requirements stipulating a minimum distance from electrical transmission lines or transformer stations to nature conservation areas and other sites that are particularly important for nature protection. Instead, individual cases have to be examined in accordance with the requirements of the German Federal Nature Conservation Act.

Protected areas were taken into account for the determination of a 1km-wide corridor, but not generally avoided at this stage. However, options within the 1km corridor for detailed routing would, in most cases, allow protected areas to be avoided if later site investigations found this was necessary. Other actions may be undertaken to avoid significant negative effects on the protected areas and species in it. For example, an alternative in some sensitive forest areas would be to use taller pylons and higher lines above the forest canopy, to avoid the need to clear vegetation.

NABU Lower Saxony, a regional branch of NABU, has 80,000 local members. In BESTGRID, NABU Lower Saxony co-operated with TenneT to conduct a study on the risks and opportunities for nature of the SuedLink development in this mountainous and forested region. At the start of their work with TenneT, in July 2014, NGO and TSO staff visited sites where ecological conditions have been enhanced beneath power lines in Belgium and France as part of a European project (see Box 6 below).

NABU Lower Saxony experts then undertook a desk study looking at routing options of the SuedLink corridor in their region, focusing on challenges and opportunities for avoiding sensitive biotopes such as areas of old growth forest. Additionally, the study looked at opportunities for improving ecological connectivity between isolated patches of richer biodiversity in the vicinity of the route. Further opportunities were identified to use route planning in forested areas to create open spaces for wildlife, such as reptiles and rare plants, and to create forest edge habitats needed by many bird and bat species.

In Germany, ownership of land and forests, and laws governing their uses, vary from one region to another. Where forests are privately owned they are usually more intensively managed than state-owned forests and the owners can also demand financial compensation for lost production. As a result, there are greater opportunities to use routing for biodiversity gains in state-owned forests in Lower Saxony.

By mapping and advising on these risks and opportunities at an early planning stage, NABU helped inform TenneT's corridor route planning at an appropriate stage in the project's development. The work also shows how similar analysis can help TenneT and other TSOs working in similar mountainous and forested regions in many parts of Europe. The results of this work were shared and developed further with state and city politicians and officials, government agencies, other NGOs and local people in two roundtable meetings in September and October 2014.

Based on this work, TenneT and NABU defined three key recommendations for future corridor route planning:

- Initial corridor planning should be 4km-wide rather than 1km, to allow for more variation in detailed routing later.
- Bundling with other infrastructure should remain the objective, but where such routes pass through protected areas an alternative route avoiding the area should also be proposed.
- Avoiding protected areas and consideration of opportunities for biotope connection should be taken into account at the stage of corridor route planning.

TenneT agreed to implement the findings where possible in the SuedLink planning[13] and to continue working together with NABU to take the recommendations forward and to monitor the effects. TenneT reports that the collaboration was very productive, with a focus on practical issues and drawing on strong local knowledge. NABU Lower Saxony found the cooperation was a great way to get the grid planners thinking about nature at an early stage, so they are not confronted with it as an 'obstacle' after more technical issues have been considered and decisions have been taken that limit flexibility.

6. HABITAT ENHANCEMENT IN EXISTING POWER LINE CORRIDORS: THE LIFE ELIA PROJECT

TSOs Elia (Belgium) and RTE (France) are working with ecologists at the NGOs Solon and CARAH to investigate and implement new approaches to vegetation management in power line corridors. The findings of this exciting work were presented to a group of environmental NGOs at a BESTGRID workshop organised by BirdLife in June 2015.

Under normal operations where a power line passes through a forested area, vegetation is 'mulched' every three years using heavy machinery (Figure 3). In other areas (sloping and rocky corridors), young trees are removed manually. These are expensive operations and create conditions that are not favourable for biodiversity.

The project has implemented a 'toolbox' of actions to reduce costs and improve biodiversity in forest corridors:

- Growing short trees at forest edges; small trees, such as endangered local fruit varieties, have been grown between forest edges and a 10m strip kept clear for access vehicles; ponds have also been created to add to habitat diversity (Figure 4).
- Restoring Natura 2000 habitats, principally peat and heath lands, which discourage tree growth.
- Mowing as an alternative to mulching.
- Using animals to graze vegetation. This is particularly useful in rocky and steep stretches of a route, where mulching is difficult. It can also help reduce the spread of invasive species.

This work involves an initial investment, but then creates a stable ecosystem that requires less maintenance. Cost benefit analysis of the project's approaches suggest a return on investment within three to nine years and overall costs two to five times cheaper over a 30 year period. It also has clear benefits for nature, creating connectivity between richer biotopes for butterflies, for example, and has proven popular with local people and land owners. With 300,000km of high voltage power lines in Europe and many more under lower voltage lines, there is clearly a case to replicate this work across Europe in places where it can contribute most to nature conservation.

FIGURE 4
USE OF SHORT TREES IN POWER LINE CORRIDORS

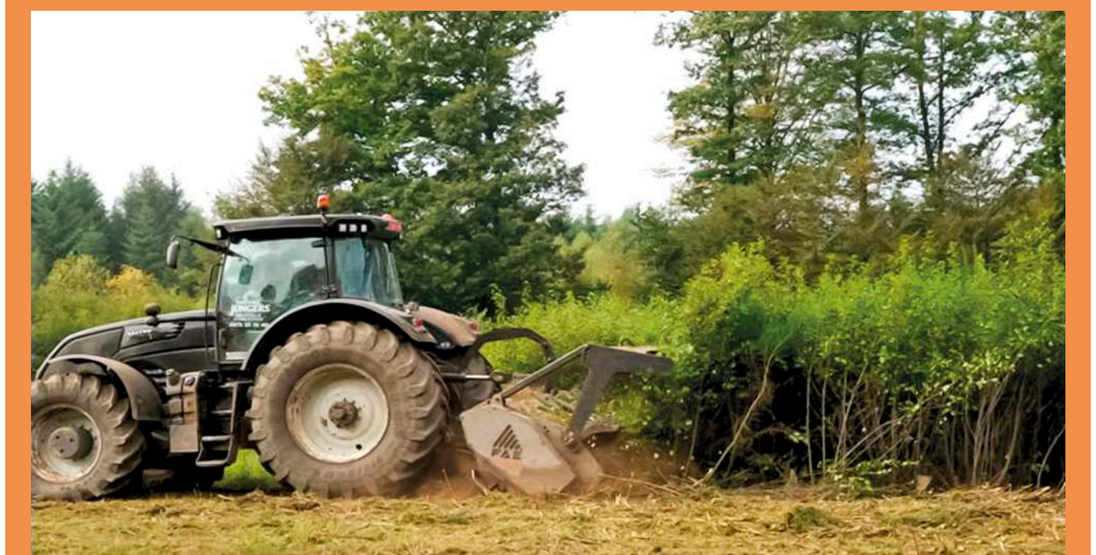


FIGURE 3 MULCHING VEGETATION IN A POWER LINE CORRIDOR

RECOMMENDATIONS FOR NATURE CONSERVATIONISTS AND SUPPORTERS

- Existing power line corridors may offer opportunities to create rich habitats for biodiversity. Approach your grid operator to find out if it might be an option. Help them to learn about the LIFE Elia project.
- If new power lines are planned in your region, offer your expertise and detailed local ecological knowledge early in the planning process to help the developer avoid damage to good wildlife habitats/populations and to identify opportunities to enhance diversity and connectivity in poor wildlife habitats.

RECOMMENDATIONS FOR TSOs AND ENVIRONMENTAL AUTHORITIES

- Send this report to the TSO team that deals with environmental planning.
- Use the contacts provided in this document to find out more about how to benefit from working with local nature conservation organisations on route planning and environmental assessments.
- Work with environmental NGOs to identify opportunities for ecological enhancement in existing power line corridors.

WEBLINKS

- The LIFE Elia project enhancing habitats in power line corridors: http://www.life-elia.eu/en/
- Details on Terna's approach to grid planning see pp. 53-61 at: http://renewables-grid.eu/documents/eu-grid-report.html
- More information on underground cabling: http://renewables-grid.eu/events/events-in-2013/rgi-cable-workshop.html
- NABU Lower Saxony's work with TenneT on ecological risks and opportunities in a mountainous forested region: www.bestgrid.eu https://niedersachsen.nabu.de/umwelt-und-ressourcen/aktionen-und-projekte/bestgrid/index.html (*in German*)

4. BIRD PROTECTION

4.1 What are the issues?

Collision with objects such as cars, power lines, windows and wind turbines is a hazard for flying birds. Whether this presents a risk to the conservation of a population of birds is a complex question to answer. The observation that cats and cars kill far more birds than power lines is misleading. From a conservation perspective it also matters what kinds of birds are involved, their population size and their conservation status.

Some species are at much greater risk than others, for two main reasons. First, some species are more vulnerable to collision because of their flight characteristics, such as their typical flight height and how well they're able to avoid obstacles. This is closely related to their body shape and wing dimensions, termed 'morphology'. Birds with heavy bodies and short wings are at the greatest collision risks[14]. Many spend most of their time on the ground or on water. Secondly, species that are long-lived and slow to reproduce - often larger birds - cannot sustain additional mortality in the same way that shorter-lived, fast-breeding species can.

Compared to major causes of bird population declines, such as illegal killing or loss of habitats, the risks posed by high voltage power lines are relatively minor. However, in the wrong place the additional mortality caused by collisions could be enough to send a local population into decline when combined with other pressures. For endangered species, population recovery is a priority, so it is vital that further risks are not created.

In contrast, electrocution is already a serious conservation threat for some bird species in parts of the world with poorly designed low and medium voltage power lines, including many former Eastern Bloc countries in the EU. Stakeholders there who are interested in bird protection may identify dealing with existing electrocution risks as the first priority (see Box 7).

Electrocution typically affects birds with large wingspans, for example storks, eagles and pelicans. This issue was not a major focus in BESTGRID, since the project related to better practices in the higher voltage transmission network. Due to the length of insulation required between power lines and the earthed parts of pylons, no bird species is large enough to be at risk of electrocution when resting on high voltage infrastructure. However, when birds urinate on live equipment or build large nests on pylons, electrocution may be possible. Providing safe nest boxes on pylons can help eliminate this problem.

Species that are known to be at risk of collision and electrocution are listed by the Council of Europe's Convention on the Conservation of European Wildlife and Natural Habitats (Bern Convention)[17]. Annex I of the Birds Directive[18] lists 193 European bird species and sub-species that are in danger of extinction, vulnerable to specific changes in their habitat, considered rare because of small populations or restricted local distribution or requiring particular attention for reasons of the specific nature of habitats. For these species Member States must conserve their most suitable territories as Special Protection Areas, which are part of the Natura2000 network[19]. Information on these species is available from the European Commission's pages on wild birds[20].

7. ELECTROCUTION RISKS IN DISTRIBUTION NETWORKS

It is well established that electrocution on existing low and medium power lines is a major cause of bird mortality, with negative effects documented on populations of Eagle owls, Golden eagles and Saker falcons[15]. By comparison, scientific evidence has not yet established that the overall or national population of any bird species has been depleted by collisions with high voltage power lines, nor with wind turbines[16].

New medium and low voltage power lines can easily be designed so that electrocution cannot occur. Where electrocutions occur in existing networks these can be eliminated through relatively simple technical changes, such as retrofitting insulation material around support structures. This is a priority for many bird conservation organisations in Europe and around the world.

In May 2015, SOR (BirdLife in Romania) hosted a BESTGRID roundtable in Bucharest with representatives of the national grid operator, several distribution network operators, the Ministry of Environment and the environmental protection agency. NGO experts who have worked with grid developers in Hungary, Bulgaria and Romania shared their experiences. Many of these related to identifying poorly-designed stretches of medium voltage power lines and making them safe for birds by insulating the live parts at the support poles. This prevents electrocutions, which are a major cause of bird deaths in many parts of the world. Electrocutions also cause power outages, which cost money and inconvenience electricity users.

In Hungary, 50,000 poles have been insulated in this way and a national law now forbids the construction of new support poles that can cause electrocution. Nevertheless, making the whole network in Hungary safe for birds remains a big challenge – 90% of potentially dangerous poles remain un-insulated according to BirdLife Hungary's experts. In other nations, such as Romania, there is even further to go in dealing with existing problems and making sure new dangerous poles are not constructed. This important work has real benefits for wildlife, addressing a significant risk with practical solutions. The workshop led to discussions on collaboration between SOR and the TSO and distribution network operators in work to protect birds from collision and electrocution risks in Romania.

Determining whether a power line in a specific location or route could have significant effects on a bird population is a complex scientific question, normally addressed through environmental impact assessments (EIA) and/or 'appropriate assessments' required under the Birds and Habitats Directives[21]. These studies might determine that significant harm can be avoided through the use of undergrounding or bird diverters – devices such as spirals or flaps attached to the line to increase its visibility and reduce collision risks. However, significant impacts can often be ruled out without requiring a detailed assessment, or a precautionary decision is taken to avoid the location based on knowledge of the species present.

4.2 How are the issues factored into decision making?

Where a proposed line is within, or close to, areas that are protected for birds that are vulnerable to collision risk, it may be a legal requirement to avoid the area, use additional mitigation measures such as bird deflectors or put part of the route underground. To a large extent these considerations have not entered thinking about how energy systems will develop at European and national levels. The location of areas used by vulnerable birds is typically only considered after the need for a line from point A to point B has been decided. This may be in a 'strategic environmental assessment' (SEA) of corridor alternatives or an EIA which addresses both corridor alternatives and detailed placement of the line and mitigation measures.

4.2.1 EU and national policies and planning

The EU has committed to halt the loss of biodiversity by 2020[22], which is its contribution to the global targets set under the UN Convention on Biological Diversity. The Birds and Habitats Directives are key instruments used by the EU in its efforts to halt the decline in wildlife. The requirements of these Directives are applied through national nature protection laws.

The Directives create the Natura 2000 network of Special Protection Areas (SPAs) for birds and Special Areas of Conservation (SACs) for other species and habitat types. These areas protect around 18% of EU land area and are designated on a scientific basis according to the importance of the wildlife population or habitat for conservation efforts. They are not strict 'nature reserves' and are often not indicated by anything visible on the ground, such as a notice board or entrance gate. However, detailed maps and information on the Natura 2000 network are easily accessed (see under 'Links' below). Rules governing development affecting protected areas that are not part of the Natura 2000 network vary from country to country.

Only *sustainable* development is permitted in SPAs and SACs, i.e. developments compatible with the nature conservation goals for which the areas were designated. The Directives therefore require precautionary avoidance of damage. In practice this means if it is *not* possible to exclude from the start that development proposals will have a significant effect on the Natura 2000 site, either alone or in combination with other plans and projects, an 'appropriate assessment' is required under national legislation implementing the Birds and Habitats Directives.

The appropriate assessment is a scientifically rigorous procedure and is normally applied during spatial planning and/or at the EIA stage of detailed project placement and design. Only if the assessment finds that risk to the relevant conservation interests can be ruled out (or is insignificant) can the development then go ahead. An exception applies where a project is needed "for imperative reasons of over-riding public interest" and no alternative solution (or route) is available and provided that compensatory habitat is created. Where these conditions have been met, a project may go ahead even if risks to the relevant conservation interests are identified.

There are advantages to factoring in the need to avoid harm to the Natura 2000 network at earlier stages than spatial planning or EIA for each power line. In developing its TYNDPs for Europe, which are renewed every 2 years, ENTSO-E makes an attempt to anticipate the social and environmental sensitivity of the power lines in the plan. This is achieved through the 'social and environmental impact indicator' in the cost-benefit methodology which is used to assess each project. A simple indication is given of the number of kilometres of each power line which is expected to pass through an area protected for environmental reasons or through a densely populated area.

Anyone interested in knowing what major transmission lines are proposed in their country, and to have a very basic indication of how these might affect protected areas, can find this out in the TYNDP. This is far from perfect, but it is a rare example of nature protection being taken into account in EU-level infrastructure planning. Where national grid development plans are not subject to SEA (and in the case of 'third party' projects proposed by developers other than TSOs) it may be the only source of information available about the potential environmental impacts of energy infrastructure 'projects of common interest' (PCIs), which are selected from the TYNDP.

Some EU Member States develop legally binding national or regional (sub-national) plans for grid development or for energy development more widely. In these nations, the planning process provides an early opportunity for nature conservation stakeholders to engage 'upstream' with the way their energy system as a whole will develop. For example, national planning can consider which areas are most suitable for wind energy development and therefore likely to require new grid connections. This process should provide opportunities to promote solutions that are positive for wildlife and nature. However, not all nations develop 'plans' of this kind, so these opportunities do not necessarily arise. The first public consultation and environmental assessment processes are often at the stage of identifying corridor alternatives.

4.2.2 Environmental assessment of corridor alternatives

Strategic environmental assessment (SEA) is a process of studying and consulting on a broad range of expected environmental impacts under alternative ways to achieve a plan's objectives. The process aims to make the proposed plan more environmentally friendly and the findings are one consideration in finalising the plan, alongside economic, social and political considerations. The location of protected areas (and the species that are protected) is one important consideration when alternative routes are considered in a SEA.

There is a requirement to consult the public on a SEA's findings. Environmental authorities (government bodies with responsibility for nature and environmental protection) are also consulted earlier on the scope of the studies, i.e. the kinds of impacts and alternative options that will be considered. There may also be opportunities for NGOs and the public to comment at this earlier stage, but this is not normally a legal requirement.

SEA applies to 'plans and programmes', in particular to spatial plans such as choice of corridor alternatives. EIA applies further 'downstream' in the planning process, to clearly defined 'projects'. At this stage a more detailed study is made regarding the likely environmental impacts of the exact routing of the line and placement of pylons or use of underground cabling etc. Again there are opportunities for environmental stakeholders to comment on the findings, for example to provide access to relevant studies or data or to raise concerns if an environmental impact has not been considered correctly. See Part 1 of this Handbook for a detailed explanation of the stages of grid planning.

The opportunities which SEA provides for earlier or more 'upstream' engagement by wildlife and nature conservation interests vary from one nation to another. In many nations, SEA is used by a spatial planning authority to inform their decision on the choice of a corridor and then EIA is used by the permitting authority when approving the detailed project design. This is the approach in Belgium, illustrated in Box 8.

4.2.3 Environmental assessment of detailed placement and design

Once a corridor has been selected, a detailed design for the project has to be agreed and permitted. This involves decisions on the exact location of pylons and their design and the placement of any risk mitigation measures, such as bird diverters. The 'appropriate assessments' required under the Birds and Habitats Directives may also be made at this stage, depending on the way in which power lines are planned and permitted in each nation. The later in the decision process these issues are considered, the more likely it is that difficulties will be encountered in meeting the Directives' requirements.

National Grid in the UK does not develop legally binding grid development plans. It instead develops a non-binding Electricity Ten Year Statement (see under 'Links' below). National Grid consults on the scenarios that underpin the Statement and on the Statement itself, but developing it does not involve carrying out an SEA process. For onshore power line developments there is no formal spatial planning process as in Germany or Belgium, so again SEA is not undertaken at the stage of corridor planning. Nevertheless, National Grid undertakes a similar process of mapping possible corridors and consulting with authorities and stakeholders before making a decision.
The first legally binding environmental assessments for onshore power lines are therefore at the permitting stage. Underground and marine cables, however, are not listed in the annexes to the EIA Directive[23], so EIA is not a formal requirement in the UK. Nevertheless, National Grid usually undertakes an EIA study in the same way as it would for an overhead power line. Box 9 below explains how environmental assessments were applied in the Nemo Link project.

4.3 What more can TSOs and environmental stakeholders do?

4.3.1 Start early and streamline procedures

In Europe, the data available on the distributions of vulnerable species and on the protected areas network are good by world standards. There is also a good understanding of how sensitive various species and habitats are to grid development and to the development of energy supply technologies, such as wind power or bioenergy crops. It is possible to develop maps that indicate the ecological sensitivity to energy supply and grid development of each square km of land area and to use this as a basis to inform national energy system planning. 'Sensitivity mapping' of this kind is already used to help wind farm developers find suitable sites in several parts of Europe such as France, Germany and Scotland. It is also used to map electrocution risks in distribution networks in several nations where this is a problem (see Box 7).

At EU level, a more sophisticated approach to grid planning could be taken to understand and communicate the environmental risks of priority power lines. This would help developers to plan ahead to avoid impacts and help conservation stakeholders to engage early to help find solutions where there may be real concerns for wildlife and habitats. Nature would also be better protected if more nations developed credible, long-term energy system and/or grid plans that take ecological sensitivity into account.

These recommendations sound like they would create additional work in what is already a lengthy process of grid planning and permitting. However, done well they should, in fact, reduce procedural requirements at later stages because much data and information has already been collected and many issues have already been identified and problems avoided or solved.

The idea of 'streamlining' environmental assessment procedures is promoted by the European Commission as one way to speed up delivery of priority (PCI) projects without compromising on environmental protection. It means doing the work more efficiently, sharing data across the various assessment processes and reducing the number of authorities that developers have to communicate with. The principles set out in EU guidance for PCIs (see 'weblinks' below) are a good basis for more efficient procedures for all power line developments.

4.3.2 Involve NGO experts in advising on risks to birds

Often the most knowledgeable experts on local ecology may be employed by nature conservation NGOs. It can be very valuable to involve them in the design and development of studies and assessments. They can provide local, up-to-date knowledge about species distributions, advise on how to find the most accurate and complete data and may help in making contact with other environmental stakeholders. In BESTGRID, for example, NABU experts worked with 50Hertz on the environmental assessment process for the upgrade of the Bertikow-Pasewalk overhead power line, to help ensure nature conservation concerns were addressed as fully as possible during planning (Box 10).

8. CASE STUDY OF SEA FOR THE STEVIN PROJECT

The need for the Stevin project (see Handbook Part 1, p. 14) was established in the Belgian National Grid Development Plan 2005-2012. These 5-yearly national plans are legally binding (i.e. the connections it identifies have to be built). An SEA process accompanies their development. The SEA informs and consults authorities, other stakeholders and the public and provides recommendations on the plan. However (as noted in Part 1 of this handbook and in a review of stakeholder engagement undertaken for BESTGRID by Belgian NGO Bond Beter Leefmilieu), public engagement was very limited at this stage by stakeholders.

This may reflect the fact that SEA at this stage is rather 'abstract' in terms of likely environmental impacts, as it remains unclear which broad corridor alternatives may be considered. Nevertheless, by publicising the opportunity to engage more widely and enabling engagement by environmental stakeholders, this national planning stage should provide opportunities for all concerned to start thinking early about climate and nature implications, such as the consequences for renewable energy generation and the geography of important wildlife habitats.

There was detailed consideration of wildlife habitats at the stage of the SEA of corridor alternatives for the Stevin project, which was undertaken in 2009-11. The public and NGOs, such as BBL and Greenpeace, were consulted on the scope of the study and this led to proposals for route alternatives and variations and many calls for the use of underground cabling. Figure 5 shows a map produced in the SEA report which addressed route alternatives in the area between the port of Zeebrugge and the city of Bruges. The area has a high population density and also some large protected areas.

The large green area in the centre of the map is a Natura 2000 area designated for overwintering geese, which are known to be vulnerable to collision with power lines. The Birds and Habitats Directives, which create and protect the Natura 2000 network, require precautionary avoidance of damage to the conservation of such areas. These effects may arise where a power line runs close to, not just within, a protected area.

The SEA process determined that significant effect on the geese could not be ruled out using overhead lines through, or very near to, the Natura 2000 area. The lines marked in red on the map, therefore, were ones where underground cabling would be the only option. The lines in orange are ones where the SEA determined that overhead lines would be acceptable provided bird deflecting spirals were used to reduce collision risks. The green lines were acceptable overhead, even without added mitigation of collision risks.

The SEA findings were one consideration used by the Flemish Government in deciding on the final route. Public consultation on this plan and its SEA report attracted 1,700 statements of opposition, many calling for full or partial undergrounding. Overhead lines through dense habitation to the south of the protected area were not socially acceptable and within the protected area they were not legally acceptable. As a result, the route chosen in the approved land use plan includes a 10km stretch of underground cabling through the south-west corner of the protected area.

A project EIA then considered detailed placement of the pylons and more detailed mitigation of environmental impacts such as bird deflectors. However, at this stage the broad route was already established, so decisions had already been taken on how to avoid impacts on protected areas and species. This underlines the importance for conservation stakeholders to get engaged 'upstream' in the planning process, when route alternatives are still open.

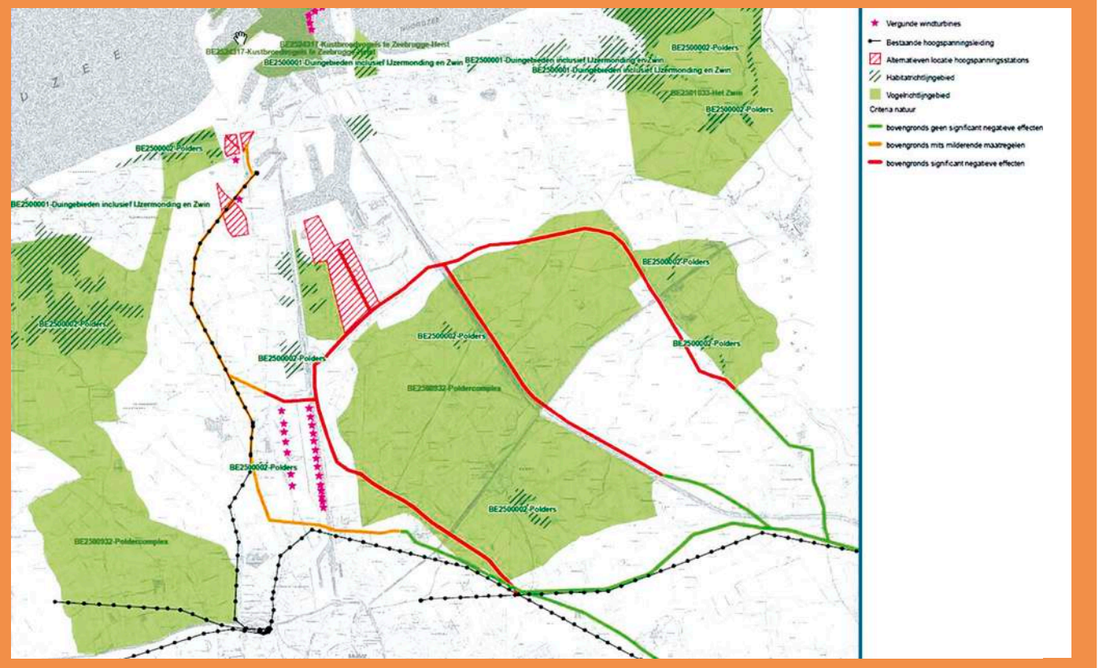


FIGURE 5 ROUTE ALTERNATIVES IN THE ZEEBRUGGE/BRUGES AREA OF THE STEVIN PROJECT

9. ENVIRONMENTAL ASSESSMENT OF THE NEMO LINK MARINE INTERCONNECTOR PROJECT

For interconnectors between the European mainland and the UK marine cabling is required. In all nations with a coastline an offshore route may be possible for certain power lines, with advantages such as greater public acceptability, but for a much higher financial cost than overhead routing onshore. Marine cabling has clear advantages for bird protection as there is no potential for collisions.

Cables are buried in the seabed to avoid risk that they could be damaged. Seabed surveys are used to find a detailed route which avoids areas of high biodiversity value. For example, in the NemoLink project the cable system was routed to avoid areas of *Sabellaria spinulosa* aggregations. This species of worm lives in a tube built of sand, gravel and pieces of shell. Surveys undertaken to inform the EIA found large aggregations of these worms forming reefs on the seabed. These ecologically important areas were avoided by distances of 90m for the larger reef formations and 150m for the smaller structures, following advice from the government's nature protection authority, Natural England.

Cable laying causes short term damage to the seabed and may temporarily suspend sediments, with potential ecological impacts[24]. However, lasting damage to sea beds and significant risks to marine wildlife are unlikely with careful routing and good practice in laying the cable. Greater risks may arise at the coast where a cable comes onshore through the 'intertidal' zone. Habitat damage at the coast can be avoided using horizontal directional drilling or routing through soft sediments that quickly recover after a cable has been laid.

Coastal zones are often important for birds and other wildlife, so it may be necessary to take precautions, such as carrying out construction work at a time of year when a protected species is not using the area. Further onshore, there is also a need to consider the environmental impact of building a converter station near the coast, the potential ecological impacts of underground cabling to the converter site and of any new or reinforced overhead lines in the onshore network.

National Grid Nemo Link Ltd chose to carry out an EIA for all elements of the Nemo Link project, even though this was not a legal requirement for the offshore cable itself in the UK (nor is it in France, but is in Belgium). A licence under the Marine and Coastal Access Act 2009 was required for certain aspects of the project, such as the laying and burial of the cable between the top of the intertidal zone, 12 nautical miles offshore and horizontal directional drilling.

There are several conservation sites of importance within the cable route corridor, including Thanet Coast and Sandwich SPA, Sandwich Bay SAC, Thanet Coast SAC and the Thanet Coast and Sandwich Bay Ramsar Site. The competent authorities responsible for licensing, the Marine Management Organisation and the local planning authority, concluded that a Habitats Regulations Assessment (i.e. an 'appropriate assessment' under the Birds and Habitats Directives) was required. They requested further information on installation methods and quantification of potential impacts on the SPA and SAC sites in order to carry out the assessment.

Impacts upon the designated sites and birds were limited by routing the cable system to avoid the areas of greatest sensitivity and directional drilling. Impacts were further mitigated by avoiding installation works in the intertidal areas in the key months when birds use the area. After a nine month licensing process, the authorities established that the project would not cause significant harm to the protected areas, so could go ahead.

10. WORKING WITH A CONSERVATION NGO FOR BIRD PROTECTION – THE CASE OF THE BERTIKOW-PASEWALK BESTGRID PILOT PROJECT

In order to minimise impacts on new areas of housing or nature 50Hertz aimed to follow the route of the existing line from Bertikow to Pasewalk as much as possible when planning how to upgrade this connection. However, the environmental assessment process also considered some route variations, to further reduce impacts. NABU accompanied the planning process. This involved advising on the scope of the assessment, joining site visits, researching and providing information on ecological risks at public events and assisting 50Hertz with stakeholder mapping.

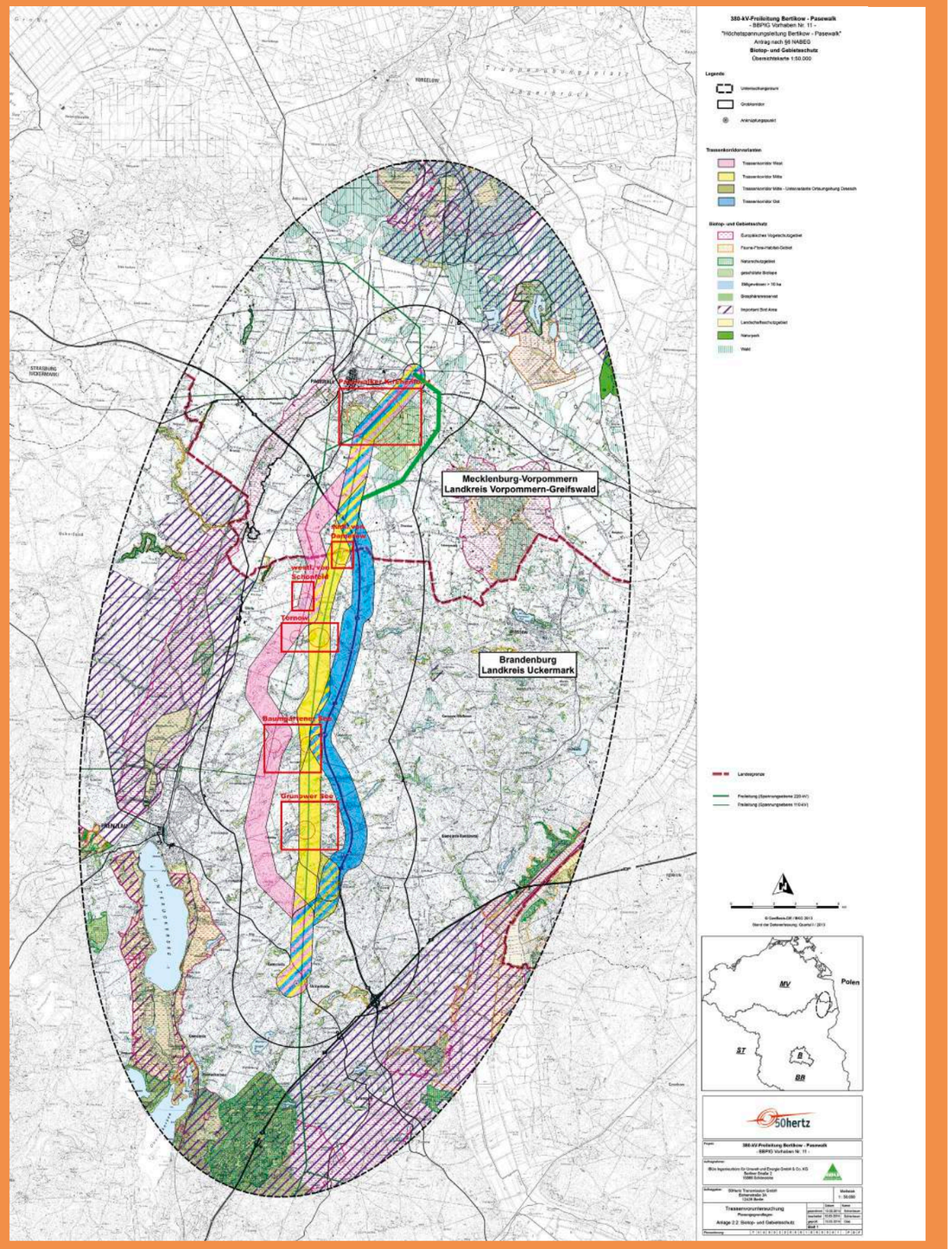
All proposed route variations avoided crossing any Natura 2000 areas. However, the line is in the north-east of Germany, which is an important area for protected breeding bird species. There are seven SPAs in close vicinity to the project. NABU researched the distribution of breeding birds known to be at risk of collision with overhead power lines, such as cranes, storks, bitterns, lapwings, curlews, snipes and eagles. 50Hertz mapped protected areas in relation to the routing options (Figure 7) and NABU provided in-depth analysis of the actual risks, based on detailed species-specific and local knowledge.

This enabled NABU to identify six locations where the proposed line could add to conservation risks for vulnerable species (Figure 7). As a result of NABU's work, an additional route variation was added for consideration, avoiding the forested area called Pasewalker Kirchenforst, at the northern end of the route illustrated in Figure 7. An ecologically sensitive approach to re-using the existing corridor through this forest was also proposed. NABU advised against a western corridor option, as it runs close to two SPAs designated for vulnerable bird species, and avoidance of lakes, grasslands and wetlands used by vulnerable birds (Figure 6). NABU also made recommendations on additional and more up-to-date ecological data sources and on the safest designs for pylons and bird deflectors from a conservation perspective.

Eric Neuling, who led NABU's work in BESTGRID, reports that early and intensive engagement with the TSO in this project has had multiple benefits. By engaging more thoroughly with independent environmental experts, 50Hertz was able to take nature protection into account more thoroughly and to build trust among nature conservation stakeholders, with benefits for environmental compliance. For NABU, working with 50Hertz in this way provided a great opportunity to engage early in project planning for the benefit of nature. It created space for informal dialogue and developing working relationships that could never be achieved by simply reacting to plans at a late stage.

FIGURE 6 EXISTING FOREST CORRIDOR WITH POTENTIAL FOR RE-USE AND ECOLOGICAL ENHANCEMENT

FIGURE 7 MAP OF ROUTE OPTIONS, PROTECTED AREAS AND SENSITIVE BIOTOPES IDENTIFIED BY NABU, BERTIKOW-PASEWALK BESTGRID PILOT PROJECT (PLANNING STATUS: MARCH 2014)



BESTGRID project visit to bird protection site identified by NABU

RECOMMENDATIONS FOR NATURE CONSERVATIONISTS AND SUPPORTERS

- If bird electrocutions occur in your region, consider approaching your local electricity supplier to develop a joint ‘sensitivity map’ which shows where vulnerable species and dangerous pole designs coincide. This can then be used to prioritise actions to save the birds and to reduce the number of power outages and forest fires that electrocutions cause.
- Contact BirdLife Europe to learn more about successful projects where NGOs have worked with distribution system operators to make power lines safe for birds.
- Find out what new power lines are planned in your region or nation. Offer your detailed local knowledge on the distribution of birds that are vulnerable to collision risk early in the planning process, to help the developers take it into account when deciding on routing.

RECOMMENDATIONS FOR TSOs AND ENVIRONMENTAL AUTHORITIES

- Work with BirdLife or other experts to map bird collision risks, to avoid adding to the mortality of threatened species when building new lines and to target mitigation measures in the existing network.
- Develop national grid development plans using strategic environmental assessments, to make sure risks to nature are taken into account early enough.
- Undertake SEA and EIA even where it is not a legal requirement: if they are done well they ensure stakeholders are fully informed and have an opportunity to provide input and help to create better plans and projects.
- Monitor and report on bird collisions, to improve knowledge about this risk and its management.

WEBLINKS

- Convention on the Conservation of European Wildlife and Habitats (Bern Convention) agreement on protecting birds from power lines: http://www.coe.int/t/dg4/cultureheritage/nature/bern/documents/072011_IKB/Protecting_birds_from_powerlines.pdf
- Guidelines on how to avoid or mitigate impact of electricity power grids on migratory birds in the African-Eurasian region: http://www.unep-aewa.org/sites/default/files/publication/ts50_electr_guidelines_03122014.pdf
- Interactive map of the Natura 2000 network: http://natura2000.eea.europa.eu
- National Grid Electricity Ten Year Statement: http://www2.nationalgrid.com/UK/Industry-information/Future-of-Energy/Electricity-Ten-Year-Statement
- More info on NABU’s work with 50Hertz (in German): https://www.nabu.de/umwelt-und-ressourcen/energie/stromnetze-und-speicher/16876.html
- BESTGRID report by NABU on Bertikow-Pasewalk: https://www.nabu.de/imperia/md/content/nabude/energie/nabu_final_report_bestgrid_2015-04-30.pdf
- Guidance on streamlining environmental assessment for priority grid projects (PCIs): http://ec.europa.eu/environment/eia/pdf/PCI_guidance.pdf

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BESTGRID pilot projects at a glance

UK/Belgium Nemo Link 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 Nemo Link 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: 2019/20.

Italy Workshops on the international transferability of good practices and testing communication tool for good practice sharing (TSO Terna).

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