e-Highway2050
Modular Development Plan of the Pan-European Transmission System 2050

Funded by the European Commission, the e-Highway2050 project aims to put forward a Modular Development Plan at the 2050 time horizon, based on a long-term planning methodology able to assess the coming restructuring and expansion operations of the European power transmission system.

The studies pave the way for an integrated European electricity market as well as a pan-European grid that is able to host large quantities of electricity from renewable energy sources and transport it over long distances. The consortium includes transmission system operators, research institutions, universities, companies and NGOs from throughout Europe.

e-Highway2050 examines the framework conditions and, using various scenarios, develops approaches for planning the expansion of the European electricity grid by 2020, 2030, 2040 and 2050 respectively. Stakeholders from all over Europe are invited to discuss assumptions and intermediate results and to assess the final results of the different work packages in different consultations and workshops. The overall objective is to support the planning of the Pan-European Transmission Network, focusing on 2020 to 2050, to ensure the reliable delivery of renewable electricity and pan-European market integration.

The project will result in a modular development plan for possible electricity highways, based on various future power system options such as high Renewable Energy Sources (RES) penetration, technology breakthroughs in transmission technologies, innovative active demand-side management etc. It will also develop options for a complete pan-European grid architecture based on different scenarios. Benefits, costs and risks will be considered for each scenario. Moreover, socio-economic and network governance considerations will be highlighted, with an emphasis on environmental and public acceptance issues.

SEVENTH FRAMEWORK PROGRAMME

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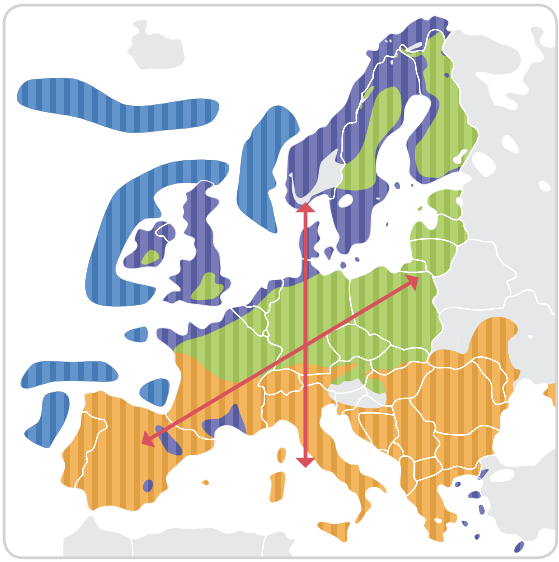
Background information

The objectives of European and national energy and climate policies require a significant change in the energy system. The electricity supply in particular will be affected by this in the years and decades to come. Consequently, one objective of the European decision makers is to increase the proportion of renewable energy making up the gross total final energy consumption to 20 percent by 2020 and even more beyond then. In parallel with this, the European Union is pursuing its objective to complete the European internal electricity market. It is aiming to increase the efficiency and reliability of the electricity supply by means of balancing electricity supply and demand. This will also facilitate the integration of electricity generation from renewable sources into the European interconnected grid.

In order to achieve these objectives, it is of particular importance that an infrastructure is created which, in the future, will enable electricity to be transported over long distances as well as providing adequate storage options. A pan-European electricity grid is also required in order to facilitate the future transport of wind energy from the North Sea, solar power from north Africa or biomass electricity from Russia, for example, to consumption centres via electricity highways (see graphic).

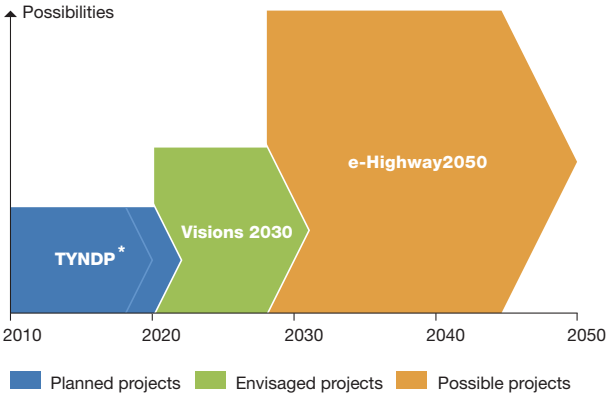
At the same time, transmission system operators must be provided with an appropriate regulatory framework with which to overcome future challenges and which will ensure the efficient use of existing transmission infrastructures and the implementation of new, efficient investment in infrastructure. The Ten-Year Network Development Plan (TYNDP) from ENTSO-E already offers a methodology for a pan-European network plan within a ten-year horizon. In addition to considering the development of production and demand, a methodology for the long-term period up to 2050 also requires that new technological solutions are taken into account – this is one of the objectives of the e-Highway2050 project.

Renewable Energy Sources (RES) development by 2050:



Wave energy | Wind energy | Electricity Highways 2050
Bioenergy | Solar energy

Towards 2050:



* TYNDP: Ten-Year Network Development Plan

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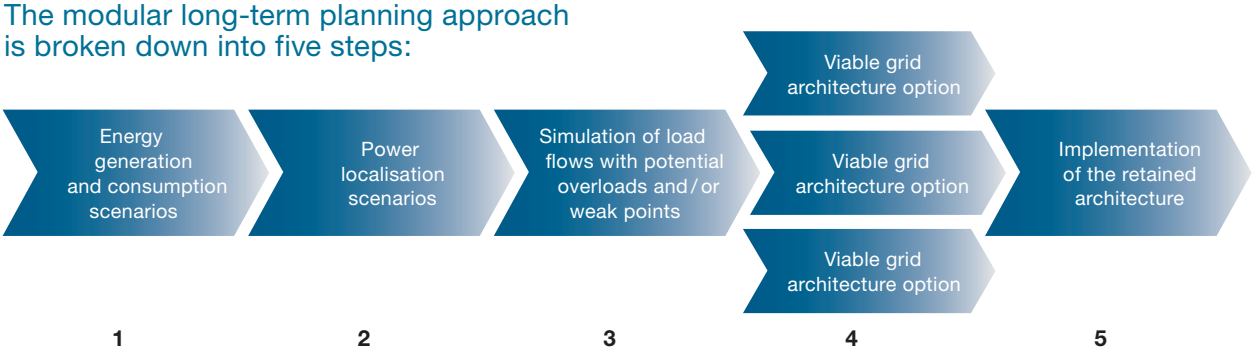
Process and work flow

Overall, the complexity of comprehensive and long-term planning requires the introduction of a new, multi-layered planning approach, taking into account many different future scenarios.

The scenario-based, top-down innovative planning methodology considers the whole electricity supply chain, taking into account all the relevant technical/technological, economic/financial and regulatory/socio-political dimensions needed to develop efficient, yet sustainable, grid architecture options which will meet future energy supply requirements. Scenarios on generation, storage capacities and consumption patterns will be worked out in detail, based on stakeholder consultations and in-depth work with professional associations.

The modular long-term planning approach is broken down into five steps:



I. Development and application of an approach to design different long-term energy generation, exchange and consumption scenarios, based on macro-economic data. (Step 1 above).

II. Development of power localisation scenarios, using the assumptions about the generation mix exchanges and consumption by area (2).

III. The use of market and network simulation techniques to identify feasible and efficient pan-European grid architectures under each of the scenarios chosen above by 2050 (3).

IV. Verification that the grid architecture options selected alleviate critical issues focusing on overload problems and possible voltage and/or stability problems for a given level of system reliability (4). In return, this must allow some of the successful architectures to become part of the final modular development plan between 2020 and 2050.

V. Development of implementation routes from 2020 to 2050, proposed on the basis of cost/benefit analyses, appropriate wider socio-economic considerations and grid governance models able to address issues such as cross-border power flows (5).

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Consortium of the project

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