Ten-Year Network Development Plan 2020

At a glance:
Power system needs in 2030 and 2040

August 2021 · Final version after ACER opinion

entsoe

ENTSO-E Mission Statement

Who we are

ENTSO-E, the European Network of Transmission System Operators for Electricity, is the **association for the cooperation of the European transmission system operators (TSOs)**. The 42 member TSOs, representing 35 countries, are responsible for the **secure and coordinated operation** of Europe's electricity system, the largest interconnected electrical grid in the world. In addition to its core, historical role in technical cooperation, ENTSO-E is also the common voice of TSOs.

ENTSO-E **brings together the unique expertise of TSOs for the benefit of European citizens** by keeping the lights on, enabling the energy transition, and promoting the completion and optimal functioning of the internal electricity market, including via the fulfilment of the mandates given to ENTSO-E based on EU legislation.

Our mission

ENTSO-E and its members, as the European TSO community, fulfil a common mission: Ensuring the **security of the interconnected power system in all time frames at pan-European level** and the **optimal functioning and development of the European interconnected electricity markets**, while enabling the integration of electricity generated from renewable energy sources and of emerging technologies.

Our vision

ENTSO-E plays a central role in enabling Europe to become the first **climate-neutral continent by 2050** by creating a system that is secure, sustainable and affordable, and that integrates the expected amount of renewable energy, thereby offering an essential contribution to the European Green Deal. This endeavour requires **sector integration** and close cooperation among all actors.

Europe is moving towards a sustainable, digitalised, integrated and electrified energy system with a combination of centralised and distributed resources.

ENTSO-E acts to ensure that this energy system **keeps consumers at its centre** and is operated and developed with **climate objectives** and **social welfare** in mind.

ENTSO-E is committed to use its unique expertise and system-wide view – supported by a responsibility to maintain the system's security – to deliver a comprehensive roadmap of how a climate-neutral Europe looks.

Our values

ENTSO-E acts in **solidarity** as a community of TSOs united by a shared **responsibility.**

As the professional association of independent and neutral regulated entities acting under a clear legal mandate, ENTSO-E serves the interests of society by **optimising social welfare** in its dimensions of safety, economy, environment, and performance.

ENTSO-E is committed to working with the highest technical rigour as well as developing sustainable and **innovative responses to prepare for the future** and overcoming the challenges of keeping the power system secure in a climate-neutral Europe. In all its activities, ENTSO-E acts with **transparency** and in a trustworthy dialogue with legislative and regulatory decision makers and stakeholders.

Our contributions

ENTSO-E supports the cooperation among its members at European and regional levels. Over the past decades, TSOs have undertaken initiatives to increase their cooperation in network planning, operation and market integration, thereby successfully contributing to meeting EU climate and energy targets.

To carry out its **legally mandated tasks**, ENTSO-E's key responsibilities include the following:

- Development and implementation of standards, network codes, platforms and tools to ensure secure system and market operation as well as integration of renewable energy;
- Assessment of the adequacy of the system in different timeframes;
- Coordination of the planning and development of infrastructures at the European level (Ten-Year Network Development Plans, TYNDPs);
- Coordination of research, development and innovation activities of TSOs;
- Development of platforms to enable the transparent sharing of data with market participants.

ENTSO-E supports its members in the **implementation and monitoring** of the agreed common rules.

ENTSO-E is the common voice of European TSOs and provides expert contributions and a constructive view to energy debates to support policymakers in making informed decisions.

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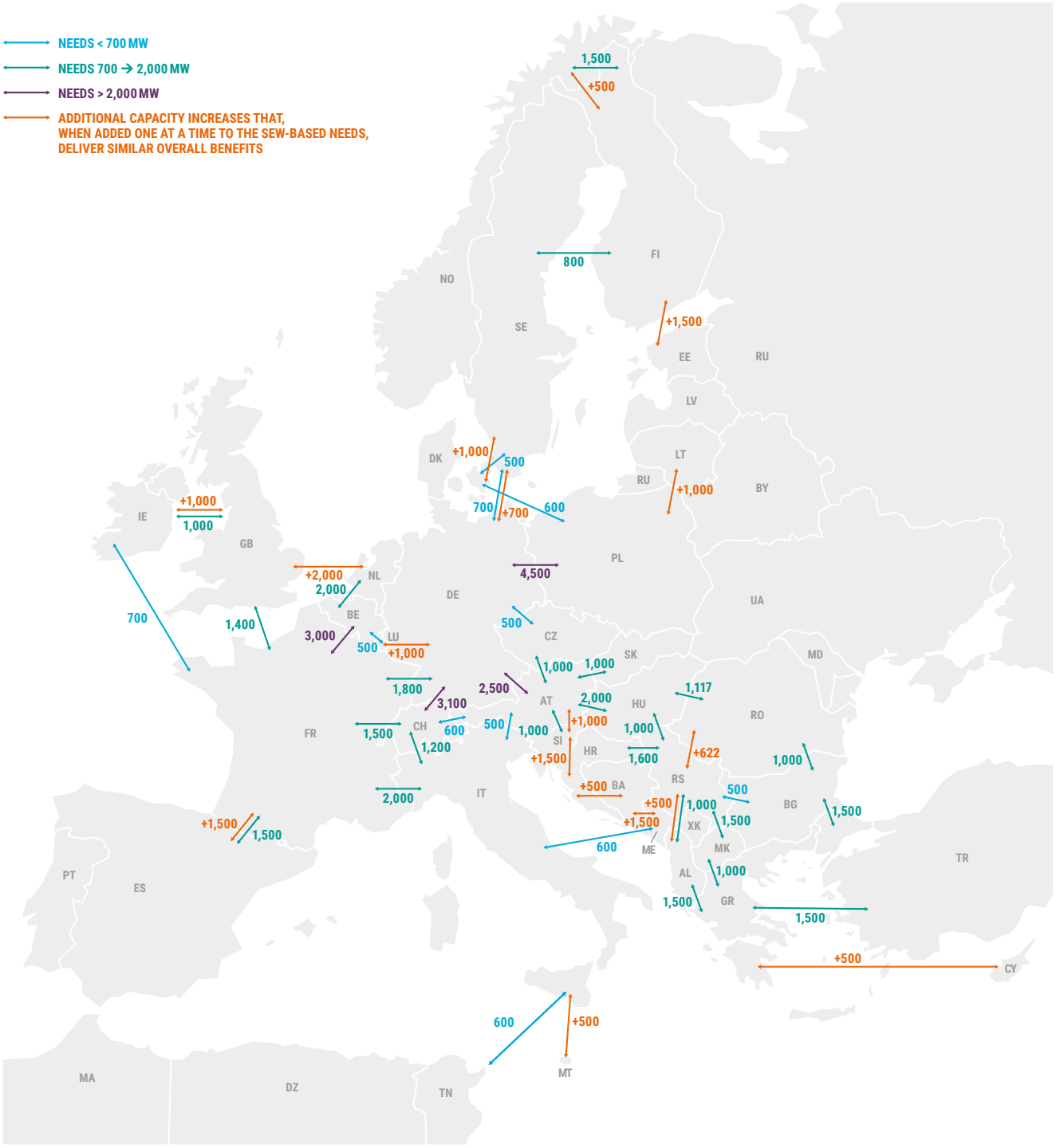
ENTSO-E would like to thank all the experts involved in the Ten-Year Network Development Plan 2020 for their commitment and enthusiasm in building this unique coordinated pan-European plan, which is essential to the timely and effective development of transmission infrastructure to deliver long-term European policy and aspirations while keeping the system secure.

› Europe's power system is evolving rapidly. ENTSO-E's System Needs study shows where action is imperatively needed by 2040 to ensure continuous access to electricity throughout Europe and deliver on the climate agenda.

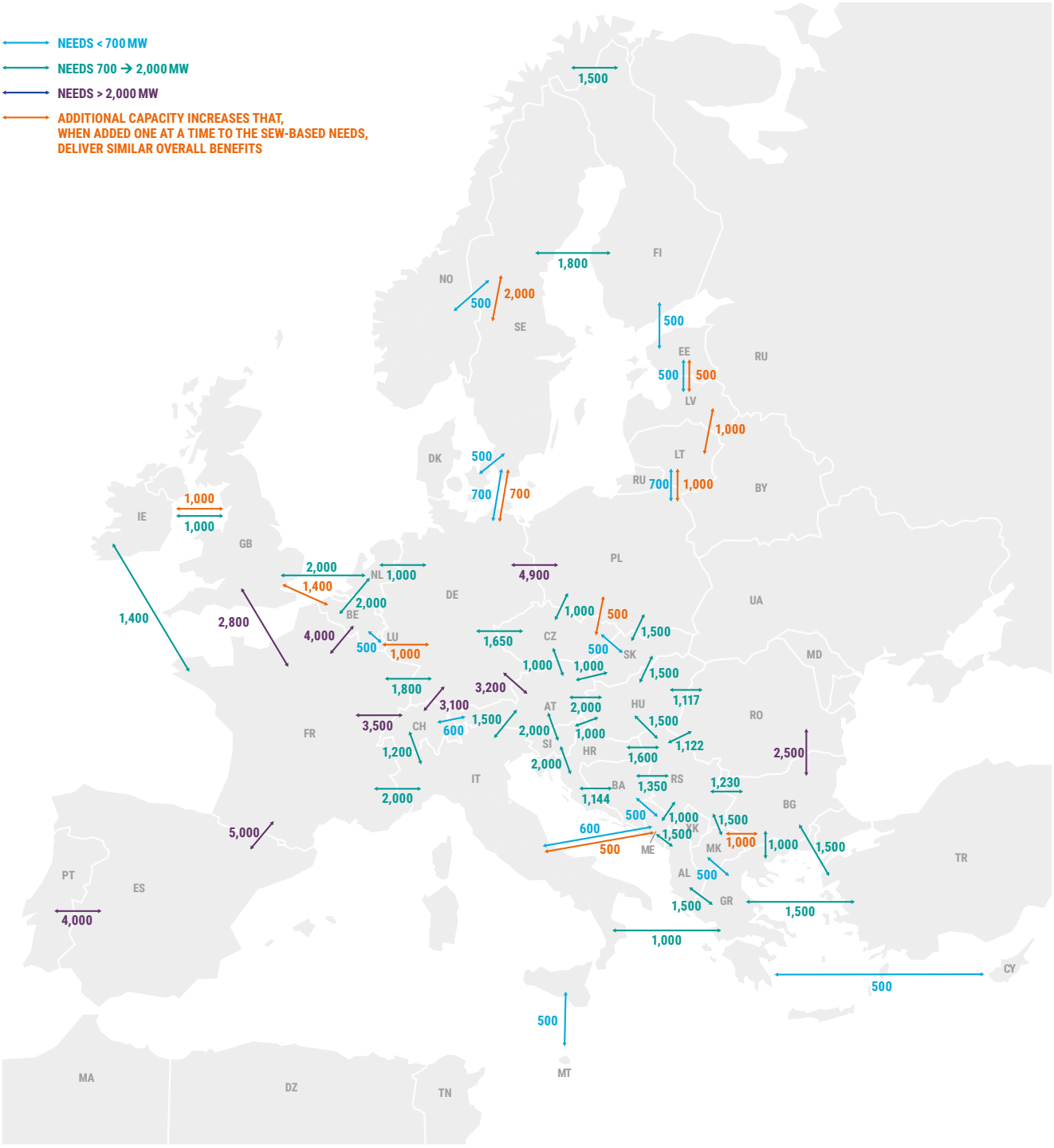
Identifying the system needs is the second step, after the definition of scenarios, in the development of the Ten-Year Network Development Plan (TYNDP), the pan-European long-term plan on how the electricity transmission grid should evolve in Europe to implement the EU energy and climate objectives. The TYNDP 2020 will perform a cost-benefit analysis of 171 electricity



Needs for capacity increases identified in the 2030 (left) and 2040 (right) horizon, additional to the 2025 network and additional network increases included in grid solutions that were only slightly more expensive than the SEW-based Needs

transmission and storage projects and evaluate how they contribute to meeting the system needs for 2030. Results will serve as basis for the selection of European Projects of Common Interest.

› In addition to the 35 GW of cross-border transmission capacity reinforcements by 2025 that are already well-advanced, the System Needs study finds that 50 GW would be cost efficient between 2025 and 2030 and 43 additional GW by 2040. Investing 1.3 bn €/year between 2025 and 2030 translates into a decrease of generation costs of 4 bn €/year, while investing 3.4 bn €/year between 2025 and 2040 decreases generation costs by 10 bn €/year.



2020

Today's power system

35 GW of cross-border capacity increases in construction or planned until 2025

If Europe stopped investing in the grid after 2025

BY 2030

49 TWh/year curtailed energy

591 Mton/year CO_2 emissions

51 bn €/year generation cost

BY 2040

244 TWh/year curtailed energy

446 Mton/year CO_2 emissions

65 bn €/year generation cost

With an expanded grid after 2025

With 50 GW of capacity increase after 2025, representing a cost of 1.3 bn € per year

28 TWh/year curtailed energy

630 Mton/year CO_2 emissions

48 bn €/year generation cost

With 93 GW of capacity increase after 2025, representing a cost of 3.4 bn € per year

134 TWh/year curtailed energy

391 Mton/year CO_2 emissions

55 bn €/year generation cost

- Addressing system needs puts Europe on track to realize the Green Deal, with 110 TWh of curtailed energy saved each year and 55 Mtons of CO_2 emissions avoided each year until 2040. Market integration would progress, with price convergence increasing between bidding zones thanks to an additional 467 TWh/year of cross border exchanges by 2040.

- The System Needs study expresses needs in terms of cross-border transmission capacity increase and identifies the most cost-efficient combination of increases, but it does not mean that the identified set of increases are the only solution. The identified needs can be addressed in multiple ways such as increased transmission capacity, storage, hybrid offshore infrastructure, smart grids and power to gas.

- Investing in infrastructure will be key to support the economy in the post COVID era, where the goal of developing Europe towards a decarbonized economy is an opportunity not only to fulfil the ambitious European objectives, but also to support the European industry. Addressing the identified needs by 2040 would represent 45 bn € of investment, translating directly into jobs and growth.

- Some of the identified needs are already covered by concrete TYNDP projects, while about 50 GW do not correspond to actual projects in the 2040 horizon. All options should be considered when these needs turn into projects and coordinated planning will be needed across sectors. This is especially important in the subsequent steps where further analyses in terms of environmental impact, viability, benefits beyond socio-economic welfare and refined costs are carried out in order to complement the definition of the best project portfolio.

- The energy transition is also creating needs for system operations. Trends show a reduction of system inertia due to increasing integration of renewable energy sources and distributed generation, leading to higher vulnerability of the system to frequency mismatches. Flexibility options will gain in importance, both at generation and demand level, and in this context the role of TSOs in securing network stability will be key.

Q&A

What are system needs?

System needs show borders/areas where new solutions for electricity exchange are needed to reach decarbonisation targets and keep security and costs under control. This study focuses on needs beyond the next anticipated wave of cross-border grid investments (35 GW by 2025). They use the National Trend scenarios for 2030 and 2040, which means that the system needs identified exist in a world where significant uptake of renewable energy sources and system flexibility already happened.

System needs or transmission needs?

The System needs study describes needs, not the solutions to the needs. The study uses interconnection transmission capacity to express the needs because it is based on electricity TSOs' expertise, data and models, but it does not mean that electricity infrastructure is the unique solution. The methodology only provides indication of where, for example, market integration could be improved, but it cannot prioritise between possible solutions. ENTSO-E expects that addressing tomorrow's challenges will require the parallel development of all possible solutions, including for example storage, the role of prosumers and generation, in addition to reinforcing the transmission grid.

Will TSOs plan the future grid based on identified system needs?

The System needs study is not a network development plan. It is a study that investigates one particular dimension of the future, which is where increases in network capacity would be the most cost-efficient from a pan-European perspective. To plan future network development, TSOs consider a multitude of aspects, including socio-economic welfare but also other benefits of projects (for instance in term of security of supply or reductions of CO_2 emissions) and other scenarios of evolution of the energy system. TSOs will use the study's findings as a tool to develop future National Development Plans, in complement to national and regional planning studies.

How are stakeholders involved in the identification of system needs?

The System Needs package, including the System Needs report and the six Regional investment plans published alongside it, will be submitted to a public consultation with the other deliverables composing the TYNDP 2020 package in early November 2020. The scenarios on which the system needs study and the TYNDP are based were submitted to a public consultation in late 2019. To further engage with stakeholders, a webinar took place on 28 September 2020.

Stakeholders comments will serve to improve the reports. Comments regarding the methodology itself will be taken into account to improve the future editions of the System needs study, as time does not allow to re-run the study. Stakeholders wishing to discuss how the assessment of system needs could be further improved are welcome to contact ENTSO-E at **tyndp@entsoe.eu**.

In January 2021, the entire TYNDP 2020 package will be submitted to ACER for a formal Opinion.

Read the full report

Visualise the system needs

Alongside the System needs report, ENTSO-E is publishing six regional investment plans diving into details of the specific needs at regional level for 2030 and 2040 and including additional studies.

Northern Sea

Baltic Sea

Continental Central East

Continental South West

Continental Central South

Continental South East

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