TeasiMed

TOWARDS AN EFFICIENT, ADEQUATE, SUSTAINABLE AND INTERCONNECTED MEDITERRANEAN POWER SYSTEM

Closing Conference

A project by

Med-TSO
MEDITERRANEAN TRANSMISSION SYSTEM OPERATORS

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INTEGRATION OF THE MEDITERRANEAN POWER SYSTEMS:

A KEY DRIVER FOR ENERGY TRANSITION

Leveraging Interconnections for a Sustainable Energy Transition in the Mediterranean

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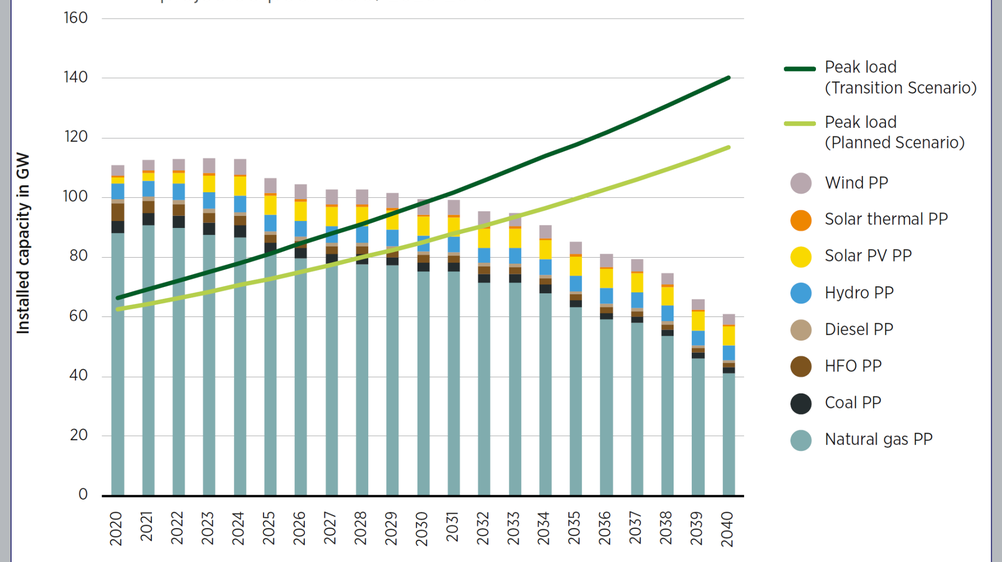
Acting Director Innovation and Technology Center

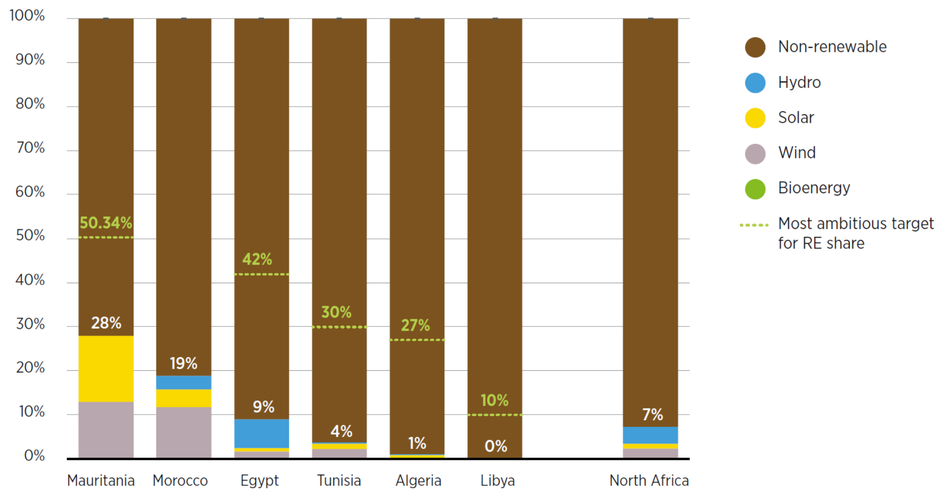
Growth in power sector can drive transition in North Africa

Figure 1-7 Existing and committed capacity in North Africa by technology, compared with projected peak load, 2020-2040



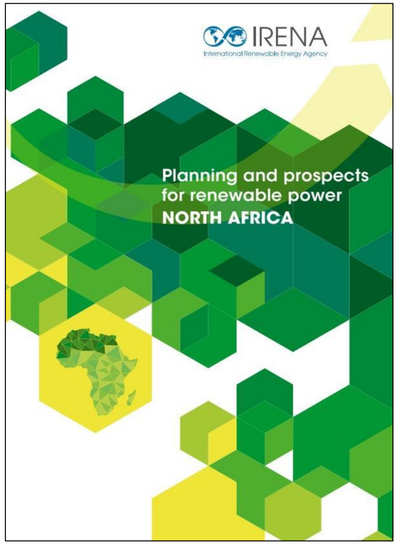
Note: GW = gigawatt; HFO = heavy fuel oil; PP = power plant.

Figure 1-9 Share of energy sources in electricity generation in 2019 and most ambitious targets for renewable energy (including hydropower) in North Africa



Source: (IRENA, 2020a; Ministry of Electricity and Renewable Energy of Libya, 2013; Ministry of Energy and Mining of Algeria, 2015; Ministry of Environment and Sustainable Development of Tunisia, 2015; Reuters, 2021a).
Note: Morocco has a target for installed renewable energy capacity, not for the share of renewable energy in the electricity mix. RE = renewable energy.

So far, the renewable energy has played a marginal role in North Africa but the region can strongly benefit from the falling renewable energy costs and its ample endowments of wind and solar energy. Power sector expansion needs in the medium to long term (2025-2040) due to retiring generation capacity and rising demand, offers a space for the transition away from fossil fuel reliance.

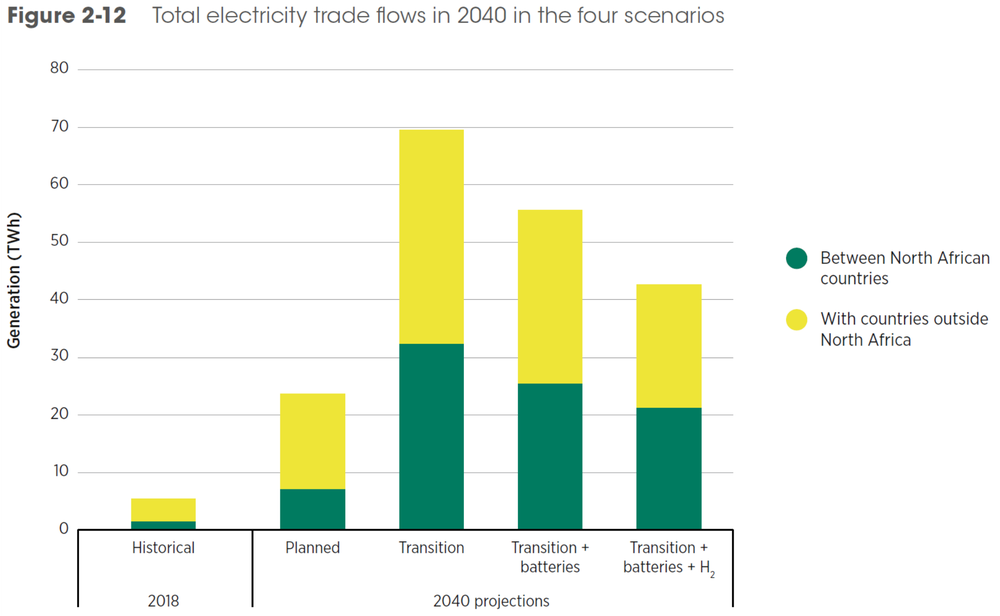


https://www.irena.org/Publications/2023/Jan/Planning-and-prospects-for-renewable-power-North-Africa

Some key drivers have already shaped up in the region:

- Most countries have NDC commitment (except Libya)
- Policy ambitions in the region reveal an overall desire to reach higher RE share
- Solar and Wind power is expanding and getting cheaper
- Over the last few years, the countries have signed several agreements partner countries and private companies to explore green hydrogen production and launch pilot projects.

Significance of Interconnections in the North Africa region



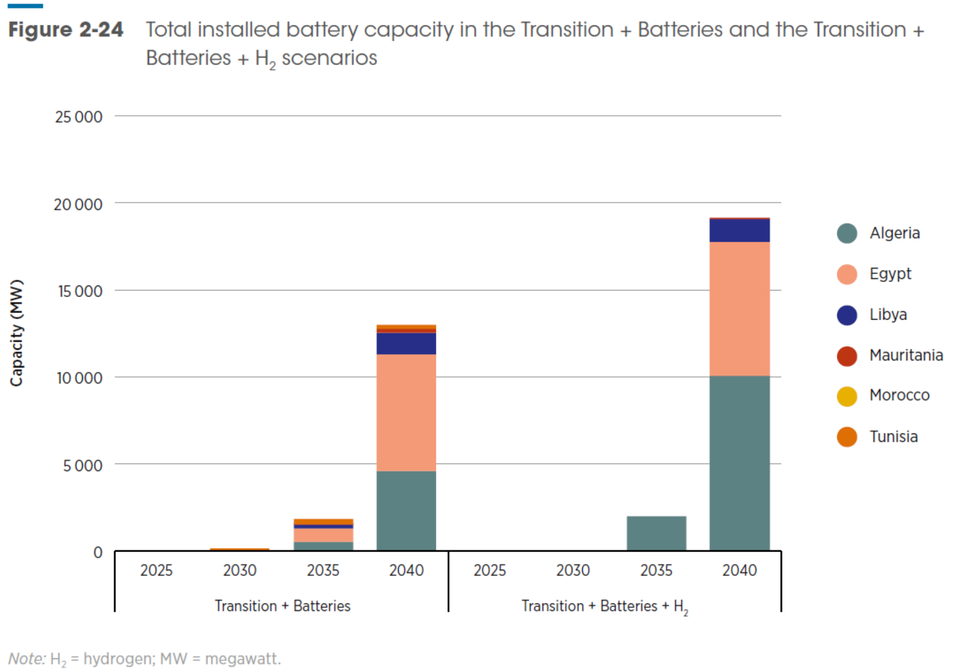
Note: TWh = terawatt hour.

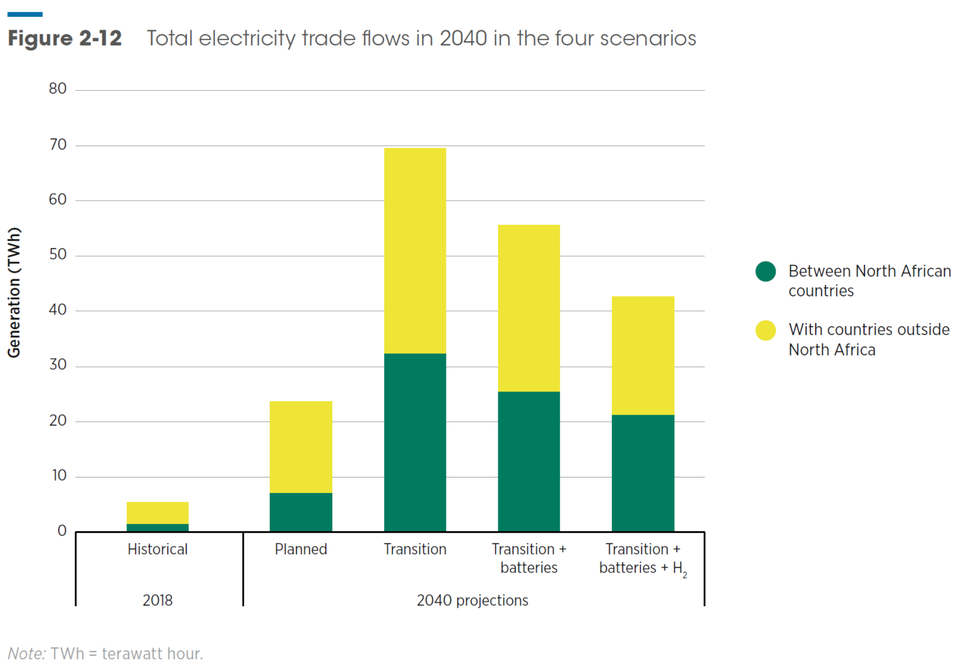
Currently, there exist major constraints on cross border electricity trade owing to lack of trade mechanisms and grid stability related operational constraints, even though the physical capacities of the interconnection lines are sufficient to allow more exchange.

Projection under planned scenario indicates the potential for the region is expected to reach 36% RE share in generation in 2040, together with a fivefold increase in energy trade.

Pursuing greater end use electrification and investments in cross-border electricity interconnections (the transition scenario), there is an opportunity to reach 87% RE share in generation by 2040 while significantly decreasing the unit cost of electricity generation (by 14% compared to planned scenario). For this to happen, the electricity trade would require 3-fold increase compared to planned scenario.

Significance of Battery storage in the North Africa region





Currently, the deployment of battery storage is not included in national energy plans in North African countries, and there are no large-scale stationary battery storage projections in the region.

With battery growth included in the transition solution, the unit cost of electricity has more room to decrease by 2040 (6.4% less than transition scenario).

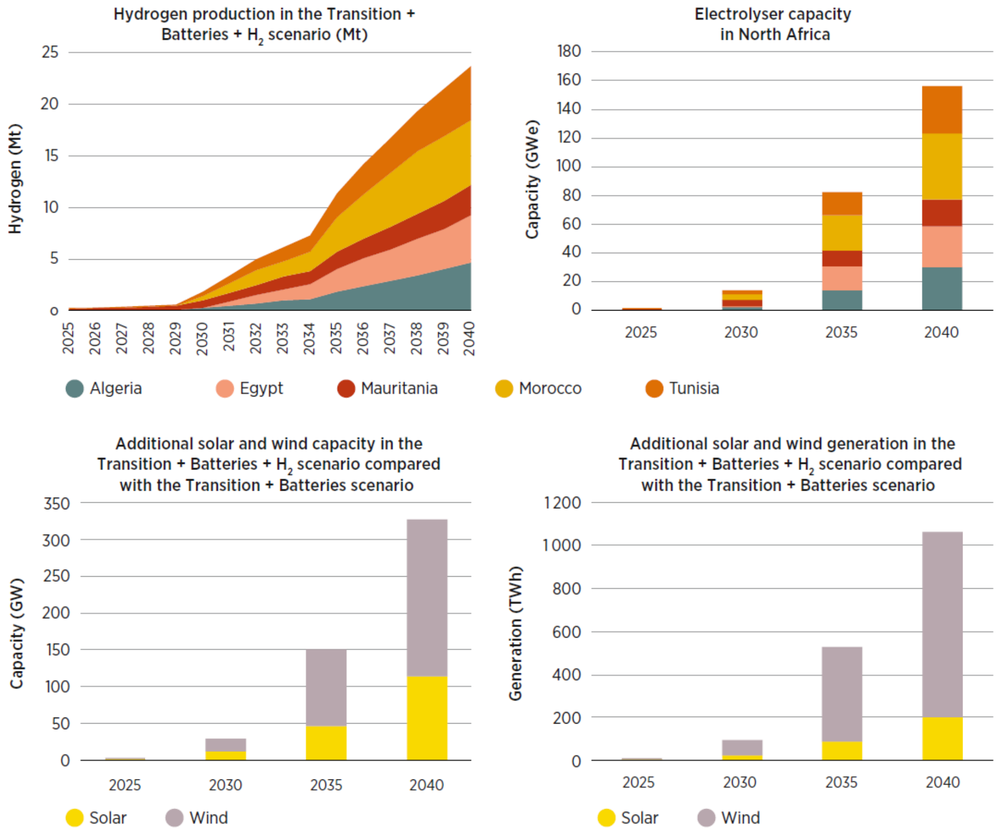
Being a crucial flexibility resource in a high VRE environment, battery storage can also lower the need for cross border interconnection capacity.

Green hydrogen production potential in North Africa region

Given the excellent solar and wind resource endowment in the region, North Africa has a strong opportunity to position itself as green hydrogen supplier.

In the scenario where electrolyzers are allowed to enter in the transition solution, the hydrogen production level can reach above 23 Megatonne by 2040. This pathway stipulates more than double growth in variable renewables capacity (wind favored over solar) leading to an RE share in generation of 94% by 2040, resulting in an overall decrease in unit cost of power generation of above 46% compared to planned scenario.

Figure 2-29 Evolution of hydrogen production, electrolyser capacity and generation from variable renewable energy in North Africa in the Transition + Batteries + H_2 scenario, 2025-2040



Note: GW = gigawatt; GWe = gigawatts electric; H_2 = hydrogen; Mt = megatonne; TWh = terawatt hour.

Table 2-9 Comparison of hydrogen production in the Transition + Batteries + H_2 scenario with national, regional and global hydrogen demand projections, 2030 and 2040

COUNTRY/REGION	SOURCE	DEMAND PROJECTIONS (MtH_2/YEAR)	
		2030	2040
Germany	National Hydrogen Strategy (Federal Ministry for Economic Affairs and Energy, 2020)	2.7-3.3	n/a
Europe	(EHB, 2021; Hydrogen Europe, 2020)	10-17.5	40
	(European Commission, 2022a)	20	
Globe	(Acil Allen, 2018; BP, 2020; COAG Energy Council, 2019; Global Alliance Powerfuels, 2020; Hydrogen Council, 2017; IEA, 2020c, 2021b; Shell, 2021; WEC, 2016)	80-212	94-391

Large scale addition of renewables crucial for the energy security in the region

Greater addition of renewables are needed to meet the 2050 target of decarbonizing the electricity sector in the region. The addition of renewables brings its own challenges such as variability of supply, its diversity, either in terms of technology, investment cost, potential or production pattern and requires adequate measures in place to counter this.

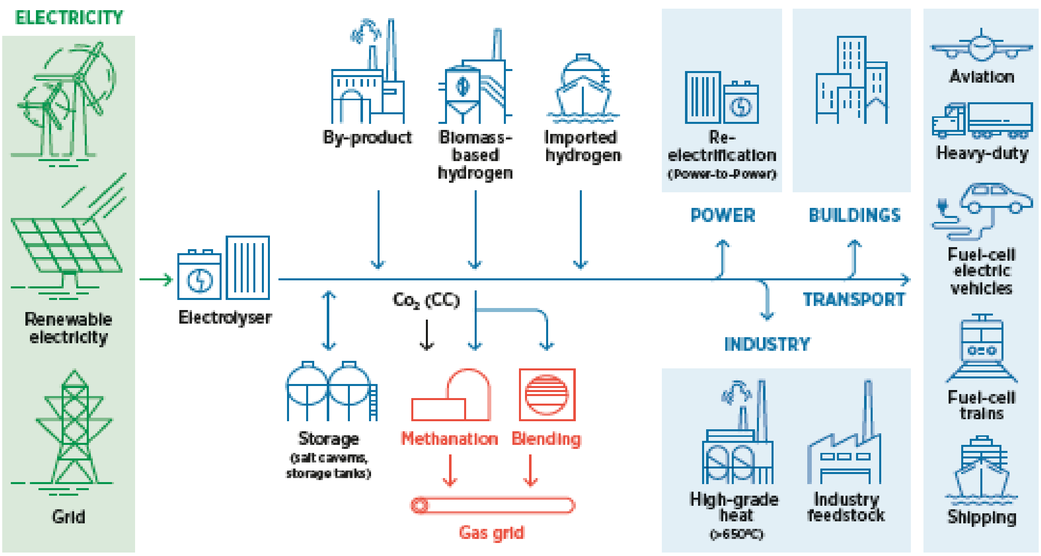
Some of the challenges that arise are from addition of RE

- **Requires higher flexibility in operation**
- **Requires larger operating reserves**
- **Causes frequent ramping of thermal generation units at higher costs**
- **Requires efficient grid management**

Challenges also exist in

- **Not utilizing the current system capacity to the fullest**
- **Major investment required in existing and new infrastructure**

Strengthening of the regional grid is key for better system integration



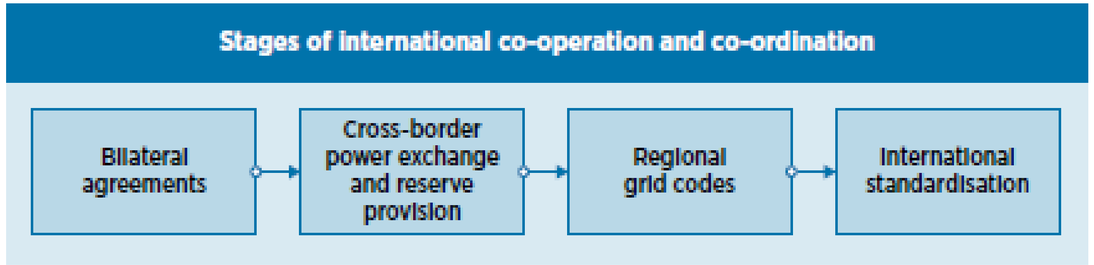
With a projected demand for electricity set to double in some countries in the region, it is key to implement solutions that foster security and sustainable socio-economic growth.

Available Solutions to strengthen the grid

- **Interconnections-** AC or HVDC/ (UHV DC) connections
- **Regional grid codes**
- **Storage systems-** Innovative operations of batteries, pumped hydro systems etc.
- **Demand response**
- **Power to X solutions** -Green hydrogen-enabling distribution of renewable power across regions and globally
- **Electric Vehicles**
- **Flexible thermal power plants**
- **Digitalisation**- Smart grids, Internet of things, Artificial intelligence and big data

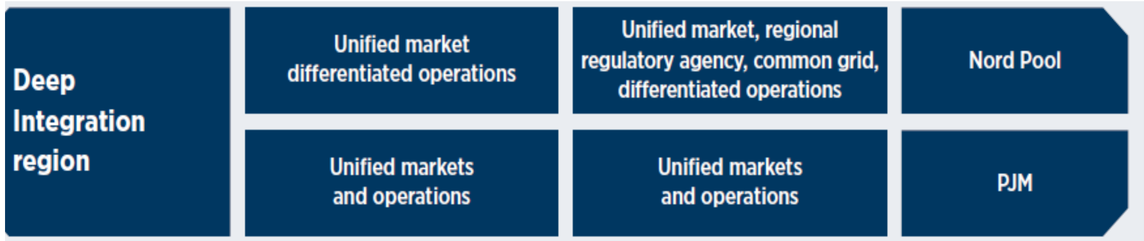
IRENA (2019), Innovation landscape for a renewable-powered future: Solutions to integrate variable renewables. International Renewable Energy Agency

The Euro–Mediterranean Power Grid Integration is critical for energy independence in Europe.



International examples show the many available options for establishing interconnectivity and electricity trading between non-synchronized regions. The use of latest technologies, a collaborative approach to implementing renewables-based interconnections providing a regulatory foundation for building further interconnection can help furthering interconnections.

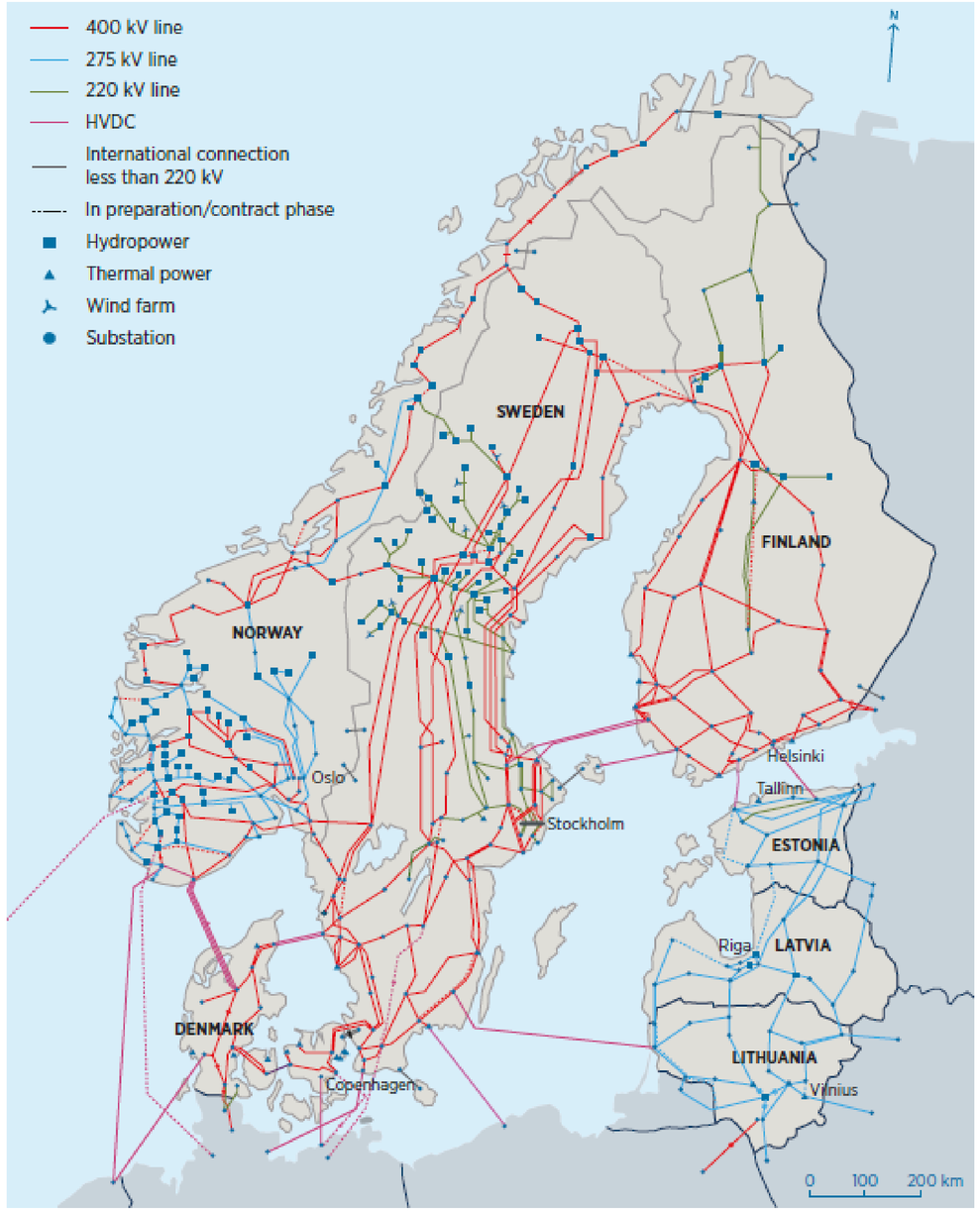
Examples of regional market operations



Current status of interconnections in the region

- 10 interconnections between the EU and neighboring countries including with Turkey and Morocco.
- Turkey's transmission grid is interconnected with South-East Europe's synchronous 400 kV grid to Greece and two lines to Bulgaria.
- Morocco's grid is linked with Spain through two 400 kV subsea cables.
- The Italy–Tunisia interconnection project is currently under implementation.

Source: IRENA and KEEI (2021), Renewable energy and electricity interconnections for a sustainable Northeast Asia, International Renewable Energy Agency.



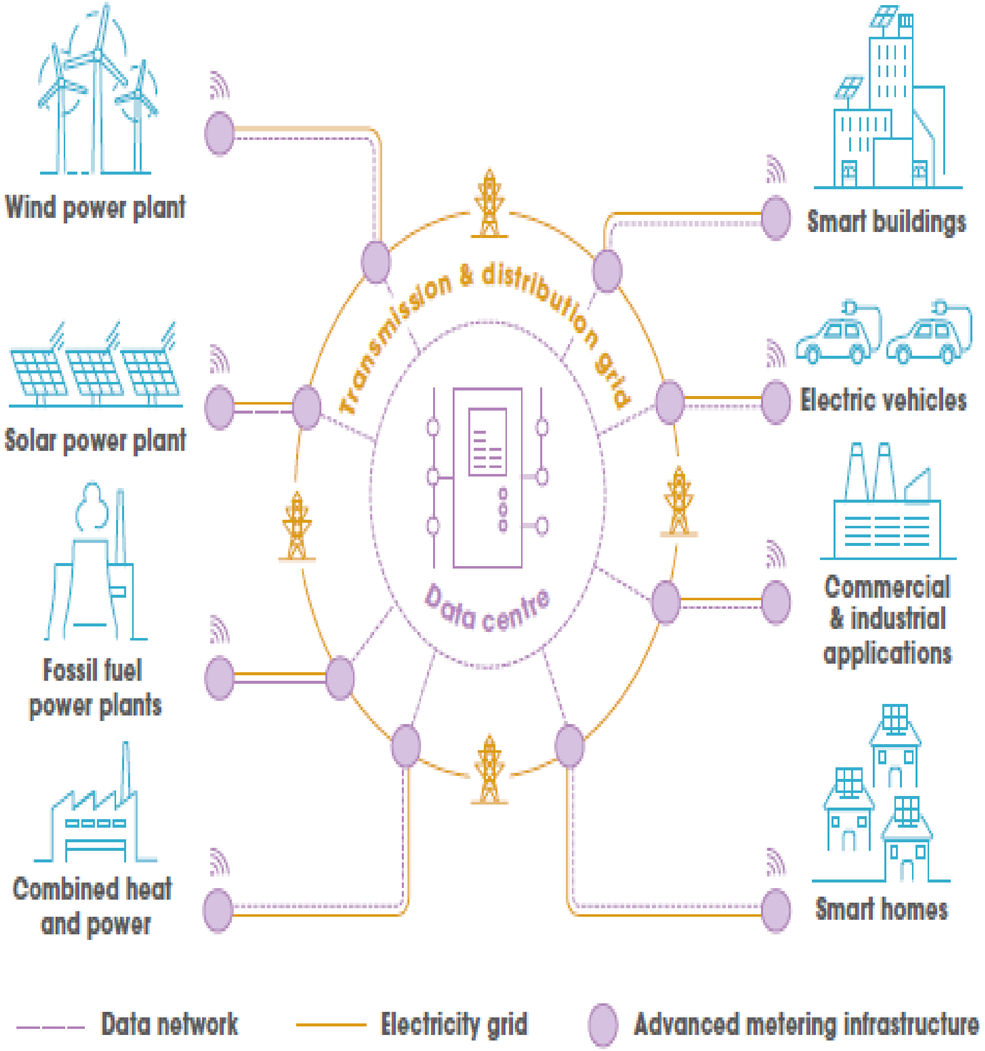
Cross-border power interconnection provides several advantages.

Cross-border power interconnection provides following advantages

- **Can promote electricity trade-** generating income from power sales
- **Foster integration of electricity markets-** evolving markets with new business opportunities for trading
- **Enable the development of and access** to larger resources for peak load balancing
- **Provide access to cheaper supply sources-** through avoided fuel costs, transmission improvement costs, generation costs and operation costs.
- **Boost the flexibility and reliability** of local grids
- **Will allow full use of renewable resources** while maintaining an efficient, reliable and affordable energy grid.
- **Allow for the sharing of reserves** between countries
- **Increase overall system security** by exploiting diversity of reserves

Source: IRENA and KEEI (2021), Renewable energy and electricity interconnections for a sustainable Northeast Asia, International Renewable Energy Agency.

Advanced digital technologies and regulations can help leverage interconnections better.



Harmonized regional grid codes and can facilitate the regional sharing of flexibility and will allow equipment manufacturers and project developers to provide equipment compliant with requirements at a lower cost owing to economies of scale.

Digital technologies, such as AI supports the decision-making process, in operation and maintenance of systems and implementation of new market designs and Big data provides a clear overview, input for AI to; and the emergence of new business models.

IoT devices enable “smart grids” through the collection, transmission and use of large amounts of data, intelligently integrating grid-connected users, optimising grid operation and increasing system flexibility.

Source: IRENA (2019), Innovation landscape brief: Internet of Things, International Renewable Energy Agency

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THANK YOU!

TEASIMED Closing Conference
Brussels, 15 march 2023

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