Options for 2030 grid development between the Arab countries and Europe to foster RE integration

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Dii grid study increases level of detail for grid infrastructure in the mid- (2030) and long-run (2050)

Desert Power Getting Started

Cost effective power system with one node per country considering HVDC technology

Dii Grid study 2050 horizon

Feasibility check through split of countries in up to 5 nodes

Dii Grid study 2030 horizon

Load-flow based grid model with several hundred nodes/country considers different technologies and interaction with existing EHV AC grid

- Reinforcements based on 2022 grid in terms of:
  - Net Transfer Capacity (NTC) of the main corridors between and inside countries in the EUMENA region
  - The size of converter stations of the HVDC links necessary to manage the power flows
  - The estimated investment and operational costs of all grid reinforcements
Three corridors ensuring the EUMENA power exchanges examined in depth

EUMENA electricity corridors by 2030

Western corridor
Central corridor
Eastern corridor
DP:GS Connected Scenario 2030 constitutes the main boundary conditions for the EUMENA Grid Study.
Sophisticated models for the optimization process considering corridors characteristics

**Setting-up the reference power system**

- Grid in year 2022
- DP:GS 2030 Scenario

**Optimization models**

- DC Load Flow computations
  - Western, Central and Eastern Corridor
    - Several thousands of nodes
    - HVAC grid considered
    - HVDC/AC reinforcements
    - Several snapshots

**Technical and economic results**

- Western Corridor
- Central Corridor
- Eastern Corridor

**Economic parameters (AC/DC facilities costs)**

**Technological parameters (AC/DC, submarine/underground, OHL)**
In the Western corridor, $3-4GW_{NTC}$ HVDC interconnections would be required to link North Africa and Europe.

- In the Western Supergrid, the most relevant reinforcements connect Morocco-Spain-France-Central Europe with $6GW_{NTC}$ capacities.
- In MENA, a $3GW_{NTC}$ interconnection would connect Morocco and Algeria.
- Network investments in the period 2023-2030 approx. 2 times higher than those between 2012-2022.
In the Central Corridor, connection from Algeria to Sardinia, Tunisia and Libya to Sicily through 2-3GW\textsubscript{NTC} HVDC links

- HVDC reinforcements not only for Europe-MENA interconnections, but also inside Italy and Algeria
- AC reinforcements sufficient inside Tunisia and Libya as well as in Central European countries
- Investments between 2022 – 2030 approx. 3 times higher than those of the projects up to 2022

Source: CESI/Comillas
Note: In the central corridor, 3 different alternatives were analyzed in order to find out the optimal solution to connect Italy to North Africa
In the Eastern corridor, $1-3GW_{NTC}$ HVDC interconnections would be required to connect both shores of the Mediterranean.

- HVDC reinforcements not only for Europe-MENA interconnections, but also inside Turkey and MENA countries where power is transmitted on long distances
- AC reinforcements sufficient to expand the European grid
- For ENTSO-E countries, investments between 2022 – 2030 approx. 60% of decade 2012- 2022

Source: CESI/Comillas
Dii’s EUMENA Grid Analysis represents the first step towards in-depth planning of relevant TSOs

- From a technical perspective:
  - The physical construction of the high ways could be an important challenge due to sea depth in some regions
  - The operation of a power system with a very high penetration of RES is an important challenge in order to assure the security of supply

- From an economic perspective,
  - investments would be approximately multiplied by 2-3 times in the central and western corridors

- The EUMENA Grid Study represents only a pre-feasibility stage in the process of analysis and establishment of the electricity highways between the MENA region and Europe.
  - Detailed analyses and final decisions are the role of local and regional institutions
Grid expansion and integration will require political commitment and international regulation.

**Short term (until 2022)**

- Building first grid infrastructures between North Africa to Europe (e.g. TYNDP 2012 projects)
- More collaboration among TSOs in order to encourage a greater exchange of information on how the systems are operated.
- Application of electricity market rules in preparation of systems integration.

**Mid-term (2022-2030)**

- Speeding-up the interconnections development in the Mediterranean area
- Adopting common policies in Europe involving technical and regulatory aspects.
- Promoting the new infrastructures as Projects of Common Interest (PCI) and starting the realization of existing ones.
- Ensuring that the new infrastructures can help achieving TSOs targets.

*In a next presentation*
Dii will provide a comprehensive summary report of the EUMENA grid study by June.

**CESI**

Pre-feasibility analysis on power highways for the Europe-MENA region integration:

- **Dii EUMENA Grid Study report**
  - 2030: Identification of first transmission highways as base for EU-MENA integration
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Thank you for your attention!

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