Regional Integration of Energy Markets: Europe and North Africa

Alternative routes to connect the South and North shores in the centre of the Mediterranean
The EU already imports over 50% of its energy needs
In 2015, the EU was importing:

- 1265 TWh from Russia
- 1082 TWh from Norway
- 314 TWh from Algeria
- 236 TWh from Qatar
- 63 TWh from Libya

*BP Statistical Review 2016
To meet climate targets, Europe can’t keep burning gas

And need to stop burning coal and replace aging nuclear fleet. Replacement Market: 50GW to be replaced by low carbon resources by 2030

**Coal Generation Declining and Need Further Reduction to Meet COP21 Target**

**Existing Nuclear Fleet Ageing and Reducing Capacity**

Source: Climate Analytics

Source: Carbon Brief
Further electricity market growth: deep decarbonisation of energy system will drive demand for electricity for transport and heating

**DISRUPTIVE IMPACT OF ELECTRIC VEHICLES**

**Electric Cars Go Mainstream**

- Source: Bloomberg New Energy Finance

**4 TO 5 FOLD INCREASE IN ELECTRICITY DEMAND**

- Source: Wuppertal Institute

The Wuppertal Institute predicts that a full decarbonisation (without EE offensive) would lead to a 4 to 5 fold increase of power demand in Germany.
CSP Exports from MENA to Europe are part of the solution

- September day load profile in Germany (MW)
- CSP with 16 hours of storage production (normalised)
- Offshore wind production (day in Sept, normalised)
- Nuclear production (normalised)
- PV production (day in September, normalised)

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<table>
<thead>
<tr>
<th>TuNur CSP</th>
<th>Offshore wind</th>
<th>Nuclear</th>
<th>Solar PV</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Only generate during high value hours of the day, eg 7am–11pm, or 2pm-10pm</td>
<td>• Intermittent over the 24h of the day</td>
<td>• Constant throughout the day</td>
<td>• Intermittent during day light hours</td>
</tr>
<tr>
<td>• No generation during low value hours</td>
<td>• Generates at average capacity during low demand periods</td>
<td>• Full capacity during low demand periods</td>
<td>• Does not generate at night</td>
</tr>
</tbody>
</table>
LCOE comparison: CSP vs PV with Storage

Existing telecom submarine cables in the Mediterranean

The cable routes on the map are stylized and do not reflect the actual path taken by systems.

Source: http://www.submarinecablemap.com/
Interconnection projects in the Mediterranean

**In Service**
- SACOI Sardinia/Corsica/Italy: 300 MW DC
- GRITA Greece / Italy: 500 MW DC
- Morocco / Spain: 2 x 700 MW AC
- SAPEI Sardinia / Italy: 1 GW DC
- COMETA (Baleares): 400 MW DC
- Malta / Italy: 200 MW AC
- Sorgente 2 Sicily / Italy: 2 x 1 GW AC

**Under Study**
- TuNur 3 Tunisia / France: > 2 GW DC
- Romania / Turkey: 600 MW DC
- Albania / Italy: 1 GW DC
- Algeria / Sardinia: 1 GW DC

**Under Development**
- TuNur 1 Tunisia / Malta: 250/500 MW DC
- TuNur 2 Tunisia / Italy: 2 GW DC
- EuroAsia Greece/Crete/Cyprus/Israel: 2 GW DC
- Elmed Tunisia / Italy: 600 MW DC

**Under Construction**
- MONITA Montenegro / Italy: 1.2 GW DC

**Proposed**
- TuNur 4 Morocco / France: > 2 GW DC
- Algeria / Spain: 2 GW DC
- Egypt / Cyprus: 1 GW DC
- Libya / Italy: 500 MW DC
- Kroatia / Italy: 1 GW DC
But permitting is a challenge: Italy

• Technical Solutions offer (STMG) from Terna, to connect up to 2,000MW at the Substation in Montalto di Castro
• Based on the STMG, TuNur will file the authorisation of the interconnection and the construction of the HVDC converter stations
• Single Authorisation Procedure (application submitted to Ministry of Economic Development and to the Ministry of Environment and Protection of Land and Sea)
  – Submission of following documents:
    1. *Executive summary and preliminary project document outlining project aspects on a cartographic map*
    2. *Environmental Impact Assessment for land and marine sections, incl seabed inspection within 12NM from shore*
    3. *Technical works layout*
    4. *Landscape authorisation*
    5. *Agreement with Terna*
    6. *Report on public utility of the project*
    7. *Report on fire prevention legislation*
    8. *Report on soil and rocks (‘utilization plan’)*
    9. *Bilateral agreement between Italy and Tunisia*
  – Payment of a fee (proportional to project size)
• After the application for the Single Authorisation, follow the “conference of Services” and provide integrations if requested, until the completion of the conference and the publication of the authorisation on the Official Journal.
• Further subsequent studies required:
  – Revised key constraint study of the submarine corridor
  – Design and Environmental Impact Assessment for land and sea
  – Submarine survey (12NM)
Permitting in Malta

- Preparation of the documents for the application to the competent authorities including:

<table>
<thead>
<tr>
<th>Entity</th>
<th>Documents required for application</th>
</tr>
</thead>
<tbody>
<tr>
<td>Continental Shelf Department (Ministry for Transport and Infrastructure)</td>
<td>• Seabed inspection of all maritime corridor up to the continental shelf boundary</td>
</tr>
</tbody>
</table>
| MEPA Malta Environment & Planning Authority | • Seabed inspection of all maritime corridor up to 12 NM, detailed design of cable installation and marine environmental impact assessment  
• Buildings: development application and permit  
• Trenching: simplified application with detailed design and environmental screening  
• Tunnel: full application for right to drill with environmental impact.                                                                 |
| REWS Malta Regulator for Electricity and Water Services | • General regulatory aspects, compliance with EU regulation about energy market                                         |
| TM Transport Malta, Malta Transport Authority | • Reserved corridors, bunkering areas, anchoring areas, fishing reserve areas                                             |
| Superintendence of Cultural Heritage        | • Verify exclusion from areas of potential archaeological interest                                                        |
| Land Registry of Malta                      | • To be involved about the land plot for the substation and the excavation                                               |

- Further subsequent studies required:
  - Desktop key constraint study of the submarine corridor
  - Design for land and sea according to all the competent authorities
  - Submarine survey (12NM in detail, up to the continental shelf)
## IT/MT Permitting timeline comparison

<table>
<thead>
<tr>
<th>TuNur Montalto Italian side permitting</th>
<th>2017</th>
<th>2018</th>
<th>2019</th>
</tr>
</thead>
<tbody>
<tr>
<td>Q3</td>
<td>Q4</td>
<td>Q1</td>
<td>Q2</td>
</tr>
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<td>Q1</td>
<td>Q2</td>
</tr>
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</table>

- Italian side environmental screening and basic design land & sea
- Cable corridor environmental studies
- Seabed inspection 12 NM for permitting
- Italian side Environmental Impact Assessment
- Italian side Filing for authorization
- Follow up to Conference of Services and related
- TUN/IT agreement for transmission discussion
- TUN/IT agreement for transmission signed
- Italian side Unique Authorisation achieved (forecast)

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<th>TuNur Maltese side permitting</th>
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- Maltese side environmental screening and basic design land & sea
- MEPA Malta Environment & Planning Authority
- Continental Shelf Department: seabed inspection
- TM Transport Malta Authority
- Superintendence of Cultural Heritage
- Land Registry of Malta
- REWS Malta Regulator for Electricity
- Maltese side Filing for authorization
- Maltese side full permitting achieved (forecast)
Why Tunisia?