Dynamic Cables: A Link to the Offshore Industry through Innovation

Offshore Renewable Energy

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15/10/2019
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Hellenic Cables S.A. at a Glance

- Worldwide sales network
- Approved supplier of the largest international Electric Utilities
- Sales in more than 50 countries
- Amongst the world largest and highly advanced Submarine Cable factory
- Majority of turnover is achieved abroad
- Expansion is fueled by ongoing CAPEX
- €240 Million since 2002
- Annual capacity of 180,000 tn of cables
- 100+ turnkey projects

Turnkey Solution provider
Long Heritage of Successful Growth

Key Milestones

1950
Production of cables by Viohalco

1973
Establishment of Hellenic Cables S.A.

1999
Acquisition of ICME ECAB

2003
New Thebes cable plant start-up of HV line

2011
Acquisition of Fulgor

2012
- 2016
€90m investment for HV submarine cables

2016
New contracts awarded by TenneT, Energinet & E.ON
Merger into Cenergy

2017
New Contracts awarded by Enel and Elia (1st Project of 220kV with approx. value of €70m)

1973
Establishment of Hellenic Cables S.A.

Very long history of more than 65 years
Hellenic Cables serves blue chip customers across a range of attractive and growing end-markets including electricity distribution, construction, renewables and telecommunications.

**Power Cables**
- High and extra-high voltage cables
- Medium voltage cables
- Low voltage cables

**Submarine Cables**
- HV & EHV submarine cables
- MV submarine cables
  - Paper insulated
  - XLPE, EPR insulated
  - Composite power
- Optical fibre submarine
- Umbilicals
- Flexible pipes

**Telecom Cables**
- Telecomunication network cables
- Optical fibre cables
- Data transmission
- Signaling, instrumentation and control cables

**Enameled Wires**
- Magnet / enameled wire for transformers
- Magnet / enameled wire for motors
- Al and Cu round and flat magnet wires

**Markets**
- Power transmission & distribution
- Construction and infrastructure
- Renewable energy
- 3G/4G/5G mobile networks
- FTTH networks
- Railways
- Oil & gas
- Motor and electric
- Electronic information
- Household appliances

**Established Relationships and Solid Track Record with Blue Chip Customers**

Utilities

Trade & Installers

Industrial
Hellenic Cables operates six production plants, of which four in Greece, one in Romania and one in Bulgaria.

**Thiva**
- **Capabilities**
  - LV/MV/HV power cables
  - Fibre optic cables
- **Capacity**: 60,000 tons
- **Area**: 175,082 m² land / 44,408 m² industrial complex
- **Production personnel**: 245

**Fulgor**
- **Capabilities**
  - MV/HV submarine cables, LV/MV/HV power cables, fibre optic submarine
- **Capacity**: c. 60,000 tons of cables and c.120,000 tons of wire rod
- **Area**: 218,247 m² land / 80,048 m² building facilities
- **Production personnel**: 350
- **Docking facilities for loading submarine cables onto cable laying vessels**

**Oinofyta**
- **Capabilities**
  - PVC compounds
  - Rubber compounds
- **Capacity**: 20,000 tons
- **Area**: 21,263 m² land / 6,444 m² industrial complex
- **Production personnel**: 30

**ICME ECAB**
- **Capabilities**
  - Power cables
  - Telecommunication cables
- **Capacity**: 60,000 tons
- **Employees**: 600
- **Area**: 268,000 m² land / 70,000 m² industrial complex

**LESCO**
- **Capabilities**: wooden packaging products (pads, reels, pallets, packing cases), including wooden spools
- **Capacity**: 16,500 m³
- **Employees**: 70
- **Area**: 25,000 m²

**Livadia**
- **Capabilities**: Cu and Al round and flat
- **Capacity**: 12,000 tons
- **Area**: 121,818 m² land / 14,048 m² industrial complex
- **Production personnel**: 50
Offshore Business
Market Outlook

Offshore Wind

a) Wind Turbines
b) Inter-array subsea cables (MVAC)
c) Export cables (HV AC or DC)
d) Power transformer
e) Power converter
f) Vertical Wind Turbine
g) Substations
Offshore Business
Global Offshore Wind - Mature & Emerging Markets

US: 2018-2030 plans

N. Europe 85% of global offshore wind (GW) and remains the most ambitious

Offshore Business
Positioning Offshore: From Local to Global player

Greece / SEE: Home market → North Sea: Established → N. America / SE Asia: Emerging markets

![Map showing Offshore Business projects and regions](image)
“Submarine Cable market shares in 2018. Hellenic Cables appeared to win a greater share than we had seen historically.”

Offshore wind connection market shares

Source: Credit Suisse Equity research, May 2019
Dynamic Cables
IAC (up to 72.5kV) and Export (> 72.5kV)

The largest offshore wind turbines ever built will begin powering millions of British homes using blades more than 100 meters long by the early 2020s. The biggest offshore windfarm in the North Sea will generate electricity for 4.5 million homes.

Larger and more powerful floating wind turbines (+12MW) are expected to be installed in the next few years.
Dynamic Cables
IAC (up to 72.5kV) and Export (> 72.5kV)
Dynamic Cables

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Platform

Buoyancy system

220 kV Export Cables

Inter-array cables

Anchors
Hellenic Cables presence in Dynamic Cables:

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<td>Postdoctoral Research Project</td>
<td>66kV Inter-array Dynamic Cable to undergo mechanical / fatigue tests at the University of Exeter</td>
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<td>Carbon Trust</td>
<td>Design and Testing submarine power cores for Dynamic 220kV Export Cables</td>
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<tr>
<td>FLOTANT – HORIZON 2020</td>
<td>Design of <strong>innovative</strong> low weight and low cost Dynamic Cable with alternative armor design</td>
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The project involves the modelling and fatigue testing of a 66kV Dynamic 3-core power cable in collaboration with the College of Engineering, Mathematics and Physical Sciences of the University of Exeter.

- Global analysis – Aero-elastic & Hydrodynamic modelling (OC4 semi-submersible platform - 5MW NREL wind turbine)
- Local load analysis / Fatigue analysis
- Cable production
- Fatigue testing (@DMaC test rig)
Dynamic Cables

Research projects

❖ Detailed 220 kV Dynamic Export Cable design.
❖ Detailed ULS and FLS analysis to approximate the mechanical performance.
❖ Manufacturing of the core of the proposed cable
❖ Performance of fatigue testing on separate cable cores lengths.
❖ Cost estimation regarding the commercial supply of the dynamic cable.
❖ Description of suitable accessories (repair joint, transition joint, hang off etc.).
FLOTANT project proposes to develop an innovative unit optimized to sustain a typical 10+MW wind turbine generator (WTG) in deep waters (100-600m), integrated by an anchoring system, a mooring system, a floater with its mast and a power export system, including a design for a deep-water substation, and O&M strategies, sensing and monitoring.

✔ Aluminium conductor  ❌ Copper conductor
✔ Synthetic armour braid  ❌ Steel armour
The future is here . . . !
Thank you!

Questions – Discussion