

HELLENIC CABLES GROUP




HELLENIC CABLES S.A.
GROUP OF COMPANIES


HELLENIC CABLES S.A.
HELLENIC CABLE INDUSTRY S.A.


FULGOR

ICME ECAB S.A.
CABLE INDUSTRY

June 2013

CORPORATE PRESENTATION

1. VIOHALCO Group

2. CABLEL Group

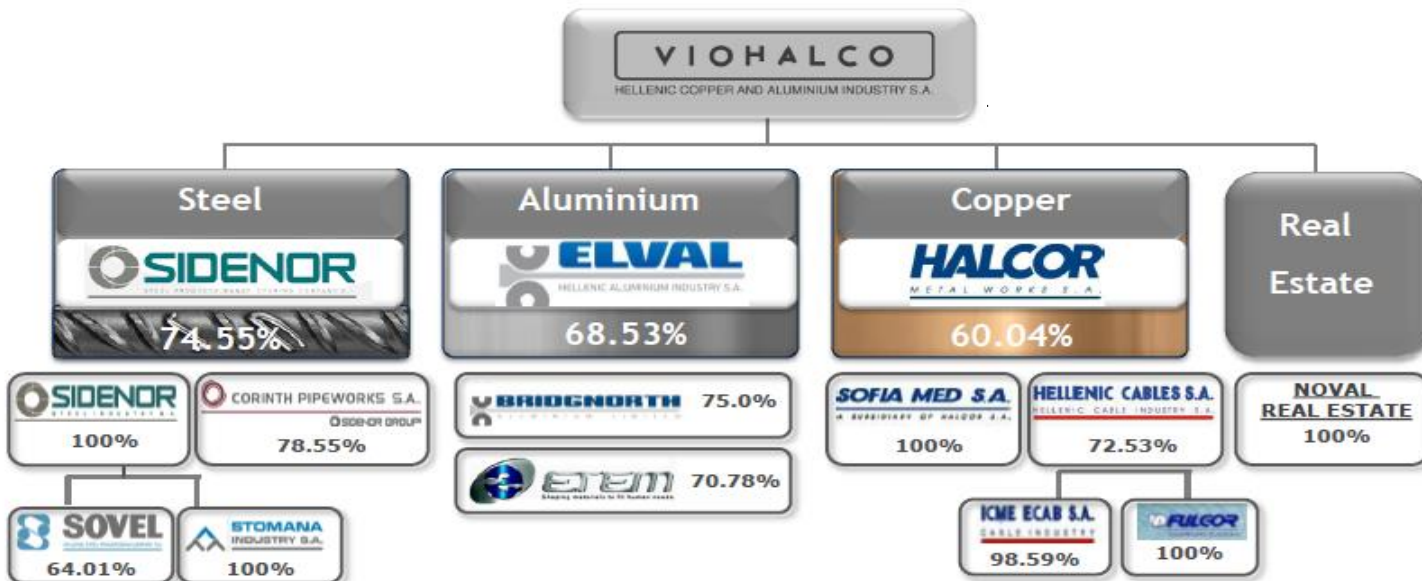
3. Submarine Cables



VIOHALCO Group

At a Glance

- ❑ VIOHALCO S.A. is the holding company of a **large European metals processing group**
- ❑ **Founded in 1937** and listed on the Athens Stock Exchange since 1947. 7 listed subsidiaries
- ❑ Turnover approx. **€3.3 billion in 2012**
- ❑ Participates in more than **90 companies** and has more than **8,000 employees**
- ❑ **Exports to more than 80 countries** worldwide, accounting for 12% of Greece's total exports
- ❑ Production facilities in **Greece, Bulgaria, Romania, Russia, FYROM and the U.K.**
- ❑ Follows a stable growth strategy by making **selective investments**
- ❑ **Group investments exceed €1.7 billion** since 2001



VIOHALCO Group Group Competencies

Production Capabilities

Steel



- 4 Mini Mill Plants
- 4 Pipes, Tubes & Hollow sections Plants



Aluminium



- 2 Al Rolling Plants
- 2 Al Extrusion Plants
- 8 other Plants (coating, foil, foundry, rolling shutters)



Cables

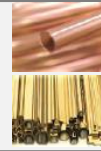


- 3 Energy and Telecom Cable Plants
- 1 Enamelled and Magnet Wire Plant
- 1 Plastic Compounds Plant

Copper



- 2 Copper Rod and Tube plants
- 2 Brass Copper Brass Plants



Production Facilities by Country



Greece: 21 plants



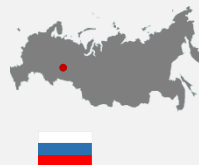
Bulgaria: 4 plants



Romania: 1 plant



FYROM: 1 plant



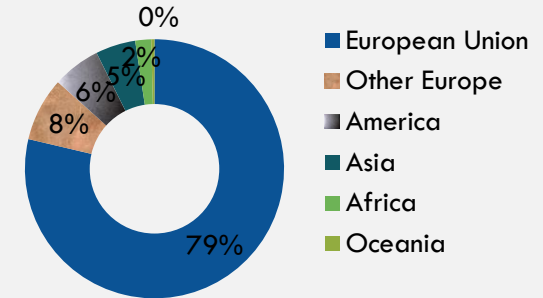
Russia: 1 plant



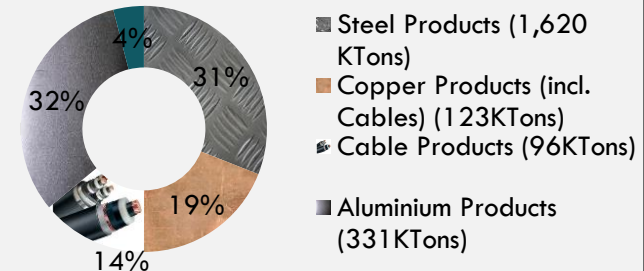
U.K.: 1 plant

2012 Sales Breakdown

2012 Turnover by Region



2012 Sales Breakdown by Metal Group



VIOHALCO Group

Aluminium

				
				
<p>Aluminium sheets and coils for: building and construction rigid packaging mass transportation automotive general engineering applications</p>	<p>Architectural Building Systems Aluminum Systems for - Doors and Windows - Façade and Skylights - Solar Protection Systems - Security - ETEM Protect Systems - Ventilated Façade Systems PVC Systems for Doors and Windows Solar Power Systems Insect Mosquito Nets Aluminum Railing Systems Aluminum Panels for doors Security / armored doors Extrusions for industrial applications, i.e. automotive, transport, etc</p>	<p>Surface-critical rolled aluminium products Litho coils for the offset printing industry including Computer-to-Plate applications Foilstock Reroll</p>	<p>Aluminium converter foil Household foil Food container foil Aluminium foil for cigarette inner liners Aluminium foil for chocolate and chewing gum inner wrapping Lacquered aluminium foil for yoghurt / marmalade lids</p>	<p>Coated aluminium products for architectural, transport and food applications Composite panels for architectural, corporate ID, signage, phase change material, sound absorption, marine and transport applications Perforated and corrugated sheets</p>
<p>www.elval.gr</p> 	<p>www.etem.com</p> 	<p>www.starlitho.biz www.starlitho.co.uk</p> 	<p>www.symetal.gr</p> 	<p>www.elval-colour.com</p> 

VIOHALCO Group

Steel

			
			
<p>SD Integrated Concrete Reinforcing System (SD Reinforcing Steel, SD Cut-to-length rebars, SIDEFIT special mesh, SD stirrup mesh, SD wire mesh, SIDEFOR stirrup cages, INOMIX steel fibers, Lattice girders) Merchant Bars (Squares, Flats, Rounds, Equal Angles, IPE Beams and UPN Channels), Pipes and Tubes (Square, rectangular & circular hollow structural section, Water & gas pipes, galvanized construction tubes and Thin wall tubes) Billets, Wire Rod</p>	<p>Semi-finished products (Billets, Blooms and Slabs), Flat products (Heavy-quarto Plates and Hot-rolled Plates), Long products (SD concrete reinforcing steel, Prefabricated stirrup cages SIDEFOR, SD wire mesh, SIDEFIT special mesh) Special Profiles (Railway Connections, Ploughshare Blades, THN Mining Profiles and Boron Flats), Merchant Bars (UPN Channels, Rounds, Equal Angles, Standard Flats), Bright Steels, Steel Balls for grinding</p>	<p>Steel pipes for the Oil, Gas and Water Industries and Hollow Structural Sections (HSS) for the Construction Sector, HFI pipes cover 8 5/8" – 26", wall thickness up to 25mm, steel grade up to X80 and length up to 18m. SAWH pipes cover 24"-100", wall thickness up to 25mm, steel grade up to X80 and length up to 18m. HSS up to 500x500x20mm, 600x400x20mm and Ø 660x25mm. Steel grade up to S460MH. External coating (PE/PP/FBE) and internal epoxy coating</p>	<p>Welding products (coated electrodes, welding wires and fluxes, flux-cored welding wires) Wire products (galvanized and black wires, galvanized mesh and Double Twist Hexagonal mesh (serasanetti))</p>
<p>www.sidenor.gr</p> 	<p>www.stomana.bg</p> 	<p>www.cpw.gr</p> 	<p>www.erlikon.gr</p> 

VIOHALCO Group Copper and Other Companies

 	 	 
<p>TALOS Copper Tubes for water supply, heating, natural gas, air conditioning, refrigeration and industrial applications CUSMART Copper Tubes for water supply, heating, floor heating & cooling TALOS DUAL Seamless Bimetallic Copper Tubes for HVAC&R and solar applications. Copper and Titanium Zinc Gutters</p>	<p>Brass Rods, Tubes, Flats, Wires, Sections and Soldering Rods, Aluminium Wires</p>	<p>Copper & Brass sheets, strips, circles and plates for construction, electrical, solar, automotive and other applications Titan Zinc sheets and strips for gutters and roofing applications. Copper flats, bars, rod and profiles for electrical applications</p>

<p>www.halcor.gr</p> 	<p>www.fitco.gr</p> 	<p>www.sofiamed.bg</p> 
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<p>Research and Development Centre in the fields of Materials Science: Materials Evaluation and Characterization Failure Analysis Analytical Chemistry Materials Analysis for Environmental Controls Mechanical Properties Testing Corrosion Testing Surface Science and Coatings Alloy and Product Development Thermomechanical Process Design Casting Process Design Mathematical Modeling</p>	<p>VI BATH Vitrous china and fine fire clay sanitary ware Acrylic bathtubs, shower cubicles, steam boxes</p> <p>AXIUM Glazed porcelain floor and wall tiles Decorative pieces Tile Adhesives & grouts</p>

 **AEIFOROS**

Slag aggregate materials for road pavement construction, Green raw materials for the building industry, Graded mill scale for cement & steel manufacturing, Non-ferrous metal scrap, Olivine products, Recycling and handling of industrial by-products including waste shipment licensing and export




www.aeiforos.gr
www.aeiforos.bg



ALUMINIUM CAN RECYCLING CENTER
Aluminium Can Recycling Center
Information Center for aluminium can recycling and its benefits

www.canal.gr






VIOHALCO Group Global Commercial Network

8

Commercial network



- 85% of Turnover in 2012 was achieved abroad
- Exports to more than 80 countries
- Group's exports account for more than 12% of Greece's total exports in 2011

VIOHALCO Group

Economies of Scale / Synergies

- ❖ Transportation and Logistics
- ❖ Purchases of key raw materials (metals)
- ❖ Financing
- ❖ Financial Products (Hedging, FX)
- ❖ Support services (IT, legal, advertising & communication)



HELLENIC CABLES
● **CABLEL'**

E TEM

ELVAL

ELVAL COLOUR

ICME ECAB
● **CABLEL'**

SOFIA MED

SYMETAL

ELKEME
HELLENIC CABLES GROUP S.A.

○ **SIDENOR**

HALCOR

Fi FITCO

BRIDGNORTH

▲ **STOMANA**
INDUSTRY S.A.

○ **CORINTH PIPEWORKS**

● **VIONAL**

≡ **ERLIKON**

1. VIOHALCO Group

2. CABLEL Group

3. Submarine Cables



CABLEL Group at a Glance

11

- The largest cable producer in SE Europe, 5 production plants, 1,300 employees, €439mil. 2012 turnover
- The 4th Largest Cable Manufacturer in Europe
- Exports to over 50 countries globally

State-of-the-art Production Facilities

1 Cable Plant, Thebes, Greece

Capacity: 60,000 Tons
 Production personnel: 245



2 Magnet Wire Plant, Livadia, Greece

Capacity: 14,000 Tons
 Production personnel: 50



3 ICME, Bucharest, Romania

Capacity: 50,000 Tons
 Production personnel: 480



5 Cable Plant (FULGOR) Corinth, Greece

Capacity: 50,000 Tons Cables and
 45,000 Tons Wire Rod
 Production personnel: 150

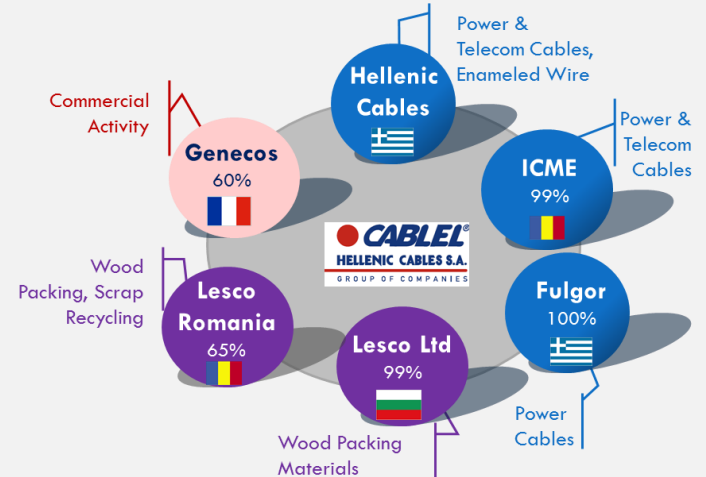


4 Compound Plant, Inofita, Greece

Capacity: 20,000 Tons
 Production personnel: 30



Group Structure



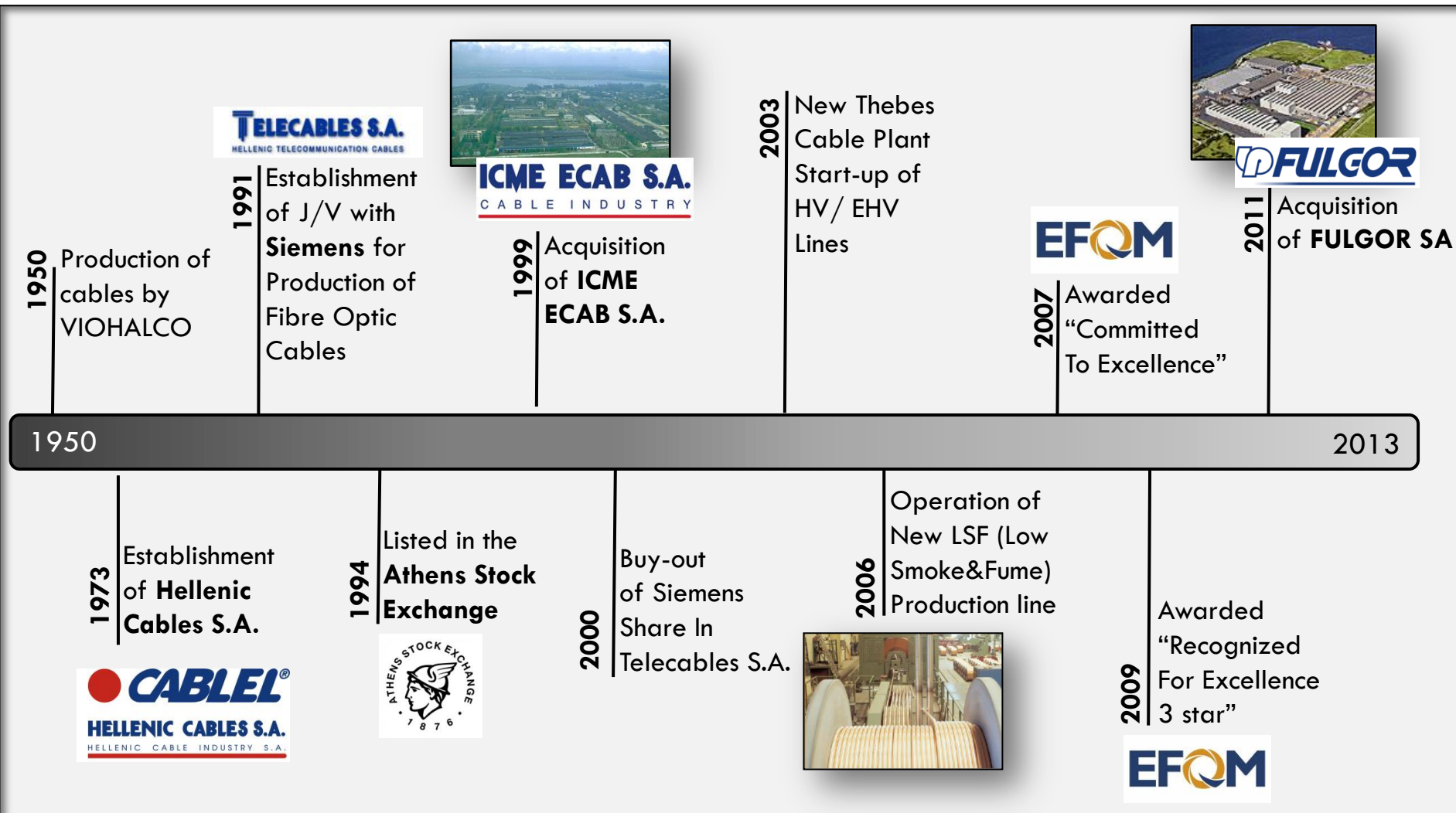
Key Financials (€ mil.)

	2009	2010	2011 ¹	2012
Turnover	241.6	351.8	414.6	439.3
EBITDA	11.1	13.2	20.9	10.7
Profit bef.Tax	(0.2)	0.6	3.6	(13.3)

(1) Fulgor is consolidated since August 1st 2011

A Long History of Successful Growth

12



Production Facilities and Warehouses

Greece

FULGOR Cable Plant

Corinth

- Cable Producer since 1957
- Vertical Integration through production of Copper & Aluminium Wire Rod
- Docking facilities for loading submarine cables into cable-laying vessels
- Capacity of appr. 50,000 tons cables & 45,000 tons wire rod
- 150 production personnel
- Production capabilities
 - LV Power cables
 - MV Power cables
 - HV cables since 1995
 - Submarine MV cables since 1972
 - Potential for HV submarine cables (up to 220KV for AC/ up to and exceeding 320kV for DC)



GREECE



● **Production Facility**

● **Warehouse**

Magnet Wire Plant,

Livadia

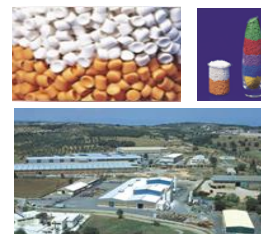
- 14,000Tons Capacity
- 50 production personnel
- 122,000m² land / 14,000m² industrial complex
- Production capabilities
 - Cu Round and Flat
 - Al Round and Flat



Compound Plant,

Inofita

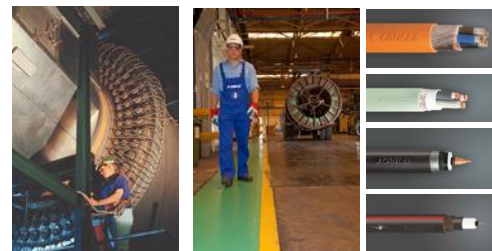
- 20,000Tons Capacity
- 30 production personnel
- 22,032m² land / 6,444m² industrial complex
- Production capabilities
 - PVC compounds
 - Rubber compounds



Thiva Cable Plant,

Thiva

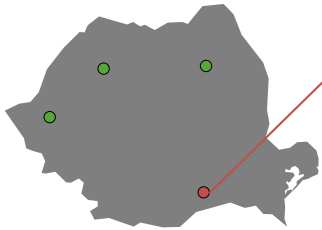
- 60,000Tons Capacity
- 245 production personnel
- 175,000 m² land / 38,300m² industrial complex
- Production capabilities
 - LV Power cables
 - MV Power cables
 - HV Power cables
 - EHV Cables up to 500kV
 - Fiber Optic Cables



Production Facilities and Warehouses

Europe

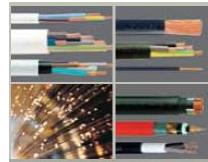
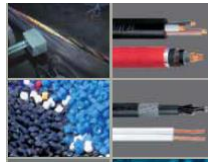
ROMANIA 



ICME Cable Plant
Bucharest

- Cable producer since 1949
- Acquired by CABLEL in 1999
- 50,000 Tons Capacity
- 500 production personnel
- 268,000 m² plot of land
- Industrial complex of 70,000 m²
- Production units
 - Wire drawing
 - Power cables
 - Telephonic Cables
 - Rubber cables
 - PVC & Rubber compounds
- 550 employees
- Over 2,000 business partners

-  **Production Facility**
-  **Warehouse**



BULGARIA 



LESCO
Sofia

- Packing materials production
- Wooden drums for cables
- Scrap Recycling



U.K. 

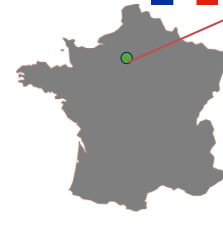


METAL AGENCIES
London

- Cable Outlet



FRANCE 



GENECOS
Paris

- Cable Outlet

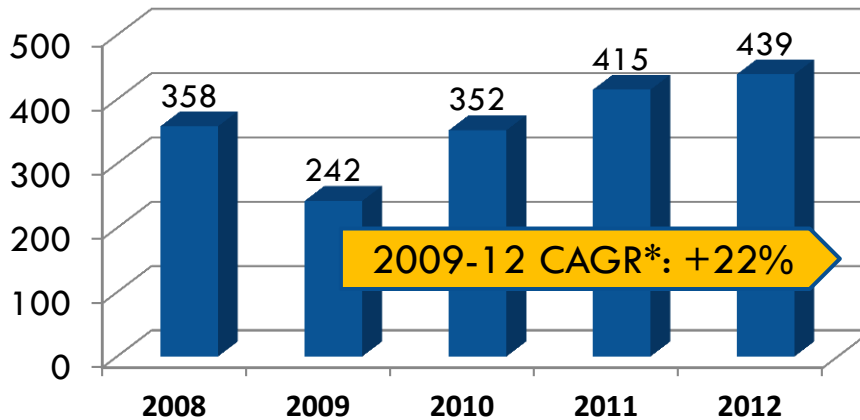


2012 CABLEL Sales by Region

Organic Sales Grow Through the Downturn

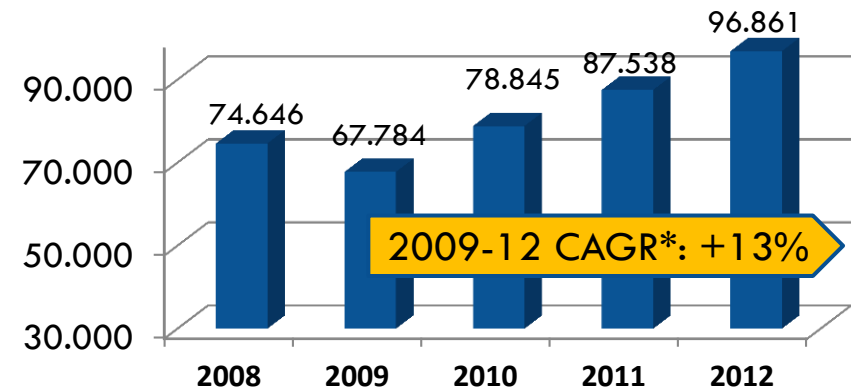
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Evolution of Group Turnover (mil. €)

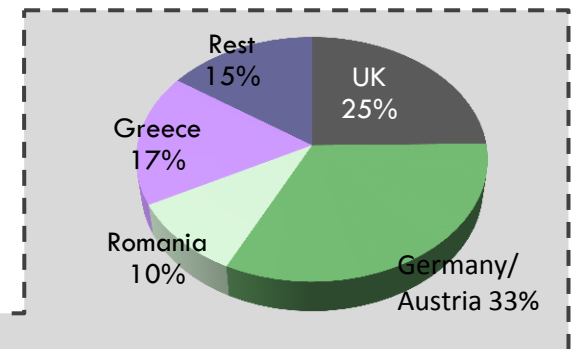
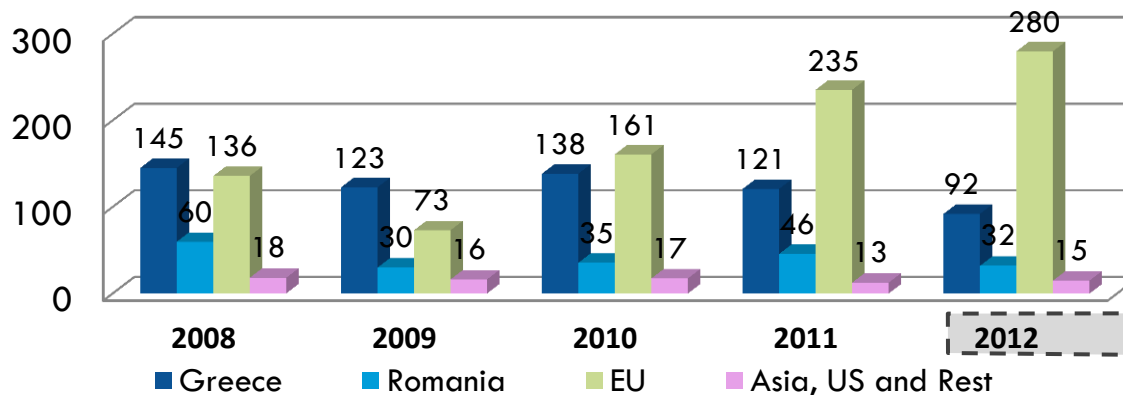


* Compound Annual Growth Rate

Evolution of Group Turnover (tons)



Evolution of Group Turnover by Region (mil. €)



Local Cable Market Leader

Global Sales Network

16

GREECE
Market Share ~ 55%



ROMANIA
Market Share ~ 50%
Significant growth potential
for power grid expansion



EUROPE and WORLDWIDE
Exports to 50+ countries globally
4th Largest Cable Maker in Europe

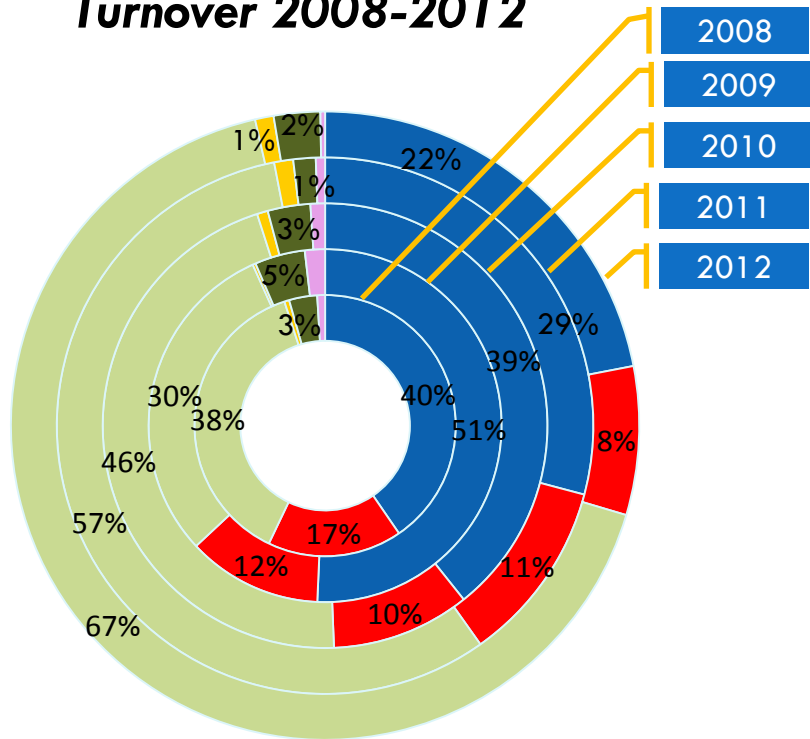


Strong Market Position

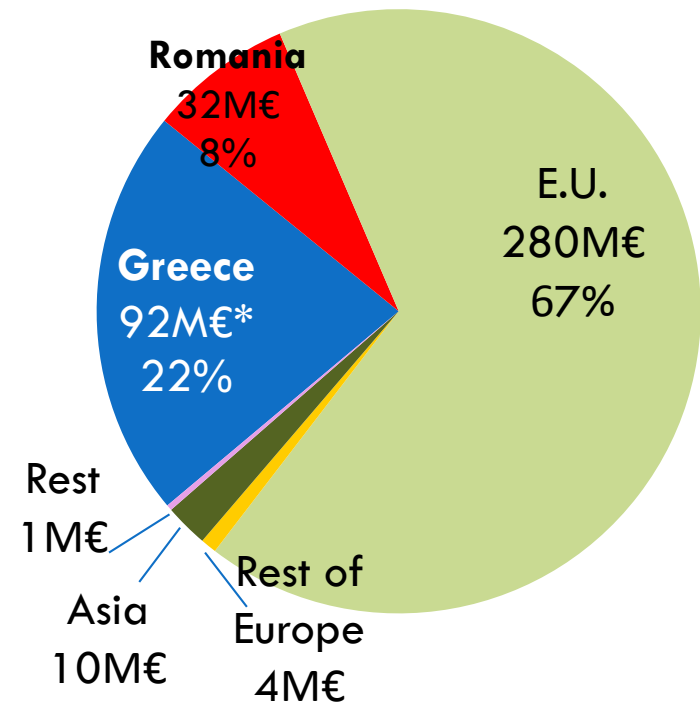
Export Oriented Sales Strategy

The Group exhibits flexibility in adjusting customer mix and finding customers in new geographical regions

Turnover 2008-2012



Turnover 2012



■ Greece ■ Romania ■ EU ■ Europe Rest ■ Asia ■ Rest

*Does not include ~ 20M€ of raw material sales to Intragroup companies in Greece

Cable Solutions Across Industries

CABLEL Unique Competitive Advantages



- LV and MV Al and Cu Distribution Cables
- Installed over 1,200km of HV underground cables for European Utilities
- EHV capability up to 400kV
- Currently implementing 250km of HV turnkey project



- ESP Cables for Onshore Drilling Pumps
- Umbilicals for Offshore (under development)
- Marine Cables for platforms and ships



- Copper Telecom Cables
- Data transmission cables (UTP Category 6/7 and FTP Cables)
- Single and Multimode Optical Fibre land cables
- Submarine Optical Fiber Cables



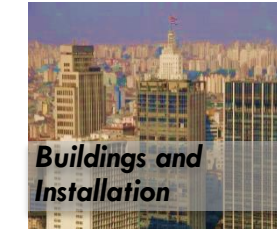
- Signaling Cables
- Control Cables
- Special LV and MV Metrocables
- 15+ Years experience
- Extensive references



- PV age resistant cables for solar parks
- Submarine Cables for Offshore wind farms



- Rubber LV and MV Cables
- Advanced technological knowhow



- Standard PVC and XLPE insulated Cables
- Latest technology LSF fire and flame retardant special cables

CABLEL EXPERTISE

Wide Product Range

Expanded Customer Mix

Specialized products for niche markets

Advanced Technology

Attention to Individual Customer Needs

Turn-key project Solutions

Wide Product Range

Major Product Groups

Power Cables



- Installation & Building
- Industrial Cables
 - Wind & Solar Parks
 - Marine
 - Rail & Subway
 - Mining & Tunneling
- Power Network Cables
 - Transmission
 - Distribution

Submarine



- MV Submarine
 - Paper Insulated
 - XLPE, EPR Insulated
 - Composite Power and Optical Fiber
- Optical Fiber Submarine
- HV Submarine (AC,DC) *under development*
- Umbilicals *under development*

Telecom



- Telecommunication Network Cables
- Optical Fiber
- Data Transmission Signaling, Instrumentation and Control Cables

Magnet Wires



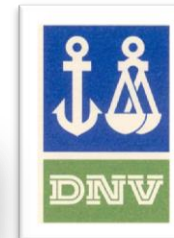
- Magnet / Enameled Wire for Transformers
- Magnet / Enameled Wire for Motors
- Al and Cu Round and Flat Magnet Wires

Compounds



- Compounds for Cables
- Compounds for other industrial uses

Certifications



Cable Supplier for Major Markets

Indicative Customers

Utilities

E-ON * ENEL * ERDF * AREVA * AREVA * IBERDROLA * INEO * CE ELECTRIC UK * OTE * ELECTRICITY NORTHWEST * VATTENFALL * MINISTRY OF ELECTRICITY AND WATER OF KUWAIT * DEWA OF DUBAI * PUBLIC ELECTRICITY CORPORATION OF LIBYA * MINISTRY OF WORKS, POWER AND WATER OF BAHRAIN * ELECTRICITE DU LIBAN * ENERGIE AG * SONELGAZ * WTEC

Trade and Installers

BATT CABLES * FABER KABEL * CLEVELAND CABLE COMPANY * ANIXTER * SONEPAR * MEINHART KABEL * HELUKABEL

Industrial

HYUNDAI * SIEMENS * VE ELECTRIC UK * DOOSAN * SAGEM * ABB * CARILLION * VATTENFALL * BRITISH RAIL * ENERGIE AG * METRO DE MADRID * TERNA * CYTA * STEWAG * SONELGAZ * WTEC * GES

*Receivers of our products through our distribution lines

Advanced Technology

Continuous Introduction of New Products

- Targeted product development for advanced technology markets
- Continuous investment in state-of-the-art machinery to ensure high levels of efficiency and strictest standards quality
- Technical assistance from the leading Japanese cable manufacturer, Furukawa
 - High Voltage/ Extra High Voltage cables, as well as for submarine cables
- Technical assistance from the Japanese submarine manufacturer, VISCAS for HV submarine cables
 - VISCAS is the joint venture of the two largest Japanese cable manufacturers (Furukawa and Fujikura) producing submarine cables

2010 -2011



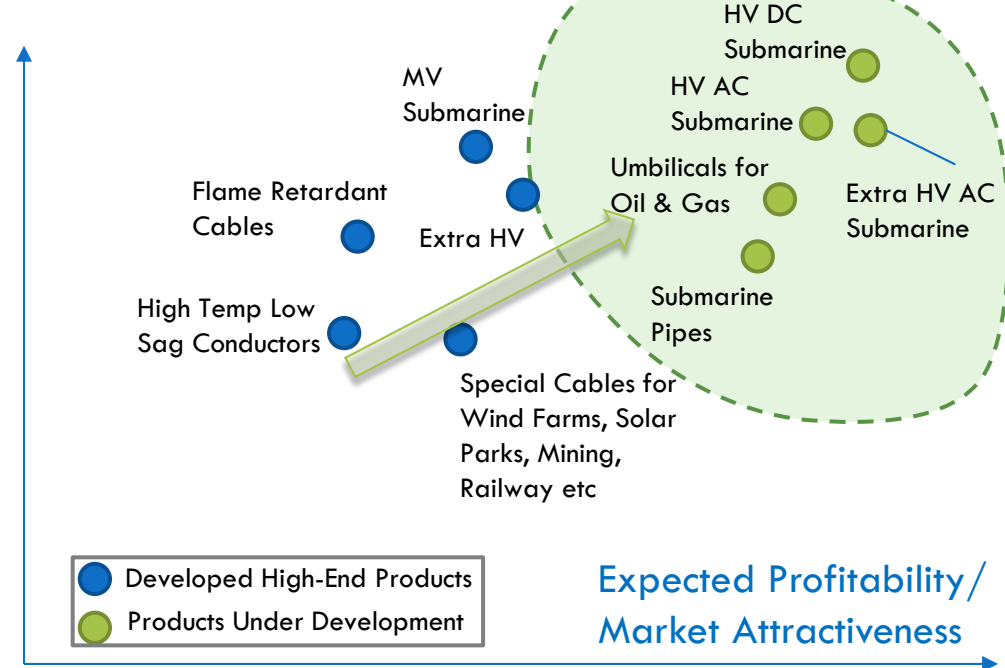
- Successful completion of 400KV PQ test, Qualifying Cable to sell EHV Cables to utilities
- Development of value add products for evolving segments, such as solar cables, aluminum enameled wires

2012 -2013 (Under Development)



- High Temp Low Sag Conductors (ACSS/ TW. GAP) (1st sale completed in 2012)
- 500KV Extra HV Underground Cables
- High Voltage AC/DC Submarine Cables
- Umbilicals for Oil&Gas Industry
- Submarine Pipes

Market Growth Potential



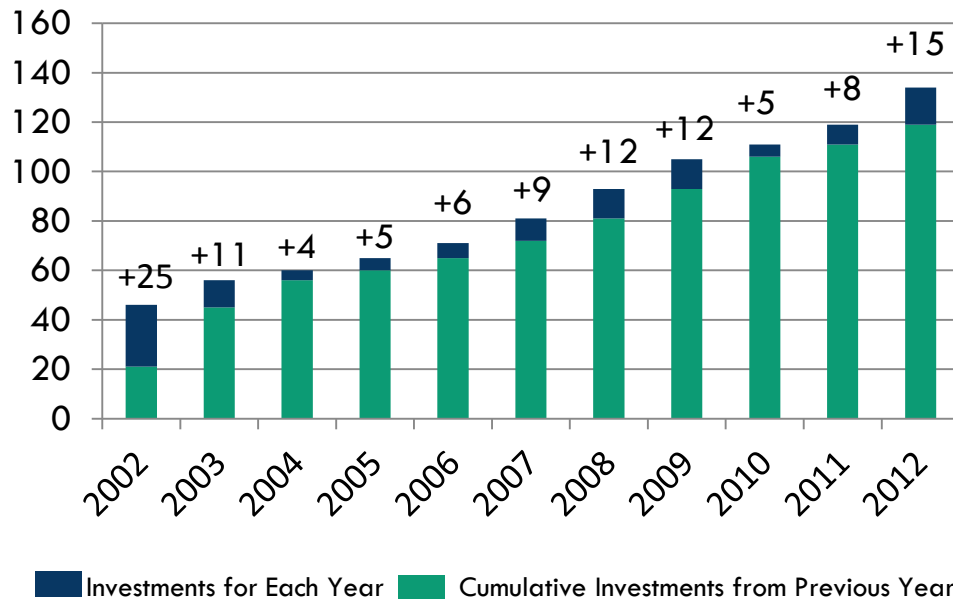
CapEx Fueling Growth

Significant Growth Investments

22

- Significant investments during 2002-2012 focused on productivity & capacity increase, as well as product diversification (increased production of MV cables, production of value added products such as HV/EHV cables)
- Milestone investment underway for production of High Voltage Submarine Cables in FULGOR, which is expected to exceed € 40 million

mil. €



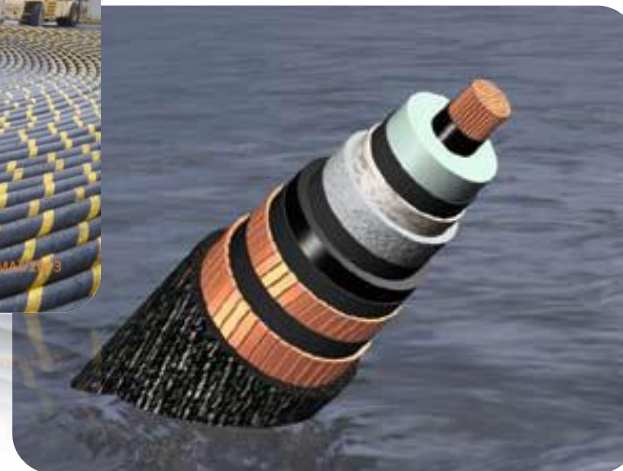
400kV Underground Cable Production



1. VIOHALCO Group

2. CABLEL Group

3. Submarine Cables





Administration &
Technical Support

CABLEL



Technical Support
& Know How

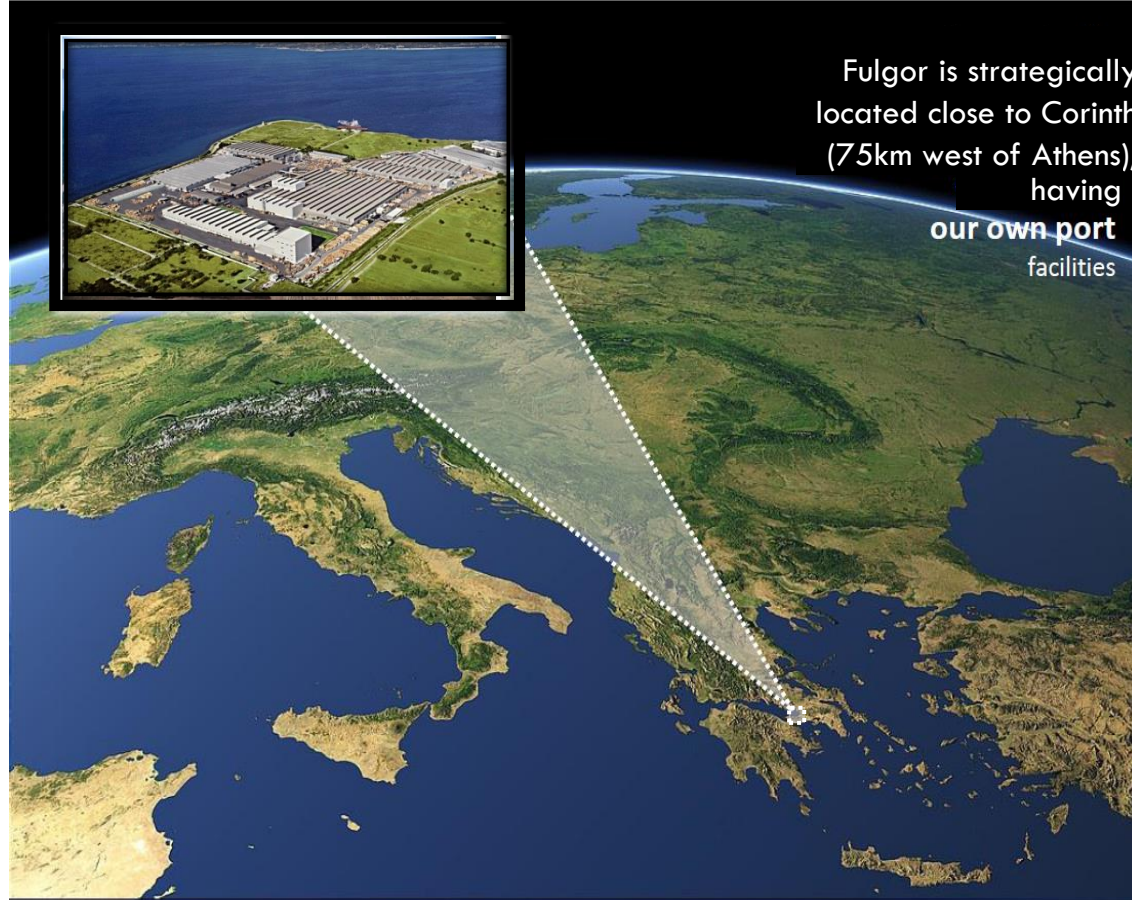
VISCAS



FULGOR Acquisition - August 2011

- ❖ Cable production since 1957
- ❖ High Voltage underground cable production since 1995, Medium Voltage Submarine Cables since 1972
- ❖ Many years of experience in Submarine Cable installation
- ❖ Own docking facilities
- ❖ Experienced personnel
- ❖ In past owned cable installation vessels

- ❖ Through its Fulgor plant located by the sea near Corinth (Greece) CABLEL produces:
 - Submarine power cables up to 33 kV
 - Optical fibre and composite power/optical fibre submarine cables
- ❖ Over **900 km power and composite power/optical fibre** submarine cables
- ❖ Over **2,200 km optical fibre** submarine cables
- ❖ The majority of the above mentioned cables have been installed by the company in "**turnkey projects**"
- ❖ Dedicated production capacity for **MV and composite MV /optical fibre** submarine cables currently amounts to 250 km/year
- ❖ Production capacity for **optical fibre** submarine cables amounts to 700 km/year



Fulgor is strategically located close to Corinth (75km west of Athens), having **our own port** facilities

Production and Quality Control Process

MV Submarine Cables

26

1. In-house Rod Production



- In-house continuous Cu casting for production of 8mm Cu rod
- In-house continuous Al casting for production of 9,6mm Al rod

2. Conductor Formation



- Wire drawing from Cu / Al rod
- Conductor stranding

3. Insulation



- The insulation is applied in three layers:
- Inner semi-conductive layer
 - XLPE insulation
 - Outer semi-conductive layer
- All three layers are applied simultaneously through a triple extrusion cross head and dry cured in a nitrogen filled catenary tube

4. Degassing

Quality Control



Production and Quality Control Process

MV Submarine Cables (Cont'd)

27

5. Pb Sheathing and Screening



A Pb sheath or alternatively a Cu or composite screen is applied over the insulated cores

6. Vertical Stranding



Individual cores are connected through factory joints before the stranding process in order to produce long continuous lengths

7. Armouring



- Under the armouring and over the armouring (serving) Pb yarns are applied at the same production phase
- This is the final phase of production unless an outer sheath is required

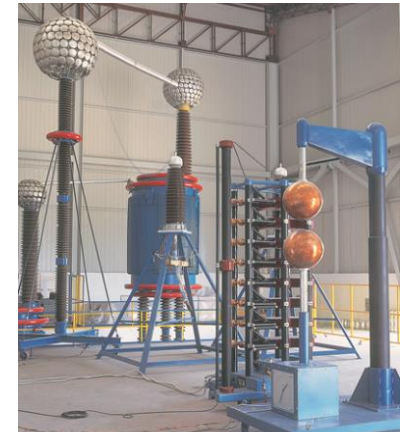
8. Storage



- The finished product is stored in static factory tanks
- The next step is packing

Quality Control

- Testing takes place during all the above mentioned intermediate production phases and on the finished product
- The factory is equipped to perform all required electrical and non electrical testing as well as type testing



Packing Options

MV Submarine Cables

28

9. Packing

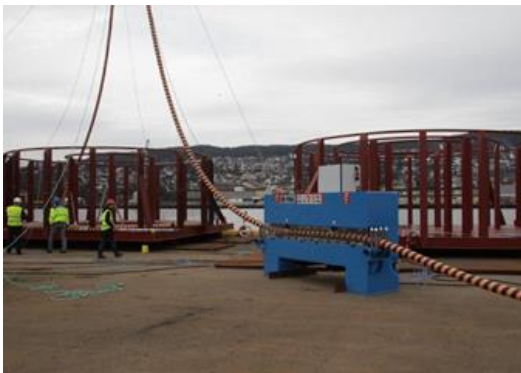
The submarine cables may be packed for the customer as follows:

A. Metallic Drums



- Coiled on metallic drums of different sizes based on customer requirements and project logistics
- The cables may be provided in continuous lengths.
 - The max. length of cable per drum is limited by the cable cross section/weight and applicable handling/transportation constraints.
 - Usually the max. gross weight of the drum does not exceed 200 tons.
- Transportation from the factory is possible by road using special trucks or by vessel which arrives at Fulgor port

B. Portable Baskets



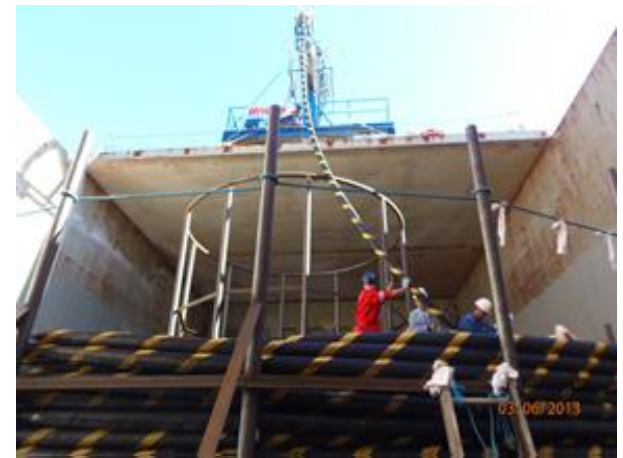
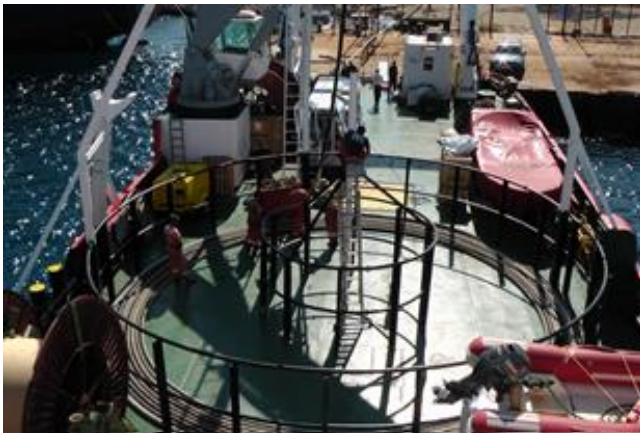
- The cables may be provided in long continuous lengths
- Basket dimensions are usually 8m x 8m x 4m (L x W x H)
 - The inner eye of the basket is adjusted to accommodate the MBR (minimum bending radius) of the cable when coiled.
 - The max. cable length per basket is limited by the cross section/weight of cable and applicable handling/transportation constraints.
 - Usually the max. gross weight of the basket does not exceed 300 tons.
- Transportation from the factory is possible only by vessel which arrives at Fulgor port

Packing Options

MV Submarine Cables (Cont'd)

C. Directly on board a cable installation vessel

- Coiled directly on board a cable installation vessel or a suitably equipped freight vessel
- The cables may be provided in long continuous lengths (45-50 km depended on cable cross section) with the use of factory joints
 - The max. continuous length of cable is limited mainly by the transportation capacity of the vessel
- Transportation from the factory is possible only by vessel which arrives at Fulgor port
 - Loading takes place through a dedicated loading line 250 m in length which connects the storage tanks inside the factory to the factory port



Recent Projects: WESTRAY - PAPA WESTRAY INTERCONNECTION

30

- The cable was loaded on board a freight vessel at Fulgor port (inside a static cable tank which was created at the vessel's hold)

Customer:	Scottish and Southern Energy (SSE) Plc
Cable Type:	6.35/11 kV 3x70 mm ² Cu/PILC (Paper Insulated lead sheathed)
Quantity:	4.6 km
Installed:	September 2012 (SSE/Briggs Marine)



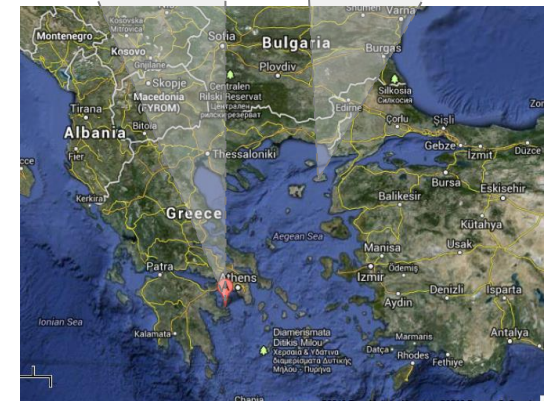
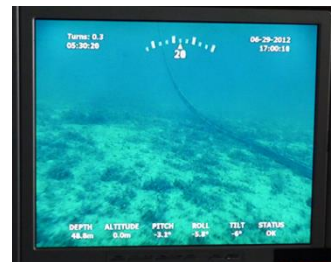
ORKNEY ISLANDS,
SCOTLAND, UK



METHANA - EGINA & THASOS - KERAMOTI (KAVALA) INTERCONNECTIONS

- The cables were loaded directly on board the cable laying vessel at Fulgor port
- The project was awarded to Hellenic cables as a "turnkey" project and it included the installation of the submarine cables and their protection at the shore ends and on the sea bed, the supply of land/submarine cable transition joints, spare cables, repair joints and all jointing/termination works as well as testing and commissioning of the two interconnections

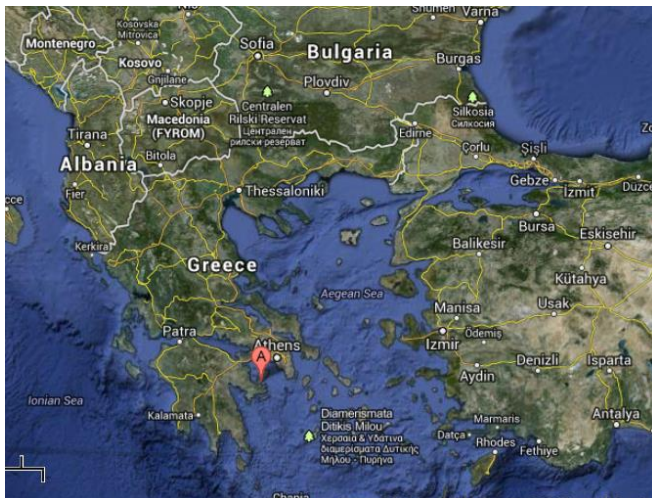
Customer:	Public Power Corporation of Greece S.A. (DEI)
Cable Type:	12/20 kV 3x95 mm ² Cu/XLPE (XLPE insulated lead sheathed)
Quantity:	10.5 km Methana – Egina 8.6 km Thasos - Keramoti
Installed:	August 2012 (Hellenic Cables)



SUPPLY OF SUBMARINE CABLES FOR INSTALLATION AND MAINTNACE - GREEK DOMESTIC INTERCONNECTIONS

32

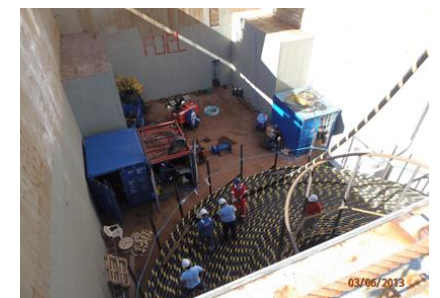
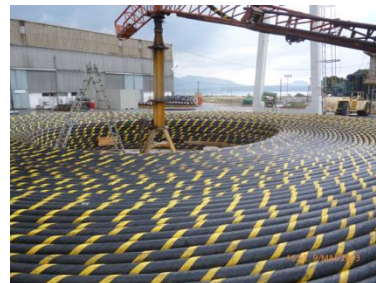
Customer:	Public Power Corporation of Greece S.A. (DEI)
Cable Type:	12/20 kV 3x35 mm ² Cu/PILC 12/20 kV 3x35 mm ² Al/PILC 12/20 kV 3x150 mm ² Al/PILC
Quantity:	25 km
Delivered:	December 2012



SUPPLY OF SUBMARINE CABLES FOR INSTALLATION AND MAINTANCE - UK INTERCONNECTIONS

- Each cable was provided in one continuous length and was loaded on board a freight vessel at Fulgor port (inside static cable tanks which were created at the vessel's hold)

Customer:	Scottish and Southern Energy (SSE) Plc	
Cable Type and Quantity:	19/33 kV 3x95 mm ² Cu/XLPE	(25.4 km)
	19/33 kV 3x185 mm ² Cu/XLPE	(13.5 km)
	6.35/11 kV 3x95 mm ² Cu/XLPE	(6.4 km)
Delivered:	June 2013	



SUCO OFFSHORE OIL PLATFORM INTERCONNECTION, EGYPT

34

- The cable will be provided coiled on a special drum which will be loaded on board a freight vessel at Fulgor port
- The supply includes also land and offshore cables, land/submarine transition and repair joints, J-tube hang-off assemblies, centralizer units, cable terminations on the platform, assembly/termination works and testing on site, supervision during installation etc.

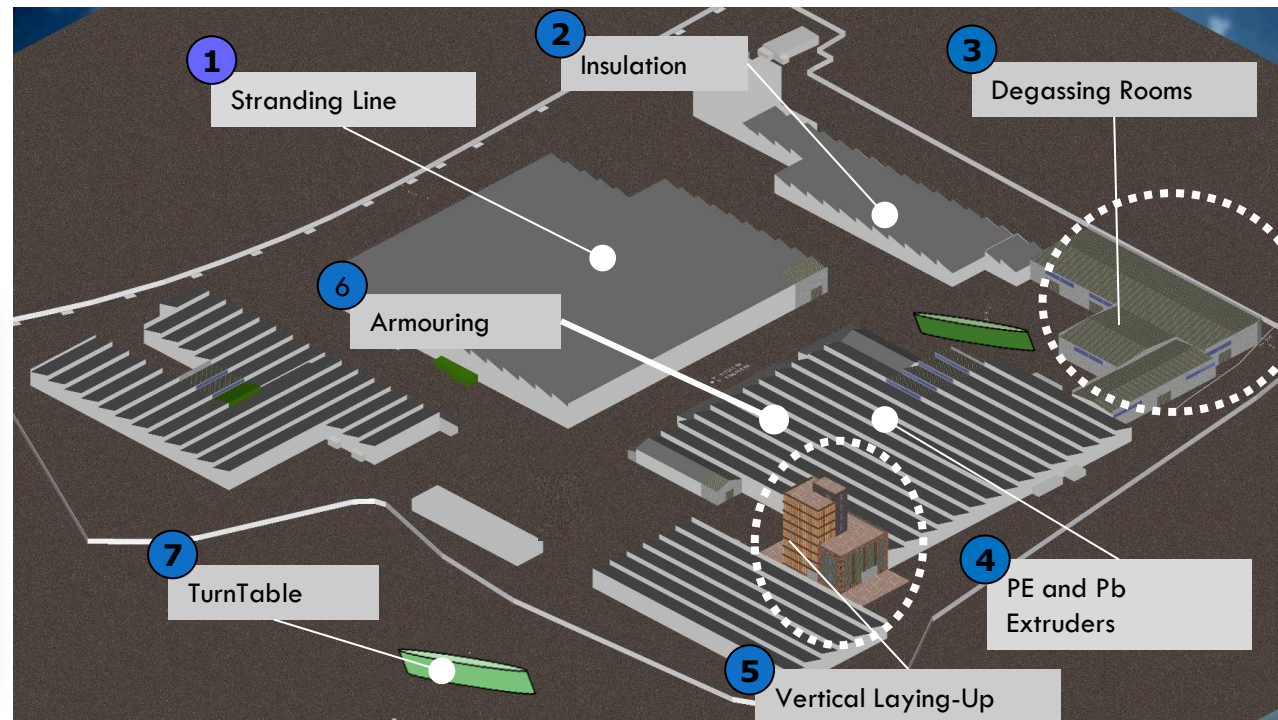
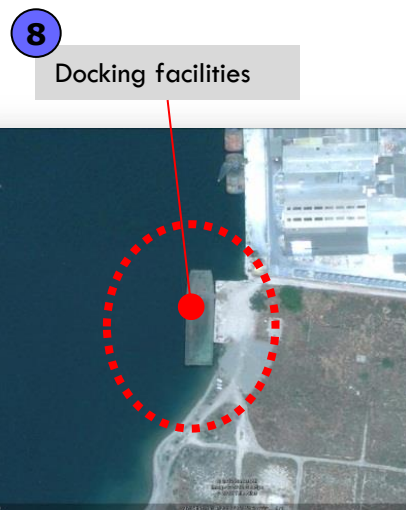
Customer:	SUEZ OIL COMPANY (SUCO)
Cable Type:	8.7/15 kV 3x120 mm ² Cu/XLPE
Quantity:	5 km (4 km of single armoured cable and 1 km of double armoured cable provided in one continuous length)
Delivery:	Expected end of June 2013



High Voltage Submarine Facilities

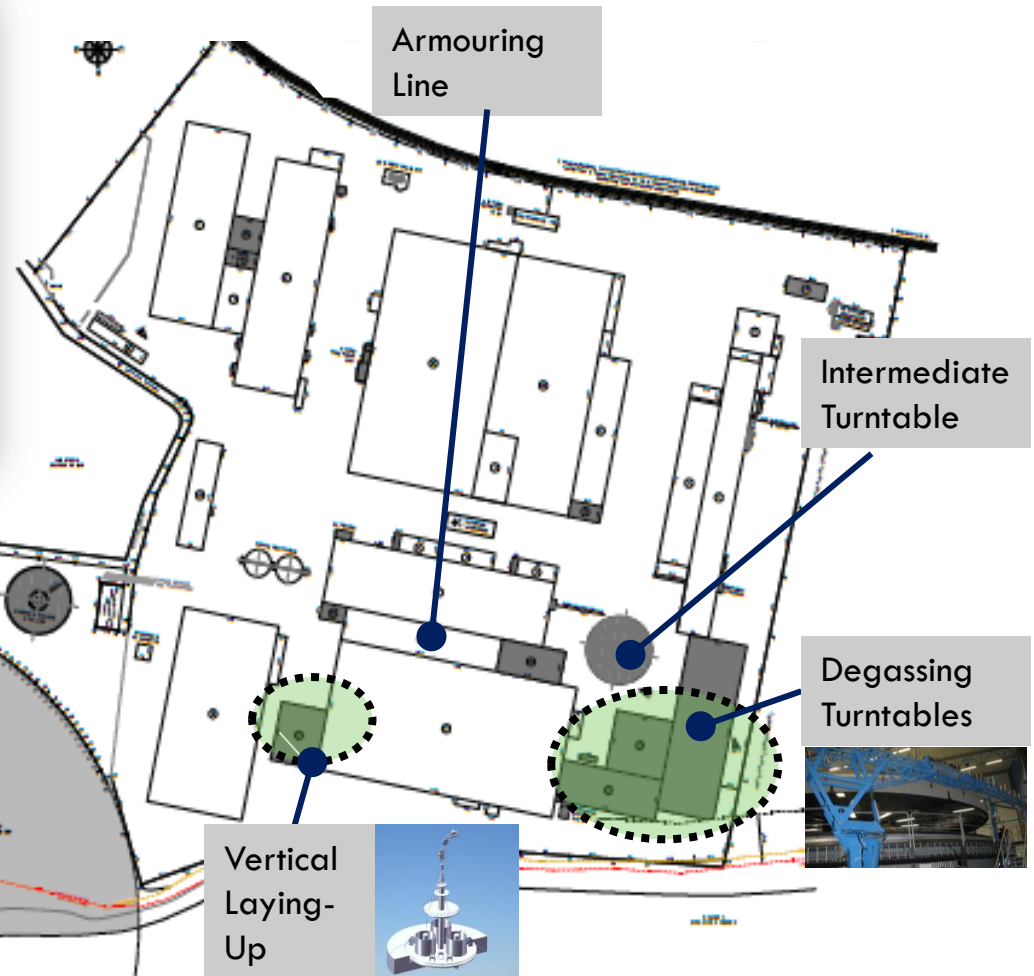
35

- Hellenic Cables is currently applying an extensive investment plan at Fulgor in order to upgrade and extend its manufacturing and testing capacities in the production of:
 - ▣ AC single core submarine cables up to 400 kV,
 - ▣ AC three core submarine cables up to 220 kV
 - ▣ DC submarine cables up to 320 kV
- All above mentioned cables will be XLPE insulated.



New Equipment in Operation by 2014

36



HV Submarine Production Capabilities

37

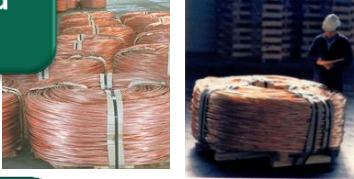
OVERVIEW

- The dedicated annual production capacity for three core HV AC submarine cables is expected to be 200 km
 - ▣ Alternatively the annual production capacity for EHV single core submarine cables is expected to be 350 km
- The company expects to complete the new investment and be able to produce HV AC submarine cables by first quarter of 2014
- The company expects to be able to produce HV and EHV DC submarine cables by 2015 with an annual capacity of 300 km
- All above cables will be produced in very long continuous lengths with a minimum number of factory joints
- Alternatively, the new investment may be used for the manufacturing of medium voltage inter array submarine cables practically increasing the production capacity for the above mentioned cables by first quarter of 2014 to 700 km per year

HV Submarine Cable Production Process

38

1. In-house Rod Production



- In-house continuous Cu casting for production of 8mm Cu rod
- In-house continuous Al casting for production of 9,6mm Al rod

2. Conductor Formation



- Wire drawing from Cu / Al rod
- Conductor Stranding

3. Insulation



The insulation is applied in three layers:

- Inner semi-conductive layer
- XLPE insulation
- Outer semi-conductive layer

All three layers are applied simultaneously through a triple extrusion cross head and dry cured in a nitrogen filled catenary tube

4. Degassing

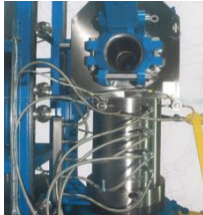


- The insulated core is wound on turn tables which are already placed in special degassing chambers
- During this process the chamber is heated and warm air recirculates for the time required to complete the degassing of the insulation, thus removing all gaseous by-products

HV Submarine Cable Production Process (Cont'd)

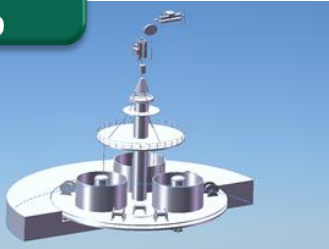
39

5. Pb Sheathing



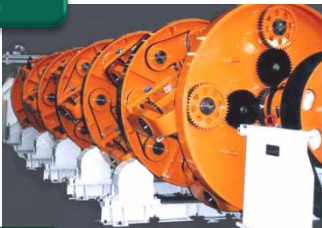
- After degassing, the core is covered first with semi-conductive water blocking tapes and then with a Pb alloy sheath of a suitable composition and thickness to achieve radial protection against water penetration
- The Pb sheath is applied with a continuous extrusion process and is followed by a semi-conductive PE sheath

6. Vertical Laying-up



- The laying up machine is vertical
- The cores, which are placed in turntables, are payed off upwards, go through the stranding die, the capstan and are wound on a turn table
- Each factory length is joined to the length that follows through a factory joint before the stranding process until the complete cable length is laid up

7. Armouring



- After laying up, various protective layers are applied to the cable, mainly for its mechanical protection such as bitumen, PP yarns, steel wires etc.
- All the above layers are applied at the armouring line and the finished cable is collected on a turntable

8. Storage



- Final storage of HV submarine cables will take place on turntables

HV Submarine Cables Quality Control

40

9. Quality Control



- Testing will take place during all the above mentioned intermediate production phases and on the finished product
 - The factory will be equipped with new testing facilities in order to perform prequalification and type testing
-
- As there is no standard covering all tests on high voltage submarine cables, the equipment and tests are based on IEC 60840 and CIGRE recommendations / ELECTRA (No171 April 1997, No189 April 2000) or their most recent editions

Loading on Cable-laying Vessels

41

- The HV submarine cables will be loaded from the final storage turntables through dedicated loading lines on the turntables of cable-laying vessels which will arrive at Fulgor port
- Fulgor port is able to accommodate all cable-laying vessels currently in operation



VISCAS Technical Support

42

- Know-how for design, materials, production and installation of High Voltage Submarine Cables
- Know-how for the design and manufacture of flexible joints
- Supply of repair joints (sea joint – repair joint) and installation know-how

VISCAS

- VISCAS is a joint venture of the two leading Japanese cable makers with the purpose of producing HV submarine cables
- Production of Submarine Cables up to 500kV since 1967 over 1,100km



Fujikura
FURUKAWA ELECTRIC

VISC
VISCAS Corporation



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