Production paradigm of high added value industrial products in Greece by recycling Aluminum, Steel and Copper

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I. **Short introduction to VIOHALCO SA**  
Steel – SIDENOR Group  
Aluminum – ELVAL Group  
Copper – HALCOR Group

II. **Product examples**  
Aluminum industrial profiles  
Copper Inner Grooved Tubes  
Steel Special Bar Qualities
Viohalco SA is a publicly traded company (Euronext: VIO) based in Brussels, Belgium, and is the holding company of a group of companies active in the fields of steel, steel pipes, aluminium, copper, cables production, processing and trade, as well as in the real estate development sector, representing currently the largest metals group in Greece.

Notes
- % share ownership as at Dec.31, 2013 or more recent announcements
- VIOHALCO is listed on the Euronext Brussels
- VIOHALCO, SIDENOR, CORINTH PIPEWORKS, ELVAL, ETEM, HALCOR, HELLENIC CABLES are listed on Athens Stock Exchange
87% of Turnover* was achieved abroad

Exports in approx. 100 countries

7,857 employees*

€ 2,885 million Turnover*

* as at 31.12.2013
Short information from

CORPORATE PRESENTATION
Group overview

- Set of modern mini-mills focusing on the production of steel products including: rebar, merchant bars, wire rod, mesh products and plates.
- Largest mini-mill producer of steel construction products in Greece and Bulgaria based on capacity (1):
  - ~3.6 MMT melting capacity
  - ~3.6 (1) MMT rolling mill capacity
- CORINTH PIPEWORKS is one of the largest and most modern steel pipe manufacturers of ERW and SAW pipes in the world.
- Holds prominent position in the energy pipes market worldwide.
- Produces also tubes for water networks and hollow sections for construction industry.

Mini Mills

Service & Distribution

- A well-established distribution network, covering Greece and the Balkans.
- The subsidiary SIDMA operates one of the largest steel service networks in South Eastern Europe.
- International presence in key markets.

Pipes Tubes & Hollow Sections

- Downstream steel production units with subsidiary plants' total capacity of about ~560 KMT.
- Portfolio of downstream products include:
  - mesh products
  - wire products
  - special steels
  - welding electrodes
  - steel fibres

Notes
1. Following the completion of future investments.
SIDENOR recycles annually more than 1 million tons of scrap

Total recycling capacity
Over 2,5 million tons of scrap
Greek Steel Plants

THESSALONIKI, GREECE
Meltshop - (1991) (1)
800 kMT/y
Long Product Mill - (1998-99) (1)
800 kMT/y (3)
(Rebar, Merchant Bars, Wire Rod)
Mesh 40 kMT/y
Land approx. 441 K sq.m.
Covered area approx. 75 K sq.m.

ALMYROS, GREECE
Meltshop - (2001) (2)
1,350 kMT/y
Long Product Mill - (1999) (2)
1,200 kMT/y
Land approx. 1,400 K sq.m.
Covered area approx. 120 K sq.m.

Notes
1. Major revamping
2. First year of operation
3. Currently 600 KMT/y, which will become 800 KMT/y after future investments

- 1 working place => 6 working places in Greek Economy
- 1 unit added value => 5,5 units added value in Greek Economy
Steel Plants in Bulgaria & FYROM

Notes
1. 2001: First year of STOMANA consolidation in Sidenor Group
2. Major revamping of facility

PERNIK, BULGARIA
- Meltshop - (2002-3) (2)
  - 1,400 kMT/y
- Plate Mill - (2003-4) (2)
  - 400 kMT/y
- Long Product Mill
  - 1,000 kMT/y
  - (Rebar, Merchant Bars)
  - Mesh 30 kMT/y
- Land approx. 3,100 K sq.m.
- Covered area approx. 284 K sq.m.

DOJ Ran, FYROM
- Rolling Mill - (2006) (2)
  - 175 kMT/y
  - Mesh
  - 20 kMT/y
  - Lattice Girders
  - 10 kMT/y
Attractive & diversified product portfolio that reduces volatility

**Greek Steel Operations**

- Rebars
- Mesh
- Merchant Bars
- Spooled Coil
- Welding Electrodes & Wires

**Balkan Steel Operations**

- Special Steels/Long products
- Plates
- Steel Balls
- Special Profiles
- Semi-Finished Products (Billets & Wires)
- Semi-Finished Products (Slabs)

**Pipes, Tubes & Hollow Sections Business**

- Construction Tubes
- Hollow Sections
- Oil & Gas Pipes
- ERW (HS), 25.0%
- ERW (pipes), 66.2%
- HSAW, 8.7%
AEIFOROS SA
was established in 2001 by SIDENOR SA initially for the recycling of steel manufacturing by-products, and expanded since then in the processing of other types of industrial by-products and wastes.

Main products of AEIFOROS:
• Ferrous and non-ferrous metal scrap (Iron, aluminum, stainless, copper, bronze as secondary raw materials for smelting.
• Mill scale (ferrous oxides) for the cement industry, steelworks and the chemical industry
• Olivine products (EBT filler sand, slag conditioner, foundry sand) and refractories for the industry through its subsidiary THERMOLITH S.A.
• Anti-skid aggregates for road construction certified according to CE13043
• Aggregates for unbound pavements certified according to CE13242
• Sand (without filler) for industrial floors, cement products (concrete tiles, paving blocks), sandblasting.
• Light fine sand and hydraulic binders
• Calcium-Silica raw material for clinker production
• Raw material for plasters, mortars and coatings
• Sewage sludge stabilizer
Pipes, Tubes & Hollow Sections

CORINTH PIPEWORKS S.A.
CPW at glance

Worldwide sales network

Approved supplier of the largest international Oil and Gas companies

94% of turnover was achieved abroad 2006-2013

Sales in 40 countries

Annual capacity of
400 kMT /y ERW/HFI
375 kMT /y HSAW
400 kMT /y LSAW *
150 kMT /y ERW/HFI**

Approved supplier of the largest international Oil and Gas companies

Major hollow section supplier of the construction sector

Amongst the world’s largest and highly advanced steel pipe producers for the Oil & Gas industry

Notes
- New investment to be operational at the beginning of 2015
Port facilities (exclusive use):
- Berth “A”: Depth: 11.10m, length: 205 m
- Berth “B”: Depth: 6.30m, length: 155m
- Berth “C”: Depth: 9.50m, length: 90m

Helical SAW plant (375 kMT/year)
- Grade up to: X80 (X100 in the future)
- O.D. range: 16” - 56”
- Wall thickness: up to 40 mm
- Manufacturer: MEG / SMS MEER (Germany)

NEW LSAW plant (400 KMT/year)
- Grade up to:
  - X80 (X100 in the future)
  - O.D.: 8” - 72”
  - Wall thickness: up to 40 mm
- Manufacturer: MEG / SMS MEER (Germany)

ERW/HFI plant (400 kMT/year)
- Grade up to: X80
- Hollow Sections: 180x180 - 500x500
- Line Pipes (O.D. Range):
  - 8 5/8” - 26”
  - Wall thickness: 4.78-25.4 mm
- Manufacturer: MS-MEER (Germany)

ERW/HFI plant (150 KMT/year)
- Threading, coupling, heat treatment
- Grade up to: S355J2H (upgrade to API grades)
- Line Pipes O.D.: 2” - 7 5/8”
  - (HS: 50x50 - 160X160)
- Wall thickness: 3.0-10.0 mm
- Manufacturer: SMS-MEER (Germany)

Coating (2 lines)
- Capacity: 6,300,000 sq.m/y
- O.D.: range: 4 1/2” - 100”

Lining
- Capacity: 2,000,000 sq.m/y
- O.D.: range: 8 5/8” - 56”

Connectors facilities
- Capacity: 4,500 joints/y
Managing big projects

**NORTH AMERICA**

**Customers**
Denbury Resources, DCP Midstream, Spectra Energy, Cheniere, Enbridge, Panhandle, Kinder Morgan, Energy Transfer, EPCO, Williams, Spartan, McJunkin, NISource, Mississippi Power, Chaparral

**Major Projects**
Kemper County IGCC CO2 pipeline: 12,000 MT
DCP Sandhills Project: 51,000 MT
Greencore CO2 pipeline: 52,000 MT
Energy Transfer projects: 134,000 MT
Spectra Temax: 26,000 MT

**SOUTH AMERICA**

**Customers**
MLP, Cunado, Penex, UPC

**Major Projects**
MLP pipeline Chile: 10,000 kMT
Citam to Sinan gas pipeline Mexico: 5,000 MT

**AFRICA**

**Customers**
Chevron Texaco, Shell, Sonatrach, Perenco, ENPPI, Petrojet, BG, STEG, ABB, Bonatti, Salipem, BP, Gasco, Vegas Oil

**Major Projects**
Hadsrului project: Tunisia: 18,000 kMT
El Merk project, Algeria: 52,000 kMT
Menzel project, Algeria: 35,000 kMT

**CIS**

**Customers**
SoCar, BP

**Major Projects**
SoCar gas pipeline: 14,000 kMT

**GREECE**

**Customers**
DEPA, DESFA

**Major Projects**
Desfa projects: 30,000 kMT

**MIDDLE EAST**

**Customers**
Saudi Aramco, Qatar Petroleum, PDO, OGC, DEWA, SCOP, Gasco, ADNOC, ENPPI, Petrofac, OMV Yemen

**Major Projects**
Saudi Aramco projects: 41,000 kMT
Gasco NGL project: 12,000 kMT
OGC project: 7,000 kMT
PDO projects: 12,000 kMT
Harweel project: 11,000 kMT

**EUROPE**

**Customers**
GDF, Snam Rete Gas, Dow Chemical, RWE, DMV, Plinacro, Enagas, TransGas, BG Group, National Grid, Bord Gais, EDF

**Major Projects**
National Grid project: 7,000 kMT
Gaz de France projects: 75,000 kMT
Breach project UK: 22,000 kMT
WAG Expansion D3: 36,000 kMT
Zimella Gervignano: 22,000 kMT
Total UK: 5,000 kMT

**CHENIERE:**
Creole Trail, USA 40,000 MT

**SONATRACH:**
Medgaz GZ4 Algeria 99,000 MT

**ENAGAS:**
Alcazar-Montesa Pipeline 71,000 MT

**CHEVRON TEXACO:**
West Africa gas Pipeline 67,000 MT

**SPECTRA ENERGY:**
Southeast Supply Header project, USA 118,000 TN
Short information from Corporate Presentation
The ELVAL Group today

The largest Greek aluminium processor, operating in manufacturing and trading of flat rolled and extruded products. The total production capacity exceeds 350 thousand tons. Significant international presence - exports exceed 85% of total turnover.

Member of VIOHALCO, the largest metal processing group in Greece, operating in the fields of Steel, Aluminium and Copper products and Real Estate development.

Shareholders Composition

- Other 26.86%
- VIOHALCO SA/NV 73.14%

- Shares listed on the Athens Stock Exchange (symbol: ELBA)
- Index Participation (SD, FTSEGT, FTSEGTI, FTSEMSFW)
- Shares: 124,100,815

Group Structure (*)

- Aluminium rolling & lithographic Aluminium coils
- BRIDGNORTH ALUMINIUM (75%) UK
- ETEM (70.78%) Greece
- Architectural & industrial profiles
- Aluminium foil & Paper processing
- SYMETAL (99.99%) Greece
- ELVAL COLOUR (100%) Greece
- Aluminium coils, lacquering & composite aluminium panels (Etalbond)
- High-end Aluminium coils (JV with UACJ Corp.)
- AFSEL (50%) Greece
- VIOMAL (50%) Greece
- Aluminium rolling shutters & window accessories

(*): most significant Group companies
## Main production Facilities

<table>
<thead>
<tr>
<th>Facility</th>
<th>Type</th>
<th>Area</th>
<th>Buildings</th>
<th>Production 2013:</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>ELVAL (Oinofyta - Greece)</strong></td>
<td>Aluminium Rolling Plant</td>
<td>486,000 sqm</td>
<td>134,000 sqm</td>
<td>241.1 thous. tons</td>
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</tr>
<tr>
<td><strong>BRIDGNORTH ALUMINIUM (Bridgnorth - UK)</strong></td>
<td>Aluminium Rolling Plant</td>
<td>268,400 sqm</td>
<td>63,000 sqm</td>
<td>87.8 thous. tons</td>
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</tr>
<tr>
<td><strong>ETEM BULGARIA (Sofia - Bulgaria)</strong></td>
<td>Aluminium Extrusion Plant</td>
<td>131,000 sqm</td>
<td>39,000 sqm</td>
<td>14.5 thous. tones</td>
</tr>
</tbody>
</table>

For ELVAL the % recycled Aluminum is 40 to 45 % (based on ~ 240 thous. tons annual production / for 2014 production)
Rolled products

Facades (Etalbond, ELVAL ENF), Gutters (Ydoral), Roller Shutters, Roofing, Wall cladding.

Rigid Packaging (Sheets, Coils)
Beverage cans, food cans & closures.

Flexible Packaging (Foil)
Household foil, cigarette packing, confectionary packaging, frozen food etc.

Transportation (Sheets, Coils)
Shipbuilding & marine applications, trucks & trains.

Building (Sheets, Coils)
Rolled products

- **Household Appliances (Sheets, Coils)**: Water heaters, fridges, cookware.

- **Automotive (Sheet, Coils)**: Heat exchangers (Brazing), components, insulation.

- **Litho Coils**: Litho coils for printing units.
Extrusion products

Aluminium systems for all types of doors and shutters, roller shutters, Venetian blinds etc.

Architectural Profiles

Profiles for special applications, industrial profiles for automotive applications etc.

Industrial Profiles
<table>
<thead>
<tr>
<th>Company</th>
<th>Fact 1</th>
<th>Fact 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>HALCOR</td>
<td>2 plants in Greece, 414 employees</td>
<td>67% of the production comes from Cu-scrap</td>
</tr>
<tr>
<td></td>
<td>- 75,000 tpy Copper tubes</td>
<td>recycling (2013)</td>
</tr>
<tr>
<td>HELLENIC CABLES</td>
<td>4 plants in Greece, 1,208 employees</td>
<td></td>
</tr>
<tr>
<td></td>
<td>- 164,000 tpy Cables</td>
<td></td>
</tr>
<tr>
<td></td>
<td>- 40,000 tpy compounds</td>
<td></td>
</tr>
<tr>
<td></td>
<td>- 120,000 tpy Copper wire rod</td>
<td></td>
</tr>
<tr>
<td>SOFIA MED</td>
<td>1 plant in Bulgaria, 600 employees</td>
<td></td>
</tr>
<tr>
<td></td>
<td>- 100,000 tpy Copper &amp; Brass rolled products</td>
<td></td>
</tr>
<tr>
<td></td>
<td>- 25,000 tpy Copper &amp; Brass extruded products</td>
<td></td>
</tr>
<tr>
<td></td>
<td>- 30,000 tpy ZnTi Sheets &amp; Coils</td>
<td></td>
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<tr>
<td>FITCO</td>
<td>1 plant in Greece, 78 employees</td>
<td></td>
</tr>
<tr>
<td></td>
<td>- 40,000 tpy Brass Bars, Tubes and Wires</td>
<td></td>
</tr>
<tr>
<td>Category</td>
<td>Products</td>
<td>Uses</td>
</tr>
<tr>
<td>------------------------</td>
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<td>----------------------------------------------------------------------</td>
</tr>
<tr>
<td>Copper Tubes</td>
<td><img src="image1" alt="Copper Tubes" /></td>
<td>- Water supply, heating, heating (pre-insulated), refrigeration, natural gas, medical use, cooling, solar energy and various industrial applications</td>
</tr>
<tr>
<td>Rolling Products</td>
<td><img src="image2" alt="Rolling Products" /></td>
<td>- Construction (roofing, gutters), electrical engineering (connectors, transformers, boilers, etc.) and decoration</td>
</tr>
<tr>
<td>Extruded Products</td>
<td><img src="image3" alt="Extruded Products" /></td>
<td>- Construction, decoration, electrical engineering (electronic control panels, valves, batteries etc.), supports for gutters</td>
</tr>
<tr>
<td>Cables – Enamelled Wires</td>
<td><img src="image4" alt="Cables – Enamelled Wires" /></td>
<td>- Power and telecommunication cables and other industrial applications</td>
</tr>
</tbody>
</table>
R&D company of VIOHALCO S.A.

http://elkeme.gr/
Est.1999 to support the technical needs of the Viohalco Group of Companies and to bridge with Academia and other R&D centers worldwide

- 25 employees including 13 engineers/scientists

**Goals:**
- Create laboratories of highest standards
- Employ highly specialized scientists & engineers
- Initiate integrated research programs in Metallurgy and Materials Science
- Collaborate with national and international laboratories
- Provide R&D services to 3rd parties

**VIOHALCO Group of Companies products**

- ELVAL/ETEM/Bridgenorth Aluminium – Flat aluminum products and extruded profiles
- SIDENOR/SOVEL/STOMANA/CPW – Steel slabs, pipes & tubes, wires, profiles
- HALCOR/FITCO/Hellenic Cables – Copper & Brass tubes, bars, wires, cables and profiles

http://elkeme.gr/
R&D activity

Sections

- Materials characterization
- Mechanical properties
- Melting Furnaces & Thermal Treatments
- Surface Science & Coatings Technology
- Corrosion
- Mathematical Modeling
- Analytical Chemistry
- Environmental Engineering
- R&D Project Coordination & Physical Metallurgy

Research & Development work

- Alloy & process development
- Industrial trials with scientific monitoring
- Thermal & casting models for refining furnace operations & metal structures
- Microstructure characterization & failure analysis
- Studies of surfaces & coatings
- Chemical/mineralogical analysis, texture, internal stresses
- LIBS (Laser Induced Breakdown Spectroscopy)
- International & national R&D projects
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II. **Product examples**
   Aluminum industrial profiles
   Copper Inner Grooved Tubes
   Steel Special Bar Qualities
## SBQs current range

### Hot Rolled Round Bars
- diameters: 22 – 120mm
- length: 6 – 7,1 meters

### Peeled Round Bars (Bright Steel)
- diameters: 30 – 115mm
- length: 6 meters, 3 meters

### Steel Grades
- **Medium Carbon Steel**
  - S235JR, S355J0/J2, C35, C45
- **Higher Carbon**
  - C50, Cf53 (<60mm)
- **Low alloyed steel**
  - 16/20MnCr5, 20MnV6
  - 38MnVS6 (<60mm)
- **Free cutting**
  - 11SMn30
- **Boron Grades (under test)**
  - 37MnCrB5 (<70mm)

### Main Applications
- Axes and shafts
- Hydraulic systems
- Mechanical processing
- Forging for Agriculture
- General engineering applications
Microstructure evolution (from cast to final microstructure / center area is depicted)

250x300 bloom  160x160mm

20MnV6

42CrMo4

Shrinkage crack

MnS

Ferrite at PAGB's

Bainite

$\Phi 70\ mm$

$\Phi 83\ mm$

$\Phi 72\ mm$

$\Phi 100\ mm$
II. Product examples
II. Product examples

Inner Grooved Tubes
Condensation

Case III: $G=400\text{kg/m}^2\text{sec}$, $x=0.5$

Smooth tube  IGT

New laboratory for IGT – Inner Grooved Tubes
Thermal efficiency measurement
Thank you!

We are what we repeatedly do; excellence then is not an act, but a habit.
Aristotle, Greek philosopher (384-322BC)