Cable Technology Update

RGI Cable Workshop
Understanding Underground Cables

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Spreitenbach, 13 – 14 February 2013

Europacable, Boulevard A. Reyers, 80 1030 Brussels
www.europacable.com

Introducing Europacable

HV & EHV Members:

BRUGG CABLES Well connected.

General Cable

Nexans

nkt cables

PRYSMIAN CABLES & SYSTEMS

Associated Member:

BOREALIS SHAPING the FUTURE with PLASTICS

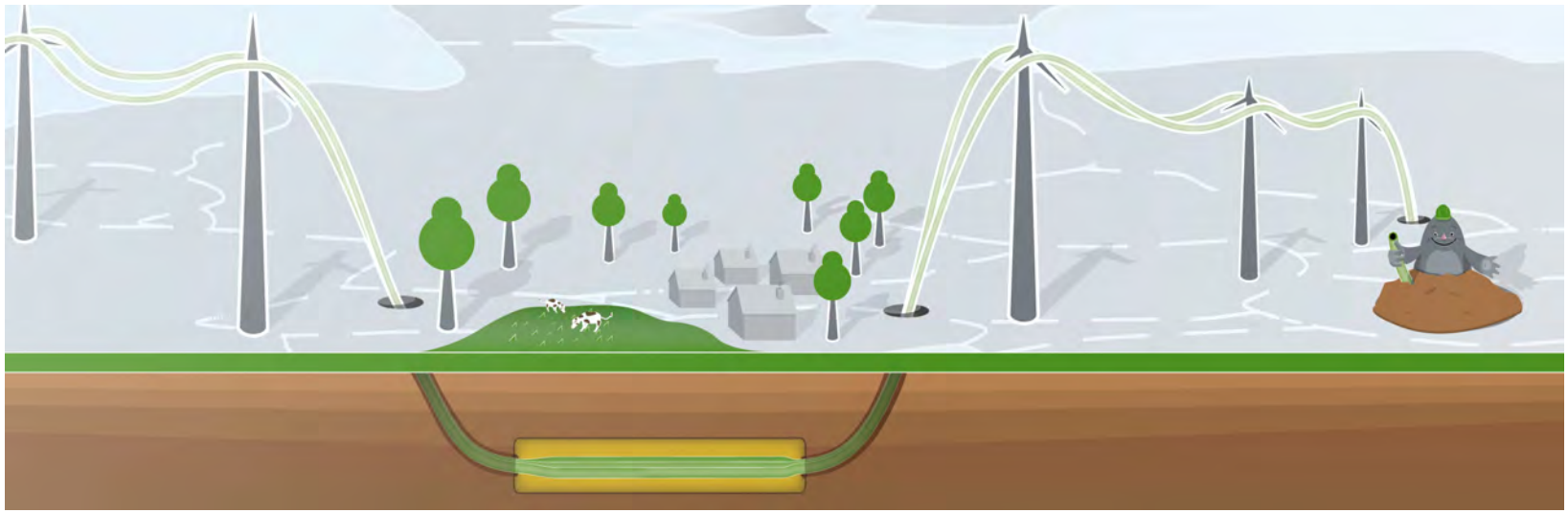
- **Voice of the European wire & cable industry at EU Level**
  - Provide clear, consistent, technical information
  - Engage with all interested parties
- Founded in 1991:
  - **SME's & multinationals** representing approx. **85%** of Europe's wire and cable industry
  - **€ 20 billion** wire & cable consumption 2009 (International Cable Federation, January 2011)
  - **2,2 million tonnes** insulated metallic cable production at conductor 2009; equalling some
  - **38 million km** of cables produced in Europe
- Registered with EU Institutions: 453103789-92
- Member of eHighway2050 Consortium

Europacable Concept of Partial Undergrounding

Essentials

- Most of Europe's new grids will be overhead lines
- **In sensitve areas, partial undergrounding may complement overhead lines to facilitate grid extensions**
  - Sections upto 20KM possible without compensation
  - Allows for alternative, possibly shorter routing
  - Limited, manageable environmental and visual impact

➢ ***Core technology: EHV XLPE Underground Cables***



EHV XLPE Cables – Key facts

Extra High Voltage cross linked polyethylene (XLPE) Cables

- Copper conductor (alternative aluminium)
- Semiconductor
- XLPE insulation
- Semiconductor
- Waterblocking
- Metallic screen and water barrier (aluminium laminated foil)
- Polyethylene outer sheath

➢ ***Notably at Extra High Voltage level, 100% precision is critical to ensure full reliability of technology***

Joint Paper Europacable & ENTSO-E, 2011

Joint effort to confirm current status of EHV XLPE cable technology

- *Transmission System Operators (TSOs) & Leading European Manufacturers*
- *Co-ordinated by European Commission DG Energy*

Approving EHV XLPE cable technology

- *"Extra high voltage cross linked polyethylene cable XLPE are mature & reliable technology"*
- *"Partial undergrounding is a means to upgrade & expand Europe's EHV electricity grid"*
- *"Solutions are to be considered on a case-by-case basis"*

➢ ***Basis for facts presented here – available at www.europacable.com***

EHV XLPE Cables – Key facts

Laying of EHV XLPE Cables

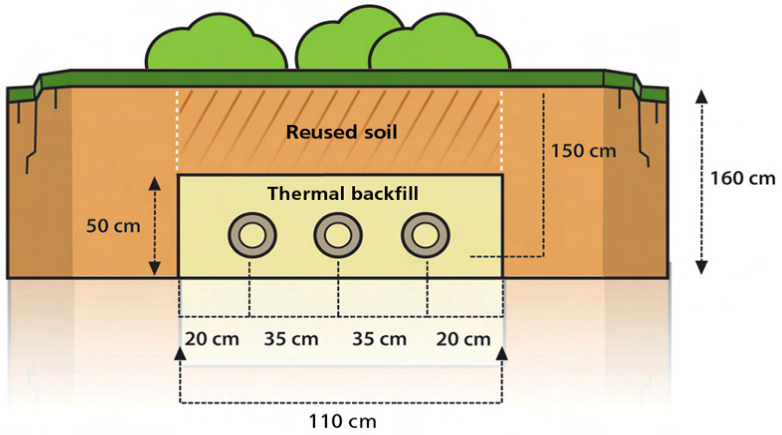
- Usually directly buried into the ground, surrounded by sand blending
- Can also be installed in tunnels, ducts or pipes (better protection against external damage at higher costs)
- Max 30% of excavated soil has to be transported away – rest is refilled

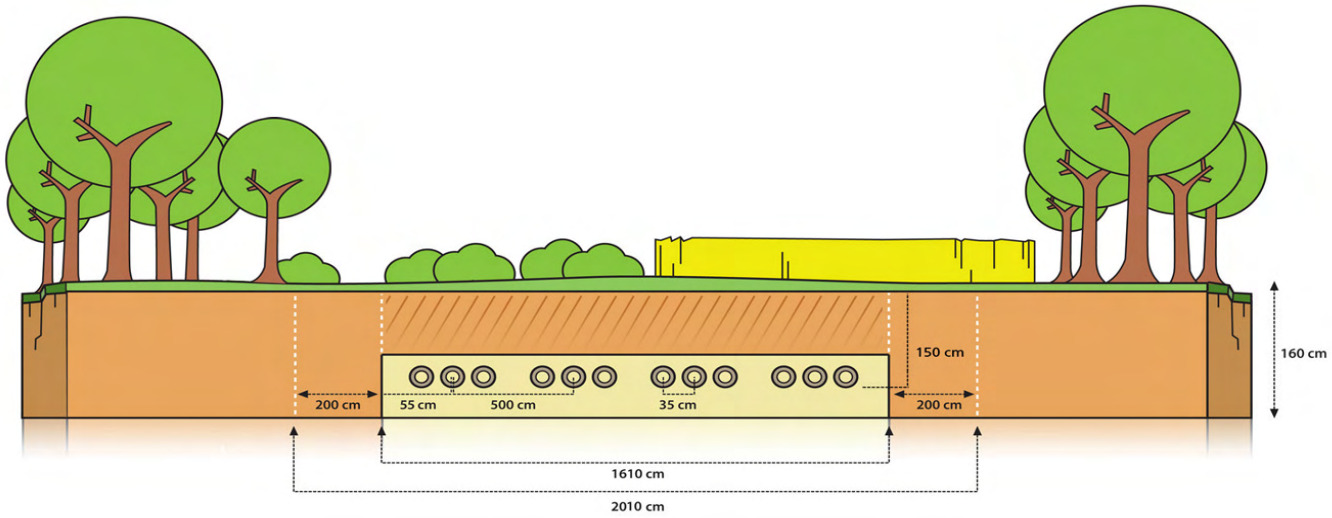
➢ ***Considerable work required during installation***

Picture courtesy of TenneT

EHV XLPE Cables – Key facts

Laying of EHV XLPE Cables





EHV XLPE Cables – Key facts

Picture courtesy of TenneT

Cable length

- For land application, EHV XLPE cables are delivered in length of 700 – 1000 meters
- Logistical constraints: Weight & size of cable drum have to be considered for transport

Joint Bays

- Cables are linked every 700-1000m by so called joint bays
  - Directly buried in the ground, surrounded only by sand blending; or
  - Placed in underground structure, typically 10m by 2.5m by 2.1m depth
- Joining EHV cables is delicate task which needs to be executed by trained experts with utmost care

➢ ***No or only little visibility of these installations above ground***

EHV XLPE Cables – Key facts

Reliability

- Cable systems undergo thorough test procedures according to IEC Standards with thermal and electrical stress levels exceeding operational levels before being placed in operation
- Once in ground, cables are well protected against external impacts

Repairs

- Single faults on cable may take longer to repair than on overhead line - repair times on larger systems are comparable
- CIGRE Brochure 379:
  - Over 1/3 of cable faults were repaired and system re-energised within less than 1 week
  - More than 75% of cable faults within 1 months
- Keeping spare parts is critical

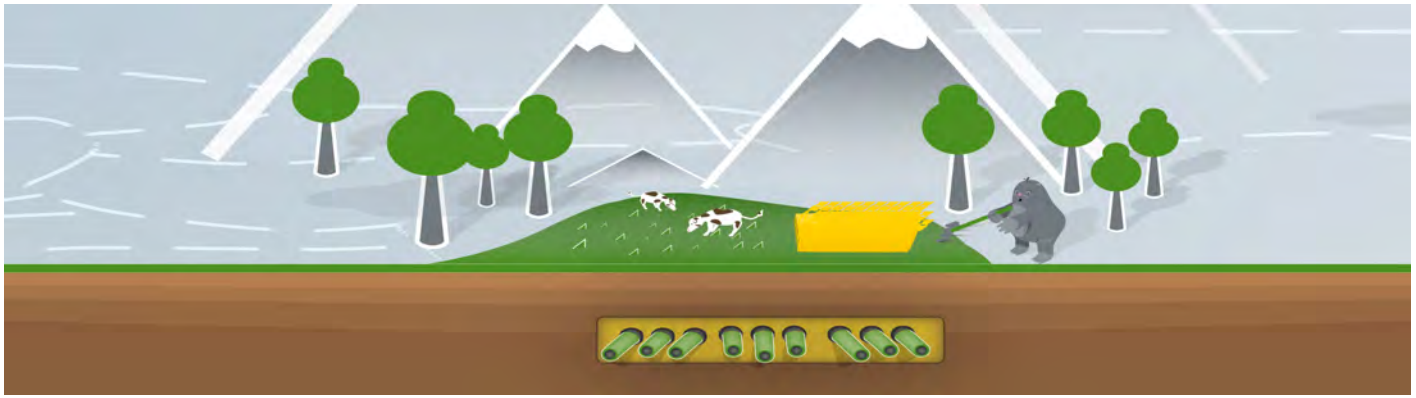
- ***XLPE underground cables are reliable technology***
- ***N-1 Criterion ensures security of supply***

EHV XLPE Cables – Key facts

Environmental impact

- Installation works represent considerable impact on the environment
- Vegetation will be re-installed after 1 – 2 seasons
- Limited impact during operation
  - No drying of soil
  - No limitation to cultivation apart from deeply rooted trees
  - No limitation on agriculture – need to introduce compensation schemes
- No risk to human health: Exposure to EMF stays well within limit of EU Recommendation 199/519/EC

➢ ***Cable section will be visible if cutting through forest – but will blend into open landscape***

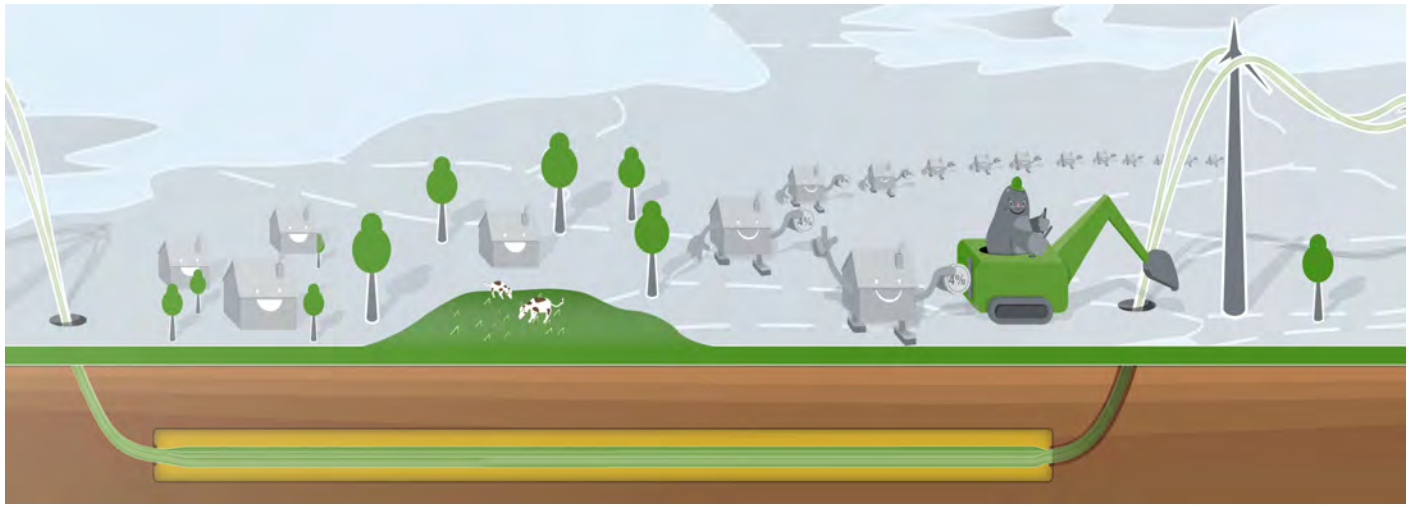


EHV XLPE Cables – Key facts

Costs of partial undergrounding

- Investment cost factor for 400 kV XLPE cables is 5 – 10 dependent on project details and soil conditions
- Cost factor applies only to undergrounded section
- Cost factor for entire line project will be 1.2 – 2

➢ ***Life cycle costs of Project are to be considered***



EHV XLPE Cables – State of the Art

AC Cables in use

- More than 25 years commercial experience at HV levels (110-150 kV)
- More than 20 years commercial experience at EHV level (220 – 275 kV)
- More than 15 years experience at EHV level (380 – 400 kV)

AC Cables installation globally since 2000

- High Voltage: > 200.000 km
- Extra High Voltage: > 10,000 km

EHV XLPE Availability

- 40% capacity increase from 2008 to 2011
- Annual capacity for Europe alone is about 3.500 KM

➢ ***Global technology leadership of European manufacturers***

EHV XLPE Cables – State of the Art

Conclusions

- EHV XLPE cable technology is fully available
- At 380.000 Volt, each project needs to be carefully evaluated on a case by case basis
- Partial undergrounding complementing overhead lines in sensitive areas is a new concept which requires new thinking & creates new possibilities for a reliable, acceptable & affordable grid extensions in Europe