First UCTE Comments

on the

BACKGROUND PAPER

UNDERGROUNDING OF ELECTRICITY LINES IN EUROPE

COMMISSION OF THE EUROPEAN COMMUNITIES

Brussels, 10 December 2003

Introduction:

UCTE welcome the EU Commission Background paper, presented on December, 10th 2003, as it presents the current situation in the field of underground cables and lines in Europe.

On the basis of the analysis carried out into the paper, it appears that no European coordinated action concerning Low Voltage and Medium Voltage electricity networks is needed, while the EU Commission is going to propose "some type of coordinated action to be undertaken at European level" in order to increase the percentage of underground sections in cases of High Voltage and Extra High Voltage networks.

In that respect UCTE highlights that some essential clarifications and adaptations are necessary to provide a comprehensive overview and that some further analysis appears to be necessary. Some statements in the paper are not generally applicable for all voltage levels, especially not for 380kV lines.

UCTE therefore presents its recommendations on some aspect of the paper with special reference to HV and EHV transmission lines.

UCTE Recommendations:

1. Security of supply

Security of supply in the HV and EHV grid is not necessarily enhanced by cables even though cables are not subject to transitory phenomena. Adverse weather conditions may not be a problem for overhead lines (OHL) if designed and maintained properly including right of way management. Experience of some European countries (Austria) is best with OHL even during heavy storm, flood, ice and snow. Flood, earthquakes and landslides may influence cable connections.

The damages in France 1999 refer to a large extent to lines on the medium voltage level which are no transmission lines. These examples can not be taken for EHV cables.
The time required to repair faults on an underground cable is a factor 4 to 5 greater than to repair an overhead line fault. Also the localisation of a fault in an underground cable is much more difficult and time consuming.

2. Acceptance of HV and EHV cables

Recent experience from Denmark has shown that the public acceptance of a 380kV underground cable (UGC) is not higher than for an overhead line. On the contrary, the percentage of properties that had to be bought or expropriated was more than twice as high in the cable section than in the section with overhead lines (OHL). Source: Eltra, 380kV line Aarhus – Alborg.

In addition the EU Commission states that local inhabitants seem to prefer underground cables as far as the electromagnetic effects are concerned.

It seems not appropriate to speak about EMF “effects” rather than “fields” as far as no proof about the effects of EMF on human beings have been yet provided.

Underground cables produce higher magnetic fields directly above them than overhead lines as the distance from the underground cables and the ground surface is constant. On the contrary both overhead lines and underground cables comply with 50 Hz limits proposed in EU Recommendation for public exposure.

3. Time for permission and installation

A reduced time for permission of a cable section as alternative especially for HV and EHV OHL may not be expected automatically. A cable alternative normally will follow another route than an OHL, needs a separate new authorization procedure and concerns other landowners and probably other communities. The Danish example shows that the acceptance is even lower for 380kV cables (see above). It has also taken several years to obtain the authorizations for the Belgian 150 kV cable project “Tihange – Avernas”.
General conclusions on the total duration for permission and installation of cable versus OHL projects can not be drawn. Each project must be evaluated on a case by case basis.

4. Effects on the environment

The effect on the environment from cables is not always necessarily less than from OHL. The better visual impact of cables especially at the HV and EHV level must be balanced against the increased use and movement of soil, restrictions of use of land above the cables, influences on the heat balance of the soil, considerably longer time for installation, reduced life time and new installation after 30-40 years.

5. Losses

The percentage of losses from UGC depends on the load. Compared with OHL they have advantages at high loads but they have disadvantages at low load situations. The situation may not be generalised and should be investigated case by case depending on the situation of the respective grid.

6. Unbundling and costs

Due to the unbundling in the electricity market the independent grid operator has a different approach than the trader. He has to provide a reliable and secure grid at reasonably low costs. The installation of expensive cables esp. on the 380kV-level would create a competitive disadvantage for the respective TSO.

When speaking about costs, the different lifetime of UGC (30-40 years) and OHL (100 years in some EU countries) may not be neglected. Cost for the substitutions as well as maintenance and operating costs shall be considered.

The present differences in costs between cables and OHL do not support the installation of cables in rural and suburban areas. Considering that the costs and benefits ratio of undergrounding cables in place of OHL depend on a case by case basis, progress in technological improvements should be favoured and realised.
Then it should be considered that the availability of transmission services play a key role in making a comparison between underground cables and overhead lines.

7. Tables and values in the background paper

It shall be mentioned clearly in all the tables and statements of the paper if the given length of cables and lines refers to system length or to route length or phase length. Otherwise the values cannot be compared (e.g. for the HTS cable in Copenhagen it has to be specified whether the 90 m are referred to the phase length or the total cable length).

8. Technical aspects

The existing grid is mainly build with overhead lines. The placing of underground cables can sometimes evoke structural problems. Indeed, due to the characteristics of an underground cable load-flow and short-circuit problems may arise.
Upgrading of an existing overhead line is possible (impossible with an underground cable). Given the problems to build new lines or to place new cables this is an additional advantage in favour of overhead lines.

MORE SPECIFIC COMMENTS ON THE EU BACK GROUND PAPER

Different current cable projects are mentioned in the main body, in Appendix 1 and Appendix 2. Therefore none of the three sections is complete regarding cable projects. This shall be mentioned in a preface.

comments to 1)
Introduction

It shall be stated if the given 0,5 % of underground 380kV cables in Europe are in urban or in rural areas.
A crosscheck in Table 3 and Table 4 is suggested. Austria is not mentioned in Table 3 but is mentioned in Table 4.

comments to 2)
Analysis by country - Current situation of underground cables and relative policies

Austria

The given factor 8 is for embedding cables in soil, the tunnel solution would lead to a factor of 10,2. Both factors are valid for this special project only with the given regional preconditions and where a longer OHL route was compared with a 7 % shorter UGC route.

Italy

Par. 1 relates to the Italian transmission Network managed by GRTN. The Italian transmission grid is made of 9.863,66 km of 380 HV lines (of which 9 km are cables considering that 6,5 km are the AC submarine cable connecting Italy and Sicily).
40 Km 380 kV line linking Redipuglia and Udine are "ongoing projects" not "planned projects".
In addition Turbigo – Rho line is for 7,2 Km in cable (double circuit XLPE 2500 mm^2).

Spain

It shall be mentioned that the final decision was for a 380kV double system cable in a tunnel (Madrid, airport Barajas).

comments on 3)
Benefits from a policy of undergrounding of electricity networks in Europe

Costs for maintenance in Australia: It would be helpful to have costs for the maintenance of cables from Europe as it is supposed that the situation from Australia may differ from the one in Europe.

- Early change of oil filled cables in UK: which voltage level?
- RTE reports about problems in joints: which voltage level?
- Time for repair of cables: which voltage level?
- Influence from undergrounding on the energy cost: It shall be stated which energy price is meant at what network level: transmission or distribution level – industrial or household?

Table 6: UCTE highly recommends to give the length of the interconnections in system length. This will allow to calculate the cost for one MW per km per system (€/MW/km) which is an important indicator.

comments on 4)
Possible contribution of underground cables in the realisation of the priority projects of the EC Communication on "European Energy Infrastructure"

France/Italy

Combination with the new High Speed train line between Lyon and Turin.
The project mentioned is not under review by RTE and GRTN

Italy / Austria

380kV Line Lienz - Cordignano: The mentioned 800 MVA is the load of one system under the n-1 criterion. Completion of the line will only take place after 2004. The given costs of 60 Mio € cannot be confirmed. So far, there was no request for cabling in the Austrian sections of the line.

The consortium for a new interconnection in GIL (future Brenner Tunnel) between Italy and Austria is between GRTN (IT) and TIRAG that is carring out the preliminary study (not yet concluded).

Italy/Switzerland:

GRTN has concluded the authorisation process. The Government on April, 29th 2004, gave the authorisation to build and operate the line on the basis of the Italian law n. 443/2001.

C) COMMENTS ON APPENDIX 1

1.1 Technical aspects

AC cables: 2000km XLPE-cables: it shall be stated which voltage level and if system- or route length is given.

Progress with UGC but no progress with OHL: Compact towers are an example for progress with OHL. The dimensions of these towers have been significantly reduced.

1.2 New technological developments

GIL (gas insulated transmission line) in Palexpo, Geneva: Assembly of the GIL took three months. The total construction time (including tunnel, civil works etc.) was 17 months. HTS cables: phase length approximately 350 meters.

HTS cables: system length or phase length?

1.3 Cost considerations

(b) Other factors to be considered for cost comparison:

The load on the Austrian transmission grid has increased as a consequence of the liberalisation of the electricity market. Advantages of cables when dealing with increased load situations can not be seen. On the contrary, due to reactive power required long cable sections are weak points when restoring the grid after collapses.

The use of land under OHL is possible as can be seen from many thousands of OHL over the countries. The agricultural use of land above a cable may have restrictions depending on the depth of lying. This has to be considered in view of a possible devaluation of the land.

Neither UGC nor OHL produce radiation. They produce EMF and their permissible levels are given in the relevant regulations.

(c) Costs of new technological developments (GIL and HTS)

As the lifetime of GIL is unknown at the time, a life cycle assessment is difficult.

1.4 Environmental considerations

see comments above

1.5 Operational considerations

Record of reliability: the voltage level shall be given, otherwise the fault rate is of little information.
Time for repair: the voltage level shall be given
Calculated continuous load in some cases 40% as set average parameter of the total actual capacity: This value needs explanation. We cannot confirm 40%.
Sabotage on cables is a higher risk as the repair time is longer.
Damages by storm in France 1999: see comment above.