Hybrid AC/DC overhead lines in Switzerland

Joshu Jullier, Junior Communication Manager
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Hybrid AC/DC overhead lines
The concept idea

Hybrid system

System 1: Three-phase alternating current

System 2: Bipolar direct current
Objectives & partners

Acceptance:
- Acceptance for conversion?
- Importance of uncertainties?

Technology:
- Optimal hybrid tower design?
- Maximum transmission power?
- Environmental effects?

System & Economy:
- Influence on existing AC grid?
- Ideal Swiss corridor?
- Benefit for hydro power?
Lack of acceptance
An issue
Lack of acceptance
Main problem of high voltage lines

Health risks
Landscape disruption
Noise
Aesthetics / visibility
General perception of danger / risk
Impact on animals
Risk through damages
Risk through air traffic
No problems
No answer

0%  10%  20%  30%  40%  50%  60%  70%  80%

Open question: «What is from your point of view the main problem?»

Graphic: Swissgrid Stakeholder Research, 2016
Acceptance for a new technology
Information matters

Treatment T1:
Extra high voltage lines are necessary for electricity transmission. Indeed, today’s grid capacity does not suffice to meet future demands.

Treatment T2:
However, this new generation of extra high voltage lines might yield more noise and might be felt more intensely when standing right below a line.

Graphic: «Information effects and public acceptance of new technologies in energy policy – the case of hybrid high voltage lines», Isabelle Stadelmann-Steffen, University of Berne, 2016
Acceptance for a new technology
Preference for hybrid lines and underground cables

Treatment T2:
However, this new generation of extra high voltage lines might yield more noise and might be felt more intensely when standing right below a line.

Treatment T3:
However, this latter variant is more expensive and when being constructed generates broad traces (like a highway) which can subsequently not be used to plant deep-rooted and high-stock trees (e.g., forest, fruit trees).

Graphic: «Information effects and public acceptance of new technologies in energy policy – the case of hybrid high voltage lines», Isabelle Stadelmann-Steffen, University of Berne, 2016
Technology

Environmental effects

» Audible noise due to corona
» AC and DC interfere with each other
» DC Corona increases electric field
Technology
Outdoor hybrid test line

» Influence of weather and pollution
» Separation distance between AC and DC
Conclusions

» Hybrid power lines and underground cables are clearly the preferred option for increasing grid capacity.

» Given the high volatility in attitudes and preferences, early and forward-looking information is crucial.

» Laboratory tests have shown the interference of AC and DC lines
Next project steps

» The results of the laboratory tests have to be verified in the outdoor hybrid test line
» Study on economic benefits of hybrid line
» Possible influences on the existing grid
Implementation
Possible Swiss corridors

- Laufenburg
- Mettlen
- All'Acqua
- Project San Giacomo
- Grynau
- Sils
- Greenconnector
- UltraNet
- SuedLink

Leitungen in Betrieb
- 380 kV
- 220 kV
- Schaltanlage
- Schaltanlage mit Transformatoren
- AC/DC-Umrichterstation
swissgrid