Planning the future electricity grid by using 3D Decision Support System

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Bottlenecks – a major problem
Main drivers of grid expansion in Switzerland

- **New large power plants**
  For example, construction of a new pumped storage power plant

- **International association**
  Increasing international energy exchange can lead to grid overload

- **Supply of downstream grids**
  New connection requests can lead to congestion
Expansion of the grid required

Strategic Grid 2025
193 km grid optimisation
87 km grid enhancement
370 km grid expansion

- Substations
- Lines
- Swissgrid projects
- Mandatory projects
Project delays: Why?
Lack of acceptance: a major reason for project delays
Overarching objective of the project

» Find the solution with the highest acceptance amongst all affected stakeholders

» Multi-Criteria Decision Analysis (MCDA) allows to respect the interests of all stakeholders
Idea of the project
Project team

Financial and technical support

Schweizerische Eidgenossenschaft
Confédération suisse
Confederazione Svizzera
Confederaziun svizra

Bundesamt für Energie BFE
Swiss Federal Office of Energy SFOE
Three dimensions of our Multi-Criteria Decision Model

- technical feasibility
- environment & landscape
- urban planning
How spatial Multi-Criteria Decision Analysis works

Factors are spatially explicit

$F_1, F_2, F_3, F_4$
How spatial Multi-Criteria Decision Analysis works

\[ \text{total}_x = \sum_{i=1}^{n} \text{resistance}_i \cdot \text{weight}_{ix} \]
Stepwise procedure from the study region to the corridor

study region

planning area

planning corridor
Netzausbau

Kategorien
- Landschafts- und Biotoptopforschung
- Bevölkerung und Raumplanung
- Technische Umsetzbarkeit

Breite Planungsgebiet

MCDA
- Raumwiderstand

Planungsgebiet
- Relative Kosten

Korridor
- Kosten pro Kilometer
- Indikative Baukosten (CHF)

Live Demo
Conclusions: How does an additional safety distance influence the results?

without safety distance: more direct connection

with safety distance: circumvention of densely inhabited areas
Next steps: Visualization of LiDAR data
Next steps: Develop an approach to integrate cable solutions
Implementation in real grid projects

» Use for planning
» Support decision of the planning territory and planning corridor
» Explain the proposed options at information events
» Visualisation of the final route from the perspective of the affected stakeholder
How we reach higher acceptance with the tool

» Demonstrate openness for different solutions and technologies
» Respect the interests of all important stakeholders by using MCDA
» More Transparency in decision process
» Higher credibility based on realistic visualisation of the line
swissgrid