DINGO - The eGo grid model: An open-source and open-data based synthetic medium-voltage grid model for distribution power supply systems

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Context

Project open_eGo:

• Develop a grid planning tool:
  • transparent
  • on multiple voltage levels
• Investigate economic viable grid expansion
• Create Open Energy Platform (OEP)
Context – Voltage levels of German power supply system

Challenges and solutions

- Challenges in MV and LV grid:
  - Heterogeneity
  - Lack of publicly available data
  - Grid extension case-by-case decision

→ Model

- Synthetic distribution grids:
  - At status quo
  - Topologies & equipment
  - Loads & Feeders
  - Open-data & -source
  - Local characteristics
2 Data basis: Damand

High-resolution spatial representation of demand by Hülk et al. (open_eGo)

Find data at:
2 Data basis: Generation

High-resolution spatial representation of Generation

- from *OPSD* project (based on *Energymap, BNetzA*)

+ method for spatial distribution

*Find data at:*

![OpenEnergy Platform](image-url)
3 Synthetic MV grids: Typification of areas

We focus on MV grids with:
- low load density areas (< 1 MW/km²)
- 20 kV, overhead lines
- ring topologie

Typification of load areas by peak load:

- **Aggregated load area**
- **Regular load area**
- **Satellite load area**
3 Synthetic MV grids: Progress of ring construction
3 Synthetic MV grids: Methodology – Overview

- Open ring topology
- Analogy from operations research: **Capacitated Vehicle Routing Problem (CVRP)**
- Objective: minimise cumulative route length
3 Synthetic MV grids: Results – Initial construction (savings)
3 Synthetic MV grids: Results – Improvements (local search)
3 Synthetic MV grids: Results – Extended topology
3 Synthetic MV grids: Results – Current & voltage issues

Rel. voltage (substation 104%)
- 104 %
- 104 - 106 %
- 106 - 108 %
- 108 - 110 %
- 110 - 112 %

Rel. Line loading
- 0 - 10 %
- 10 - 20 %
- 20 - 30 %
- 30 - 40 %
- 40 - 50 %
- 50 - 61 %
3 Synthetic MV grids: Results – Reinforced

Rel. voltage (substation 104%)
- 104 %
- 104 - 106 %
- 106 - 108 %
- 108 - 110 %
- 110 - 112 %

Rel. line loading
- 0 - 10 %
- 10 - 20 %
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- 30 - 40 %
- 40 - 50 %
- 50 - 61 %
3 Synthetic MV grids: Conclusion

- Generation of heterogeneous, synthetic MV grids which are technically stable
- Results strongly depend on initial assumptions, e.g.:
  - categorisation of load areas (aggregated, regular, satellites)
  - max. count of rings
  - max. length, max load of branches
  - initial cable/line types
  - search buffer (radius) for conn. points

- Problems concerning initial assumptions
  - hard to determine since values given by DSOs reflect both: basic principles of initial grid planning and extension of existing grids
  - need for further sensitivity analysis
Distribution Network GeneratOr (DINGO)

Find code:  Find data:  Find info:

github.com/openego/dingo  oep.iks.cs.ovgu.de  openegoproject.wordpress.com

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Thank you!