Economic Assessment of Active DG System Integration Utilizing Infrastructure More Efficiently

DG DEMO NET CONCEPT

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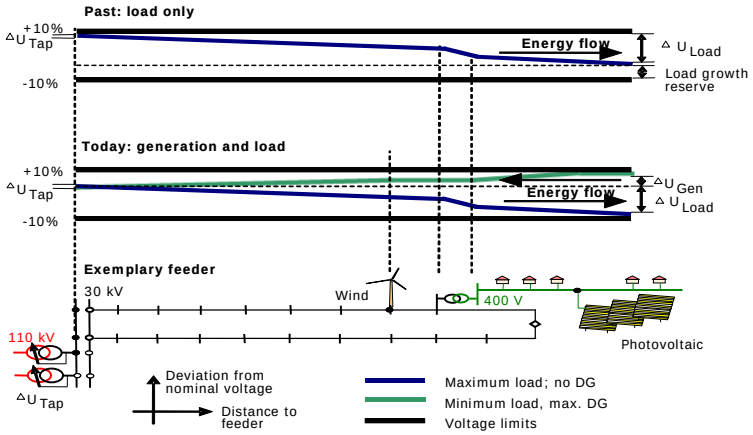
Outline

- **Problem definition**
- **Methodology**
- **Case studies incl. results**
- **Conclusions**
- ***Prospects***

Vienna, 15.05.2008

There's a competition between DG and load for utilisation of existing grid infrastructure



Problem definition
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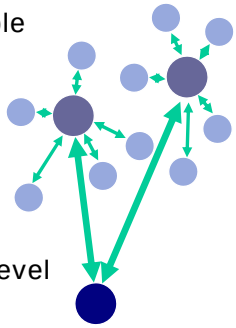
Key Issue: Choose suitable Communication Infrastructures and control mechanisms

- Possibly heterogenious
  - Use existing infrastructure as far as possible
- Options for communication
  - **Optic fibre**
    Most expensive, most advanced solution
  - **Radio link**
    DNOs option of choice where feasable
  - **DLC**
    DNO-owned, but some problems on MV level
  - **GSM**
    Availability issues, public network



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Methodology

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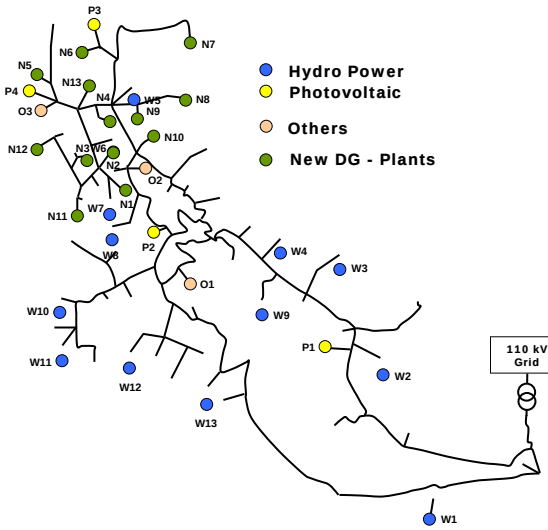

Important topics to evaluate:

- ➔ Increase in DG penetration (potentials)
- ➔ Validate the technical solutions via simulations
- ➔ Cost of conventional grid connection
- ➔ Cost of active grid connection
- ➔ Compare the cost (of several approaches)

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Methodology

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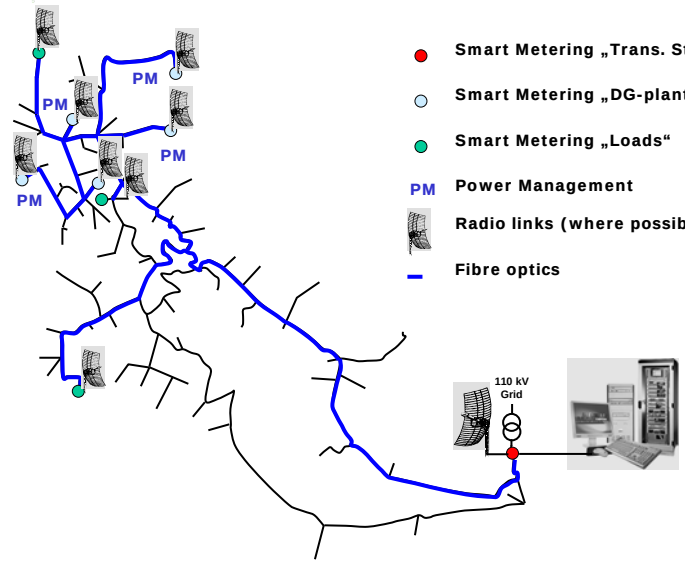

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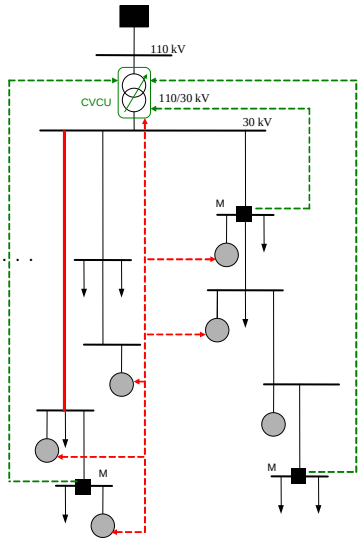
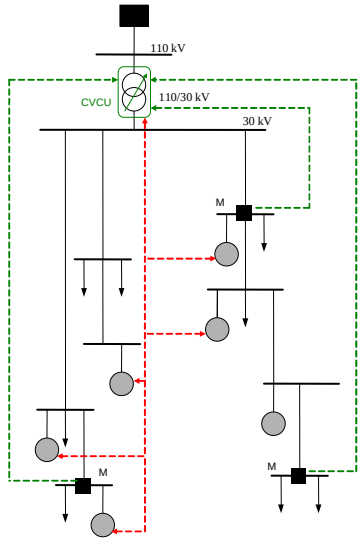
	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Year 9	Year 10
DG1	x	x	x	x	x	x	x	x	x	x
DG2	x	x	x	x	x	x	x	x	x	x
DG3	x	x	x	x	x	x	x	x	x	x
DG4	x	x	x	x	x	x	x	x	x	x
DG5		x	x	x	x	x	x	x	x	x
DG6		x	x	x	x	x	x	x	x	x
DG7		x	x	x	x	x	x	x	x	x
DG8			x	x	x	x	x	x	x	x
DG9										x
DG10							x	x	x	x
DG11	x	x	x	x	x	x	x	x	x	x
DG12	x	x	x	x	x	x	x	x	x	x
DG13_1				x	x	x	x	x	x	x
DG13_2								x	x	x
DG13_3									x	x
DG14					x	x	x	x	x	x
DG15						x	x	x	x	x



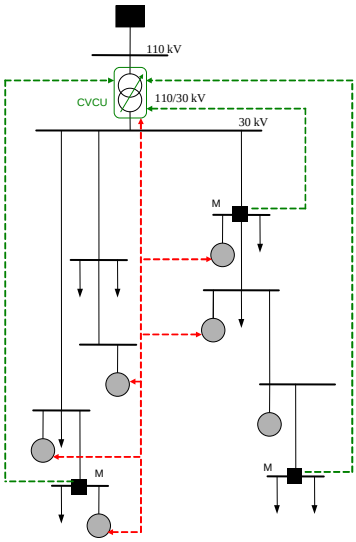
$$Rc_i = \sum_{j=1}^{40} \frac{Cr_i * (1+p)^{j-1}}{(1+r)^{(j-1)+i}}$$

Cr = Operation and maintenance cost of grid asset [€]
p = Yearly increase in operation and maintenance cost [%]
j = Year of asset operation
i = Year of asset installation



$$Tc = \sum_{i=1}^{40} (Grc_i * P_i + Rc_i)$$

Tc	=	Total cost of grid integration strategy	[€]
Grc	=	Grid reinforcement cost (net present value)	[€/MW]
P	=	Yearly DG capacity to connect	[MW]
Rc	=	Accumulated running cost	[€]
i	=	Year of asset installation	



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Methodology
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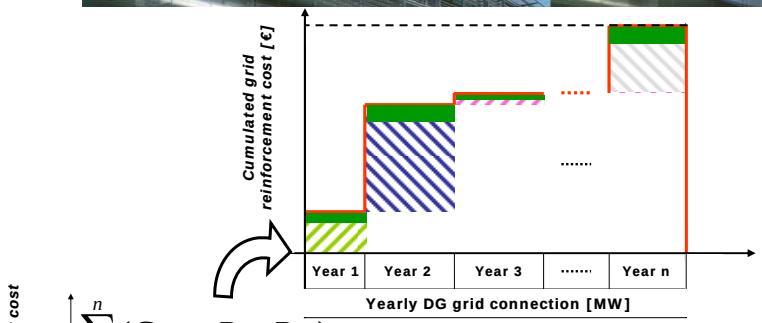

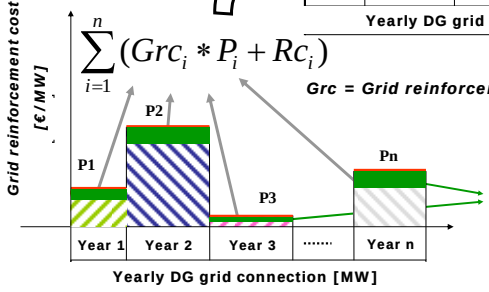

$$\sum_{i=1}^{n} (Grc_i * P_i + Rc_i)$$

Grc = Grid reinforcement cost (net present values) [€/MW]

P = yearly DG power to connect [MW]

Rc = running cost (for 40 years, calculated as present values) [€]

Year 0 = reference year

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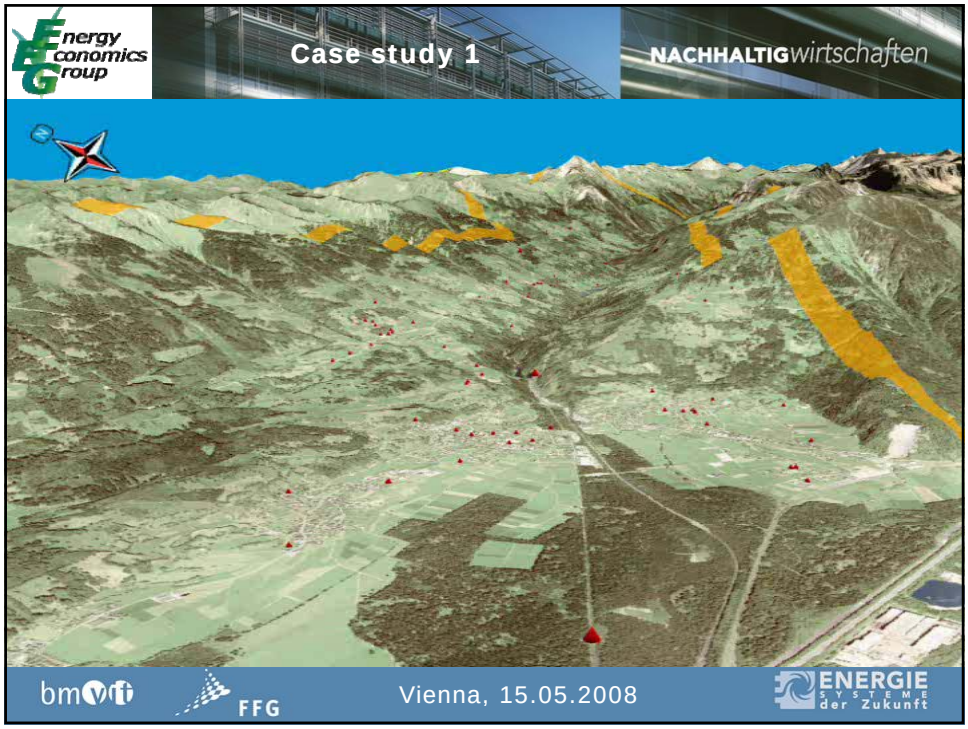
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Case study 1
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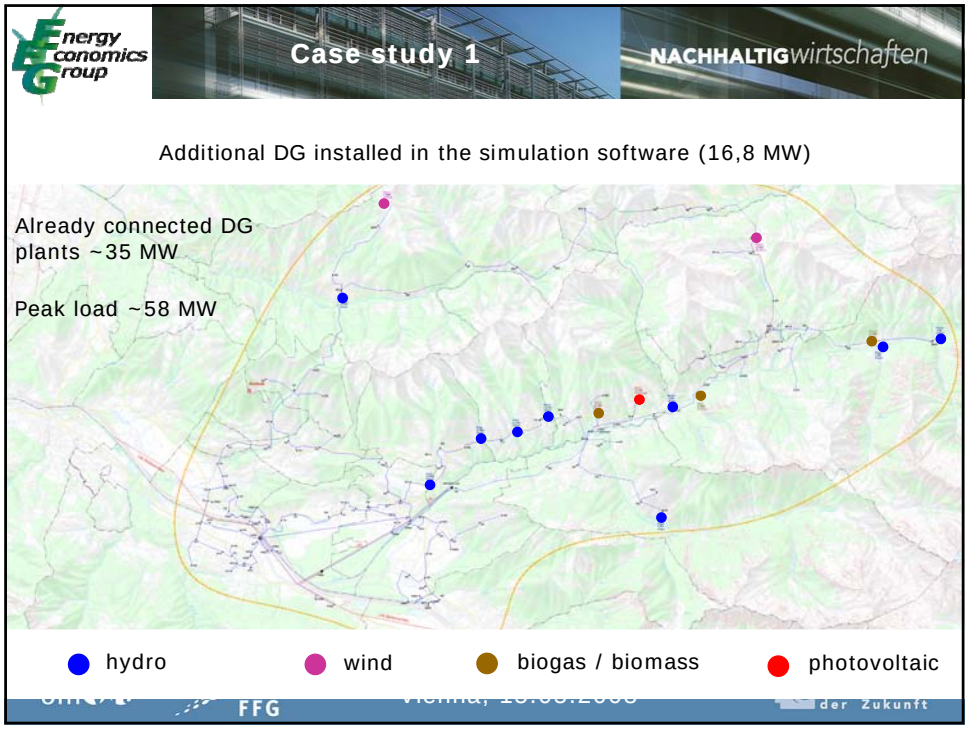
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Case study 1
NACHHALTIGwirtschaften
Additional DG installed in the simulation software (16,8 MW)
Already connected DG plants ~35 MW
Peak load ~58 MW
hydro
wind
biogas / biomass
photovoltaic
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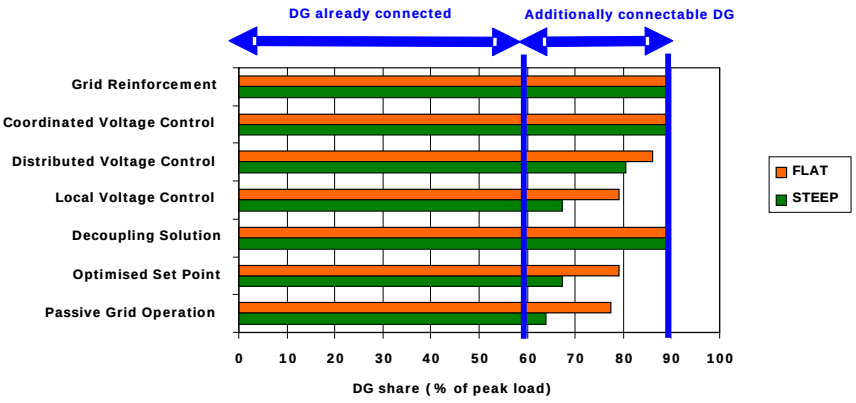
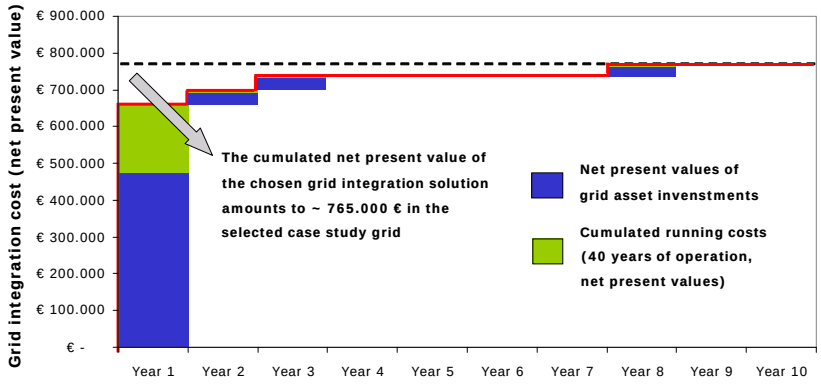
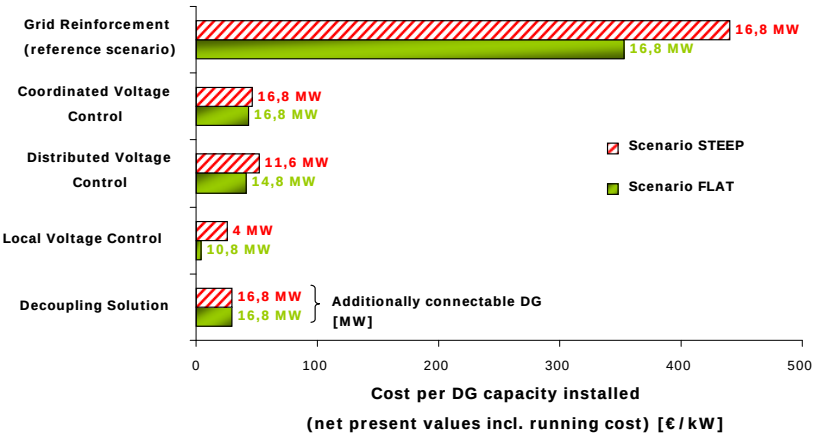
Case study 1: connectable DG shares for different grid integration strategies



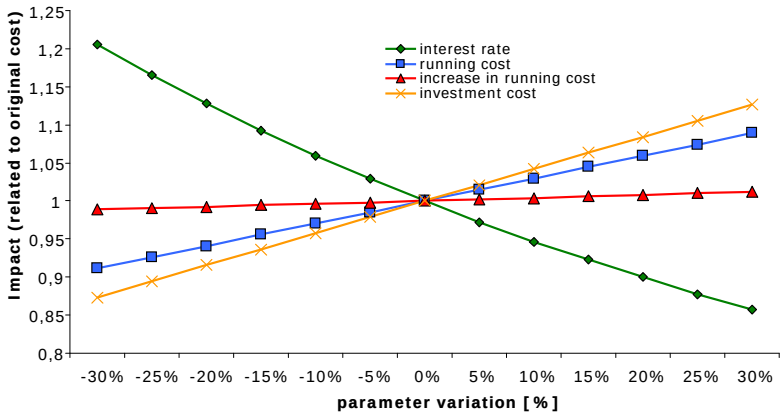
Case study 1: Coordinated Voltage Control - Scenario STEEP



Case study 1: Cost comparison of technical solutions



Case study 1: Sensitivity analysis



Case study 2

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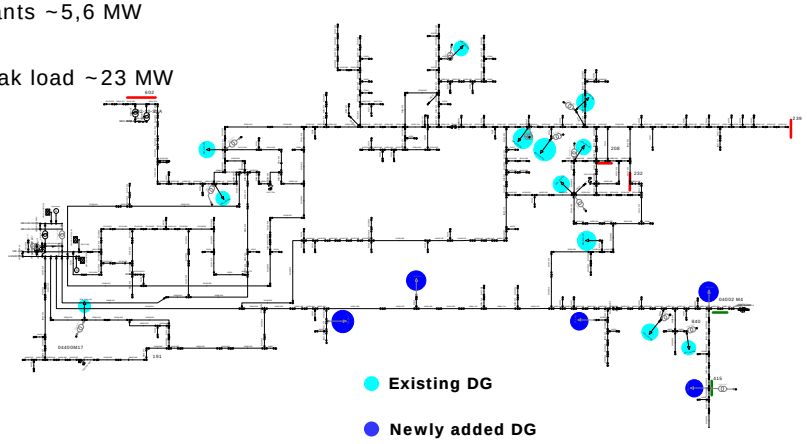
Additional DG installed in the simulation software (6,6 MW)

Already connected DG plants ~5,6 MW

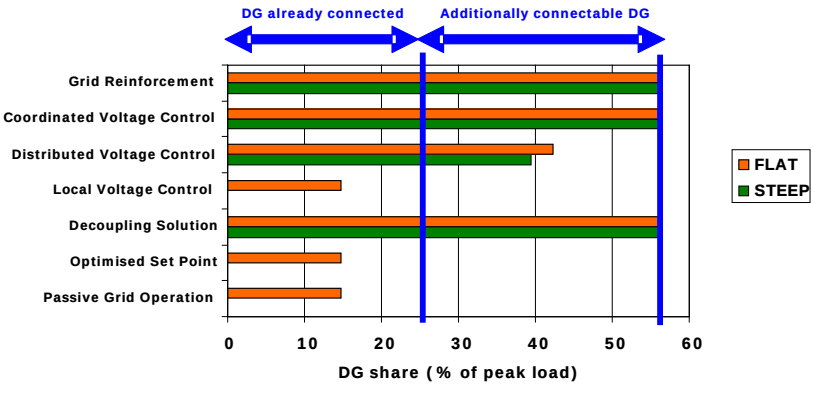
Peak load ~23 MW



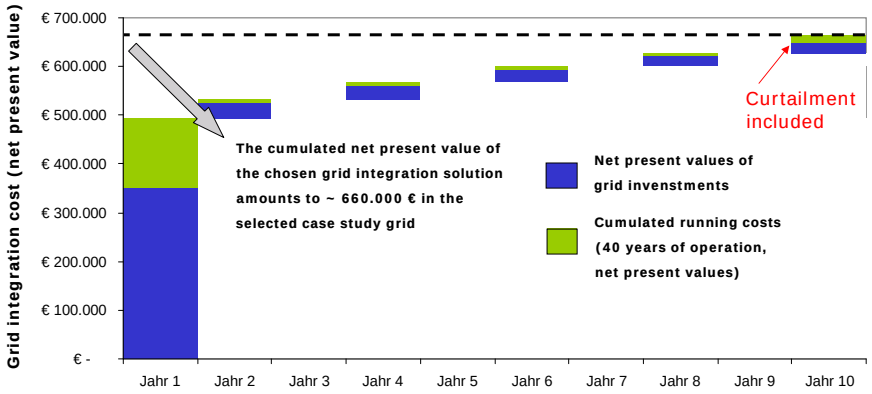
Results

NACHHALTIGwirtschaften

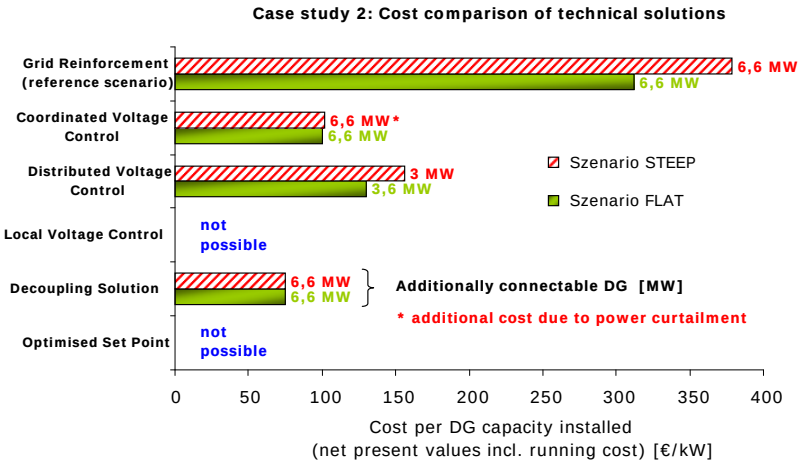
Case study 2: connectable DG shares for different grid integration strategies



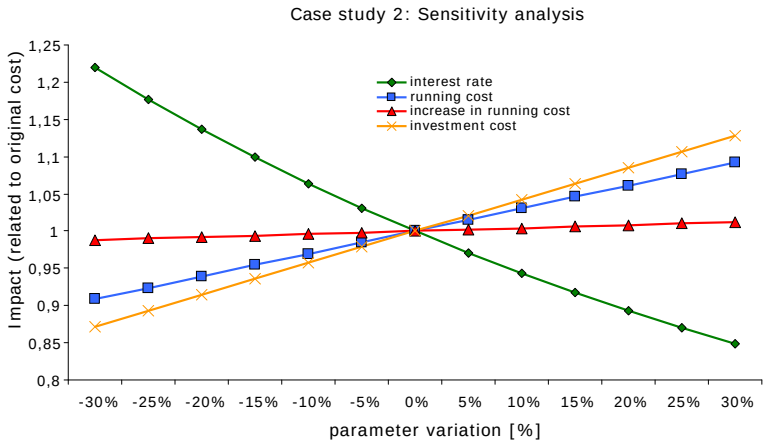
Case Study 2: Coordinated Voltage Control - Scenario FLAT



Case study 2: Cost comparison of technical solutions



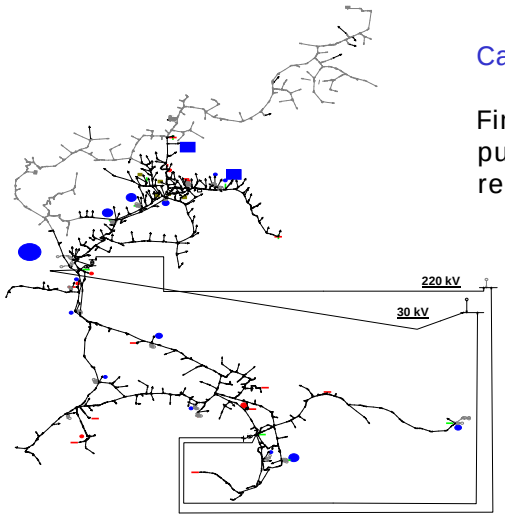
Results



Conclusions

- "More active" methods of DG grid integration are economically competitive – compared to conventional grid reinforcement measures – as well as technically realisable, enabling a better utilisation of the grid
- This implies a large innovation to the grid- as well as plant-operator (and possibly for load / consumers) with respect to present grid operation and market conditions
- With respect to a national and EU-wide commitment on more DG, therefore the design of a fair cost allocation policy should be considered
- The results presented are based on specific case studies and therefore cannot be generalised for all MV grids

- It must be mentioned that the „Decoupling Solution" reaches it's cost advantage particularly by the chosen integration strategy of additional DG units (grid connection of a multiplicity of additional DG plants within only one grid branch)



Case study 3

Final results will be published in the project report

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Prospects
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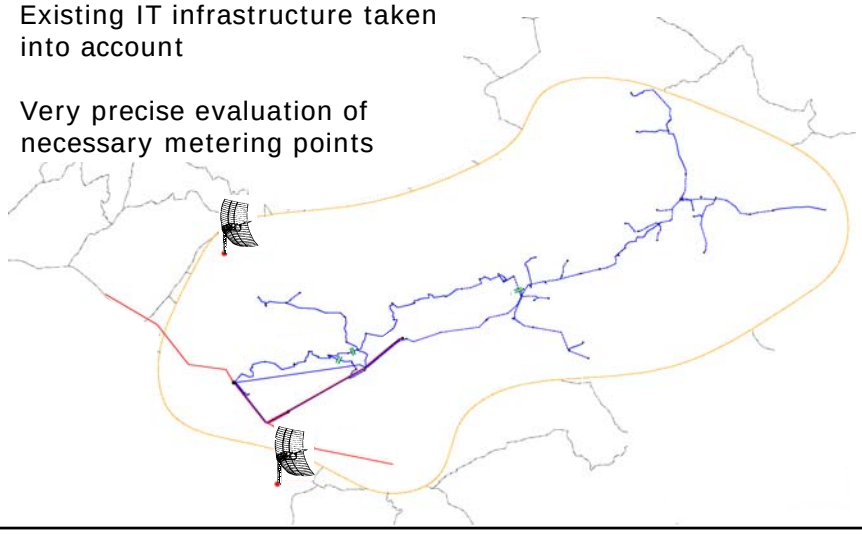
Planning of real implementation

- Existing IT infrastructure taken into account
- Very precise evaluation of necessary metering points



Prospects

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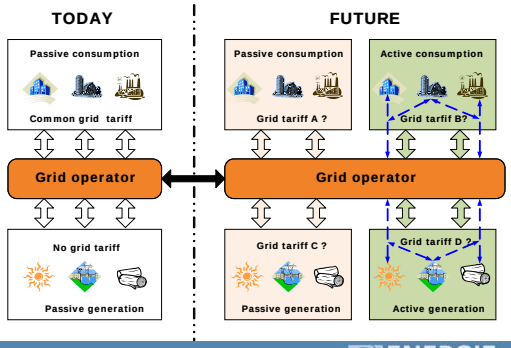
Follow up project KONDEA key topics:

- Which technical grid operation solutions have the potential to enable a tight cooperation between distribution gird operators, producers and consumers in the future?
- How can innovative business models be arranged, in order to enable an energy-efficient active grid operation achieving minimal cost for society?



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Discussion

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Questions?

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