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Deutsche Energie-Agentur

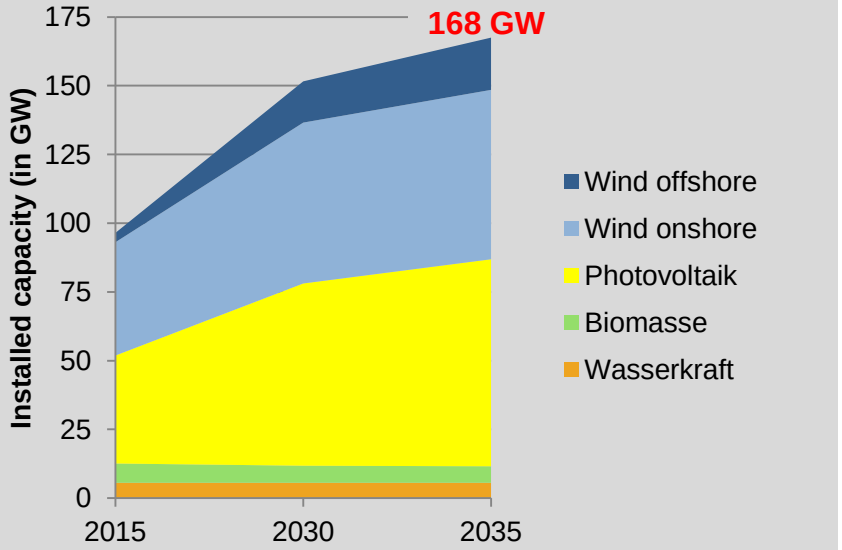
Stefan Mischinger, November 22nd, 2017, Berlin

POTENTIALS FOR OPTIMIZING EXISTING CAPACITIES ON TRANSMISSION LEVEL

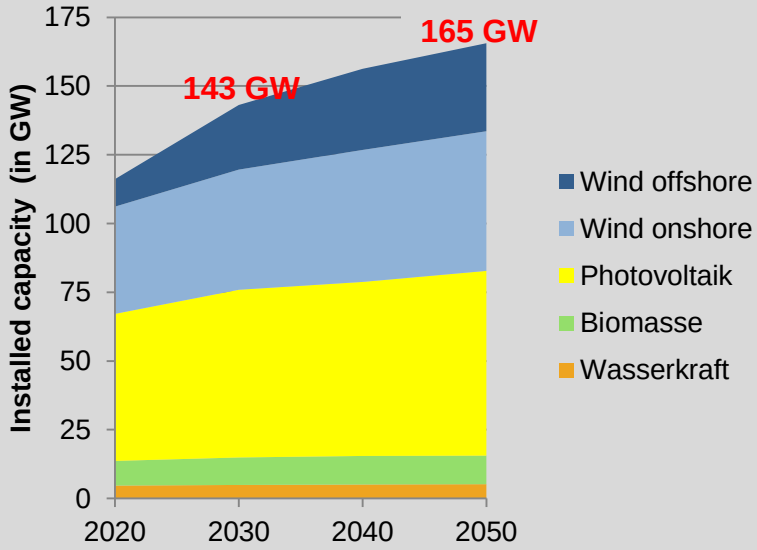
GENERATION BECOMES MORE INTERMITTENT AND DECENTRAL

- **Energy transmission objectives until 2050: e.g. 80-95 % reduction of greenhouse gases; 80% share of renewables in generation**
- **The current installed capacity of renewables is around 90 GW. To meet energy transition objectives increase is necessary**

Development of renewable capacity in scenario B of the grid development plan (Source: Netzentwicklungsplan 2017-2030)



Development of renewable capacity in scenario 2011A of BMWi long term scenarios (Quelle: Langfristszenarien, 2017)



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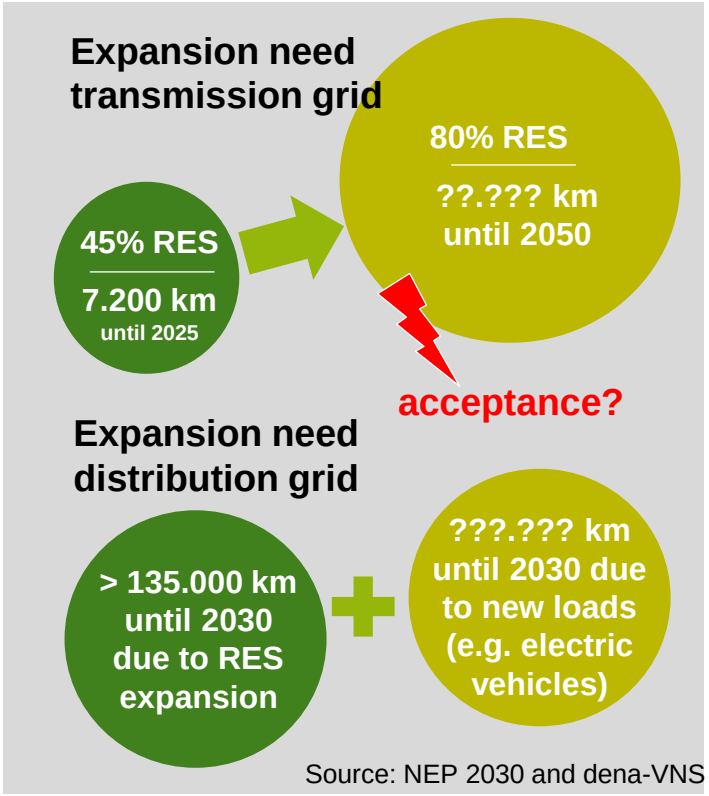
ELECTRIC GRIDS NEED TO ADAPT TO THE CHANGE IN GENERATION AND LOADS

- **To laws address construction projects for transmission grid development**
  - Energieleitungsausbaugesetz (ENLAG)
  - Bundesbedarfsplangesetz (BBPlG)
- **Status of ENLAG** (End of 3rd quarter 2017)
  - Since 2009, 750 km of 1,800 km have been realized
  - 23 km realized in the 3rd quarter of 2017
- **Status of BBPlG** (End of 3rd quarter 2017)
  - 5,900 km expansion need (thereof 3,050 km grid reinforcement):
    - around 3.000 km in approval procedures
    - 450 km approved and 150 km realized



Grid expansion need to be complemented with intelligent operational solutions

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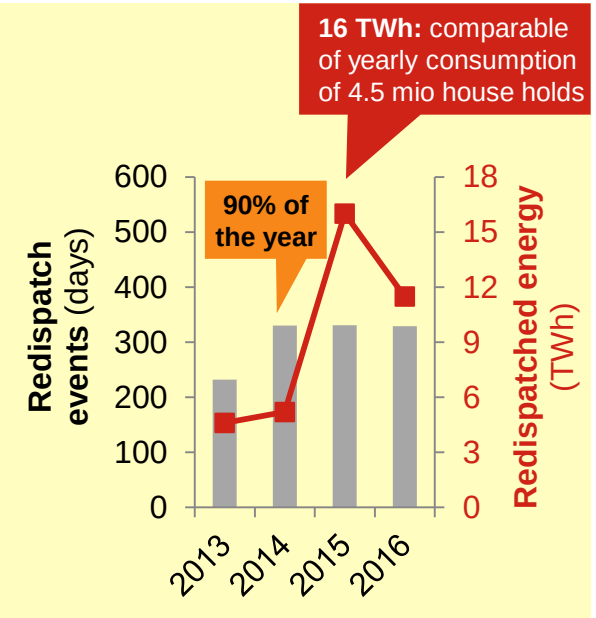
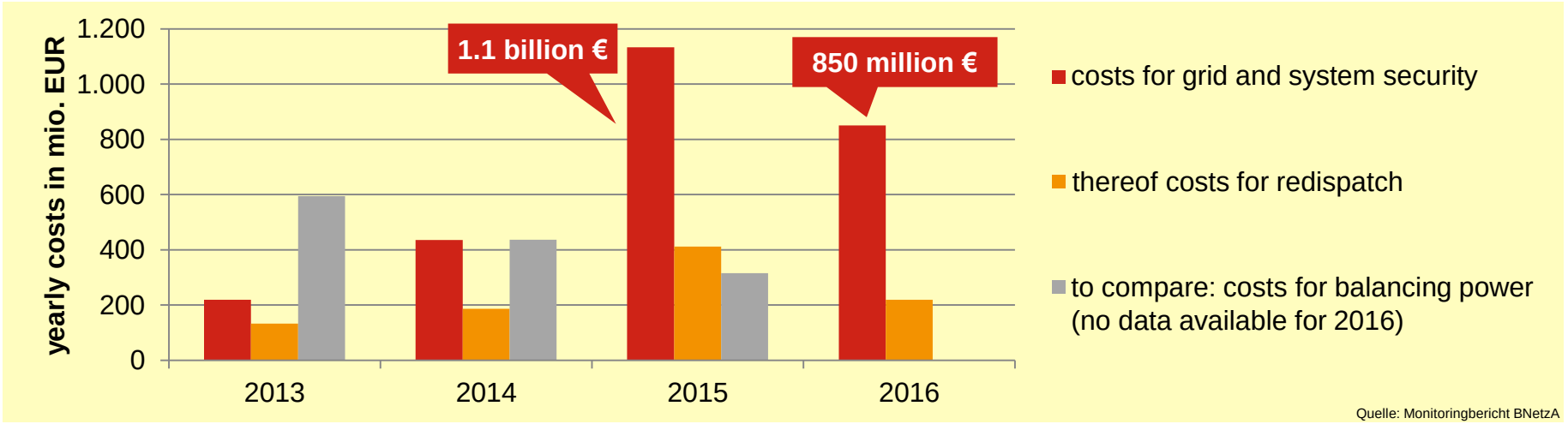
HIGH COSTS FOR GRID AND SYSTEM SECURITY

Increased technical and economical challenges due to existing grid congestions

- Congestions on transmission level in particular between the North and South of Germany
- Grid expansion delayed to acceptance problems
- In consequence: High costs for redispatch and congestion management





Quelle: Monitoringbericht BNetzA

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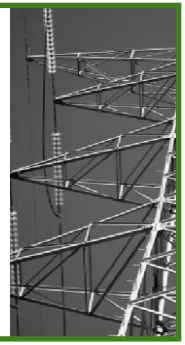
GRID EXPANSION AND OPTIMIZATION WORK TOGETHER

Higher utilization of existing transmission capacity

Objective: decreasing costs for grid and system security

Increase of transport capacity



process optimization for redispatch and grid planning

No alternative for grid expansion but supplement

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DIFFERENT OPTIONS FOR HIGHER GRID UTILIZATION

- **Operational measures** such as monitoring of overhead lines
- **Conversion of existing operation resources** einer with the objective of having a higher capacity, such as high temperature power lines
- **Power flow management** with special operating resources in order to control power flows
- **Expansion of grid monitoring** and Introduction of automatic assistance systems with the aim to operate the grid closer to the stability limit

OPERATIONAL MEASURES

MONITORING OF OVERHEAD LINES

- Higher utilization between 105% and 150% possible depending on the weather
- technical adaption also in substation (especially protection) needed
- duration of realization about 2 years
- Main challenges
  - Violation of law (BImschV)
  - Interaction with parallel infrastructure (e.g. Gas)

CONVERSION OF EXISTING GRID OPERATION RESOURCES

HIGH TEMPERATURE POWER LINES

- Higher transmission capacity of cables with similar weight and dimensions
- Increase of transmission capacity by conversion of power lines
  - without larger power poles and
  - without considerable changes in the static of power poles
- Challenges due to laws and parallel infrastructures (Gas, oil)
- In general, planning and approval phase of several years

POWER FLOW MANAGEMENT

EFFECT

- Higher utilization of less utilizatied power lines

MAIN TECHNOLOGIES FOR POWER FLOE MANAGEMENT

- phase shifting transformers
- flexible AC transmission systems (FACTS)
- DC coupling

REALIZATION

- In general without long approval processes since realizaiton in substations possible

AUTOMATIC ASSISTANCE SYSTEMS

DYNAMIC SECURITY ASSESSMENT (DSA)

- enables optimized grid utilization regarding stability
  - Today: thermal limits are main challenge, not stability limits
- DSA has the following elements
  - dynamic network calculation
  - dynamic grid protection
  - optimized monitoring of grid dynamics
- DSA is currently under development

LIST OF MEASURES FOR HIGHER GRID UTILIZATION

In 2017, the ministry of economics and energy initiated a stakeholder process controlled by dena and BET in order to identify short term measures for higher grid utilization:

Contributors:

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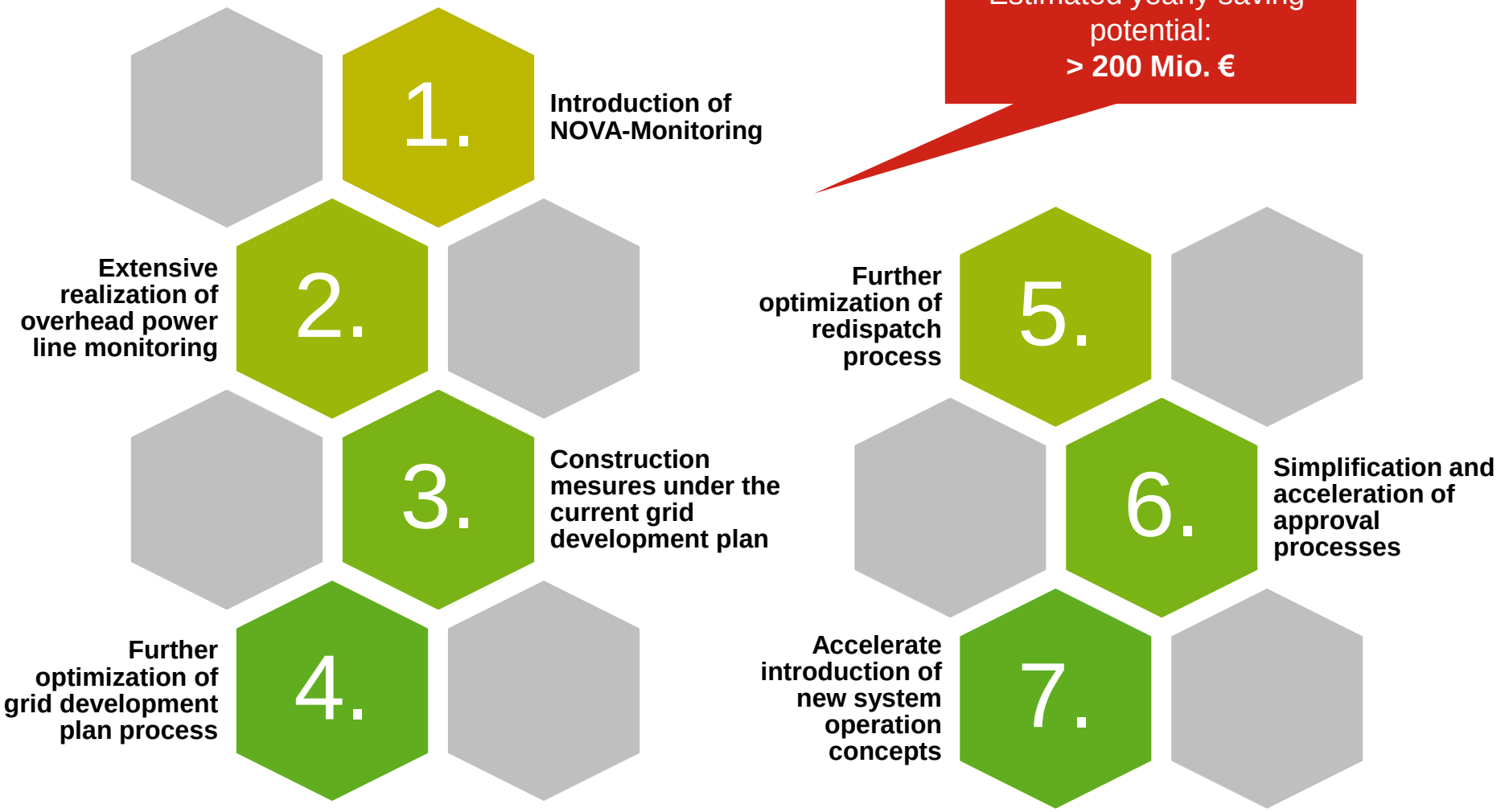
LIST OF MEASURES FOR HIGHER GRID UTILIZATION

Estimated yearly saving potential:
> 200 Mio. €



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THANK YOU

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