Diskussionsvorschlag

The Mechanism of the “Grid Signal Light” as a Part of the Smart Market/Grid System

The Cooperation between Customers, Energy Logistics, Grid and Regulation

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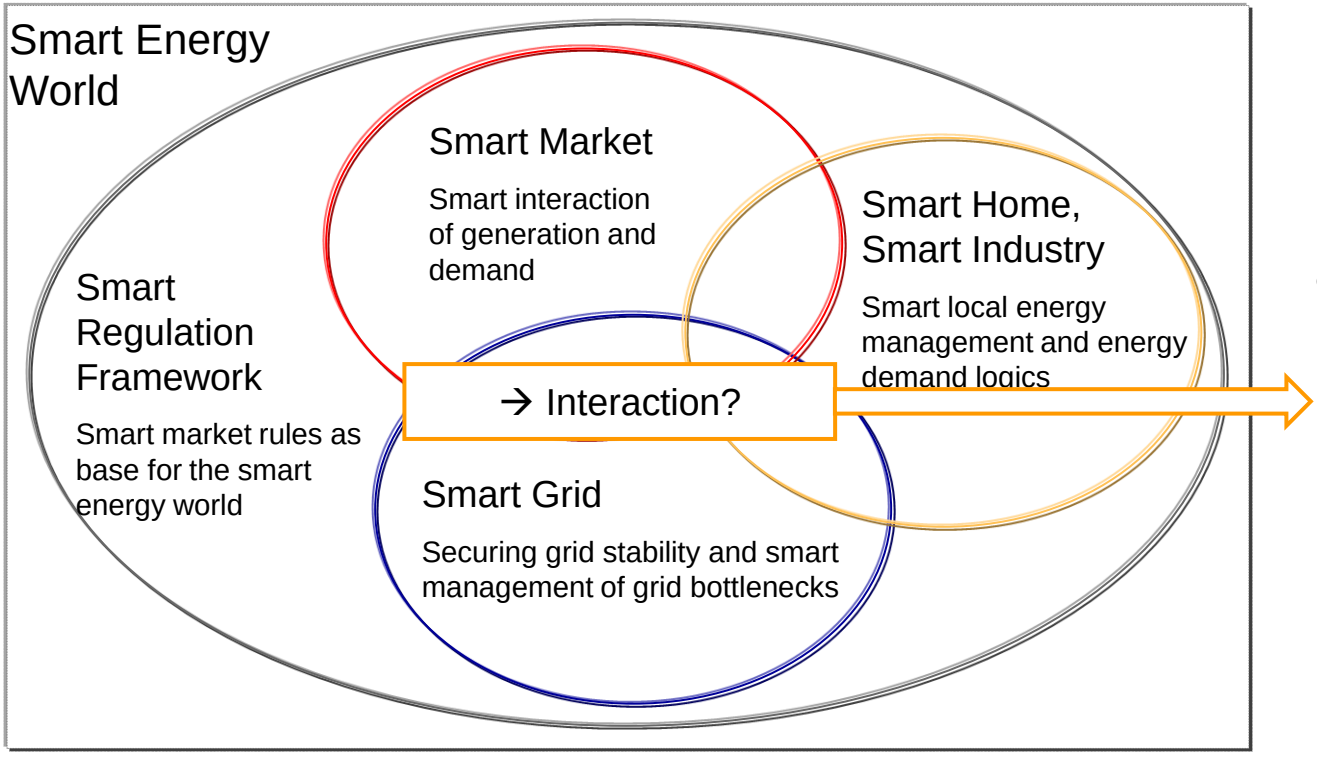
Initial Position
- The “Energiewende” as Driver of Change

The “Energiewende” requires a modified market design

- High portion of fluctuating renewable generation becomes the dominating factor in the electricity system
- This results in the demand for market design for smart grid/smart market with benefit for the energy system
- Approach to that problem:
  - Demand response approaches for physical integration of fluctuating renewables
  - Prevention and management of local grid bottlenecks as well as on low voltage as on medium voltage levels via integration of smart market

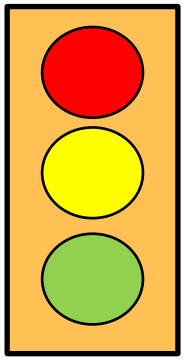
Background
The Players of a Smart Energy World

- Essential: How can the interaction of the players of a smart energy world be organised?
- The concept of “grid signal light” is developed to organise the interaction of smart market and smart grid



„Grid Signal Light“

The grid signal light shows the effective system state at the different grid nodes and controls the interaction of the players



Grid Signal Light
Grid Bottleneck Management starts with Approaching the Defined Limiting Values Only

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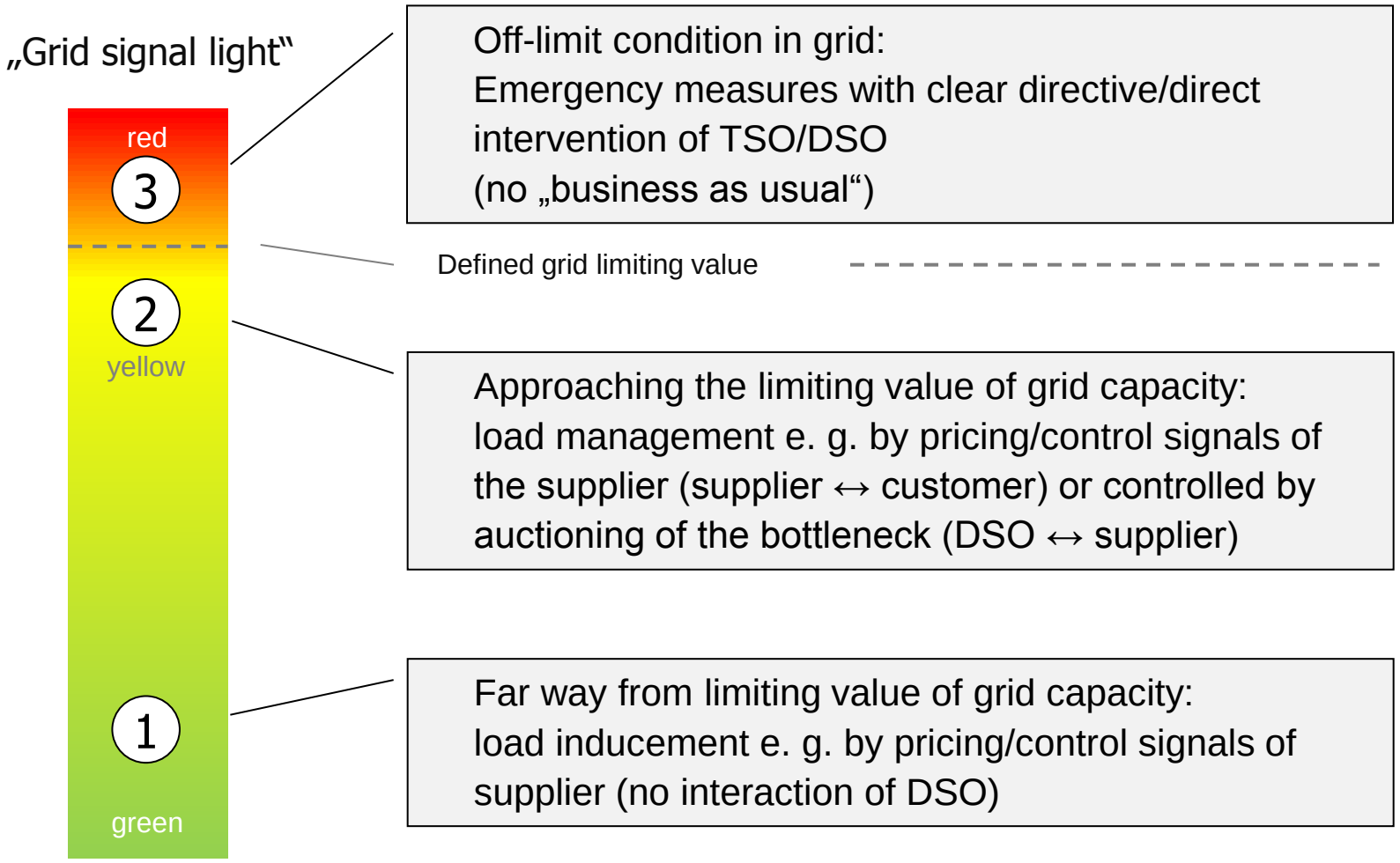

Components of a Smart Energy World
Logic of grid signal light as meta-level

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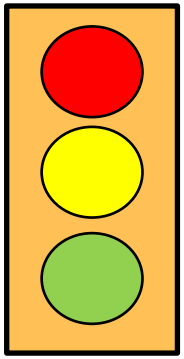
Smart Market
- Smart energy logistics and smart trading (pricing for load inducement)
- New balancing and billing rules

Smart Processes
- Processes capable to mass market
- Upgraded operation systems
- Modified data format, dead-lines, standards

Smart Regulation Framework
- Adapted legislation and market rules



Smart Capacity Markets
- secured capacity (generation, storage, load shifting)
- Fluctuating capacity for renewables

Smart Grid
- Smart DSO
- Active grid capacity and bottleneck management
- Revised fee system for grid use

Smart Meter System
- Operation of smart meter systems
- Data plausibility check
- Data transfer

New role of dynamic balance group manager (DBB)

Customer / customer needs

New role of grid bottleneck manager (NKB)

Management / Prevention of Grid Bottlenecks
5 Approaches for Different Voltage Levels (schematic)

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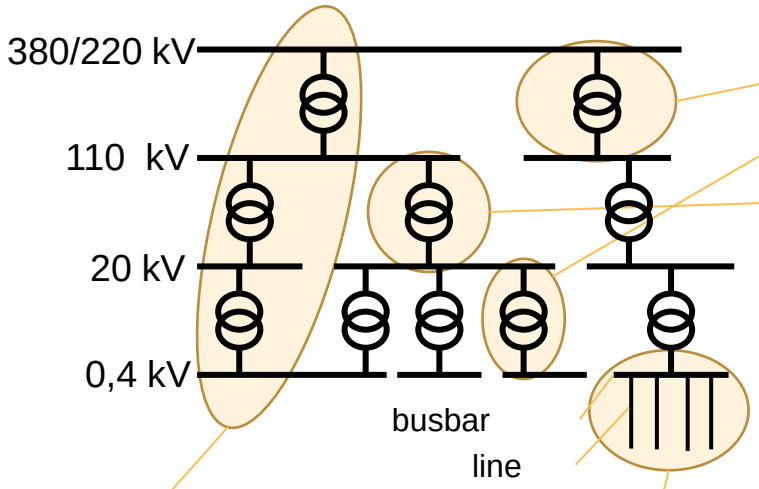

„Fire Brigade Approach“

- Feed in management (§ 13, II)
- Shedding of grid areas
- Redispatching of TSO

„Active Grid Management Approach“

- System service tender by TSO → already existing
- Grid capacity system services tenders by DSO → new

Active Approaches

„Copper/Technical Approach“

- Extension of grid capacities in the relevant nodes
- Specification of technical restrictions

„Utilisation Factor Approach“

- Specification of (dynamic) utilisation factors for prevent bottlenecks

Passive Approaches

„Black Out Approach“

- Acceptance of black outs
- Approach is not acceptable

„No Go“- Approach

Approaches for Grid Capacity Management
- Which Approach is Most Efficient?

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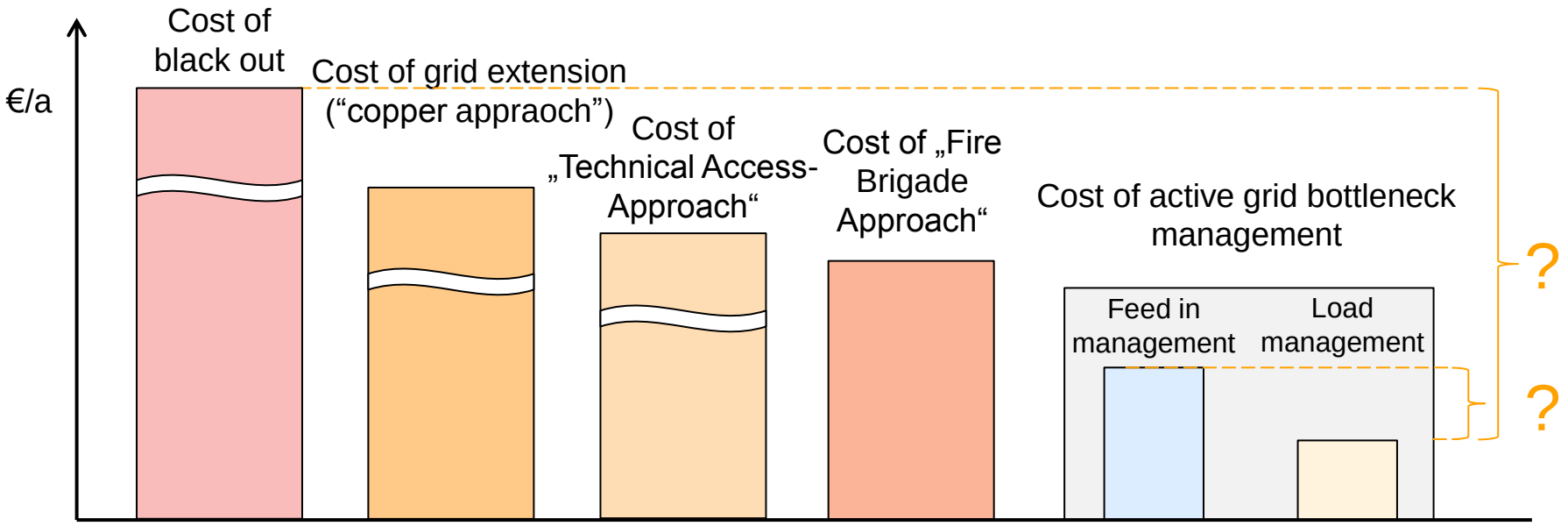
- Which approach is economically most efficient?
- Approach for grid bottleneck management: Grid bottleneck management has to be more efficient than assumed cost of required grid extensions, black out and/or other technical access approache



Challenge of Utilisation Factor on Local Substation Level Approach for Green and Yellow Phase?

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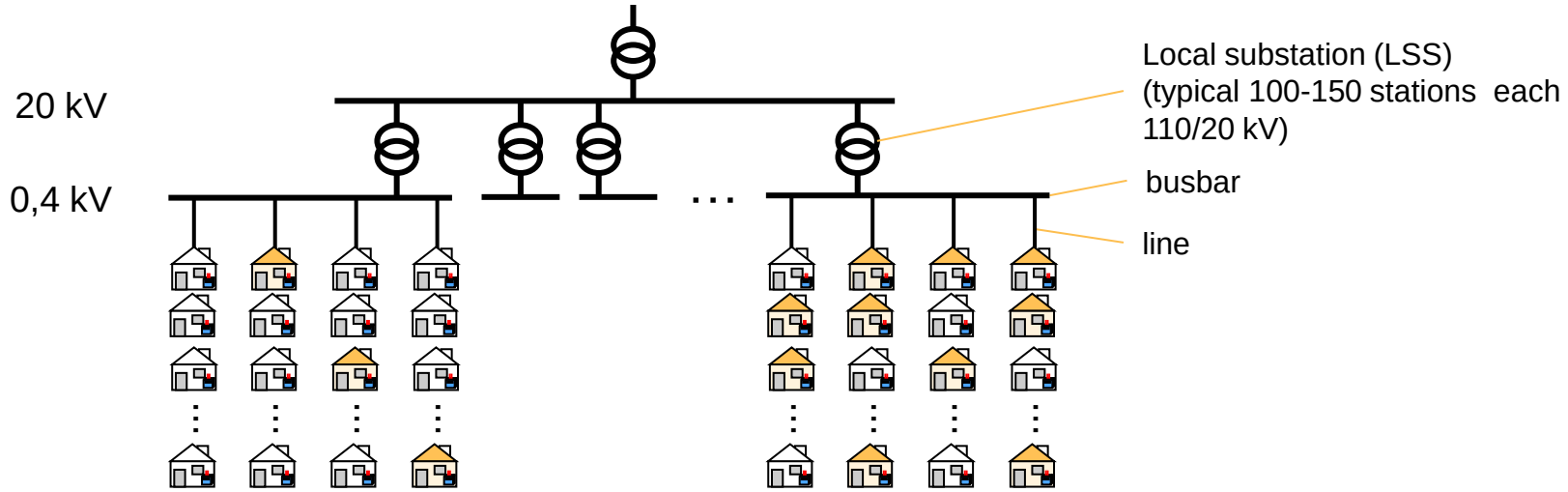
- Challenge:
  - Grid bottlenecks result from high demand of customers especially on low voltage level due to optimisation of smart customers demand on base of market prices (e. g. all smart customers maximise demand in times of lowest prices)
- Approach:
  - DSO specifies **maximum specific utilisation factors** for affected local substations or grid clusters: Phase green factor 1, phase yellow specified factor <1
  - All customers connected to the respective local substation get the same utilisation factor
  - Factor is fix (always same value) or graduated fix (e. g. during night time higher than during day)
  - These utilisation factors may be specified dynamically in the future as well, e. g. dependent on temperature, PV feed in or specified by DSO

Challenges of Utilisation Factor on Local Substation Level Approach for Green Phase (Example)

- Smart customers participating in the system obtain a separate (reduced) grid fee
- Supplying dynamic balance group manager/supplier has to guarantee maximum acceptable utilisation factors for the DSO via interaction with smart customers
- Approach leads to avoid yellow and red phase



LSS 1 with 5 smart customers:

- No demand induced bottlenecks regardless energy logistics
- Utilisation factor 1

LSS 2 with 30 smart customers:

- Demand induced bottlenecks depending on energy logistics
- Utilisation factor < 1

Summary

The introduction of new market rules like the grid traffic light principle enables a successful implementation of the “Energiewende”.

- Interaction of smart market and smart grid is crucial

Selected changes in the regulation framework lead to the introduction of:

- A dynamic balance group manager (DBB) as part of smart market functions
- A grid capacity manager (NKB) as part of smart grid functions
- Mechanisms of the grid signal light principle and the interaction of DBB and NKB
- New mechanisms capable of mass market processes for balancing energy as part of smart market functions
- New grid fee principles as part of smart grid functions

Thank you for your attention!

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