European Experiences – Issues and Solutions in Germany

Plenary: 'Planning for and Operating the Next Generation Grid'

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Agenda

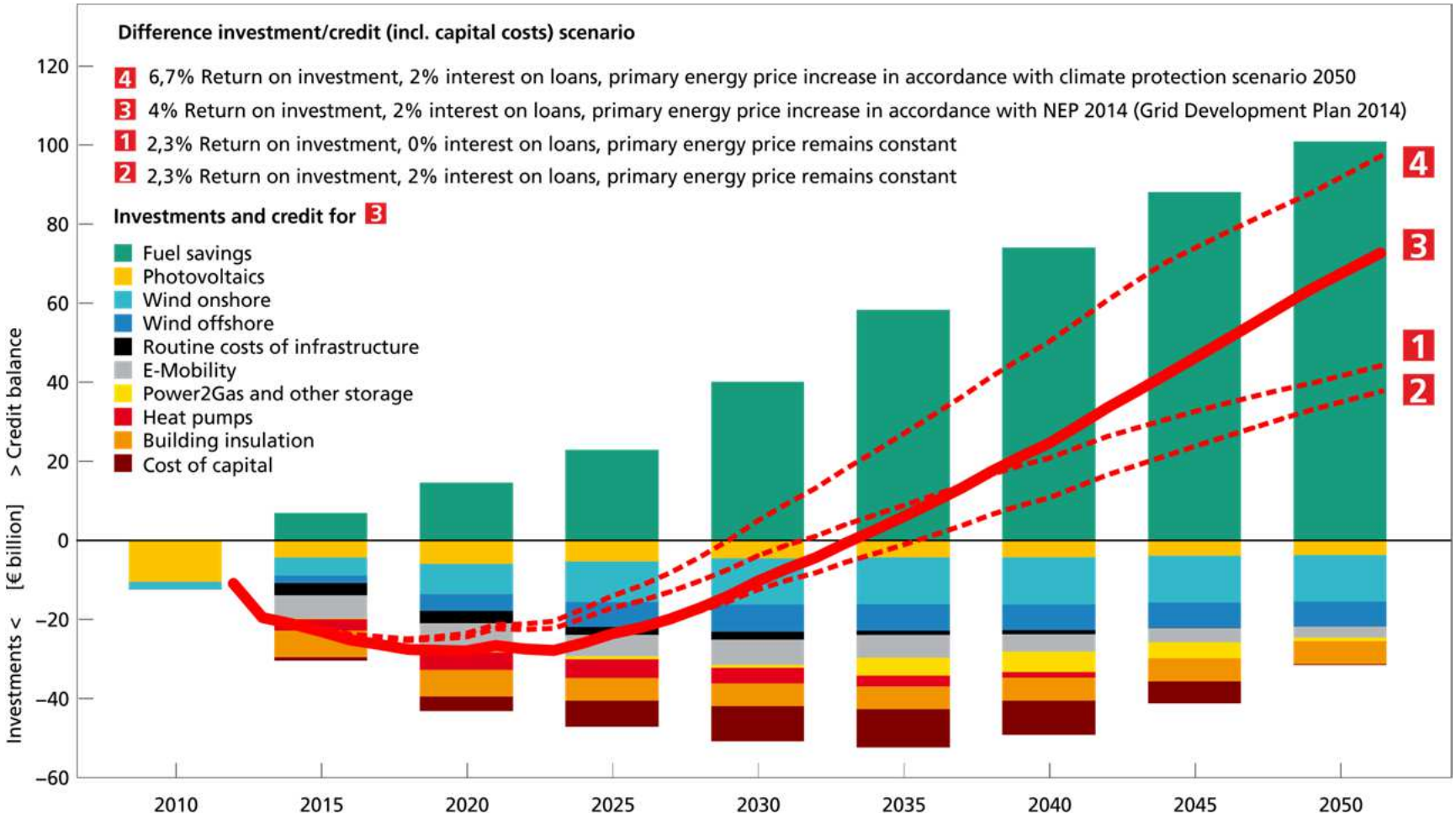
- ‘Energiewende’ (Energy System Transformation)
- Network Development
- Distribution System Issues
- Solutions: Smart Grid Toolbox

‘Energiewende’ (Energy System Transformation) in Germany

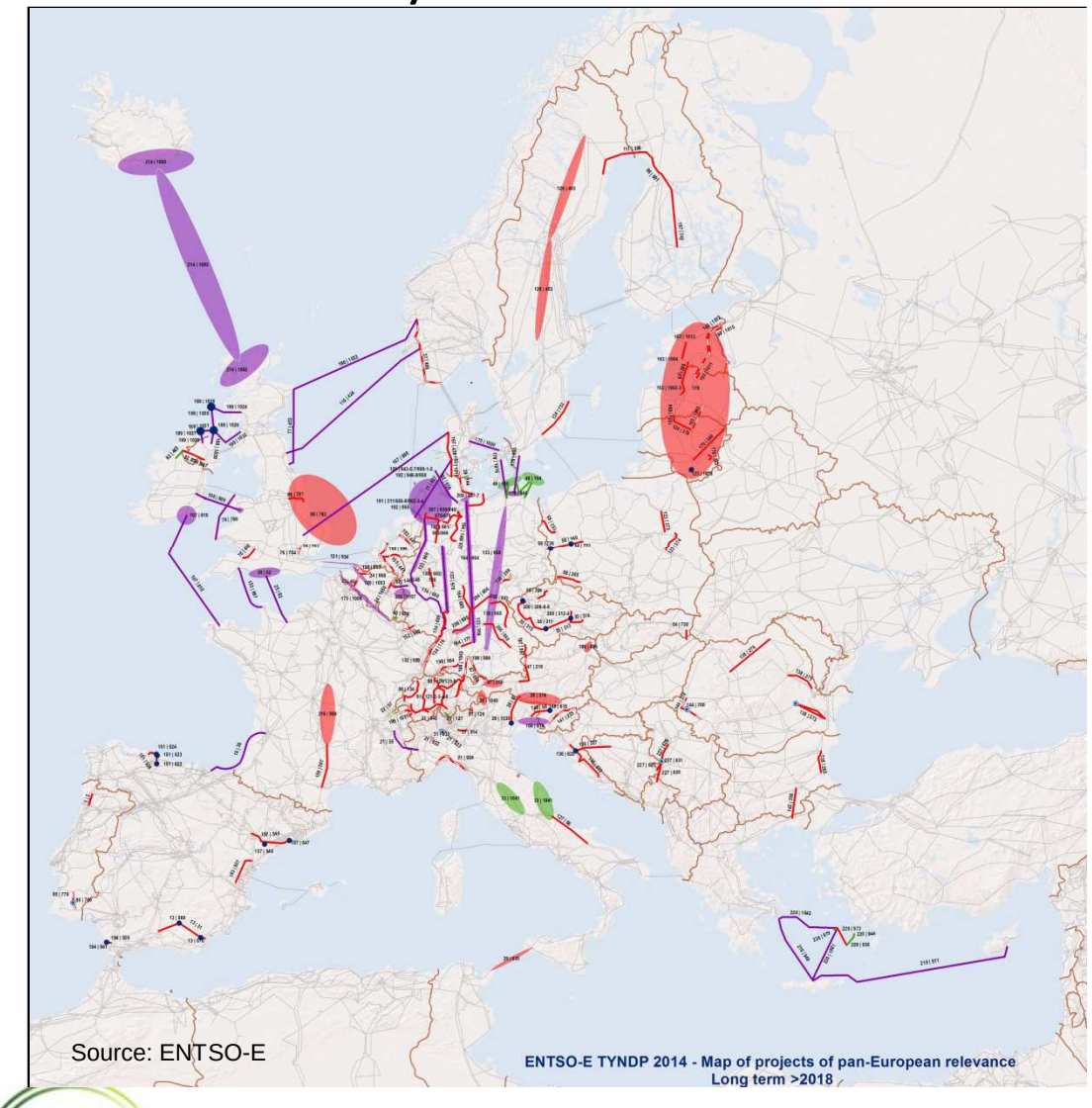
- **2014/2015: Status report electricity sector**
  - Load: ~600 TWh, ~ 80 GWp
  - ~25 % RES (Wind, PV, Biomass, Hydro)
    - ~40 GWp Wind in MV/HV
    - ~37 GWp PV in LV/MV
- **Political Aim 80 % RES in 2050**
- **100% RES scenario (RES & Energy Efficiency):**
  - 230 GWp Wind & 200 GWp PV → PV & Wind as major electricity source
  - e.g. Electrical Vehicles → electrification of mobility sector
  - e.g. Heat-Pumps → electrification of heat sector
  - Power2Gas

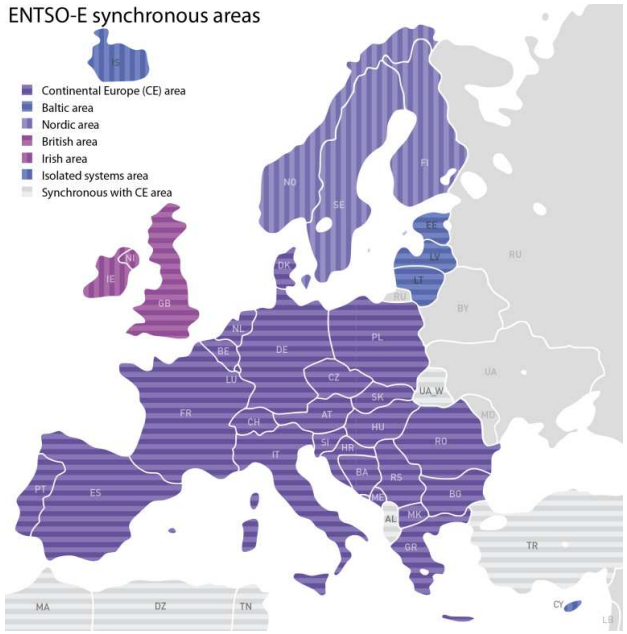
Source: fotolia.com

Business Case 'Energiewende‘ by Energy Systems Integration



Transmission System – ENTSO-E TYNDP 2014 - 2030





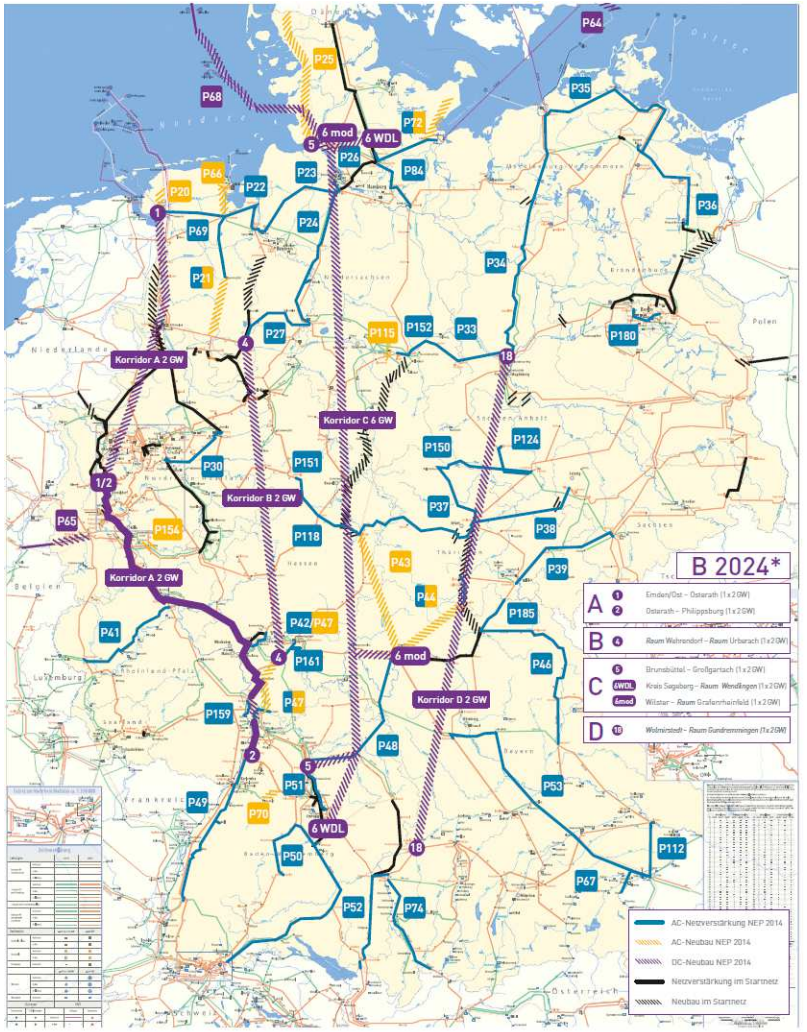
Source: ENTSO-E

Legend

- DC
- ≤ 150, AC, New
- ≤ 220, AC, New
- ≤ 220, AC, Upgrade
- ≤ 330, AC, New
- ≤ 330, AC, Upgrade
- 400, AC, New
- 400, AC, Upgrade
- Investments under consideration and/or which route is not yet fully determined
- Substation New
- Substation Upgrade

Transmission System Grid Development Plan 2024 Germany (4 TSOs)

- Annual rolling process for the next 10-20 years
- Solve present/expected congestions
- North-South HVDC corridors
  - Wind in the North
  - PV/Load centers in the South/West
- Offshore Grid Development Plan
  - Connect Offshore Wind Power Plants
  - DC connections



Source: www.netzentwicklungsplan.de

Distribution System Issues in Germany
→ voltage and thermal limits → grid reinforcement

Distribution System Issues in Germany

- Standardized Testing Procedures for DER units

European harmonization

DERlab

- PV Battery Systems:
  'grid feed-in'
  → 'self consumption' / autonomy

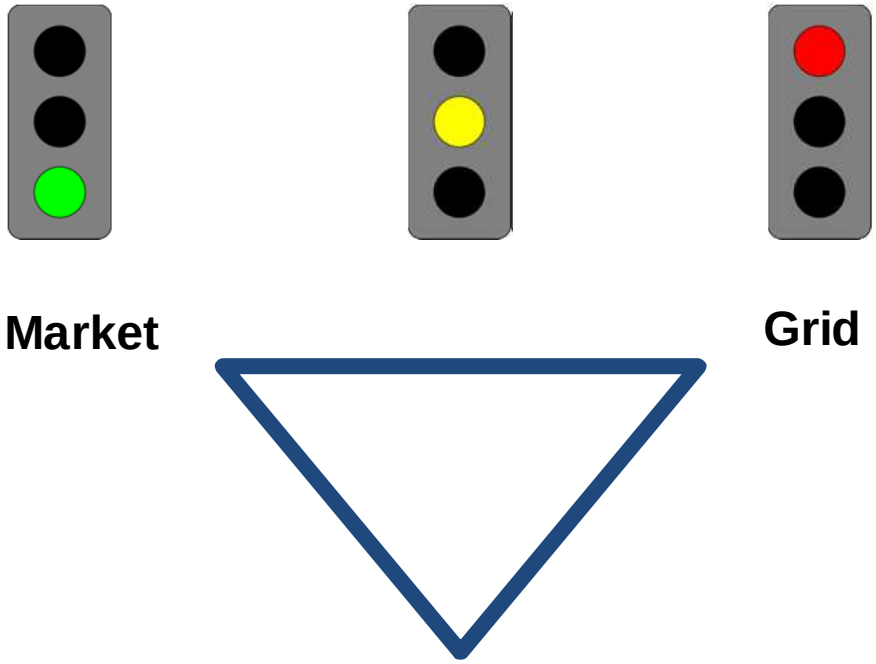
Source: BOSCH Power Tec GmbH

- Smart Meter → Privacy/Security Issues
  → Business Case?
  → step-wise roll-out intended

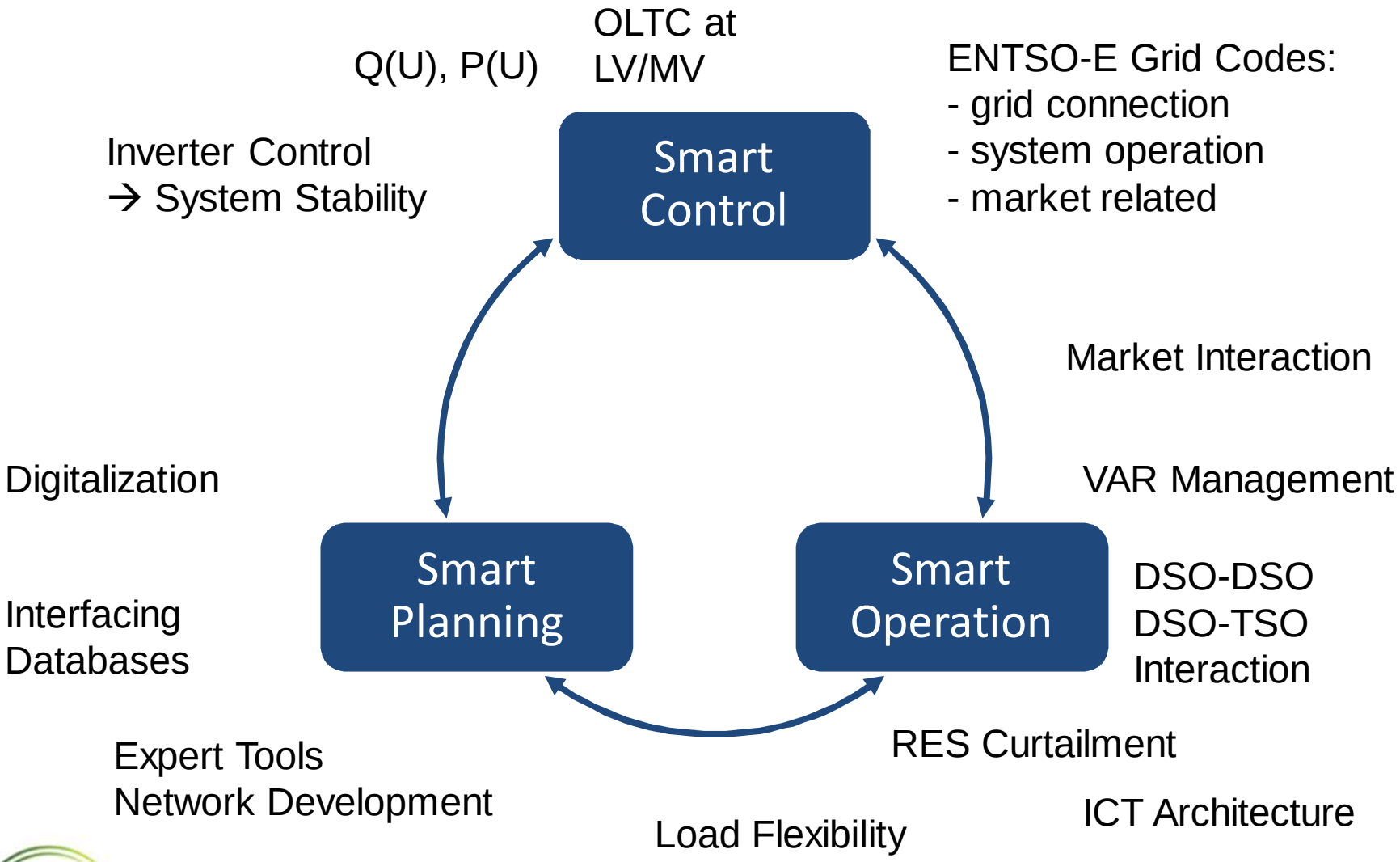
Smart Grid – Smart Market

- Traffic Light System:

  Amber Phase: Market-Based Use of Flexibilities of DER units for Distribution System Operation (congestion management)



Smart Grid Toolbox → enabling RES as a major energy source



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Energy System Technology to realize the ‘Energiewende‘