

System Stability Roadmap of the German federal government

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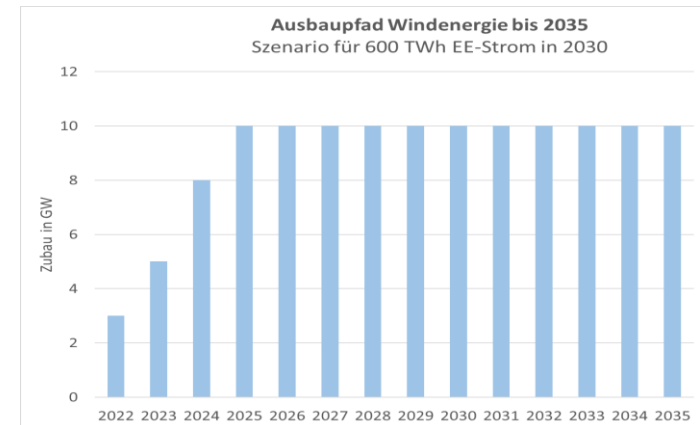
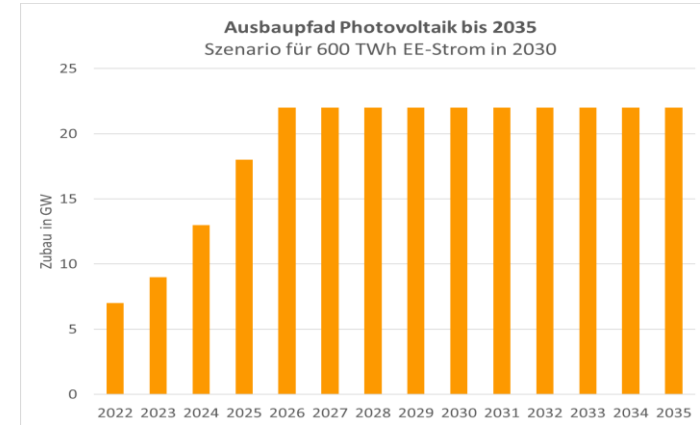
A changing energy system

- 2030 expansion targets: **360 GW RES**
 - PV: 215 GW Onshore wind: 115 GW
 - Offshore wind: 2030: at least 30 GW
- from 2026 at least **35 GW/a RES** new-build in DE alone

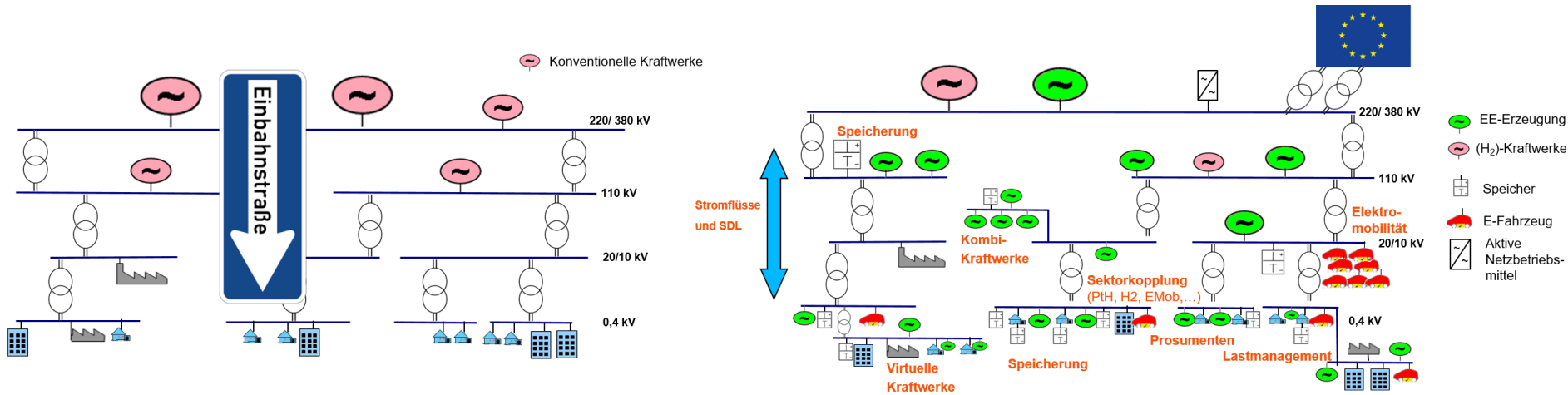
➤ Additional consumers up to 2030

- 15 million e-cars
- 1 million public charging points
- 6 million heat pumps
- 10 GW of electrolysis facilities

→ Installations must have the “right” characteristics for the future power system



From a monolith to a complex system



- An electrical engineering paradigm shift (synchronous generators to power electronics)
- Future system operation needs new rules
- Installations must become grid-forming or system-supporting

Action required: interim conclusion

→ Fundamental and very rapid change

- Must be addressed proactively and be broadbased, all stakeholders and all grid users needed
 - major transformation process
- Must also be reflected in further development of ancillary services / technical requirements for grid users
 - massive time pressure, not least due to upfront times for development and introduction
 - in the short term, relevant contributions from all grid users needed, and grid participants must understand their role as part of the system
- Rules must be **mass-market-capable**

Defining system stability

- **System stability** = system security = grid security
≠ market-based resource adequacy
- **Secure and resilient grid operation with 100% RES,**
independent of the precise future composition of the power plant portfolio

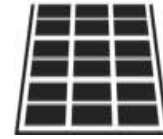
System stability roadmap: drawing it up

- **Broadbased stakeholder process** (since autumn 2022)
 - Associations, grid- und installation operators, FNN (VDE Forum), DKE, scientists; BNetzA/BMWK
 - In total more than 150 people from more than 80 institutions
- **Roadmap drafted with active stakeholder participation**
 - 4 thematic working groups with 11 subgroups
 - Advisory Board
 - Total of more than 70 sessions
 - The various aspects were studied, prepared and discussed in a structured way; specific draft texts were supplied, collated to form the roadmap
 - Support from the contractors, ef.Ruhr and dena



System Stability Roadmap: goals and content

- Overarching goal: secure and resilient grid operation with 100% RES
- Roadmap: the route towards this goal



WHAT?

Identify challenges/ required action



WHO?

Designate responsible parties and processes



WHEN?

Timeline, also basis for implementation and monitoring

System Stability Roadmap



Roadmap Systemstabilität

Fahrplan zur Erreichung eines sicheren und robusten Betriebs des zukünftigen Stromversorgungssystems mit 100 % erneuerbaren Energien



7 thematic fields

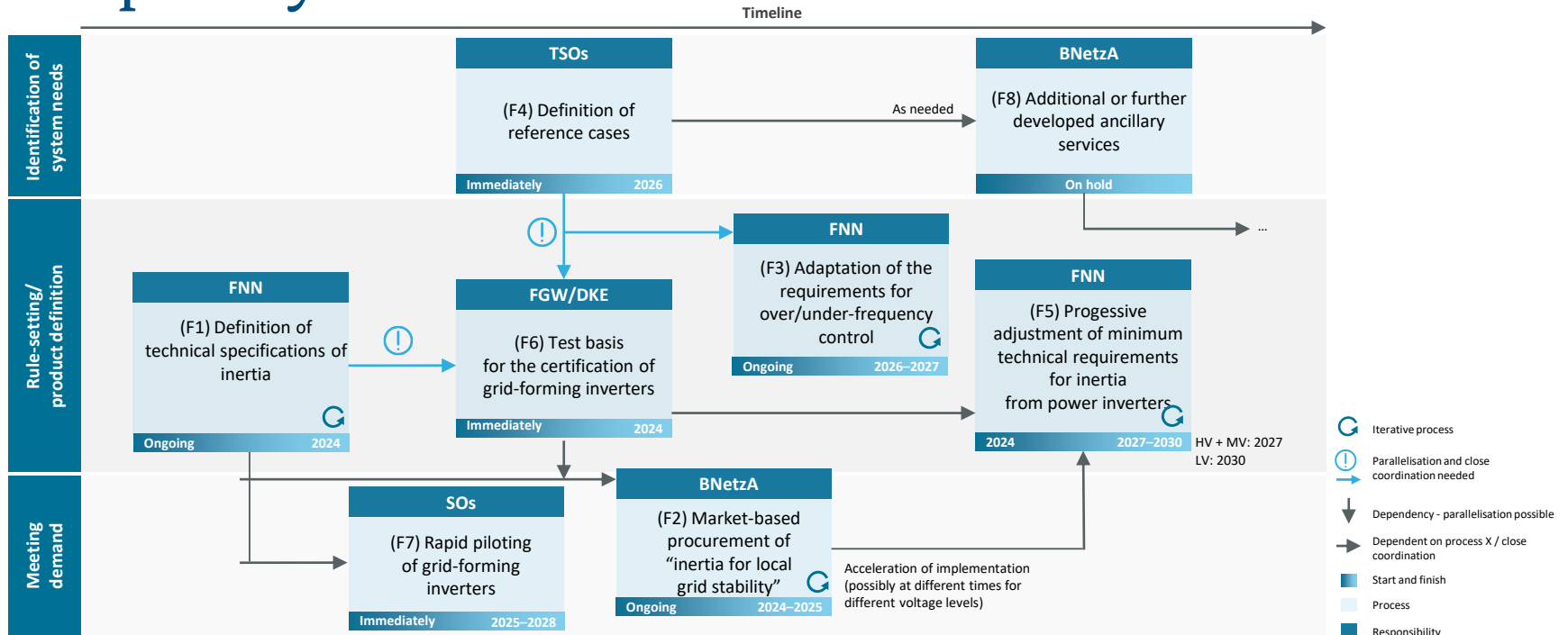
- Frequency
- Voltage
- Resonance stability
- Short-circuit current
- Angular stability
- System control
- Restoration of grid/supply

41 theme-specific processes

10 overarching processes

- Strategic and coordinating function
- Implementation and monitoring

Process dependencies by fields of action: Example: Frequency



General solutions: the three pillar model

Three basic ways of providing ancillary services:

1. **Technical requirements** (obligatory, EU Network Codes + Technical Connection Rules (TACs))
2. **Market-based procurement** (fees paid, voluntary, BNetzA, TSOs, DSOs)
3. **Fully integrated network components** (TSOs, DSOs)

→ Requirements (in terms of timing and volume) in some of the thematic fields are so great that **all options need to be used and all voltage levels included**

Implementation: ongoing processes

Examples of ongoing and structure-generating processes

- System stability report by the TSOs and monitoring by the Bundesnetzagentur
- Network Development Plan 2037/45: large budgets for ancillary services
- Forward-looking grid planning by DSOs
- Market-based procurement of ancillary services
- Revision of European network codes (Regulation, mandatory)
- Revision of TACs by FNN
- R&D
-

Implementation: System Stability Forum

- **Central body** supporting implementation of the System Stability Roadmap
- **Platform for dialogue and coordination** for the stakeholders
- Recognise problems as early as possible, analyse and resolve potential conflicts
- Serves the **monitoring** of the implementation processes by the BMWK and BNetzA
- Participants in the forum are a specific group of relevant stakeholders (BNetzA, TSOs, DSOs, associations, scientists)
- Three meetings of the System Stability Forum planned each year

Conclusions

- Stable grid operation essential for a climate-neutral electricity system
- Shift to 100% RES and new electricity consumers (e-mob, heat pumps, electrolyers) represents deep-reaching systemic change for the electricity grids
- Greater demands with regard to system stability will arise for all stakeholders
- Also via RfG, to be adopted this year, in effect from 2028
- We are trying to accelerate the development via the 3 pillar model
- Issue is of great urgency, changes must be prepared and need time for technical development, new demands must be defined as quickly as possible
- Structures provide clear framework

Thank you!

Download System Stability Roadmap, available in German or English:

www.bmwk.de/Redaktion/DE/Dossier/roadmap-systemstabilitaet.html

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