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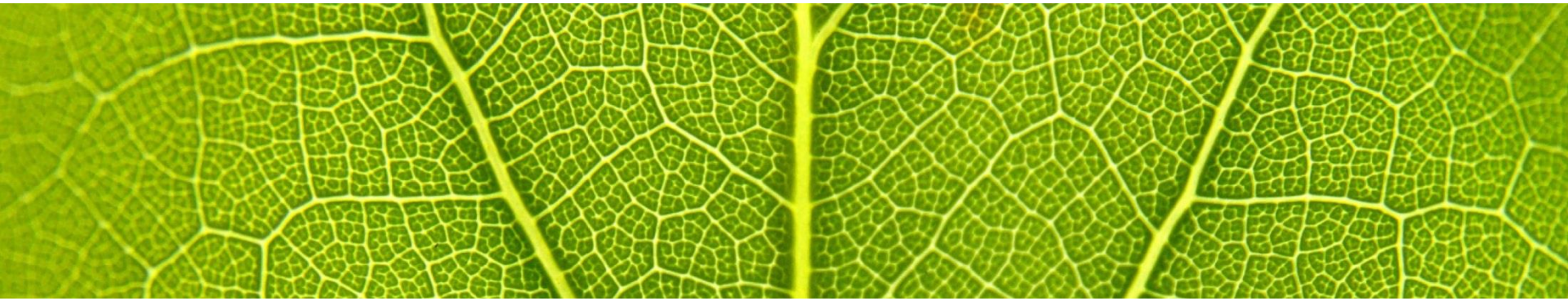


Flexibility Tracker

Indicators for Power System Flexibility

Strommarkttreffen - VKU
05/08/2016, Berlin
Thobias Sach

Introduction – Preliminary remark

> The Flexibility Tracker is **work in progress** by Ecofys in a series of projects on power system flexibility in collaboration with Leonardo Energy

> Previous projects were:
  - **Flexibility options in Electricity Systems** (2014; link to report)
  - **Power System Flexibility Strategic Roadmap** (2015; link to report, paper, webinar)

Overview

Why? Arising flexibility gap

Whereby? Flexibility options

How? Flexibility tracker

Discussion

Definition of power system flexibility

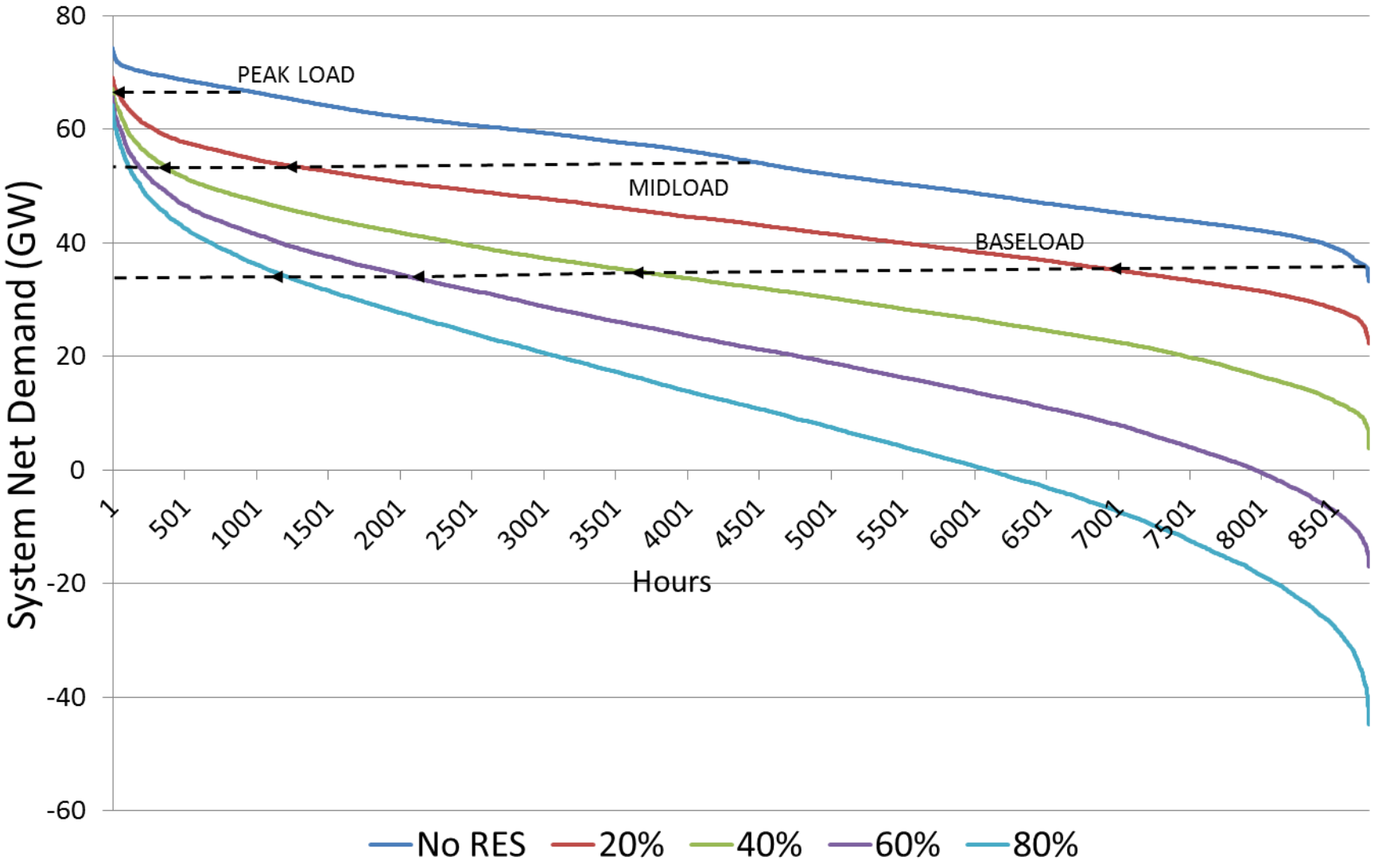
- Electricity is a special good. Demand and supply have to be balanced at each moment.

- **Definition of power system flexibility**
  - The extent to which a power system can adapt electricity generation and consumption as needed to maintain system stability.

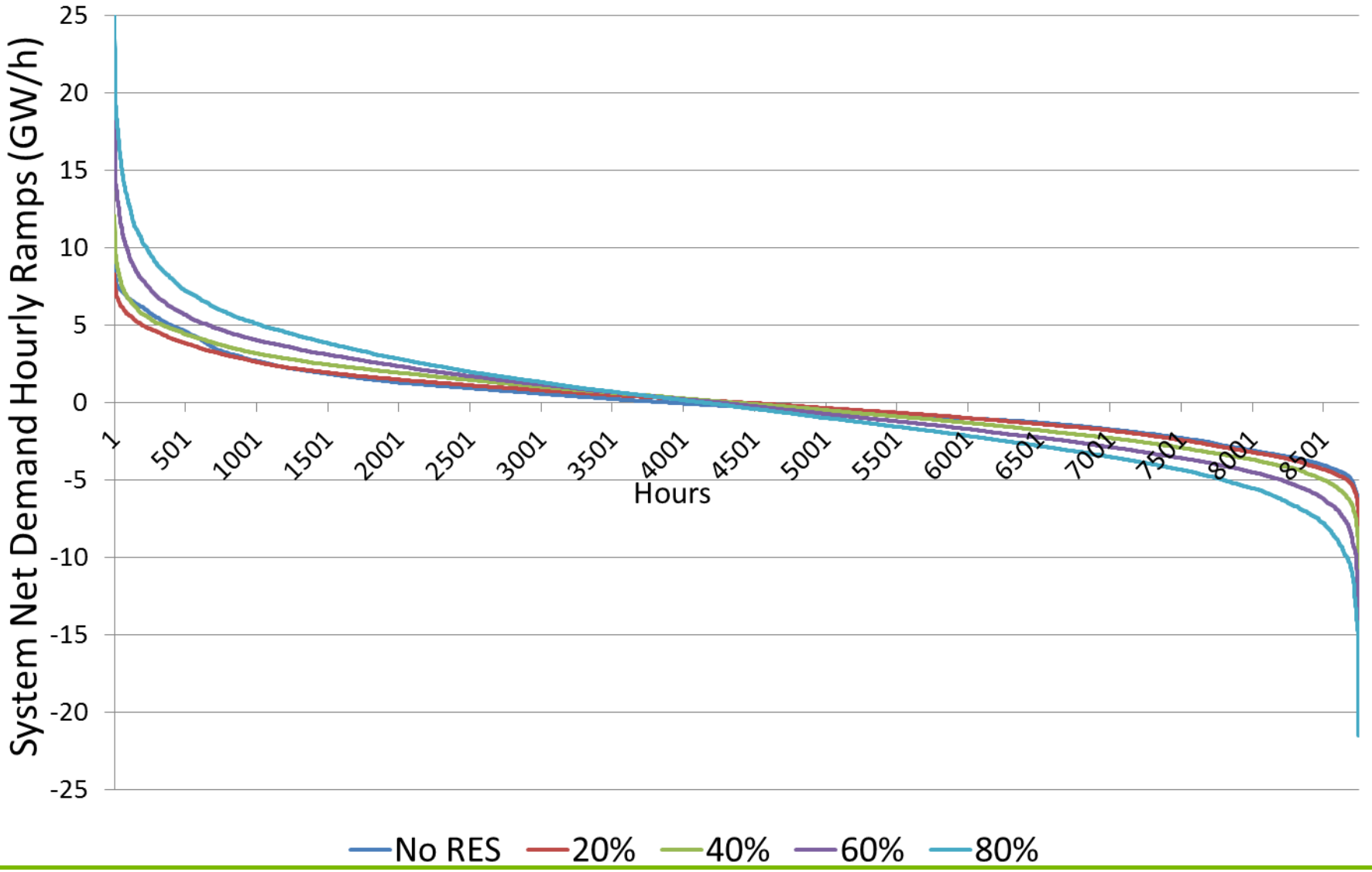
  - Flexibility is the ability of a power system to respond to changes in demand and supply

- **What happens when shares of variable renewables (VRES) increase?**

Residual load pushed downwards: Reduced full load hours for conventional technologies



Residual load ramps increase with higher VRES shares: Increased need for flexibility



Impact of increasing shares of VRES: a flexibility gap calls for new flexibility options

Low VRES

Flexibility need:

- Demand variations
- Supply uncertainty (unit loss)

Flexibility provision:

- Supply side (conv. power plants)

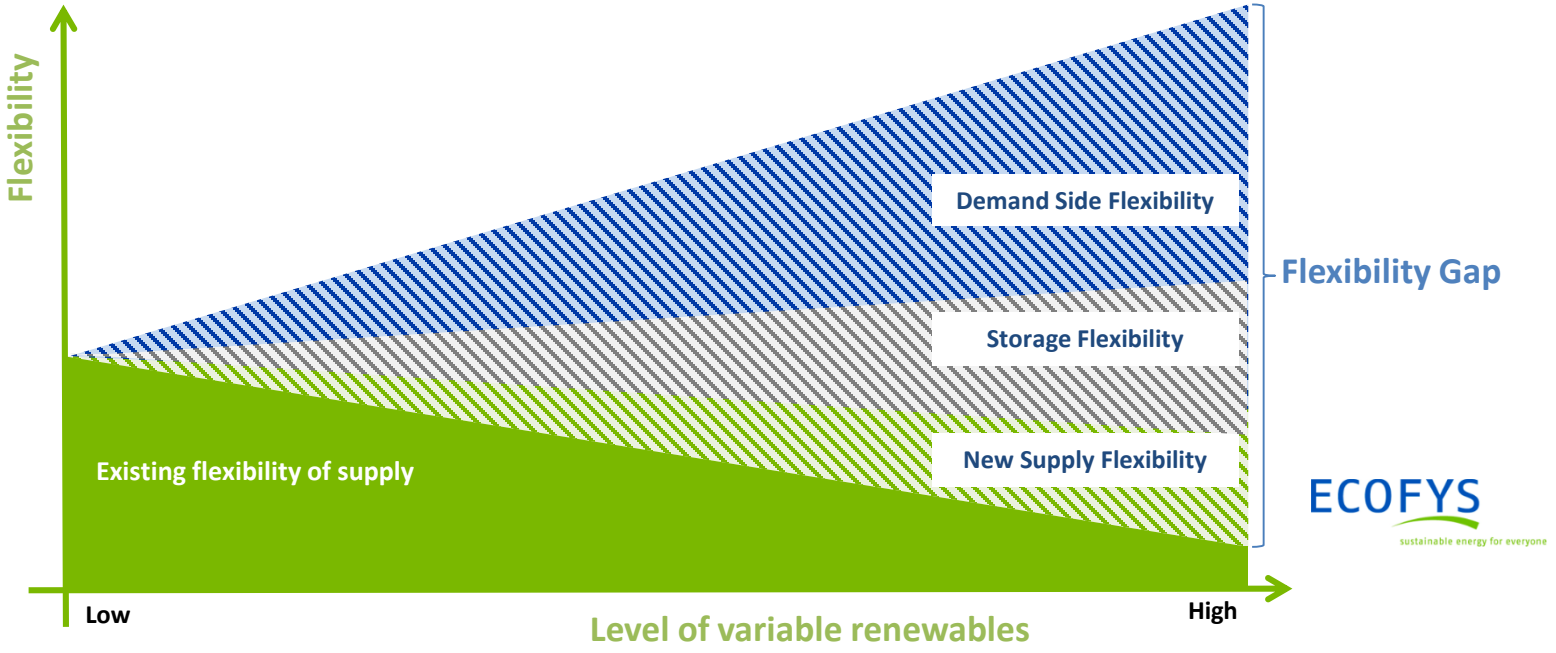
High VRES

Flexibility need:

- Higher (net) demand variations
- Supply uncertainty (unit loss)

Flexibility provision:

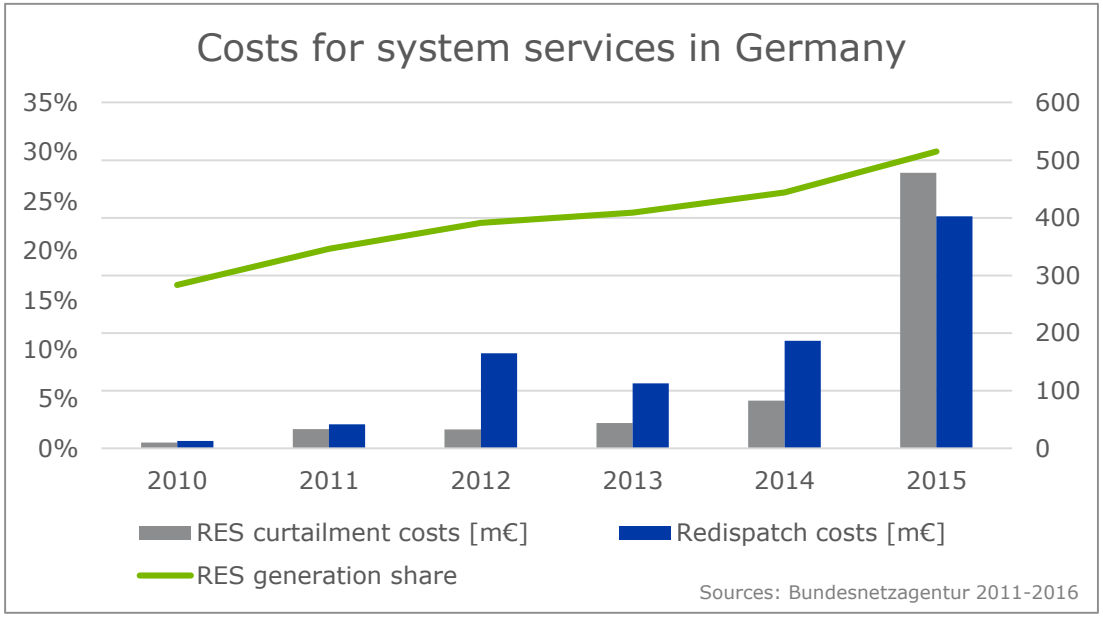
- Lower from supply side (conv. generators displaced by VRES)



Existing flexibility measures and signs of inflexibility

- **Existing measures to provide flexibility are mainly on the supply side**
  Ramping capability, low must-run capacity, and short start-up/shut-down times are commonly used measures to provide flexibility.

- **Signs of inflexibility:** frequency excursions due to difficulties in balancing demand and supply, significant RES curtailment, balancing schedule violations, negative market prices, price volatility and price spikes



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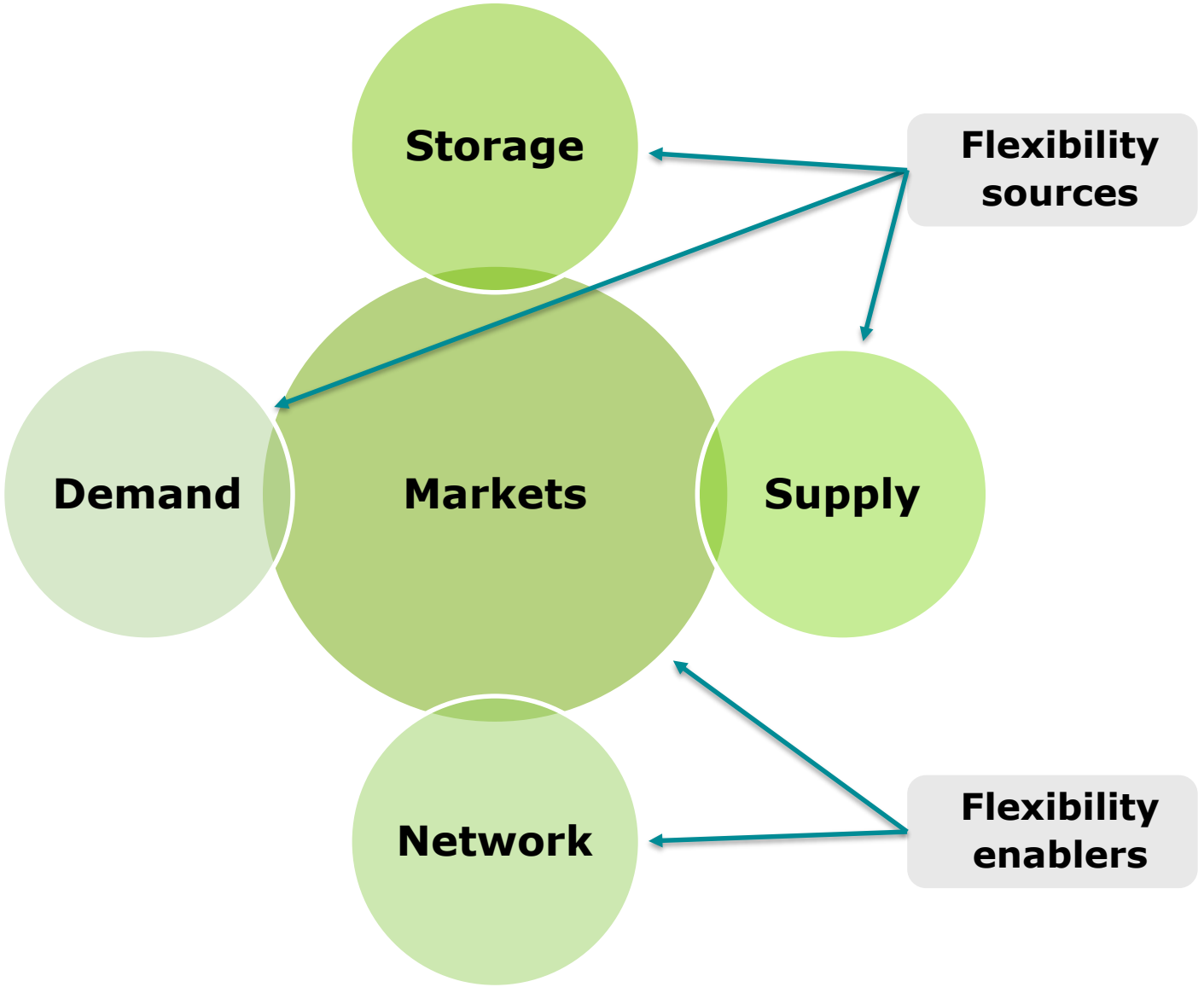
Categorisation of flexibility options



Power System Flexibility Vision: 7 key elements

1. Exploit flexibility and energy storage inherent in **demand** (prosumers)
2. Enable liquid, expanded and close-to-real-time **power markets**
3. **Control VRES** generators to provide grid support services
4. Set price incentives or mechanisms that **reflect diversity-related benefits** in the development of variable resources.
5. Deploy **bulk energy storage** to cover longer periods (weeks to months) of low renewable energy supply.
6. Develop **smart grids** for the coordination of flexible resources across voltage levels
7. Establish new electric energy uses to capitalize on the **surplus energy events**

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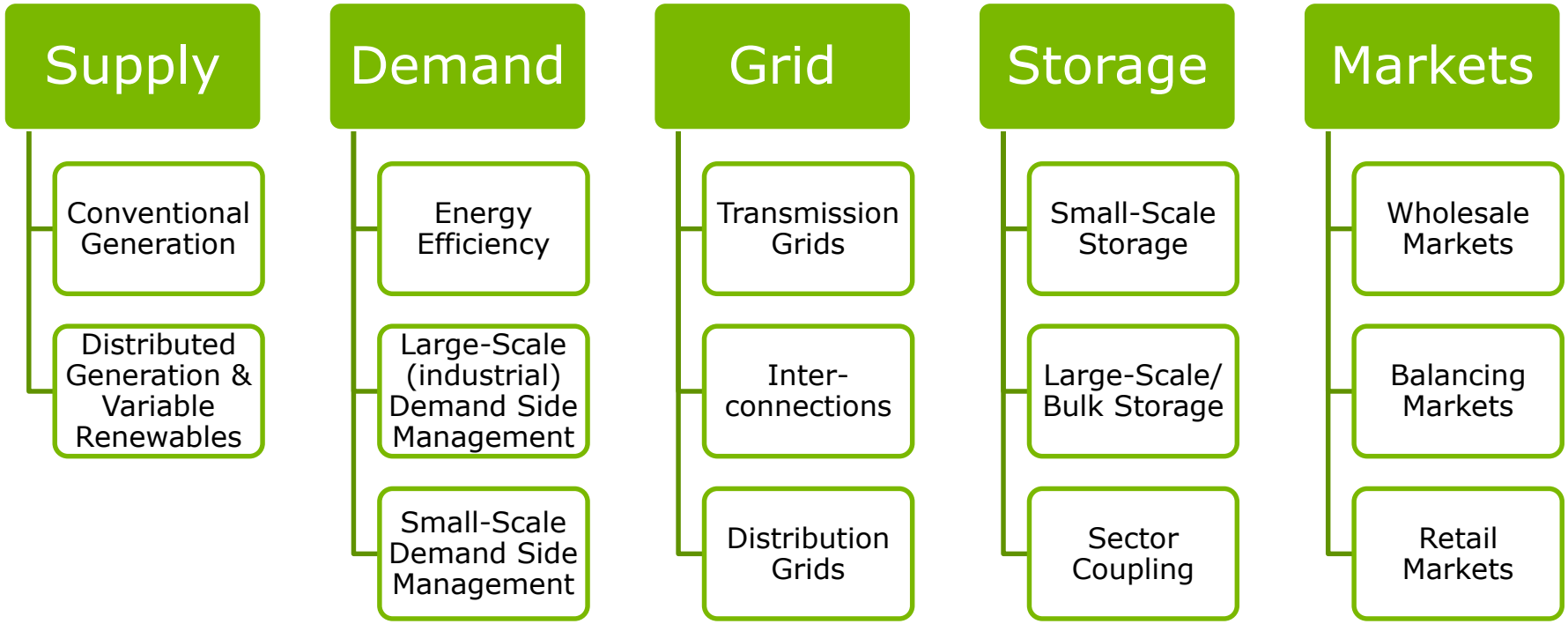
Flexibility Tracker: Categorisation of actions



> 5 categories, 14 subcategories and 52 KPIs (based on factual and qualitative questions)

> The structure allows:
  - ranking each system per category/subcategory (flexibility 'identity')
  - obtaining comparison reports per subcategory or KPI

Example: Demand Side Contribution

> KPIs consist of a number of factual and qualitative questions, example:

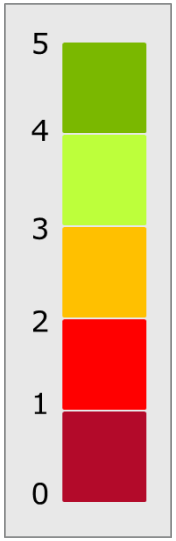
Subcategory	Question	Range and Scoring
Energy Efficiency	Are measures initiated by policy makers on track to meet the national short-/mid-term energy efficiency targets (2020)?	Yes/Trend/No (Scoring: Yes: 1, Trend: 0.5, No: 0)
	Is the long-term potential of energy efficiency measures for the system being assessed?	Yes/Trend/No (Scoring: Yes: 1, Trend: 0.5, No: 0)
Large-Scale (Industrial) Demand	Are there significant industrial DSM programmes?	Yes/Trend/No (Scoring: Yes: 1, Trend: 0.5, No: 0)
	Is industrial DSM participating in wholesale markets?	Yes/Trend/No (Scoring: Yes: 1, Trend: 0.5, No: 0)
	Is industrial DSM participating in balancing markets?	Yes/Trend/No (Scoring: Yes: 1, Trend: 0.5, No: 0)
	What is the theoretical potential of industrial DSM? [Industrial DSM potential / peak load]	Industrial DSM potential/ peak load (Scoring: ≥5%: 1, <5% & ≥2.5%: 0.5, <2.5%: 0)

> The answers are provided by official sources and reviewed by country experts

Scoring: rating against the 100% RES goal

- **Score individual questions:**
  - Clear guidelines on how to interpret results
  - Scale Low/Medium/High = 0/0.5/1
    - Provision of ranges for interpretation of achieved goals
    - Medium for Y/N answers where plans are not fully set in action

- **Total scoring: weighted average of all answers**
  - Weighting factors are applied allowing some questions to have more significance: achieved goals (e.g. VRES penetrations) rate higher than plans
  - Final score presented in a range 0-5 on a red-green colour code:
    - 0-1: dark red (insufficient-very low readiness)
    - 1-2: red (insufficient-low readiness)
    - 2-3: orange (medium readiness)
    - 3-4: light green (medium-high readiness)
    - 4-5: green (high readiness)



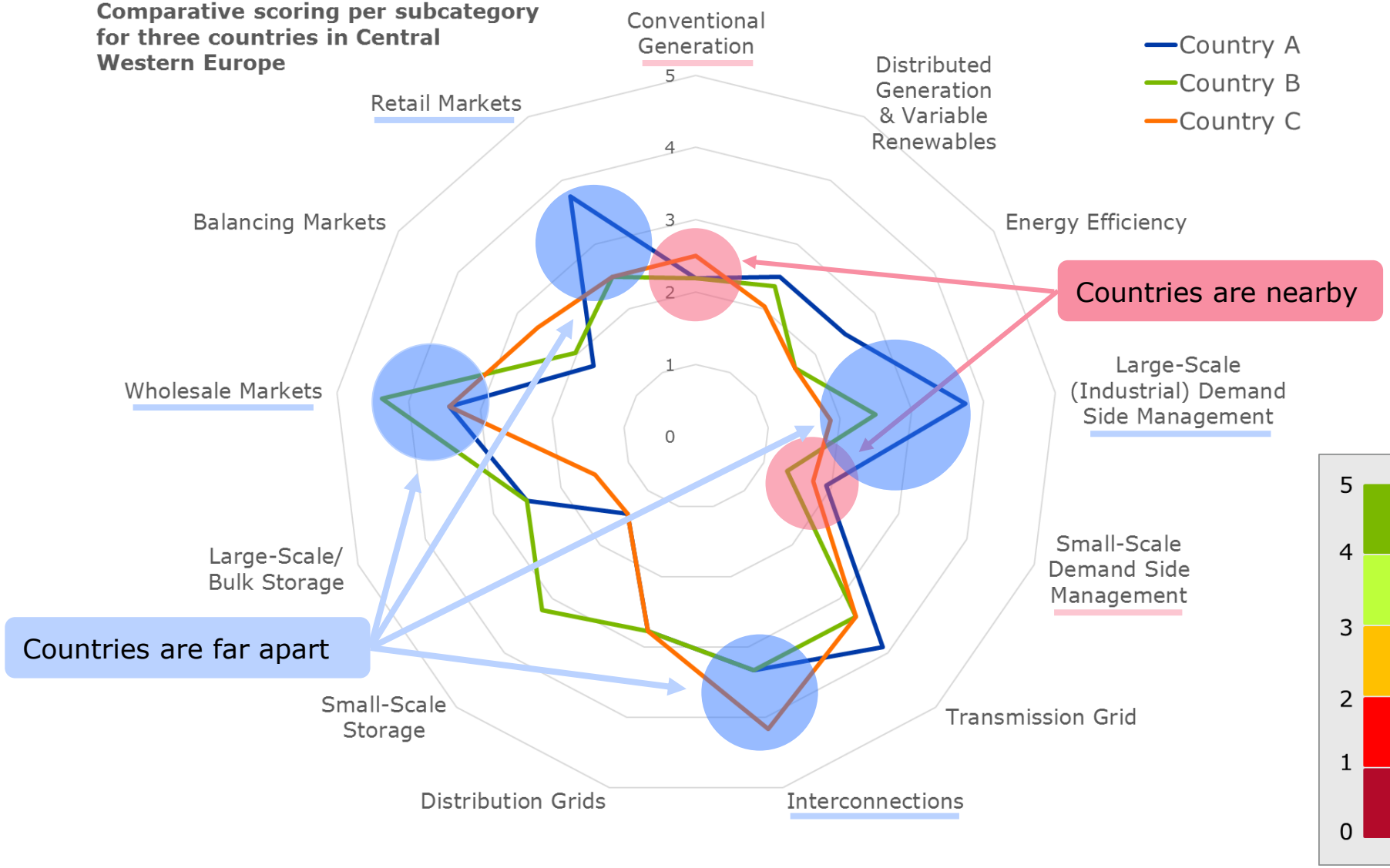
Functionalities

- **Flexibility 'identity'** of each country: assessment across all options
- **Overview across all countries**: comparison and combined plots
- **Country reports:**
  - Country factsheets: VRES targets, key info on system & flex options
  - Highlights of key factors affecting the rating
  - Action plans on flexibility
- **Category/subcategory reports**: which countries are better on a specific actions and why?
- Identification of **best practices**, enable exchange of policies
- **Periodical updates**, tracking of developments

Preliminary results

Work in progress

Comparative scoring per subcategory for three countries in Central Western Europe



Conclusions from the preliminary results

Work in progress

- **Structural challenges.** There are areas where all assessed countries score equally low and need to improve, e.g.:
  - Increase flexibility of conventional generation
  - Deployment of small-scale demand side flexibility

- **Individual challenges.** There are also areas where certain countries rank significantly higher than others. Besides possible explanations by structural differences, these are areas for the identification of best practices, e.g.:
  - Deployment of industrial demand side management
  - Interconnections
  - Wholesale markets
  - Retail markets

- **A detailed report with results for Belgium, Germany, the Netherlands, Poland and Spain will be available in autumn.**

Thank you for your attention!

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