



IEA ENARD Annex II

DG system integration in distribution networks

The transition from passive to active grids

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- IEA ENARD Annex II
- The current status of distribution grids
- IEA ENARD Annex II recommendations

The scope of Annex II is to address DG system integration into low & medium voltage networks including technical, economical, organisational & regulatory aspects

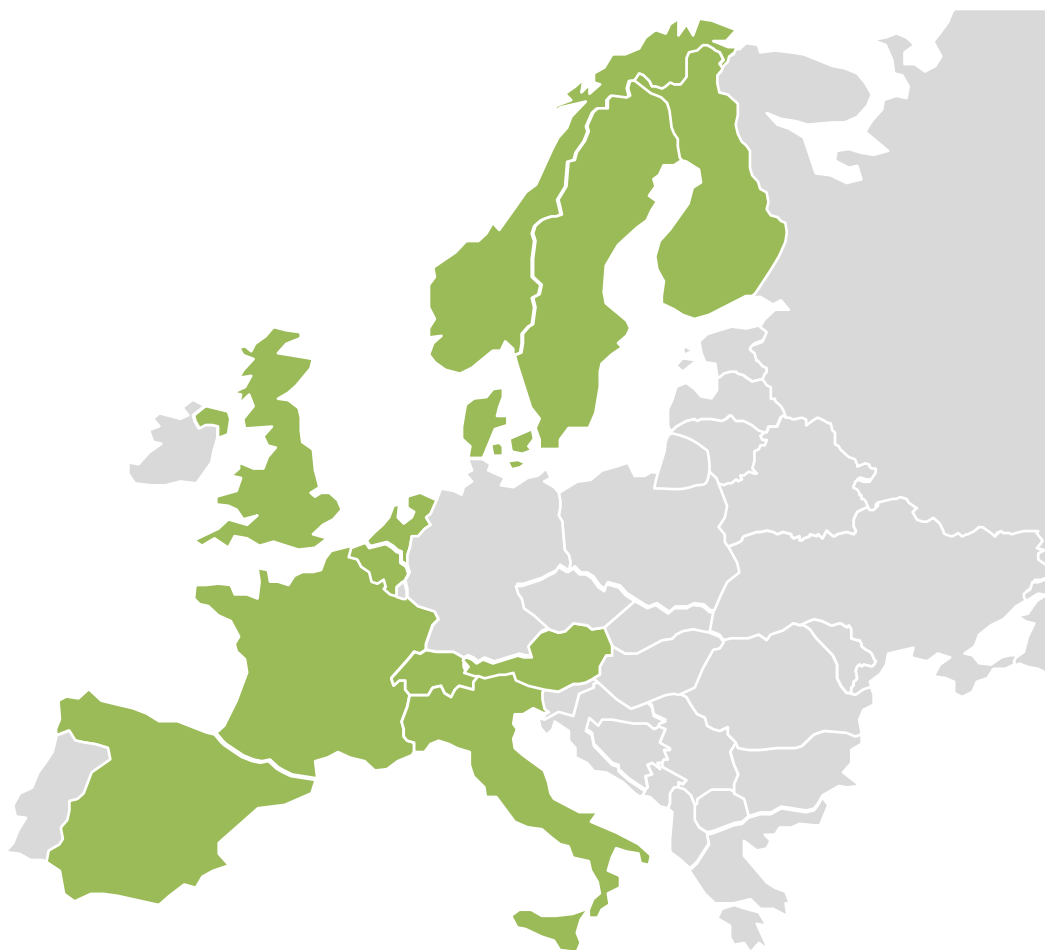
Annex II aims to:

- Build up and exchange knowledge on DG system integration and existing approaches to active network management

- Promote possibilities for the implementation of active distribution networks

- Develop an authoritative set of guidelines to facilitate the transition from today's passive distribution networks to the active distribution grid that will be increasingly required in the future

The IEA Implementing Agreement ENARD organisation has 14 member countries (status March 2011)



 ENARD member country

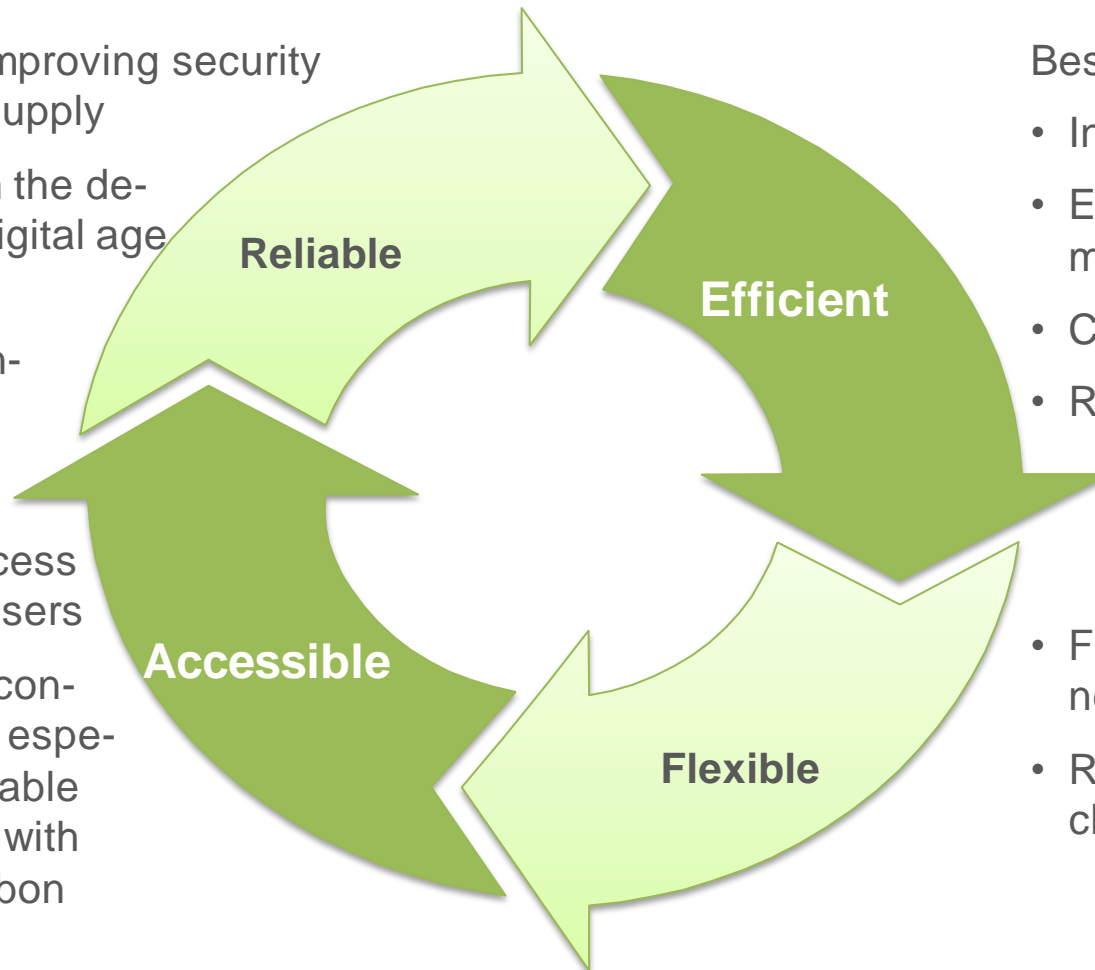
Additional ENARD members:

- United States of America
- Republic of South Africa

The future network vision with major changes in efficiency and accessibility

A future network is an electricity supply network that effectively and efficiently meets the world's future needs

- Assuring and improving security and quality of supply
- Consistent with the demands of the digital age
- Resilience to hazards and uncertainties
- Connection access to all network users
- Granting easy connection access especially for renewable power sources with zero or low carbon emissions

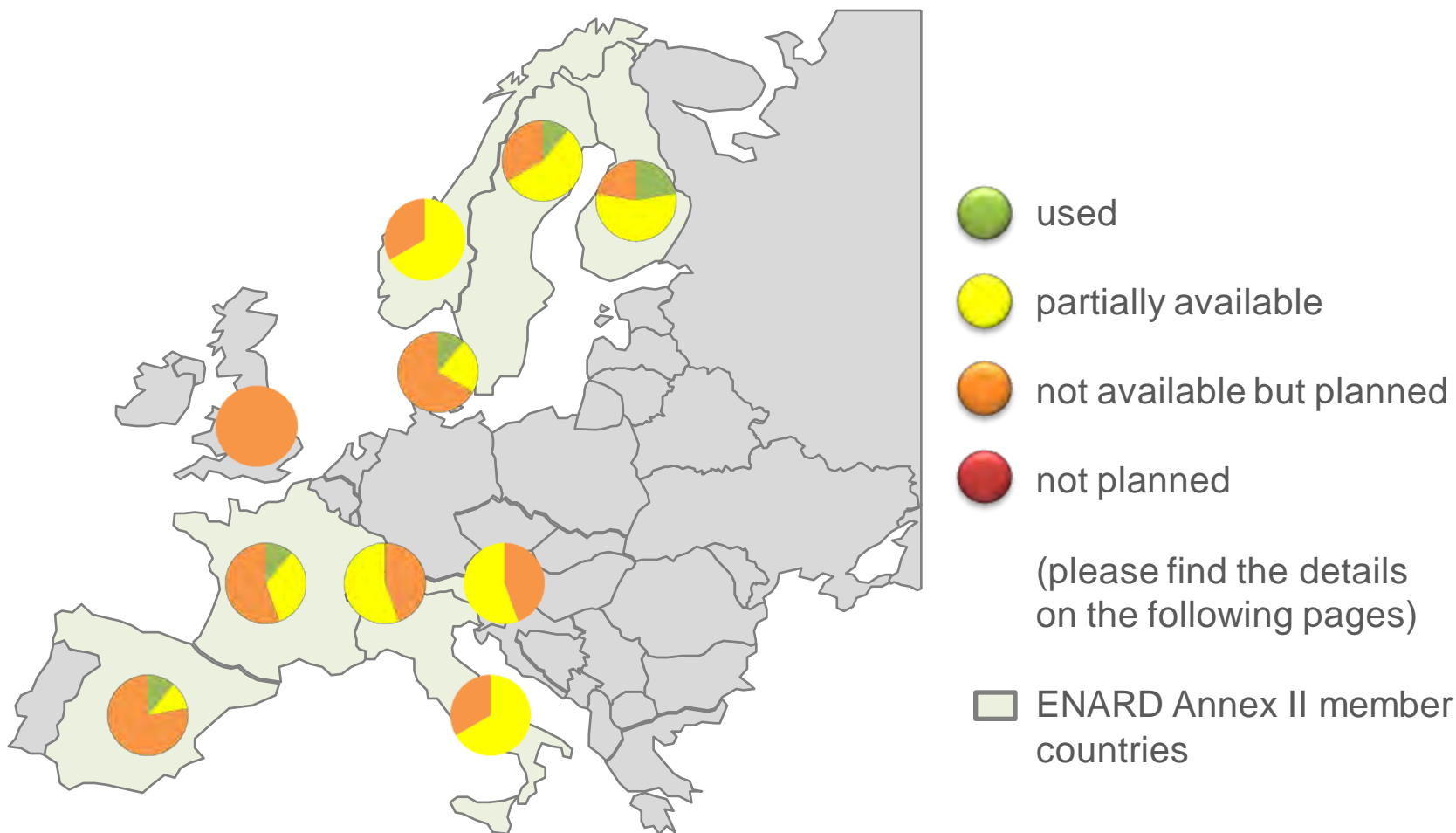


Best values through

- Innovation
- Efficient energy management
- Competition
- Regulation
- Fulfilling customer's needs
- Responding to the challenges ahead

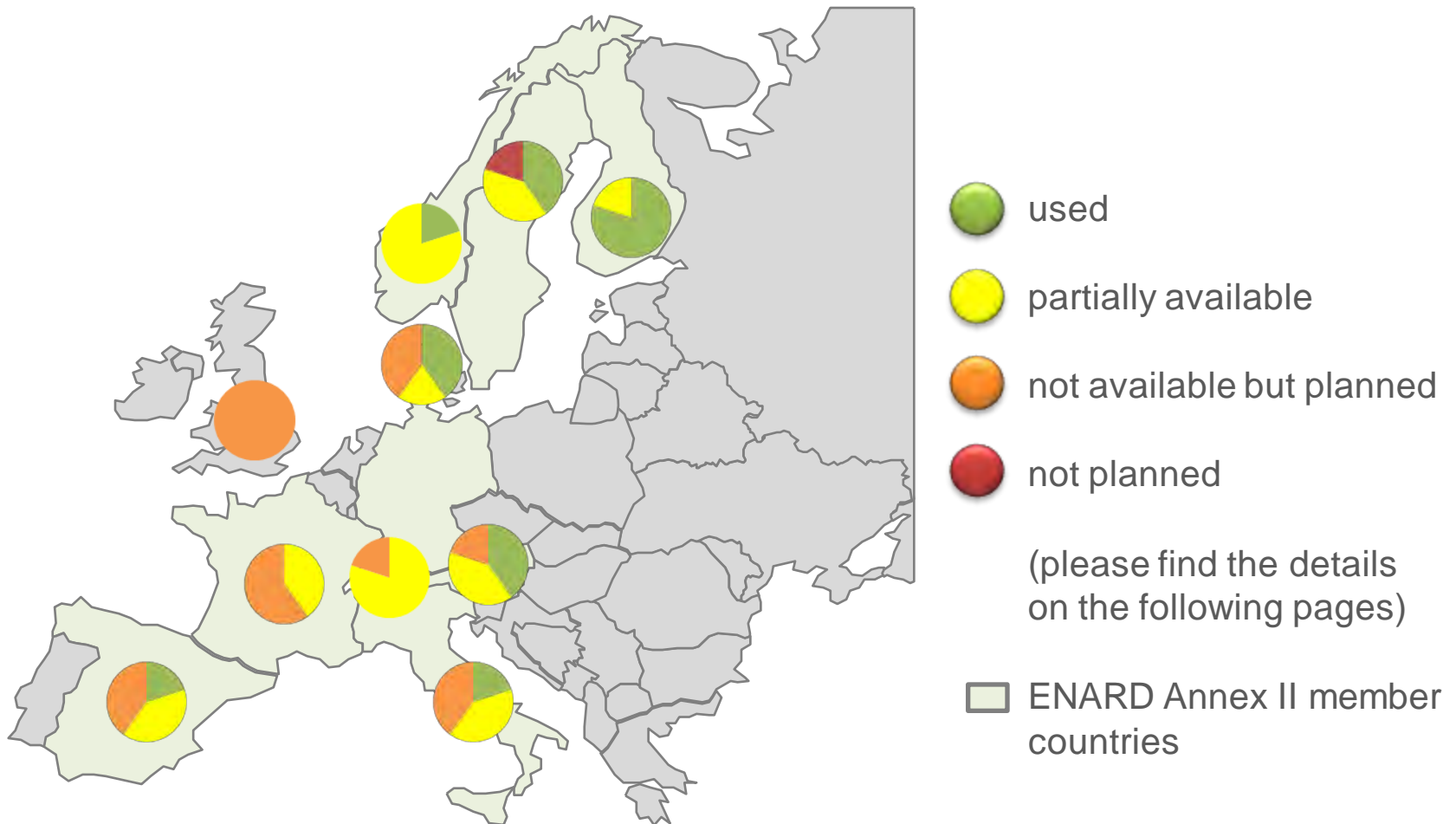
Active networks overview (9 specific questions)

Active networks as e.g. MV & LV load control, are in the IEA ENARD Annex II member countries mostly either planned or partially available



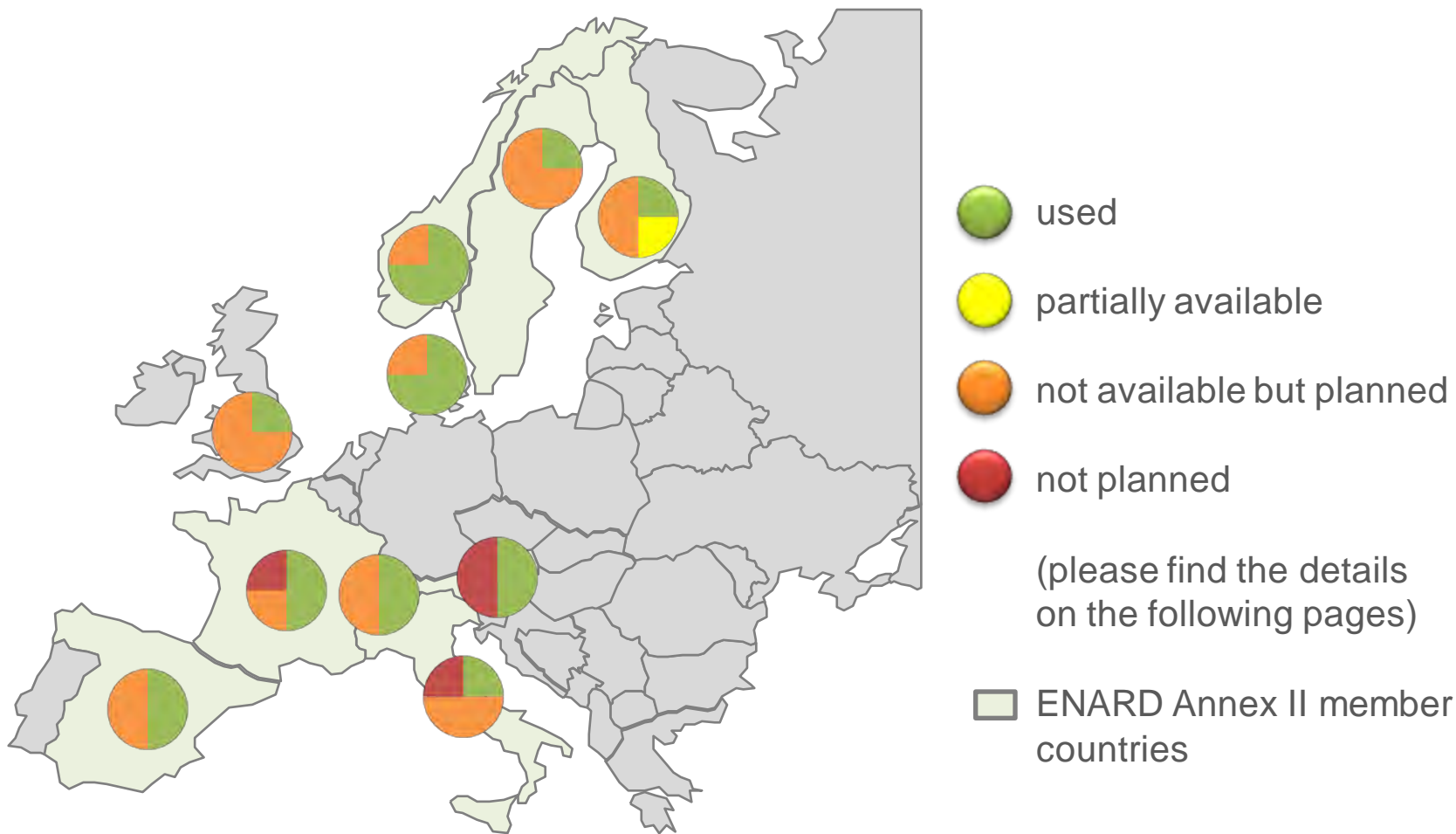
Customers (5 specific questions)

There are still a lot of challenges on the way to the “smart customer” – especially demand side management



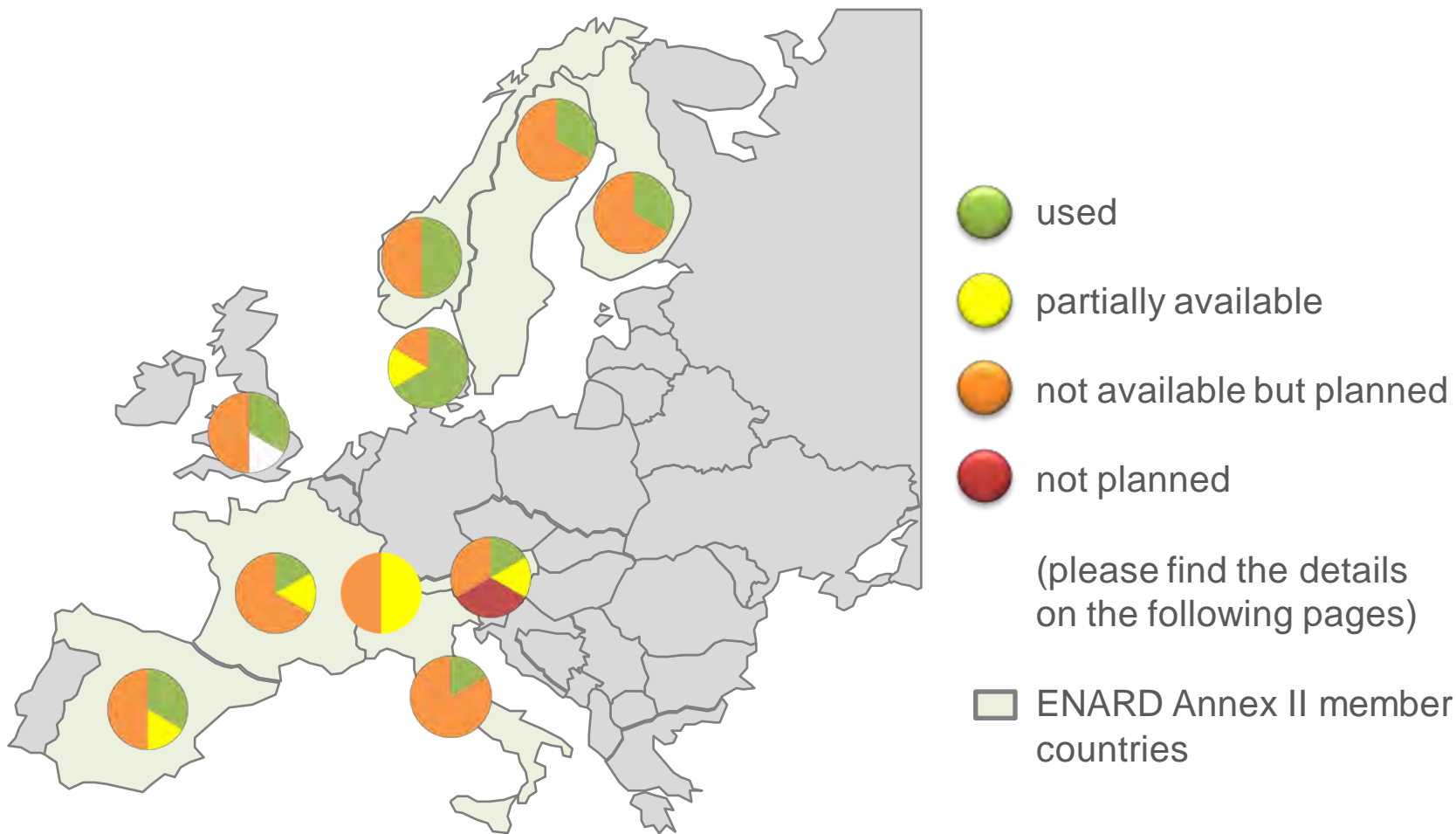
Economy (4 specific questions)

Many countries have fixed tariffs for DER plants but do not have ancillary services from commercial entities and a dynamic energy pricing at distribution grid level



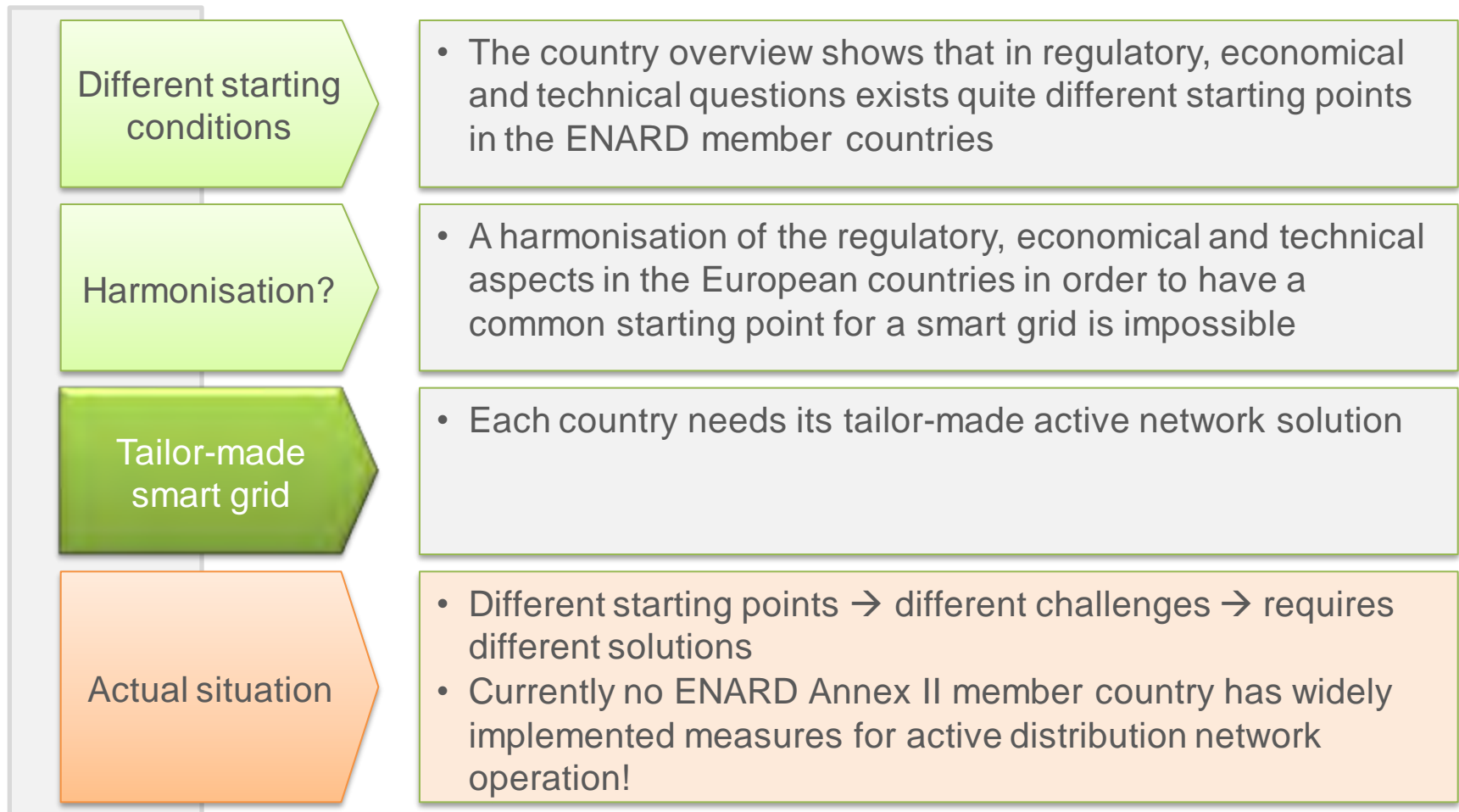
Regulatory (6 specific questions)

On the regulatory side also many challenges are waiting as for example DG integration for DNOs, DG market integration, market coupling, real time pricing



Conclusion from the country overview

Due to the different starting points, each country needs its individual smart grid



Clear energy strategies

- Clear national and international energy strategies are required
A clear commitment and vision for future electricity mix
 - Which amount of a certain technology
 - Should a country be self-sufficient (per year or per second)

Clear structure & continuity in regulation

- Many different models are used, thus a clear structure and continuity of regulation models is required, that is fair for DNO and DER – changing regulatory framework is a critical uncertainty for long term investments in electricity networks

Harmonization of support schemes

- Fixed feed in tariffs are a clear incentive for DG but in many cases act as barrier for active network integration. The different DG support measures and level of support (regional, national and international) need to be harmonized

Recommendations (2/6)

Cost handling

- Clear handling of R&D demonstration costs by DNOs and related legal security and exceptions for demonstration/trial projects is required (e.g. benchmarking of DNOs without considering R&D efforts)

Market follows power systems dynamics

- Market must follow the dynamics in the power system as much as possible and must allow the DER integration into the distribution grids. Aggregator in the market needs to be clearly defined
 - Markets and business models in the distribution grid level will be needed (e.g. ancillary services)

New contract and business models

- New contract and business models, due to different technical and economical interests of DNO and DER (quality and security of supply versus maximizing power feed in) need to be introduced for new and existing DER units

Recommendations (3/6)

Efficient use of electricity networks

- Efficient use of electricity networks will be essential in the future. Networks will be operated more efficiently if DNOs are able to take more system operation responsibilities for active network and active use of DG resources and demand response

Smart meter

- The smart meter is a possible enabler for DG system integration. A flexible smart meter with bidirectional communication can be sensor and actor in future networks. Open questions
 - Cost for smart meters and who is going to pay
 - Business models for metering (liberalized metering)
 - Network operators, DG operators & consumers should benefit

Harmonized tech. requirements & standards

- Harmonized technical requirements and standards (for DG, communication and smart metering equipment) are needed in order to ensure quality and safety of future active networks

Harmonized procedures for grid connections

- Harmonized and more systematic procedures for establishing grid connections need to be established, for instance information flow between DG unit operator and DNO

Interface between distribution & transmission grids

- More focus should be laid on the interface between distribution and transmission networks

Flexible storage and loads

- The usage of storage and more flexible loads, for instance electric vehicles, must be increased. New applications such as electric vehicles should not be seen only as a new load type but also as a possibility for active operation

Recommendations (5/6)

Reactive power management

- Reactive power management will be more and more important and can be relatively easy implemented

Enhanced protection strategies

- New and enhanced protection strategies and equipment is required for networks with a high share of DG

Build up new knowledge

- Due to the increasing system complexity, in general for future network operation DNOs as well as education institutions need to build up new knowledge

New Demonstration projects

- More active network demonstration projects are necessary to gather more practical knowledge and best practice examples for future network operation
- Ongoing knowledge exchange & intensified dissemination are needed

Biggest challenge: grid policy & regulatory aspects

- Grid policy and regulatory aspects were identified as the most challenging issues concerning massive DER integration in distribution systems. Therefore in future activities dealing with DER and network related grid policy issues should be intensified.