MICROGRIDS IN SYSTEM OPERATION – TASKS & TESTING NEEDS

Validation and Performance of Microgrid Functionalities

Fraunhofer IWES

IEA ISGAN – SIRFN: Participants

Overview

- The Smart Grid International Research Facility Network (SIRFN) is a collaboration among world-class smart grid research and testing facilities
- SIRFN's collaborative testing/evaluation capabilities are meant to be leveraged by the international community to enable improved testing / evaluation of smart grids.

Participants (15)

Major Active Subtasks

- RE & DER Integration
- Smart Grid Modelling
- Power System Testing
- Advanced Laboratory Testing Methods

Website

sirfn.net

Operating Agent

sirfn@der-lab.net

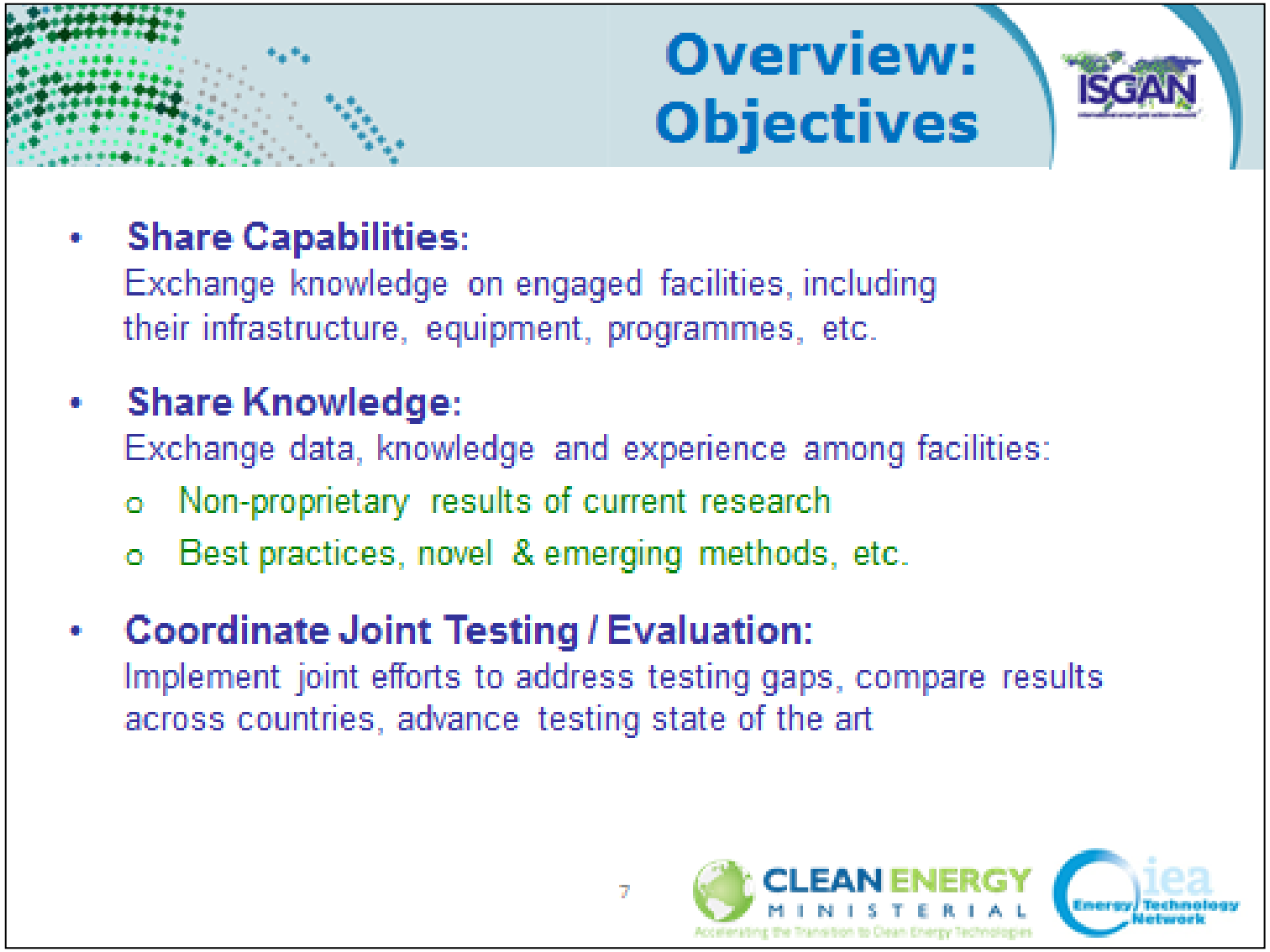
IEA ISGAN – SIRFN: Outcome

Progress to Date & Outcomes

DER Inverter Test Protocols: PV and ESS

- **Progress:**
  - Conducted inverter and energy storage experiments and compared results
  - The first public draft of BESS interoperability test protocols has been completed and issued (following earlier work on PV)
  - Five (5) functions particularly effective for BESS included in that draft: Active & Reactive Power Request, Power Factor Request, VoltVar and Frequency/Watt
  - Harmonization with existing international codes and standards
  - All labs performed tests on the five functions
  - SIRFN group is continuously updating the certification procedures for both PV and BESS
  - Agreement from five (5) SIRFN labs to encode the draft PV and Energy Storage protocols in the SunSpec System Validation Platform (SVP) connected to test equipment and interoperable inverters.
    - SIRFN is drafting and refining automated test scripts for advanced inverter functions in UL 1741, IEC 61850, and national grid codes.
  - Interest from three Nationally-Recognized Testing Laboratories (NRTLs) in the U.S. to use the SVP to conduct the testing
  - SIRFN members are participating in Standards Development Organizations (SDOs) to create national test procedures based on the work in this project.

IEA ISGAN – SIRFN: Invitation to participate



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IEA ISGAN – SIRFN: Power System Testing / Microgrids

Scope

The main scope of the activity will be to evaluate microgrid requirements for helping blackstart of the grid and propose a testing procedure for microgrid basic functionalities.

Objectives

- To define the microgrid functionalities
- To define a set of key performance indicators for evaluating this functionalities
- To define testcases for evaluation the KPIs or a subset of them
- To define the testing procedure for the functionalities.
- To strengthen inter laboratory collaboration through common research activities, e.g. round robin testing.

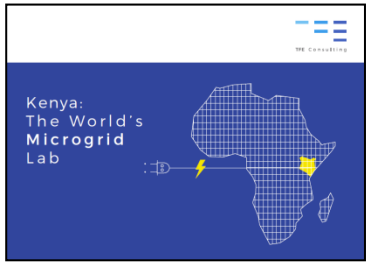
Microgrids – Standardisation Activities

IEC TS 62898-1: Purpose and applications of microgrids	IEEE P2030.7: Types of microgrids
a) Microgrids that aim at **improving reliability**, and securing the energy supply for all or part of their loads by islanding: 1) Distribution microgrid, for example part of utility grid, campus, activity zone; 2) Facility microgrid, for example microgrids in a customer installation, a military base, a hospital. c) Microgrids that **aim at reducing energy costs for microgrid users** in the grid-connected mode by optimizing the assets such as energy storage, dispatchable loads and generators, providing ancillary services to the grid; d) Microgrids that **aim at providing disaster-preparedness** by optimizing the assets such as energy storage, dispatchable loads and generators. This kind of microgrids may be built in natural disaster prone areas, designed for the zone where enhanced power supply is required for some critical loads, etc.	A.3.1 **Large self-contained complexes** These systems exchange power with the grid (buying and selling under contract, for example), have enough local generation to operate in islanded mode, usually only serving part of the load, and can provide ancillary services to the distribution grid. They can include large commercial and industrial installations (processing plants, ports), large building complexes, larger mixed use (commercial and residential) urban areas, utility distribution microgrids, institutional and government installations (research centers, hospitals, and prisons), university campuses, and critical infrastructures (military, hospital). A.3.2 **Community microgrids** They include renewable distributed generation, distributed or centralized storage, and controllable loads.

- Standards dealing with testing requirements are on the way.

Why microgrids? Access to clean energy.

Source: TFE Consulting



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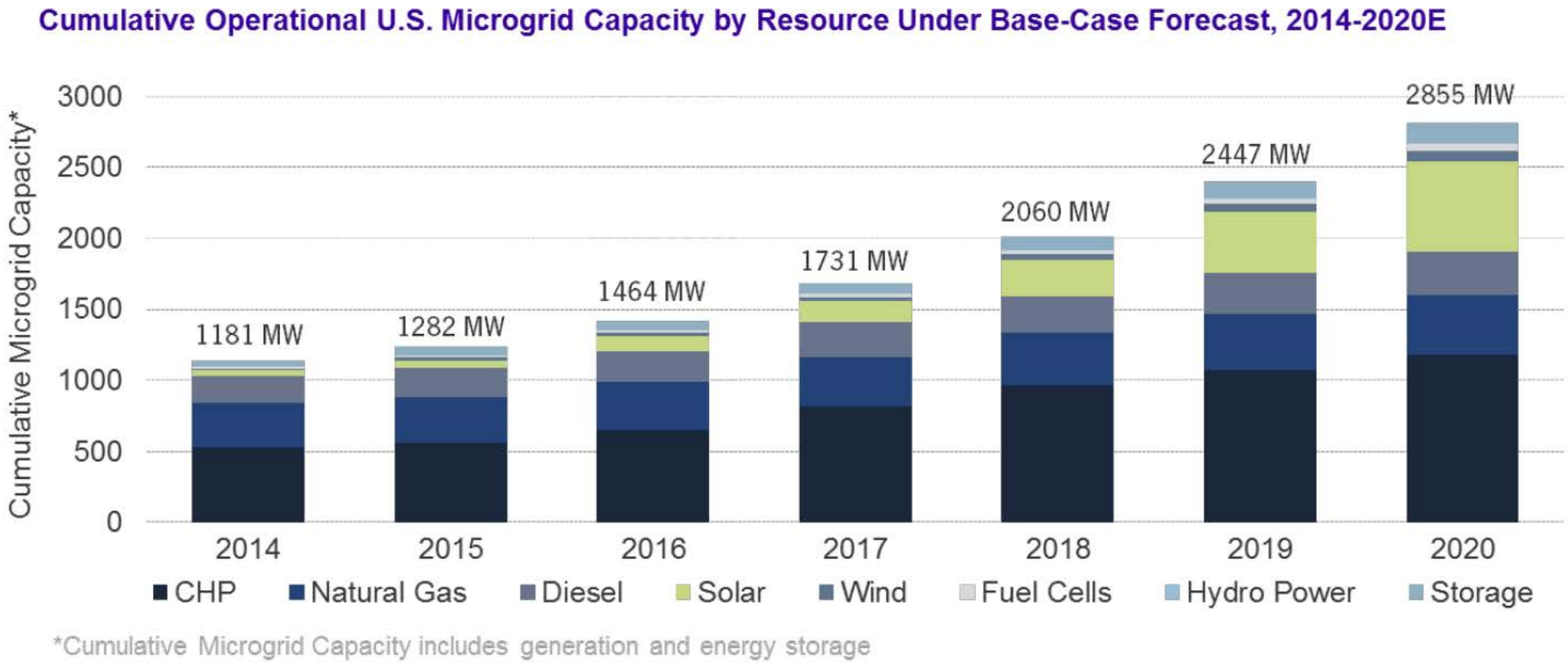
Why microgrids? Access to clean energy.

- Mission Innovation Challenge (http://mission-innovation.net/our-work/innovation-challenges/)

  (1) Smart Grid Innovation Challenge,
  including on/off grid operations and demonstrating the robust, reliable operation of MW-sized micro grids and

  (2) Off-Grid Access to Electricity Innovation Challenge,
  Technology innovation needs include renewable sources integration, storage and smart small-scale grid management technologies (e.g. systems safety, reliability and scalability, interoperability between grid components to allow demand growth, smart and integrated control, etc.).

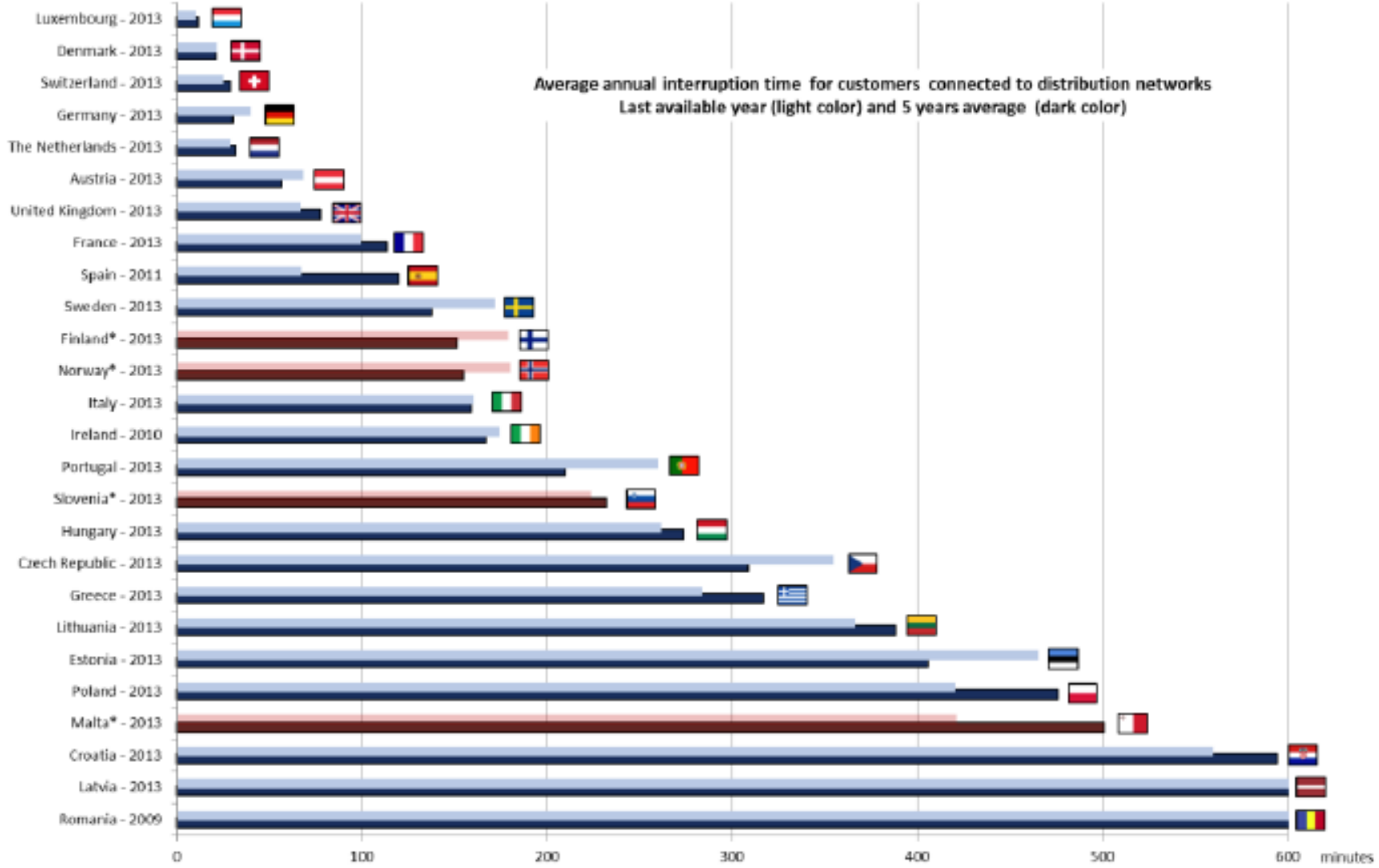
Why microgrids? In the US?



- Enhanced share of renewables?

Source: GTM Research 2014

Why microgrids? In Europe?



- Enhanced continuity of supply?

Source: CEER 2015

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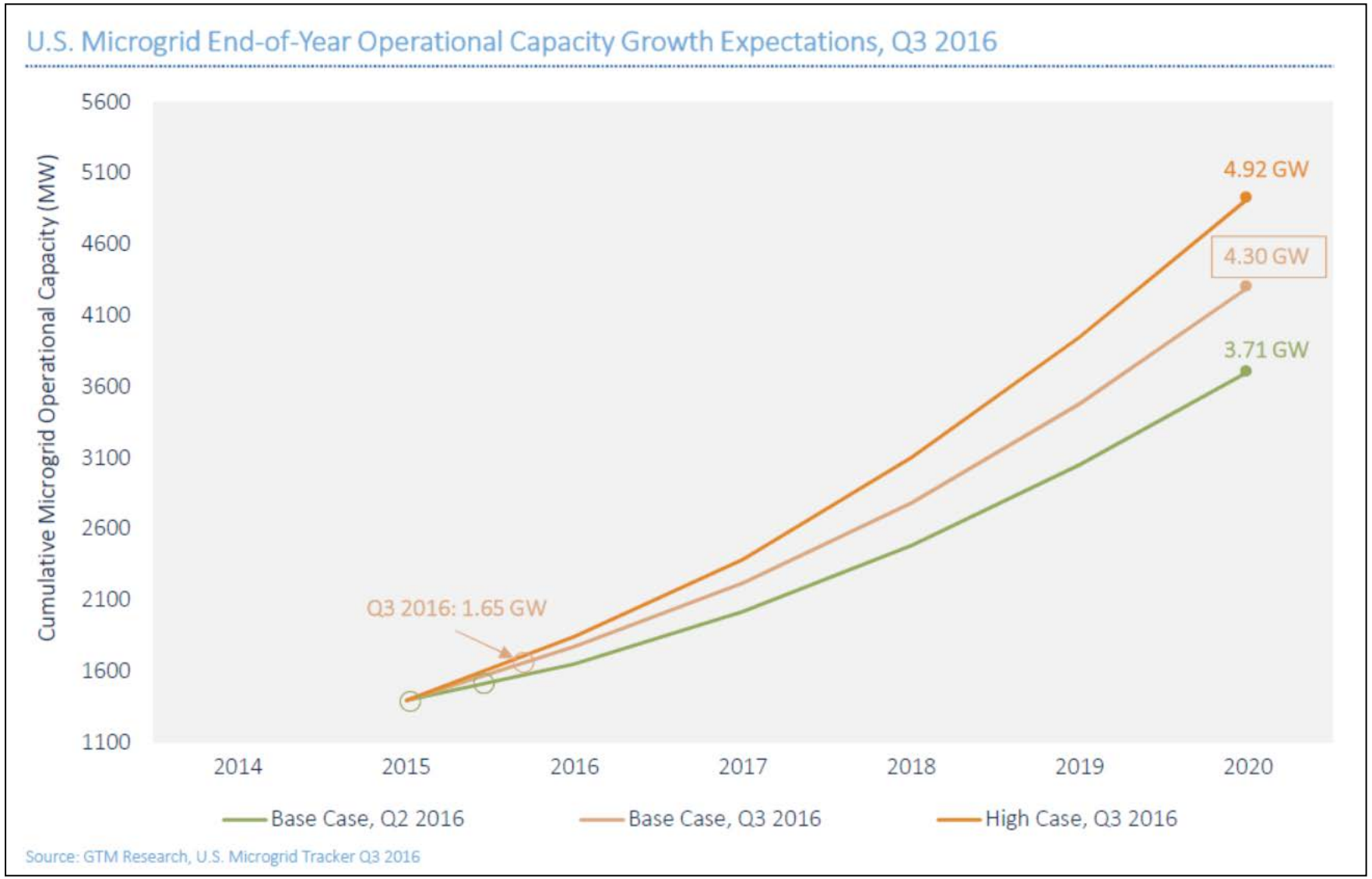
Trends to microgrids. In Europe.

- More complex system operation because of large numbers of distributed generators
- Thesis: one future path of the power systems is evolving towards cell grid oriented system operation making way of microgrids operation and integration in the system
- Concepts promoting subsidiarity in politics: decision on the lowest possible level,
  in power supply: balancing in the smallest possible grid cell
  - Electra web-of-cell approach for future system operation
  - VDE study „Zellularer Ansatz" (cellular approach)

- Advantages
  - Optimization of sector coupling?
  - Minimization of grid/ transportation infrastructure and energy losses?
  - Enhanced resilience?

Trends to microgrids. In the US.



The panellists

- Jochen Kreusel, ABB, Germany
- Blake Lundstrom, NREL, US
- Changee Cho, KERI, Korea
- Chris Caerts, VITO, Belgium
- Wolfram Heckmann, Fraunhofer IWES, Germany

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ISGAN Annex 5

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Utility microgrids. What does ist mean for system operation and for validation and security?

- What do you reckon is the main driver for microgrids and what is the main challenge?
  - In your country? In your main market?
- Will microgrids enhance renewable integration and lead to a higher hosting capacity of the system?
- Can testing be done in generalized or benchmark microgrids?
  - Will there be a “plug&play” certificate for microgrid components, controllers, generators, loads?
- Microgrids are islands in the system. Why should we, all at once, allow for or even aim at islanding?
  - Will microgrids lead to even higher complexity and less robustness or can they reduce complexity in system operation?
- Where on the dependability time vector do you find dedicated microgrid contributions?

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Contact

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