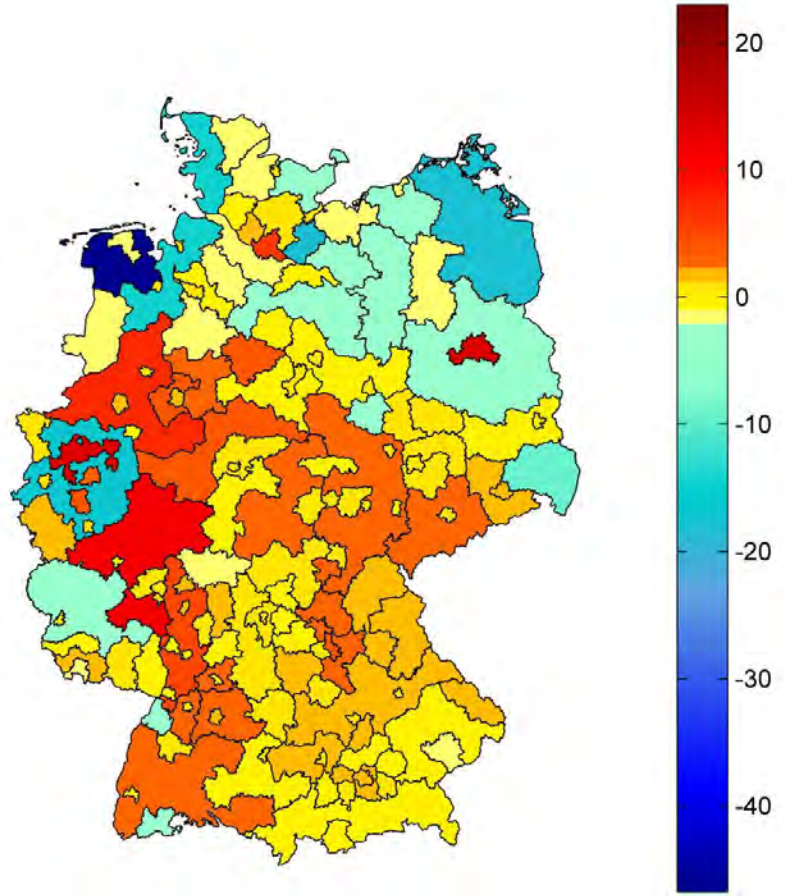
Speicherung – Voraussetzung für 100 % Strom aus Erneuerbarer Energie?



IEA ECES Annex 26
Future Energy Storage Demand

eces26

Dr. Christian Doetsch
Operating Agent IEA ECES 26

Fraunhofer UMSICHT
Germany

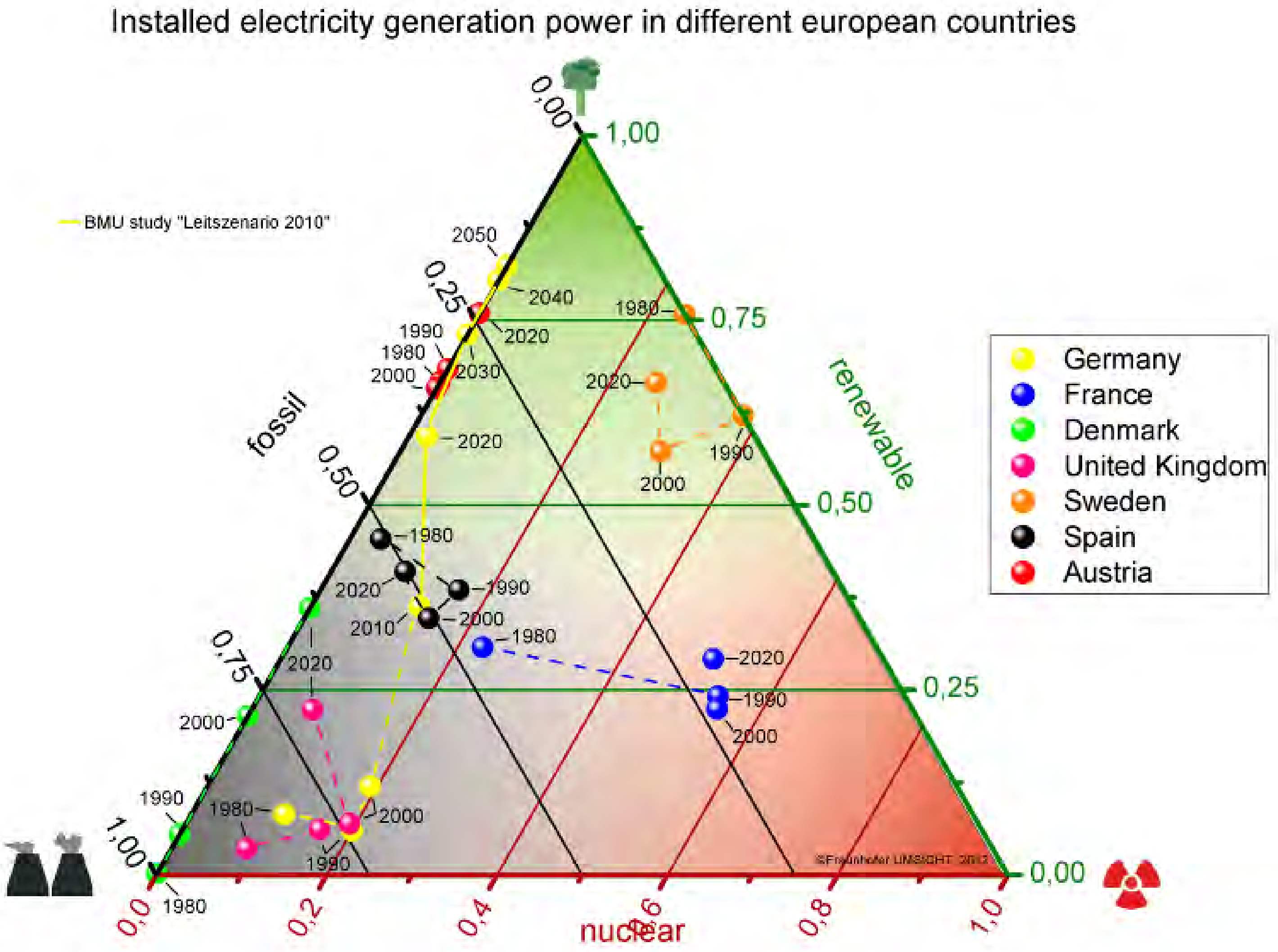
Fraunhofer UMSICHT

Change of the electric energy system

- **Energy System**
  - ▶ change to renewable energies
  - ▶ much more fluctuations
  - ▶ less base load power plants

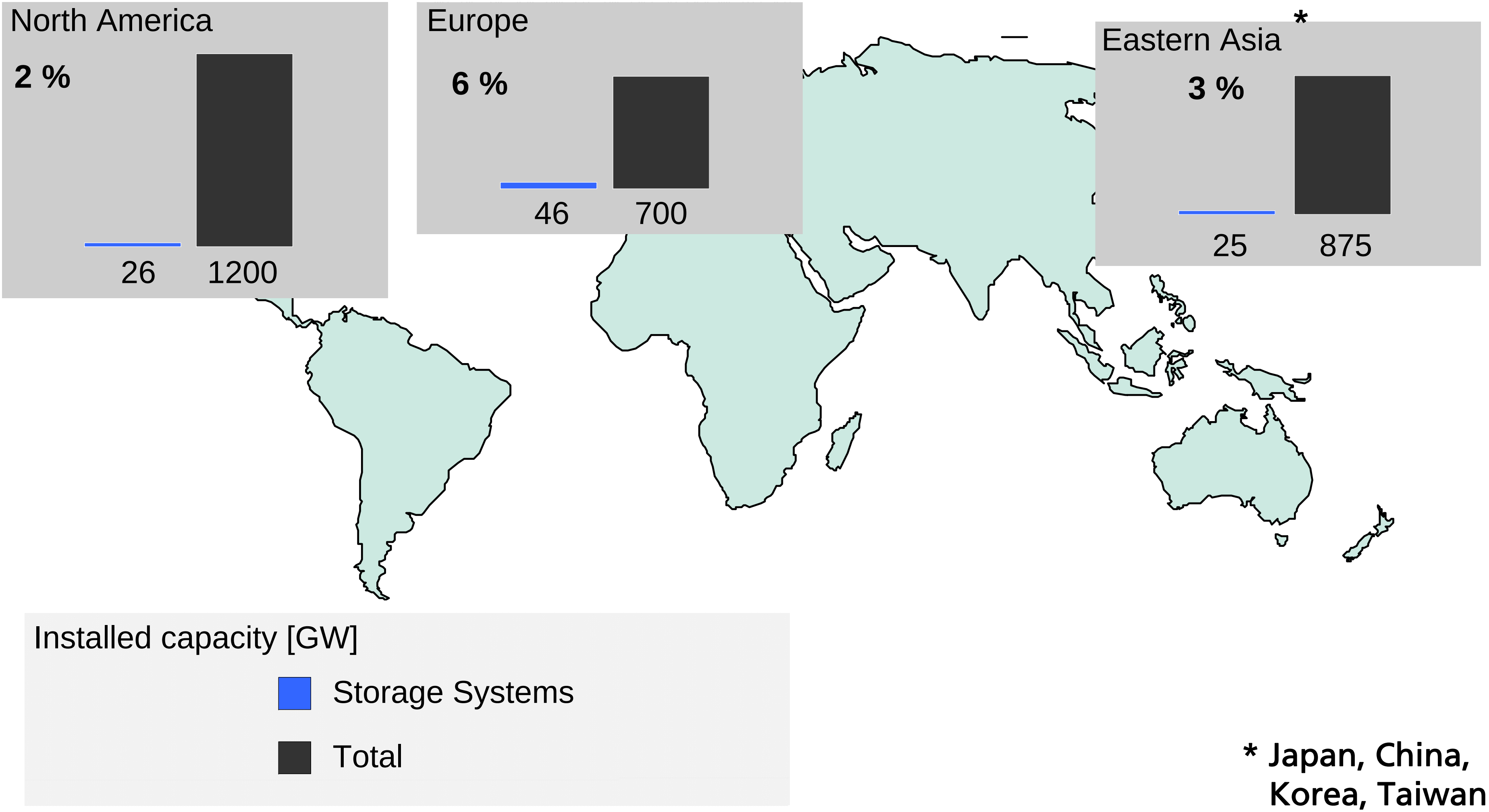
- **Challenges**
  - ▶ balancing the grid at each time
  - ▶ managing the temporar surplus or lack of energ

Need of energy balancing devices



Fraunhofer UMSICHT

Installed energy storage system vs. installed generation capacity



* Japan, China, Korea, Taiwan

Fraunhofer UMSICHT

Pumped Hydro Energy Storage

- **Less opportunities to enlarge the PH storage capacity**
  - ► less topological areas in the north
  - ► new big PH systems have acceptance problems because of massive impact on nature

- **Less storage capacity in Germany compared to other countries**
  - ► PH capacity in Germany approx. 0.04 TWh / 6 GW

	Storage capacity*	Power*
Austria	**4,5 TWh**	**6 GW**
Norway	**81,7 TWh**	**29 GW**
Sweden	**33,8 TWh**	**16 GW**

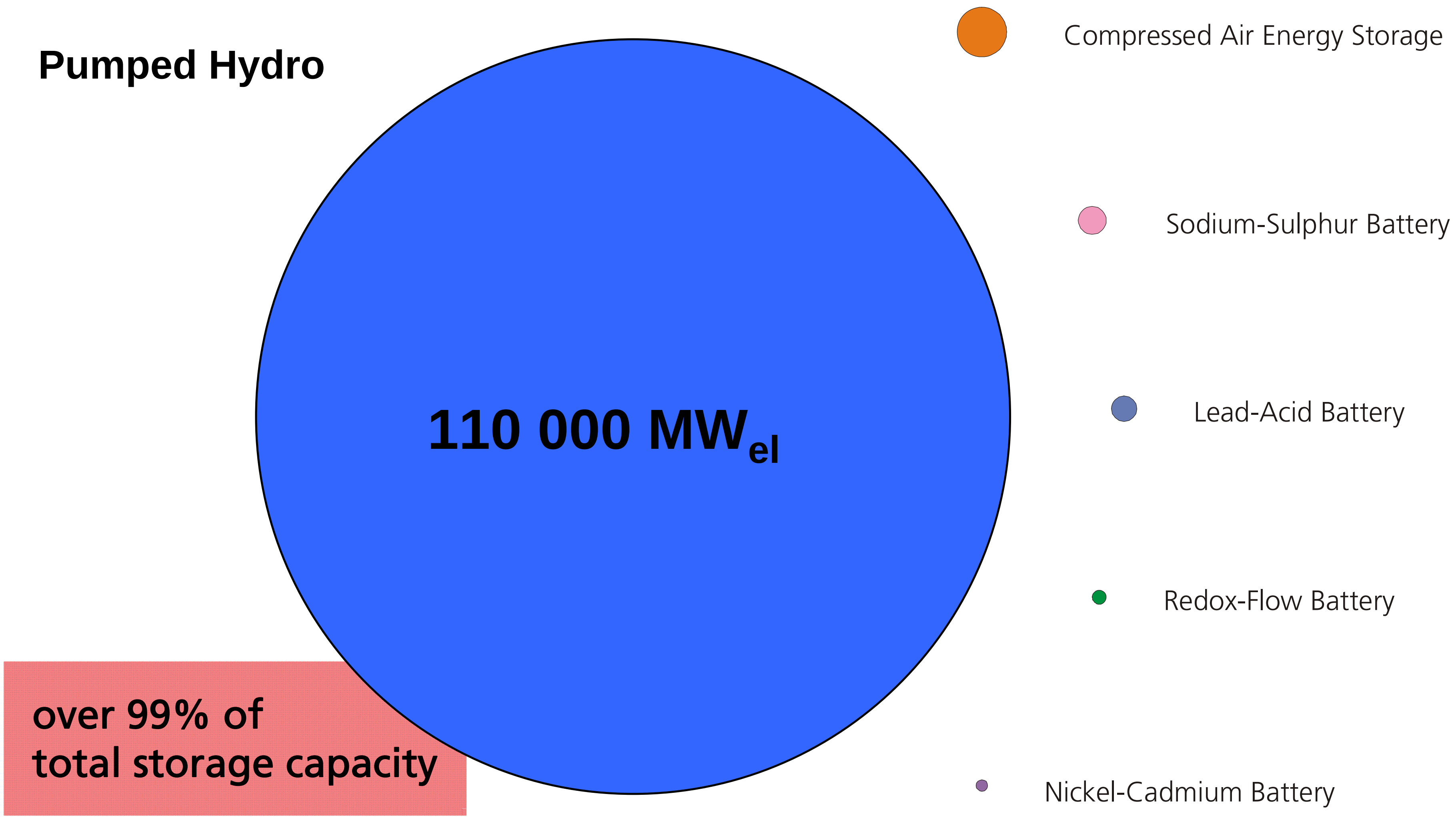
*** potential/ realized [Study from Dr. Kleimaier)**

Worldwide installed storage capacity for electrical energy (2010)

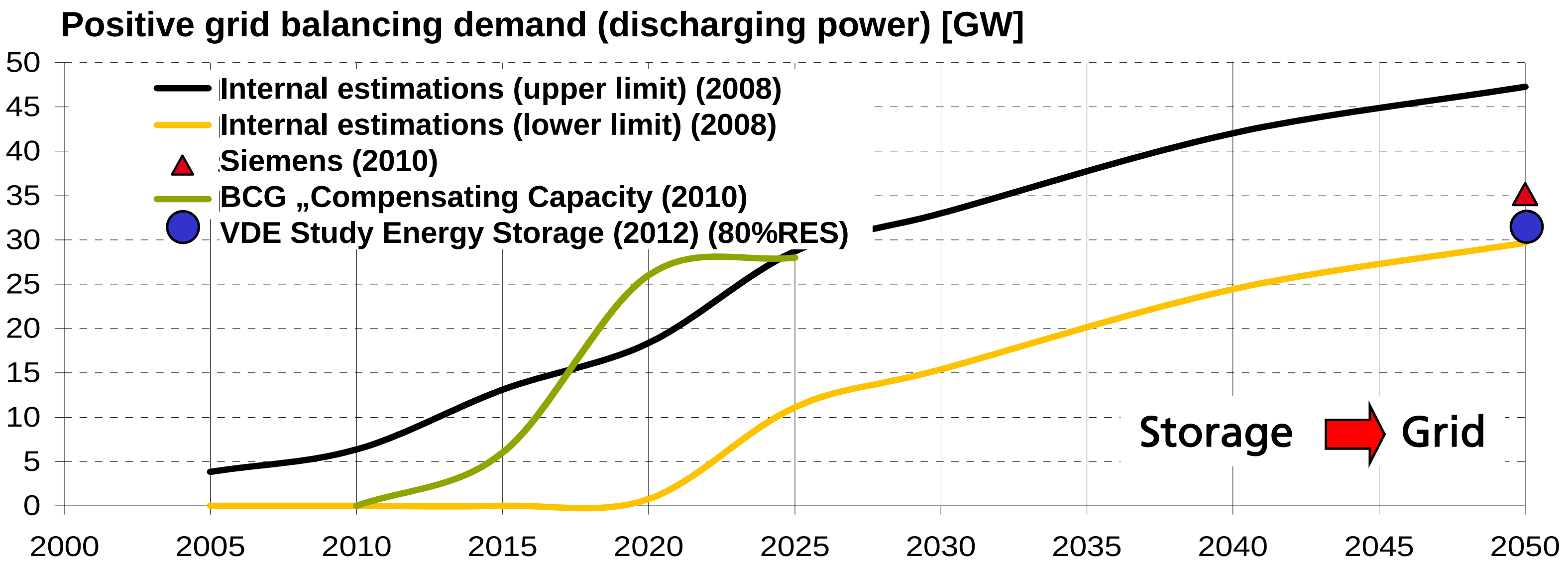
CAES	**477 MW_{el}**	Compressed Air Energy Storage
NaS	**302 MW_{el}**	Sodium-Sulphur Battery
LA	**125 MW_{el}**	Lead-Acid Battery
Redox	**38 MW_{el}**	Redox-Flow Battery
NiCd	**26 MW_{el}**	Nickel-Cadmium Battery

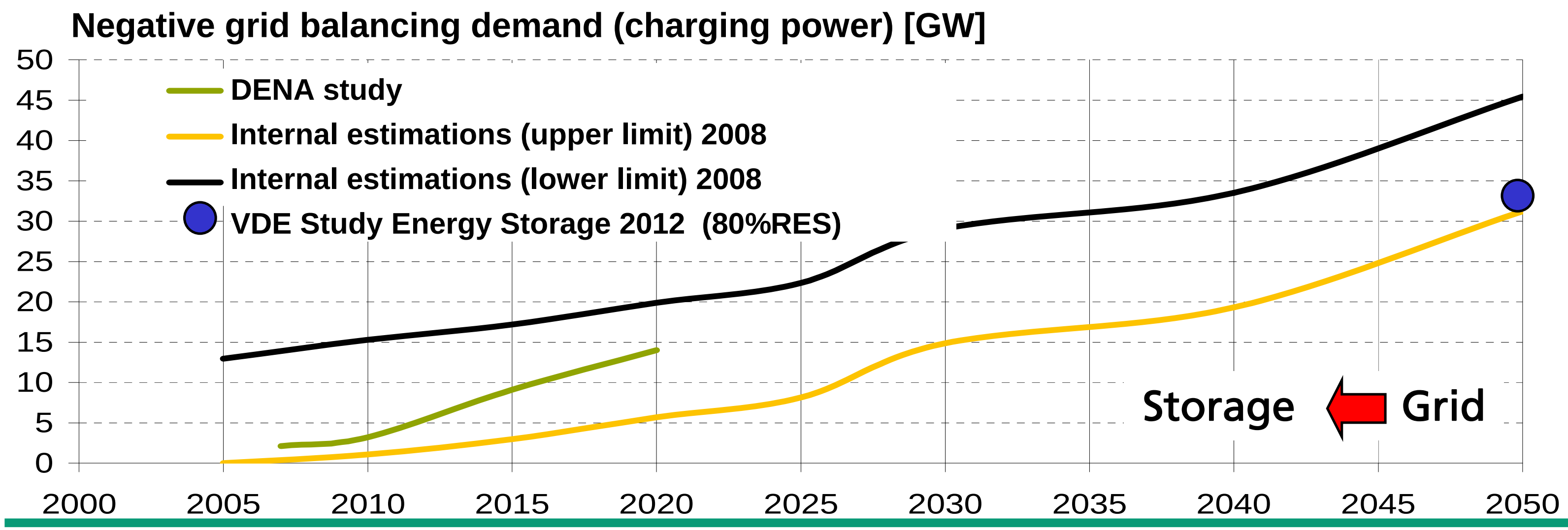
Fraunhofer
UMSICHT

Worldwide installed storage capacity for electrical energy (2010)



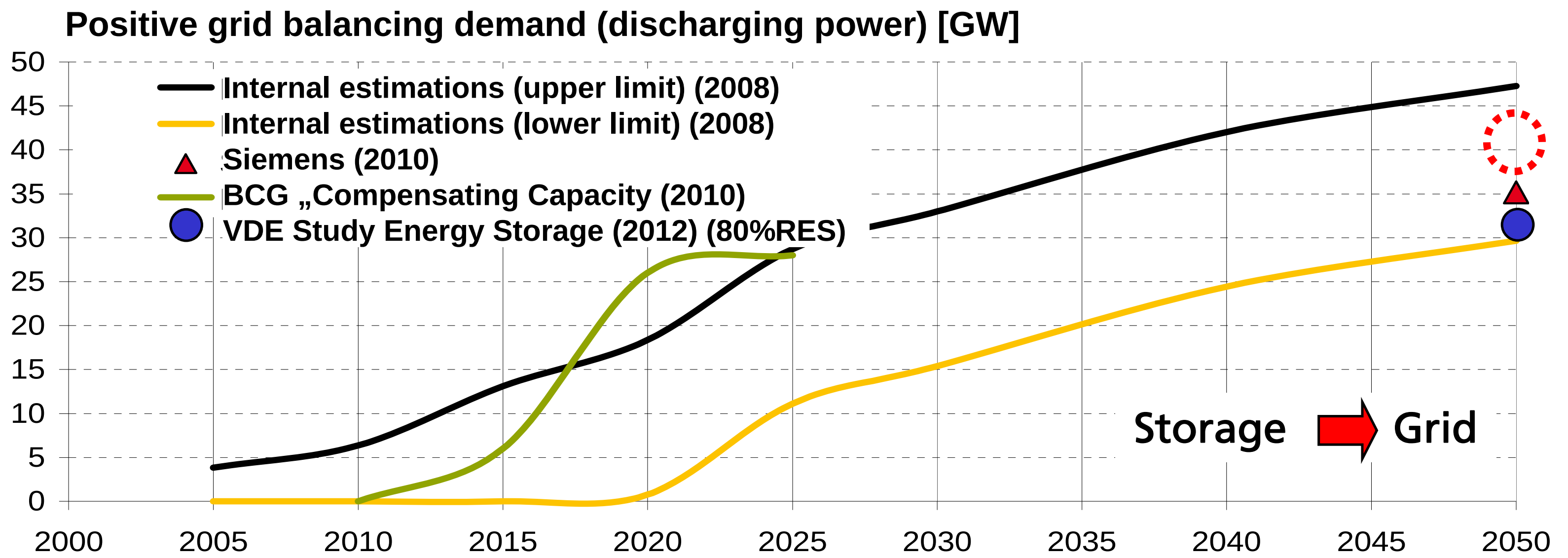
Estimations for Grid Balancing Demand (Germany, Peak Load 90 GW)

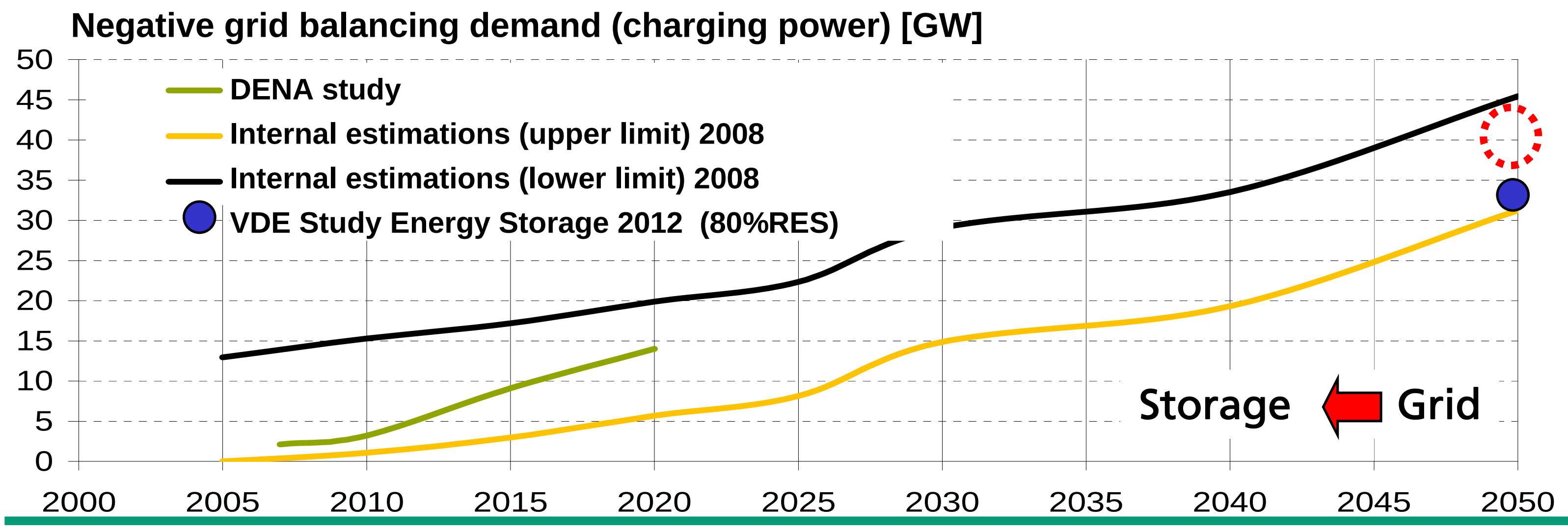




Fraunhofer UMSICHT

Grid Balancing Demand: Power [GW] vs. Stored Energy [GWh/a]





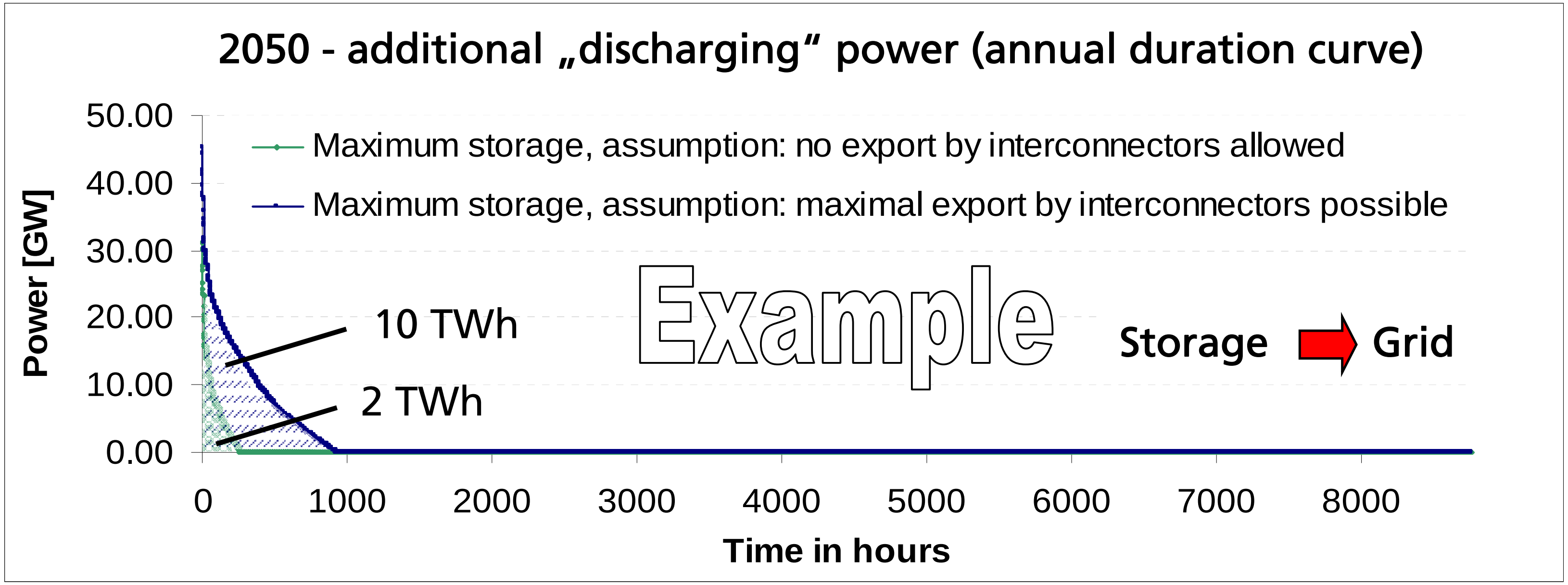
Example:

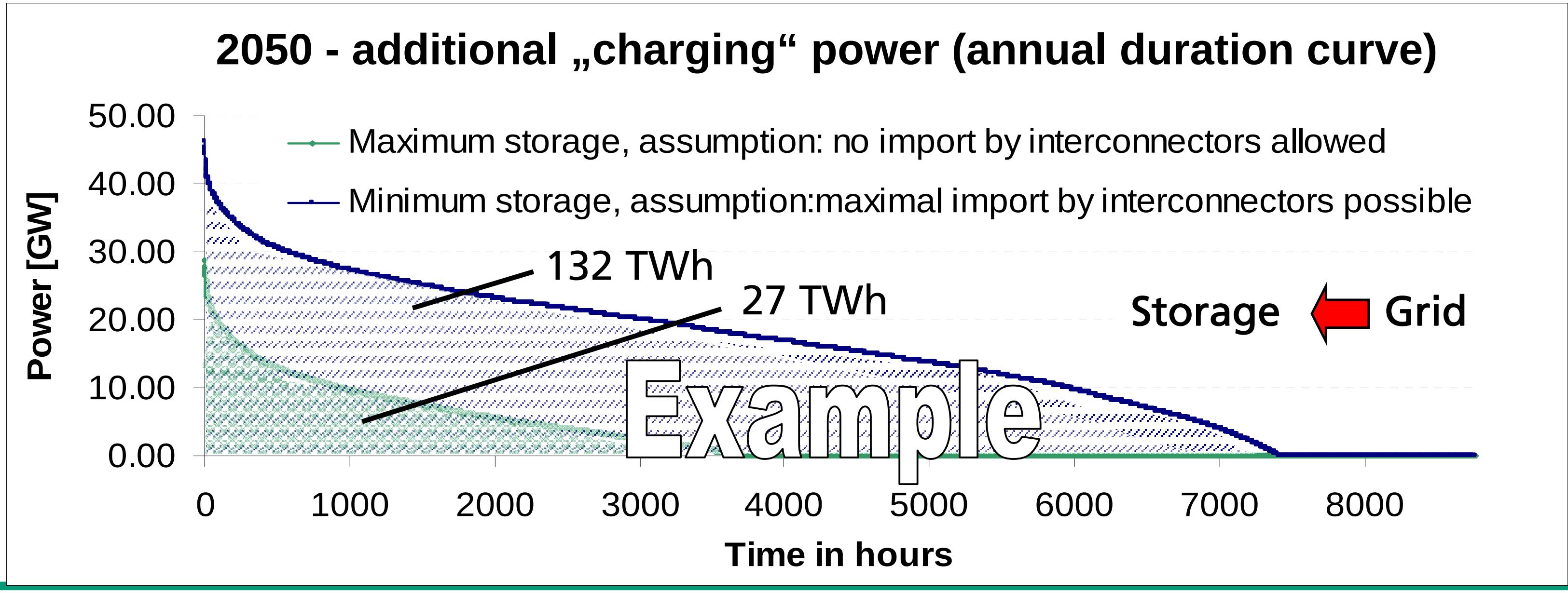
Grid Balancing Demand 2050

positive: approx. 40 GW

negative: approx. 40 GW

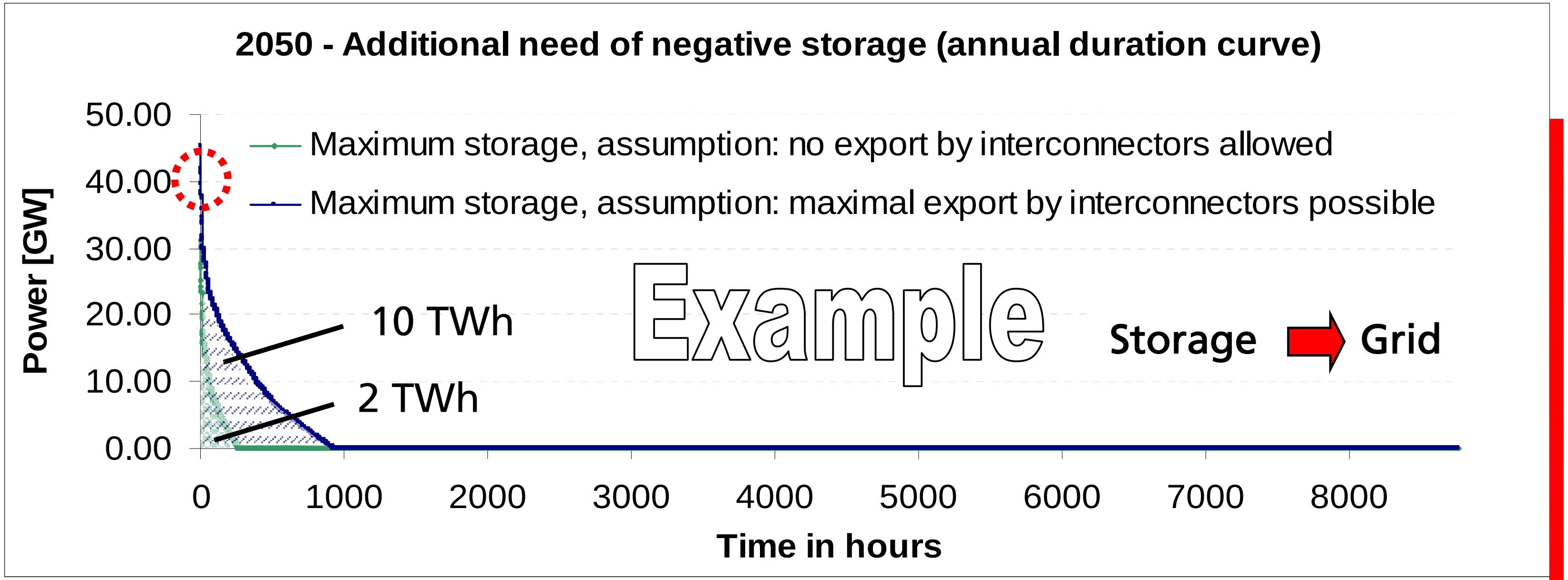
Grid Balancing Demand Analysis: Power vs. Yearly Stored Energy

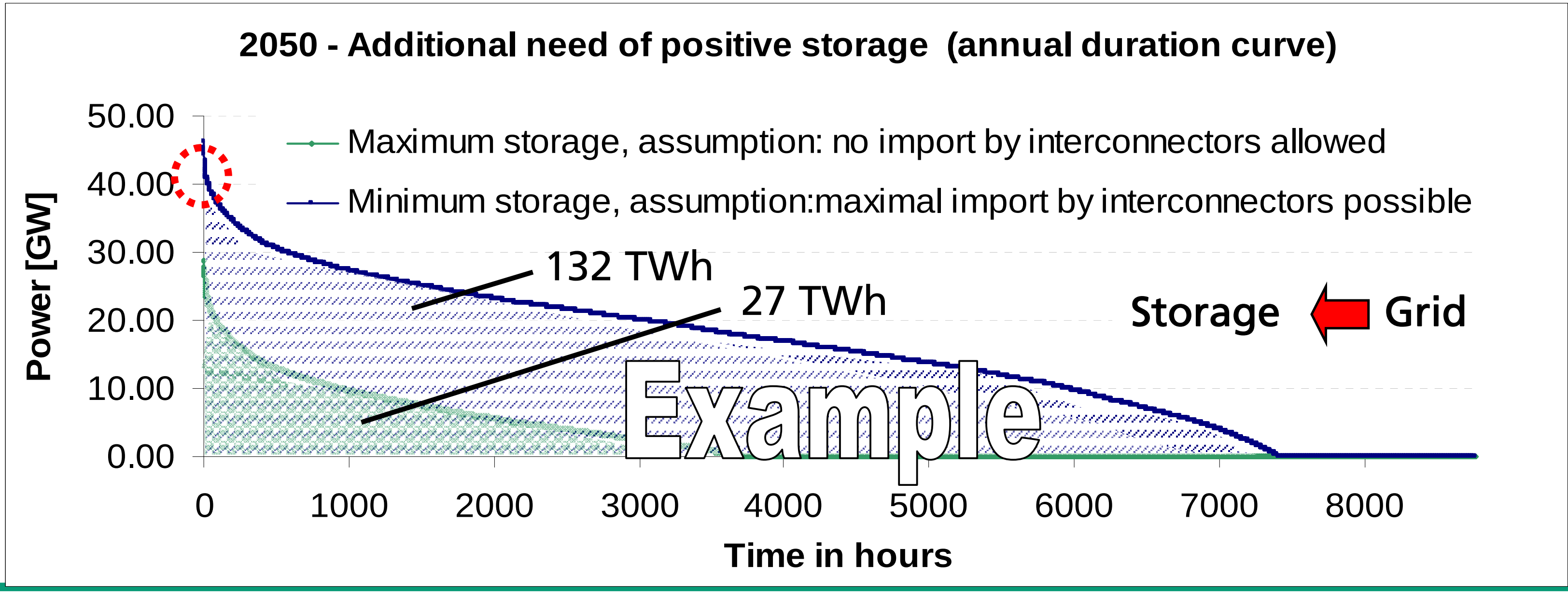




Fraunhofer UMSICHT

Grid Balancing Demand Analysis: Power vs. Yearly Stored Energy





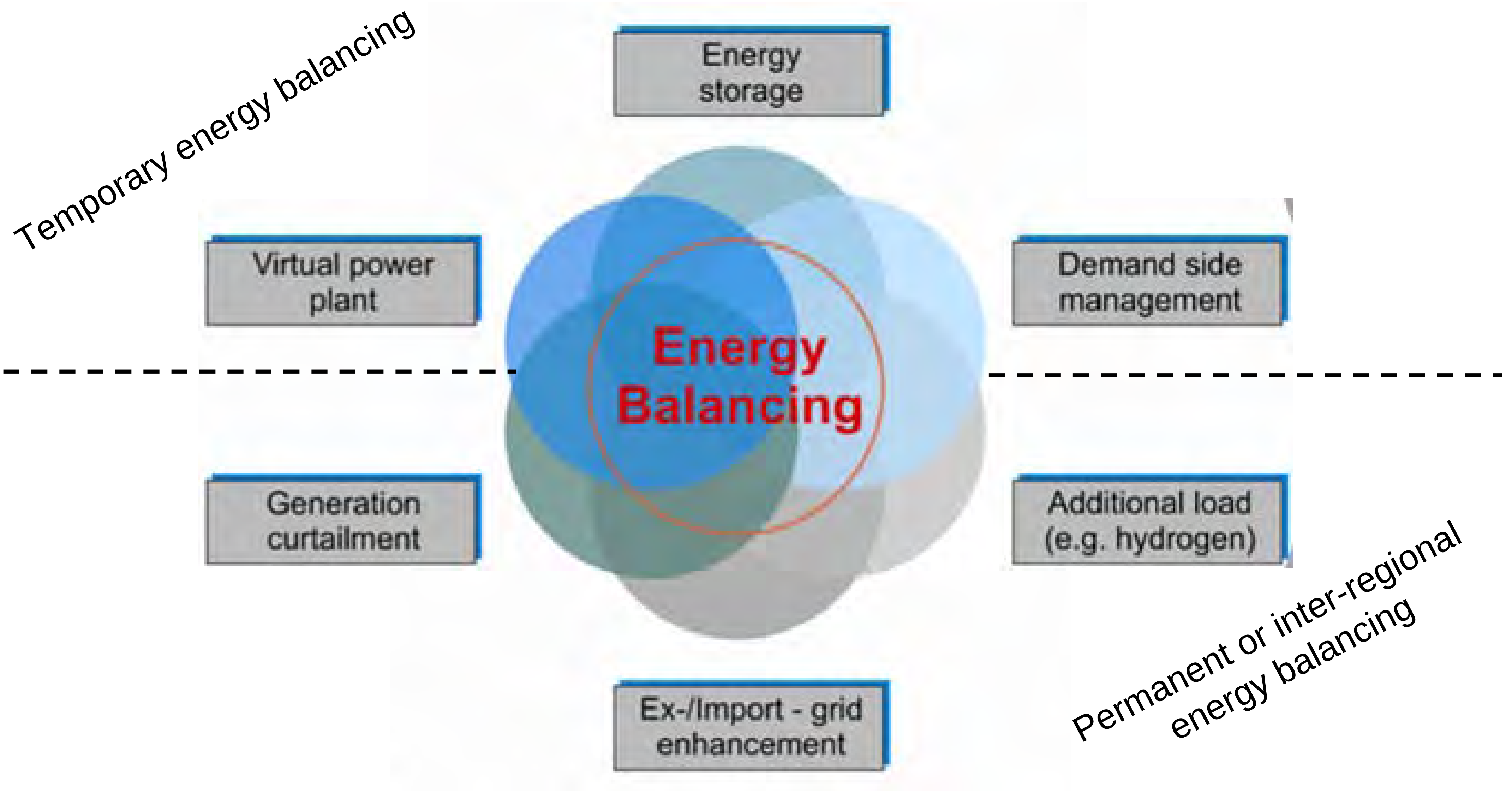
Example:

Grid Balancing Demand 2050

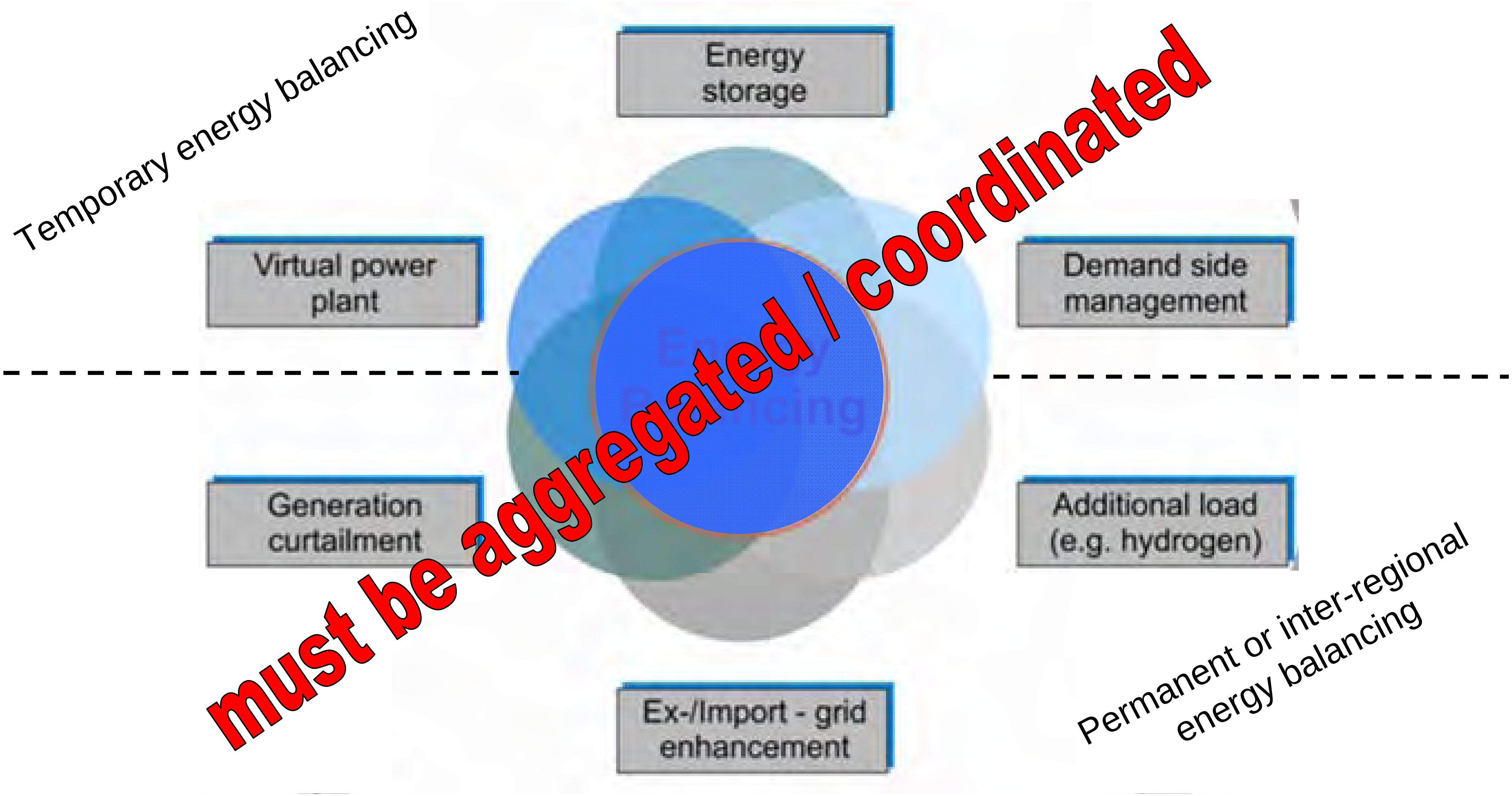
Discharging: 2-10 TWh

Charging: 27-132 TWh

Measurements for “Grid-Balancing”



Measurements for “Grid-Balancing”



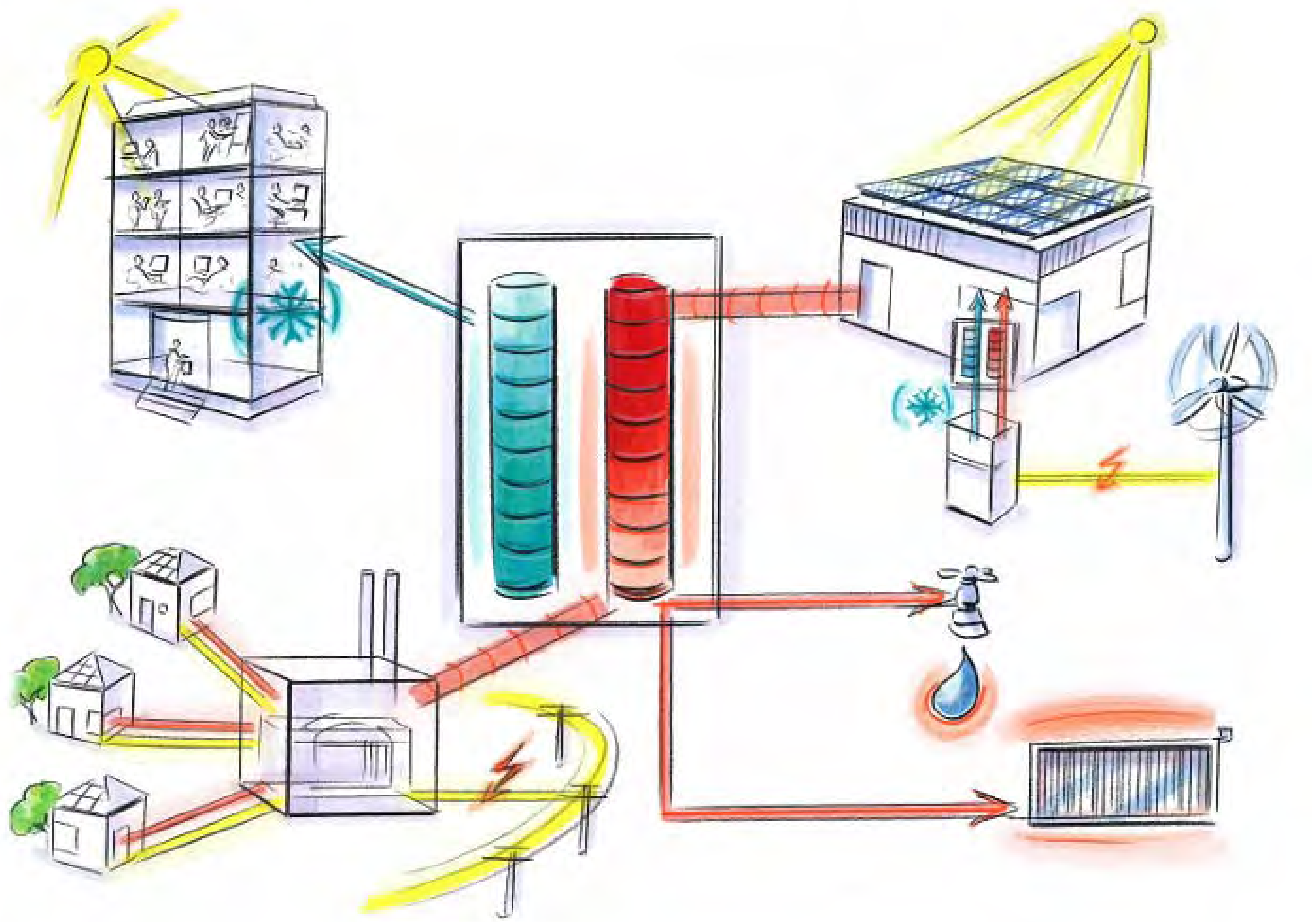
Thermal storages as additional „electric“ storages

Thermal storages with

- heat pumps
- cooling devices
- combined-heat-and-power
- district heating
- domestic hot water
- central /decentral HVAC

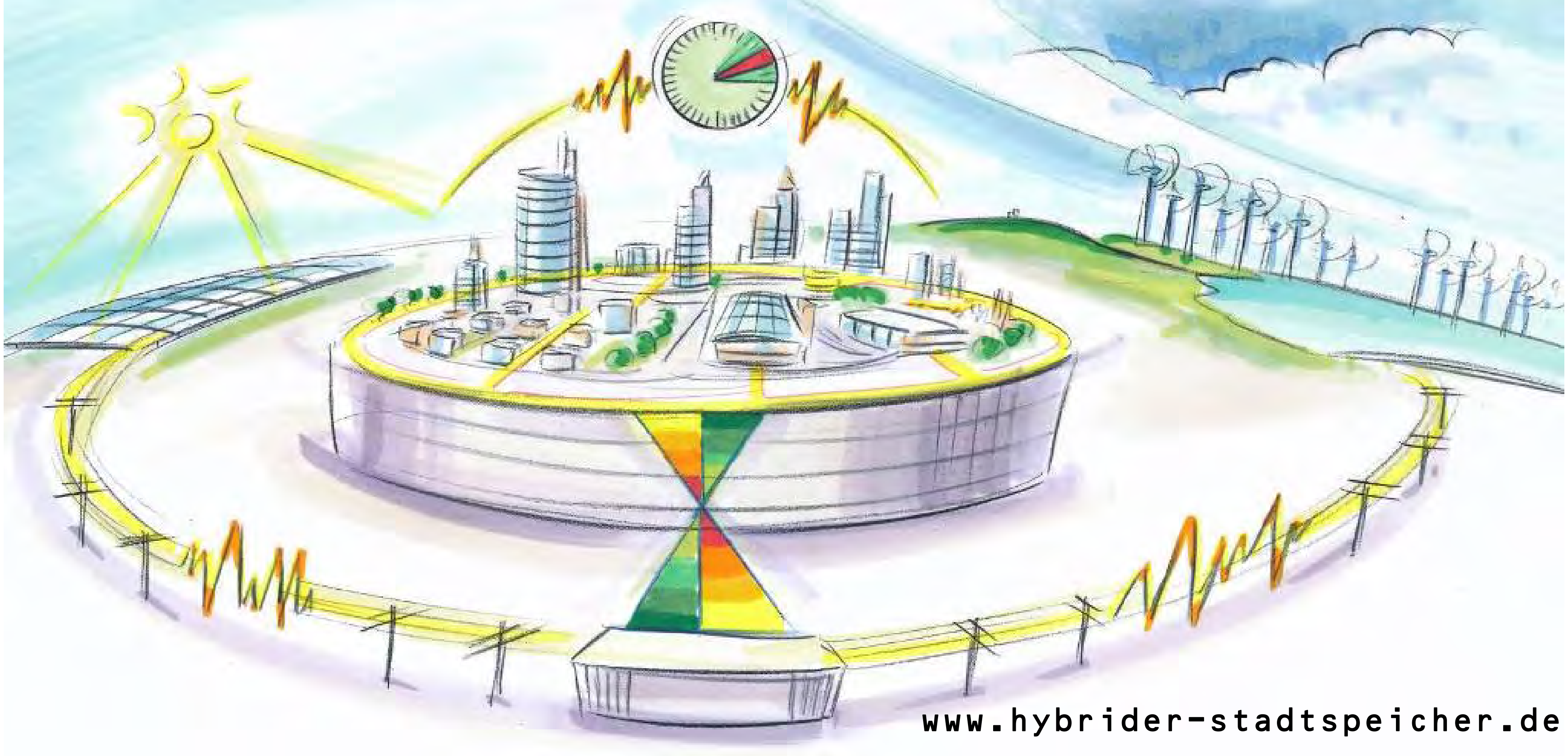
…decouples electric and thermal energy fluxes

…and enables this units to be flexible and to work as “electric” storage



Vision » hybrid urban energy storage «

Realization of high shares of renewable energies by a smart combination of different storages: Few huge centralized storages, some big decentralized storages and many small decentralized storages and virtual storages (incl. thermal storages) **mostly located in the city.**



Fraunhofer UMSICHT

IEA - ECES 26 »Future Electric Energy Storage Demand« - Preface

The main objective of this task is to develop a method or approach to calculate the **regional energy balancing demand** and to derive **regional storage demand** rasterizing the area and taking into account that there are competitive technical solutions.

Additionally there are two important aspects. On the one hand an overview about the different technical and **economical and legal framework requirements** in the different countries.

Case Studies: Running projects, planned projects and future projects of stationary energy storage systems.

And on the other hand **typical operation modes for energy storages** and derived from this typical charge/discharge curves, needed for future standardizations.

ECES 26 »Future Electric Energy Storage Demand« - Work packages

WP 1. Technical and economic framework requirements for electric energy storage systems

WP 2. Calculation Method to determine spatial demand for electric energy storage systems

WP 3. Technical Storage Issue: Application of electric energy storage systems

WP 4. Requirements for test procedures

ECES 26 »Future Electric Energy Storage Demand« - Organization

Operating Agent (Germany)

Dr. Christian Doetsch
Head of Business Unit Energy Efficiency Technologies
Fraunhofer Institute for Environmental, Safety, and Energy Technology UMSICHT,
Osterfelder Strasse 3, 46047 Oberhausen, Germany
Phone. +49 (0) 208 8598 1195
Fax: +49 (0) 208 8598 1423
E-Mail: christian.doetsch@umsicht.fraunhofer.de

Project start:

- Kick-off Meeting, Germany, Oberhausen, 2010-Apr-08
- 2nd Meeting, Spain, Barcelona, 2010-Oct-25
- 3rd Meeting, France, Le-Bourget-du-Lac, 2011-Oct-19/20
- 4th Meeting, Spain, Lleida, 2012-May-14/15
- 5th Meeting, Belgium, 2012-November-06/07

ECES 26 »Future Electric Energy Storage Demand« - Work package 1

WP 1. Technical and economic framework requirements for electric energy storage systems

- **a)** Survey about number, capacity and type efficiency, experience of storage systems
- **b)** Survey about technical key figures of different countries (power plant fleet, grid structure, future scenarios/forecasts)
- **c)** Survey about economic framework requirements (special tariffs/ laws)
- **d)** Assessment and comparison of technical and economical general conditions

Leader work package 1

(interim)
Dr. Bert Droste-Franke
European Academy

Dr. Bert Droste-Franke
Project Coordinator
Europäische Akademie zur Erforschung von Folgen wissenschaftlich-technischer Entwicklungen Bad Neuenahr-Ahrweiler GmbH, Wilhelmstr. 56, 53474 Bad Neuenahr-Ahrweiler, Germany
Phone: +49 2641 973 324
Fax: +49 2641 973 320
E-Mail: bert.droste-franke@ea-aw.de

ECES 26 »Future Electric Energy Storage Demand« - Work package 2

WP 2. Calculation Method to determine spatial demand for electric energy storage

a) Survey/assessment of different methods to estimate the demand of energy storages
b) Development of a detailed methodology to estimate regional demand for energy storages in Germany (incl. needed model simplification, assumptions)
c) Development of a simplified methodology to estimate regional demand for energy storages in other countries (incl. needed model simplification, assumptions)
d) Competing technologies (shares depending on economics)

Leader work package 2

Dr. Yvonne Scholz
(new and former)
DLR - GERMANY

Yvonne Scholz
Institute of Technical Thermodynamics, Systems Analysis and Technology Assessment (TT-STB), German Aerospace Centre, Pfaffenwaldring 38-40, 70569 Stuttgart, Germany
Phone: +49 (0) 711 6862-296
Fax: +49 (0) 711 6862-747
E-Mail: yvonne.scholz@dlr.de

ECES 26 »Future Electric Energy Storage Demand« - Work package 3

WP 3. Application of electric energy storage systems

a) Survey of estimations (of other groups) about the future energy storage demand
b) Examination of (typical) applications (today/future)
/ business cases for storage systems
c) Case studies
d) Competing technologies (grid extension, DSM, curtailment) and interfaces
to smart grids (control method, Information transfer etc.)

Leader work package 3

(interim)
Dr. Grietus Mulder
VITO, Belgium

ECES 26 »Future Electric Energy Storage Demand« - Work package 4

WP 4. Requirements for test procedures

a) Overview about current technologies

b) Definition of typical applications and operation modes for energy storages

c) Deriving typical charging/discharging cycles for these applications

d) Guidelines for testing energy storage systems

Leader work package 4

Dr. Marion Perrin
INES-CEA - FRANCE

ECES 26 »Future Electric Energy Storage Demand« - Next Steps

Next Steps / Outlook

- Finalizing data for the survey about current technologies (WP1)
- Developing a first model for simulating (spatial) energy storage demand (WP2)
- Collecting data to running case studies (WP3)
- Attracting more industrial partners
- collaborative publications in or between work packages, e.g.
  WP1: “Survey about storage capacities, grid structure and power plant fleet”
  WP2: “Total and spatial grid balancing demand in Germany in 2030”
  WP3: “Meta-study/survey about worldwide energy storage demand”
  WP4: “typical applications and operation modes for energy storages”

Next Meeting

5^{th} Meeting: 2012-Nov-06/07 at EASE (Brussels) and VITO (Mol, Belgium)

ECES Annex 26 »Future Electric Energy Storage Demand«
Participating Research Centers / Companies

Fraunhofer UMSICHT

cea ines INSTITUT NATIONAL DE L'ENERGIE SOLAIRE

DLR

EUROPÄISCHE AKADEMIE zur Erforschung von Folgen wissenschaftlich-technischer Entwicklungen Bad Neuenahr-Ahrweiler GmbH

vito vision on technology

iSEA

VTT

EVONIK INDUSTRIES

VORWEG GEHEN

Fraunhofer IOSB

tu technische universität dortmund

e-it Fakultät für Elektrotechnik und Informationstechnik

SAMSUNG

Birthplace of S&T Entrepreneurship KIST

e.on

NEXT ENERGY

EWE

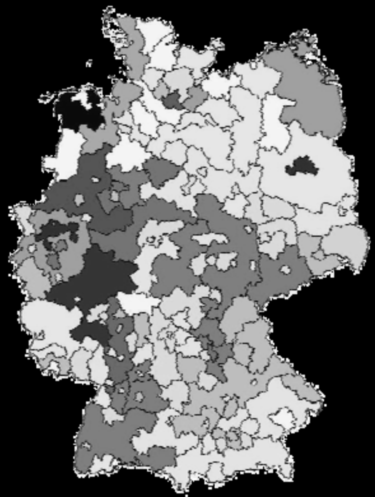
Participants of eces26

[2012-May-14/15 4th Meeting, Lleida Spain]

Fraunhofer UMSICHT
Osterfelder-Straße 3
46047 Oberhausen
www.umsicht.fraunhofer.de

Dr. Christian Doetsch
Tel.: +49 208 8598 1195
christian.doetsch@umsicht.fraunhofer.de

Fraunhofer
UMSICHT



IEA eces26

Dr. Christian Doetsch
Tel.: +49 208 8598 1195
christian.doetsch@umsicht.fraunhofer.de