Hoe houden we het duurzame elektriciteitssysteem betrouwbaar: Super-grid, opslag, demand response

KIVI NIRIA, EU-2050 Power Lab, Utrecht

Prof.ir. Mart van der Meijden

25 november 2013

Met dank aan

Ir. Jillis Raadschelders, DNV KEMA

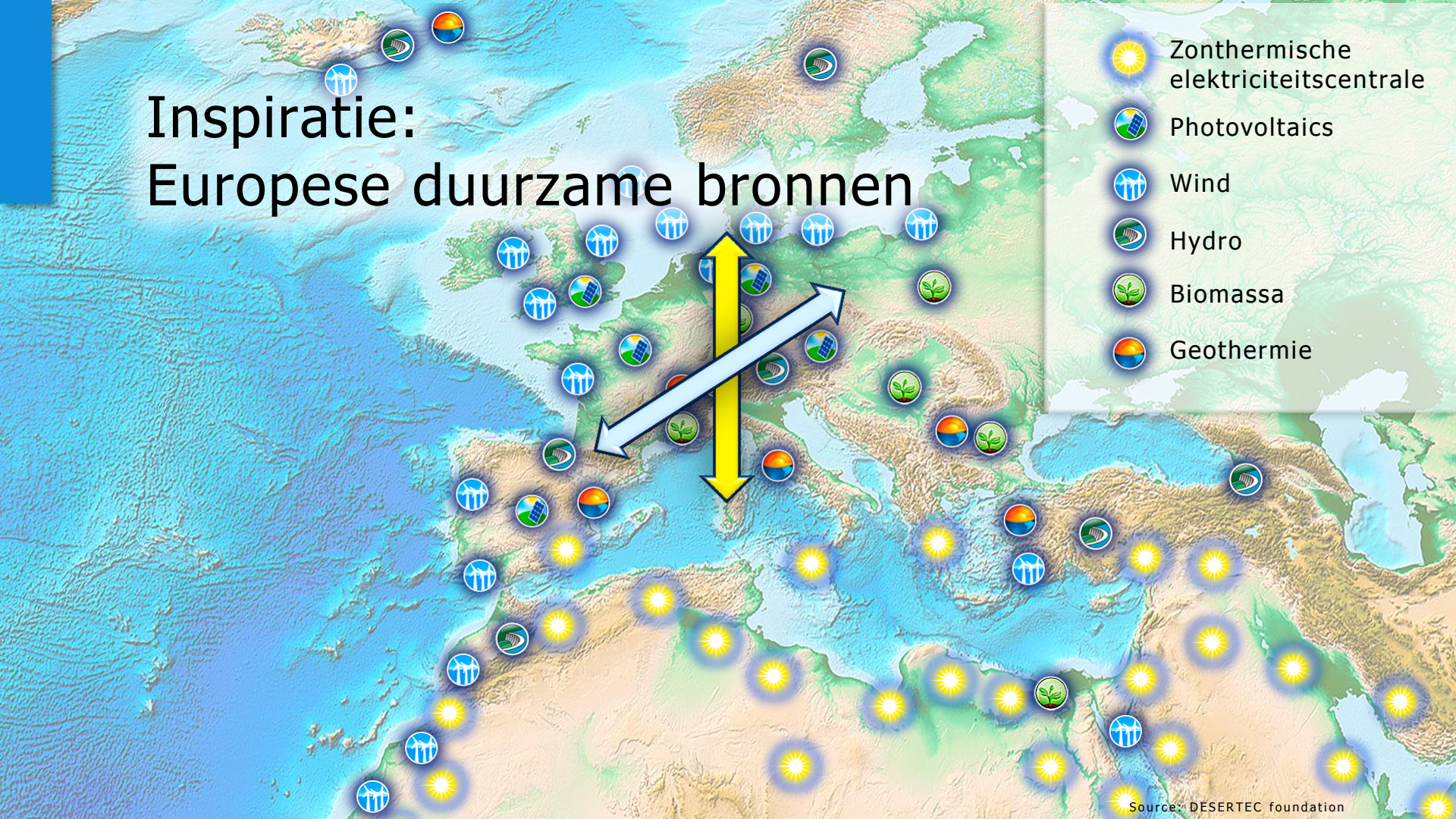
Prof. Dr. René Kamphuis, TNO/TU-Eindhoven

Ir Peter Molengraaf, CEO Alliander

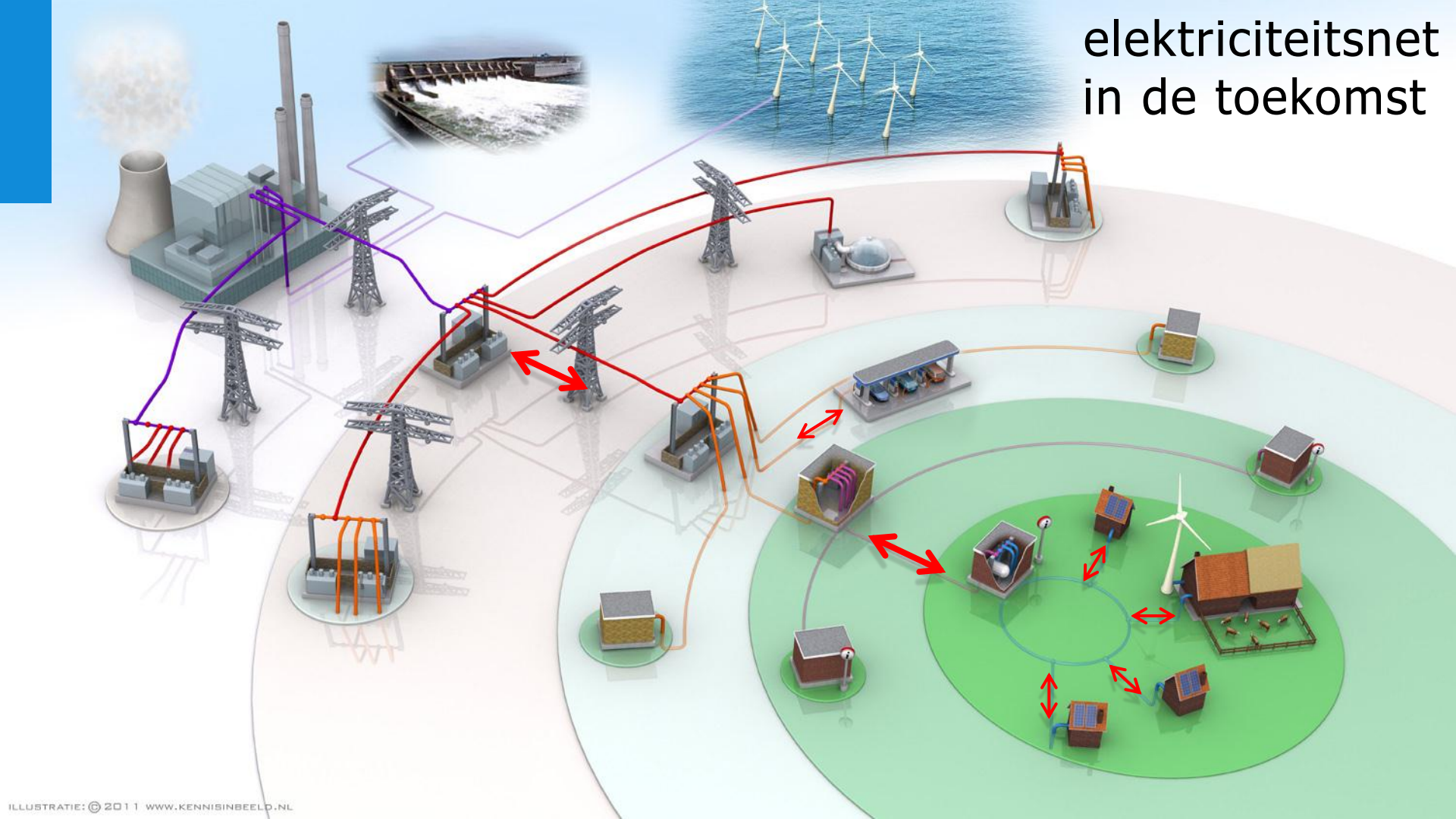
E-Bridge/UMS group

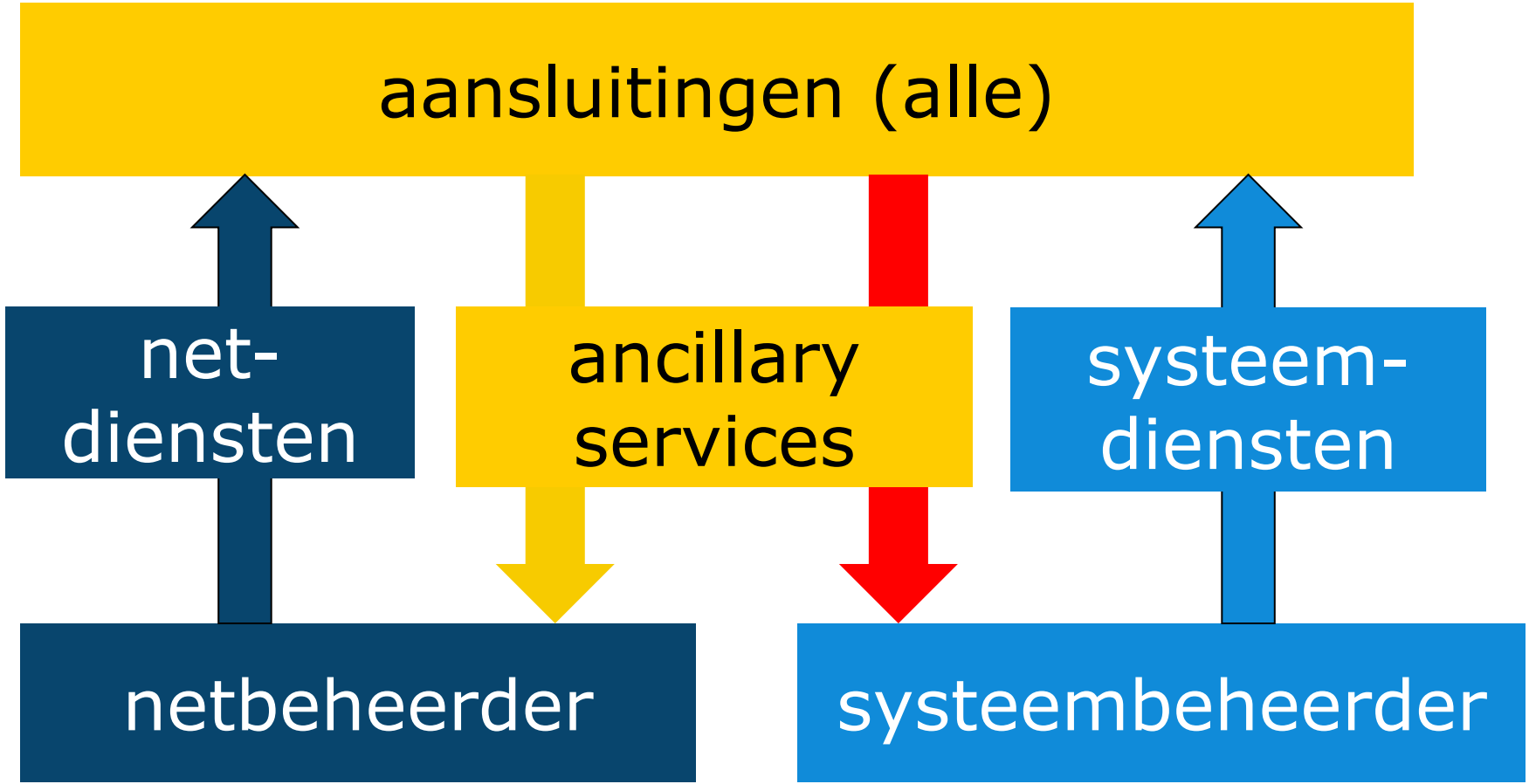
TUDelft/TenneT

Inspiratie:
Europese duurzame bronnen



elektriciteitsnet in de toekomst




aansluitingen (alle)
net-
diensten
ancillary
services
systeem-
diensten
netbeheerder
systeembeheerder

“Energy Storage in 2050?”

JILLIS RAADSCHELDERS — DNVKEMA, Arnhem

Utrecht, donderdag 16 mei, 2013

KIVI NIRIA

KEMA DNV

Summary

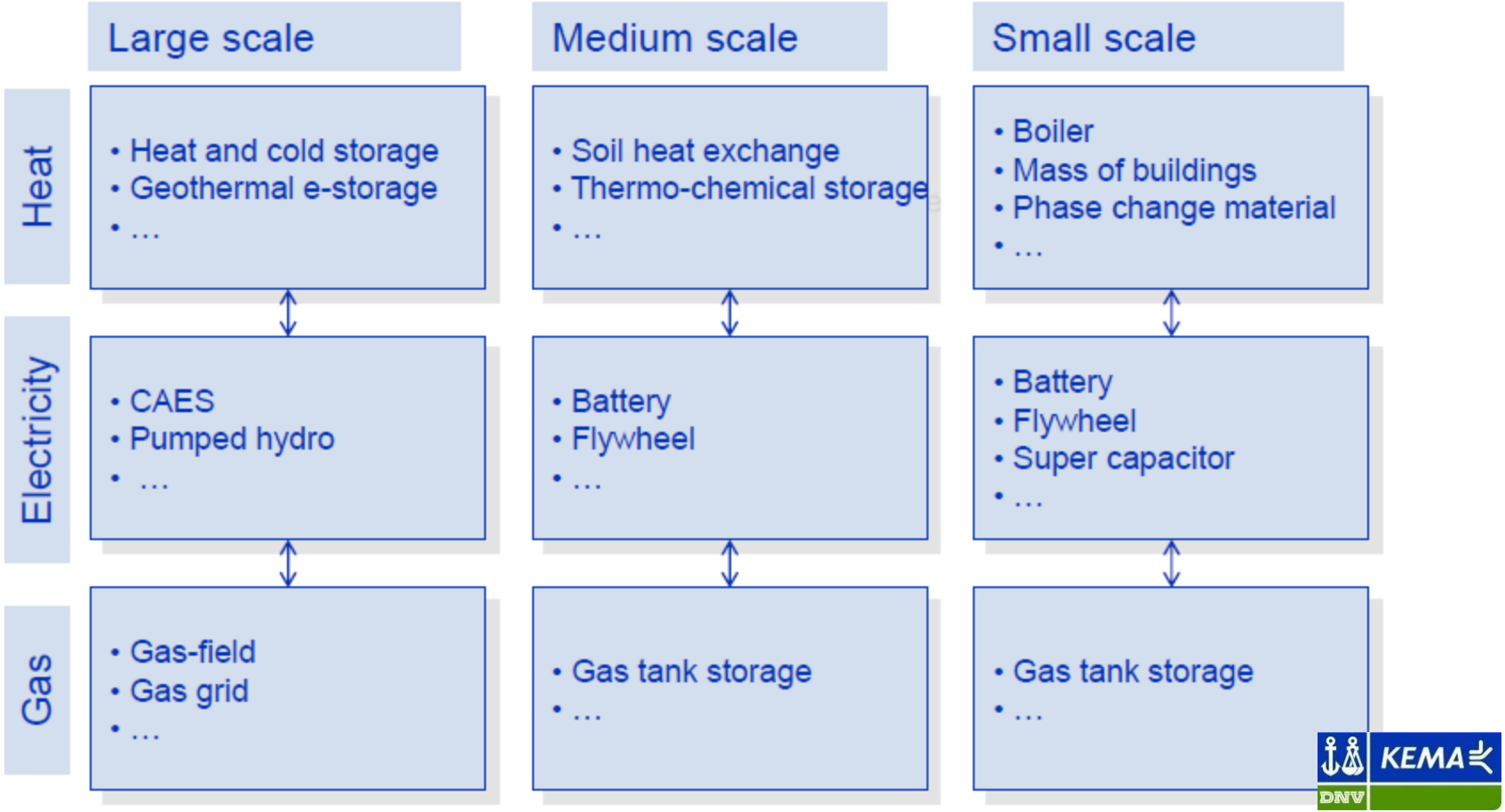
- Energy Storage means: Electricity but also gas, oil, heat & cold
- Storage on Transmission level & Distribution level
- “Storage” is not a value proposition, Flexibility or System Services are.
- Challenge is economical, not technical, value is differentiated over many stakeholders
- Storage needs to compete on Level Playing Field (not yet established)
- Storage adds cost to the energy system, but is required for 100% renewable
- Private Households may/will invest in DG-Storage combi.
- Technology development takes > 15 years, honoring the “10 times” rule-of-thumb

KEMA DNV

More flexibility is needed
some alternatives

1. Fast controllable power generation (and/or curtailment of e.g. wind power)
2. Increase interconnection capacity
3. Smart integration of DG, mainly small RES
4. Demand response, demand side management, and an active participation of end-users
5. **Energy storage**

Energy storage at three levels



TU/e Technische Universiteit Eindhoven University of Technology

TNO innovation for life

Demand response: Needs and possible realisation

René Kamphuis, bijdrage Duurzame elektriciteit in 2050; KIVI/NIRIA

Utrecht, May 16th 2013

Trias energetica (2020)

1. Increase efficiency of energy usage

2. Use renewables

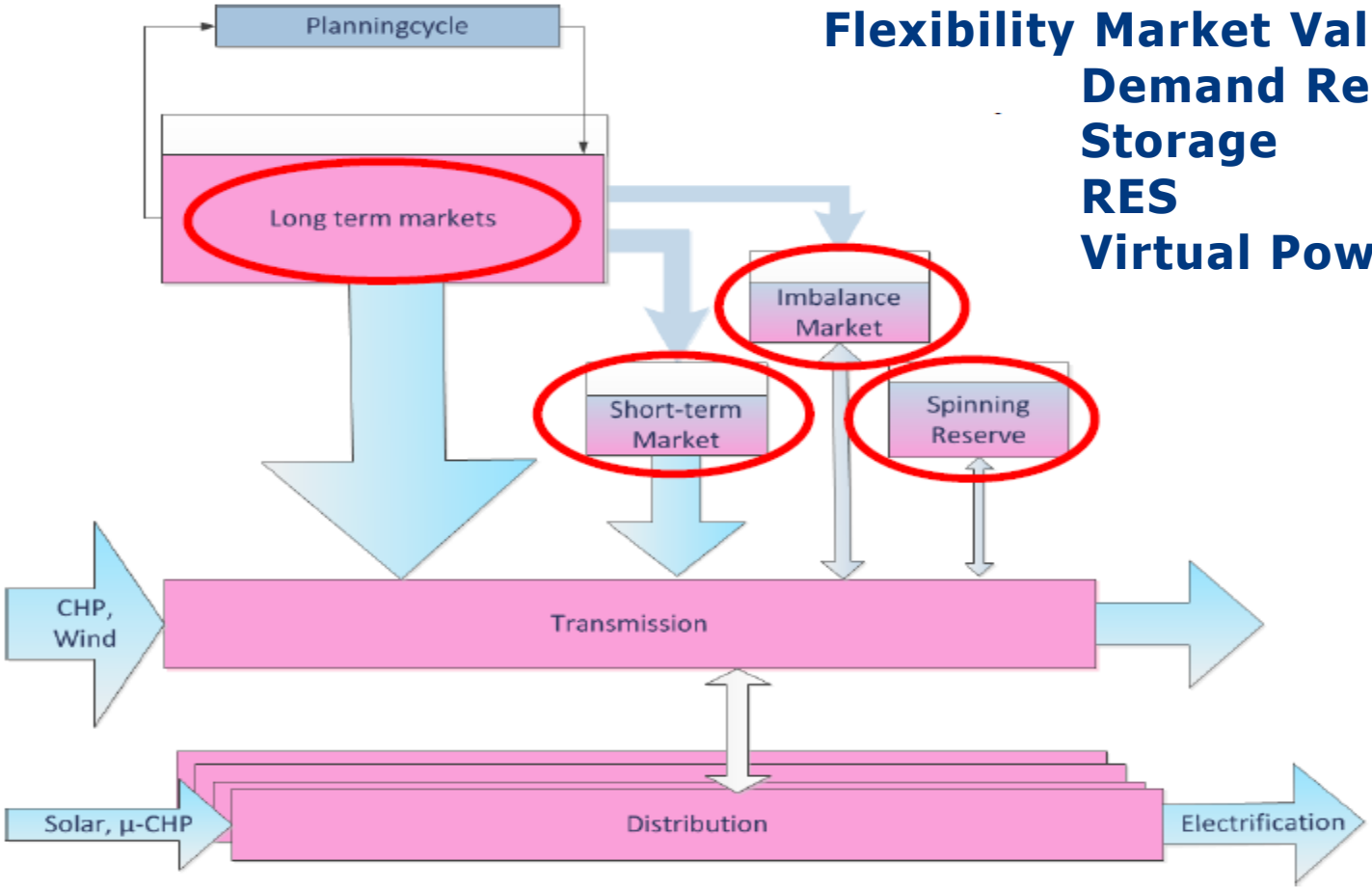
3. Clean usage of fossil fuels

37 percent of renewable electricity

Drivers for demand response on the system level

- Matching load and generation on:
  - The European level
  - The national level
  - The regional level
- Role in several phases of operation:
  - Normal operation
  - Capacity management/critical operation
  - Gracefull degradation; load shedding
  - Power Outage/Black start
- Reduce grid and backup investments
- Less reserve power and curtailment of renewables
- Consumer participation

Flexibility Market Value of
Demand Response
Storage
RES
Virtual Power Plants



“In 2023 gaat de lamp uit!”

2 oktober 2013 Ridderzaal

Peter Molengraaf

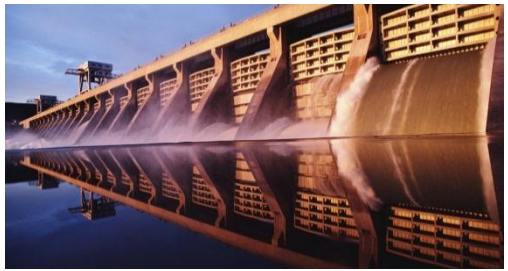
INNOVATIECONFERENTIE
Netherlands Academy of Technology and Innovation

Zowel bedrijven als huishoudens zullen er aan moeten wennen dat de prijs van Elektra per 15 minuten gaat variëren:

- **Momenten dat het niks kost**
- **Momenten dat het onbetaalbaar is**

2 oplossingsrichtingen:

- **Variabele tarifering**
- **Opslag van energie**



White Paper on a Sustainable Design of Electricity Markets

- Challenges from Renewables and Guidelines for a Sustainable Market Design

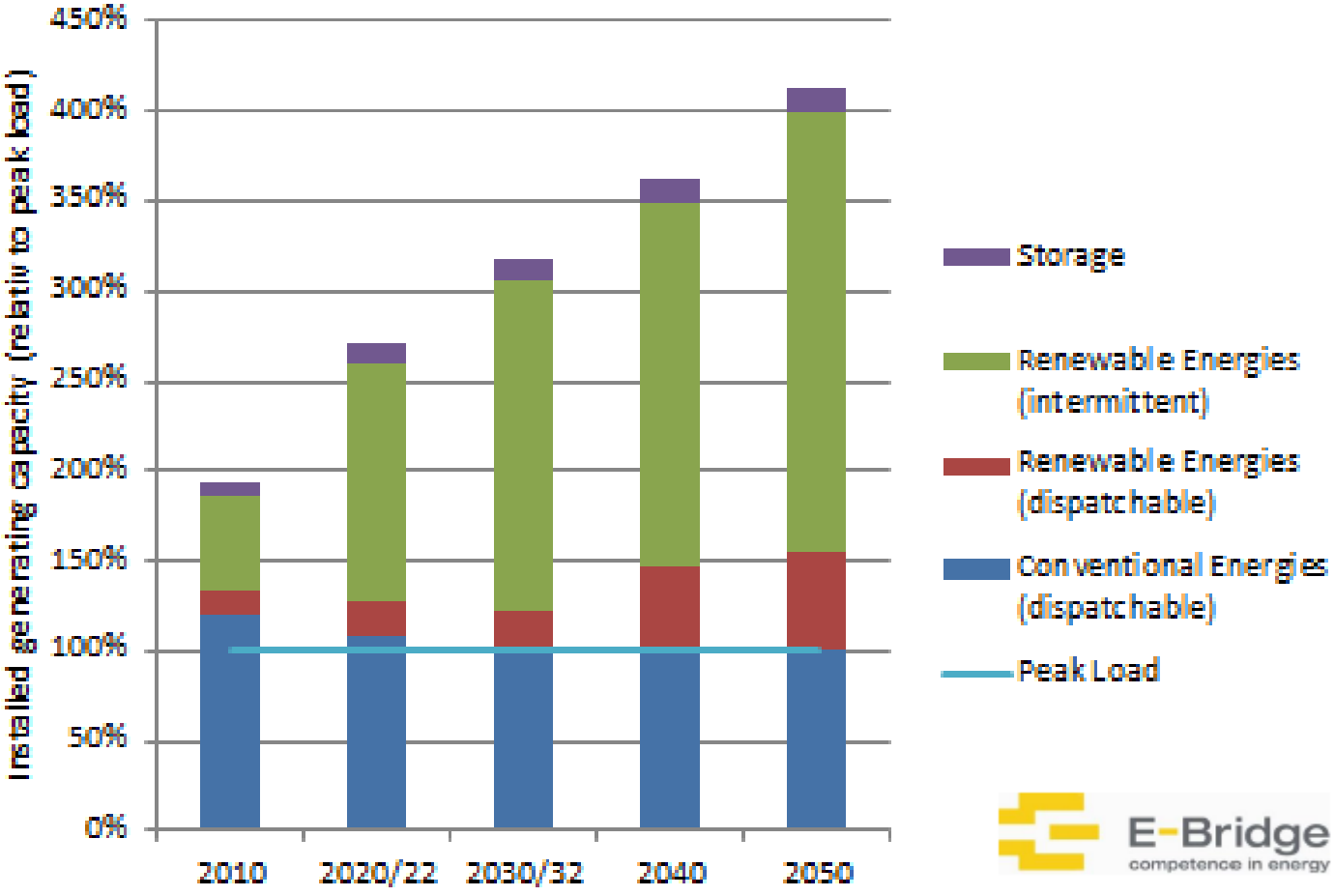
- Dr. Jens Büchner, Remco Frenken, Dr. Vigen Nikogosian, Prof. Dr. Frank A. Wolak

- 15 November 2013

E-Bridge competence in energy

UMS group

http://www.tennet.eu/nl/en/news/article/tennet-describes-requirements-for-a-sustainable-market-design.html



[Source: Netzentwicklungsplan 2012; Leitstudie BMU 2011]

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The five guidelines for a sustainable market design

1

Strengthening of the „Energy-Only-Market"

Stimulate market parties to fulfill their balancing obligations

Full integration of renewables into the energy market

2

Enhancement of the support mechanism for renewable energies

Creation of a social consensus on penetration targets and a desirable speed of renewables

Revise support mechanism in order to facilitate the attainability of the penetration targets and to introduce increased competition among the RES

3

European coordination of security of supply

Ensuring the feasibility and consistency of the national energy policy targets within the European internal energy market

Ensuring national supply security interests are met

4

Monitoring of the functioning of the electricity market

Monitoring of the effectivity of the network expansion

Monitoring of the requirements for the long-term security of supply

5

Creating a possibly temporary safety net as a safeguard against a potential market failure (consisting of a "physical safety net capacity" and a "long-term futures contract obligation")

Summary: Challenges of the future

Policy

Economy

Technology

Dank voor uw aandacht