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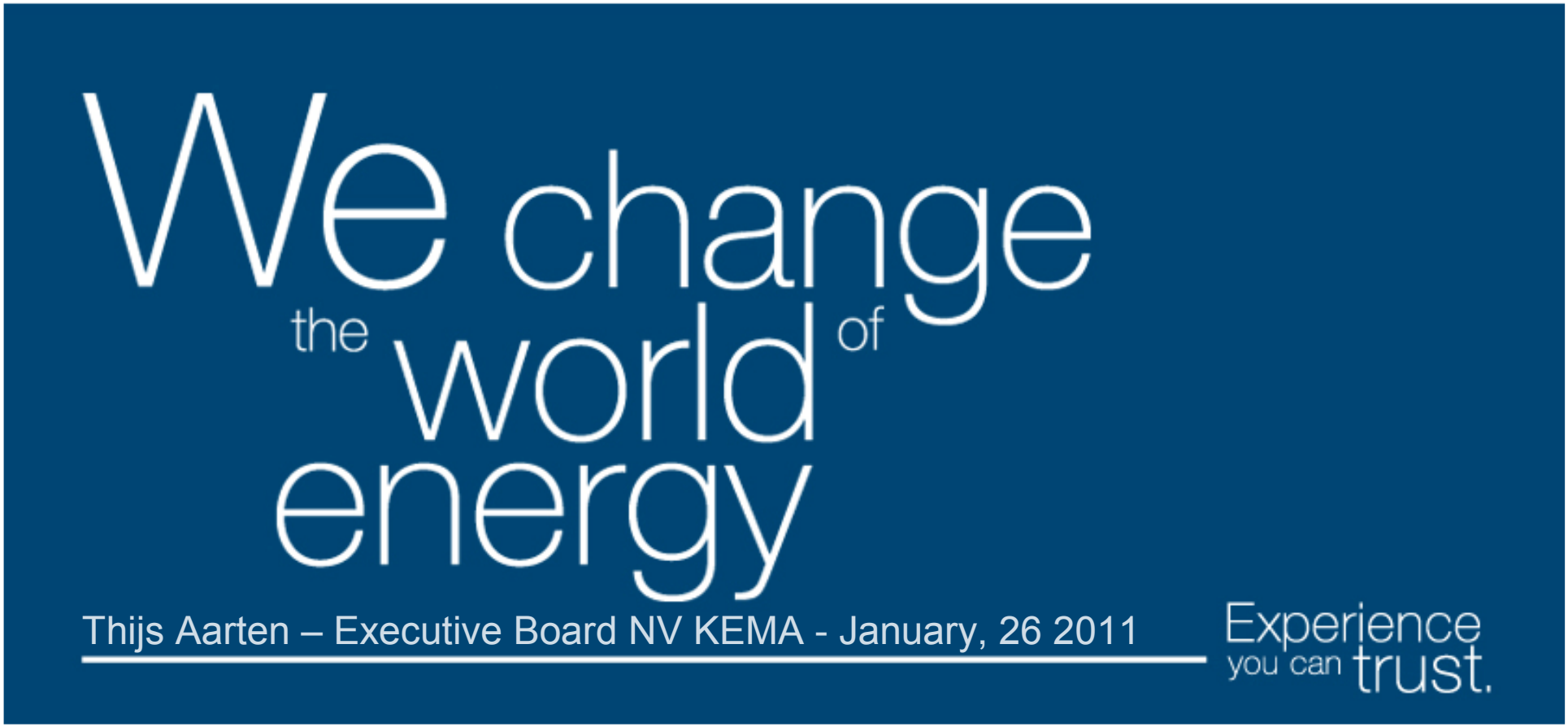
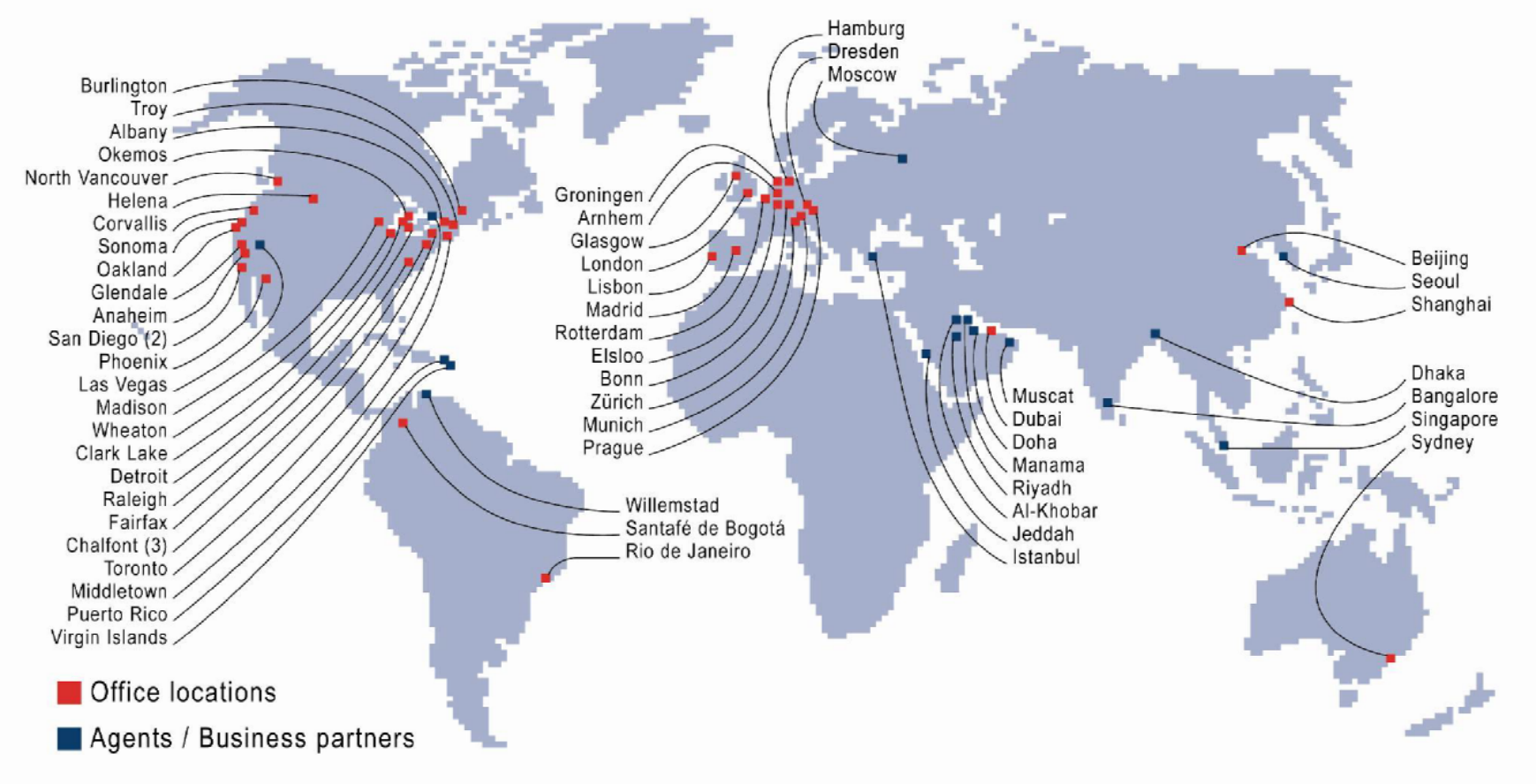
Smart Grids – The Enablers of the Energy Transition



KEMA Around the Globe



- Since 2008 we served more than 1600 different customers in more than 100 countries
- More than 1700 staff with offices and representation in more than 20 countries

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This is a view on the globe, but what about our global view on the energy transition?

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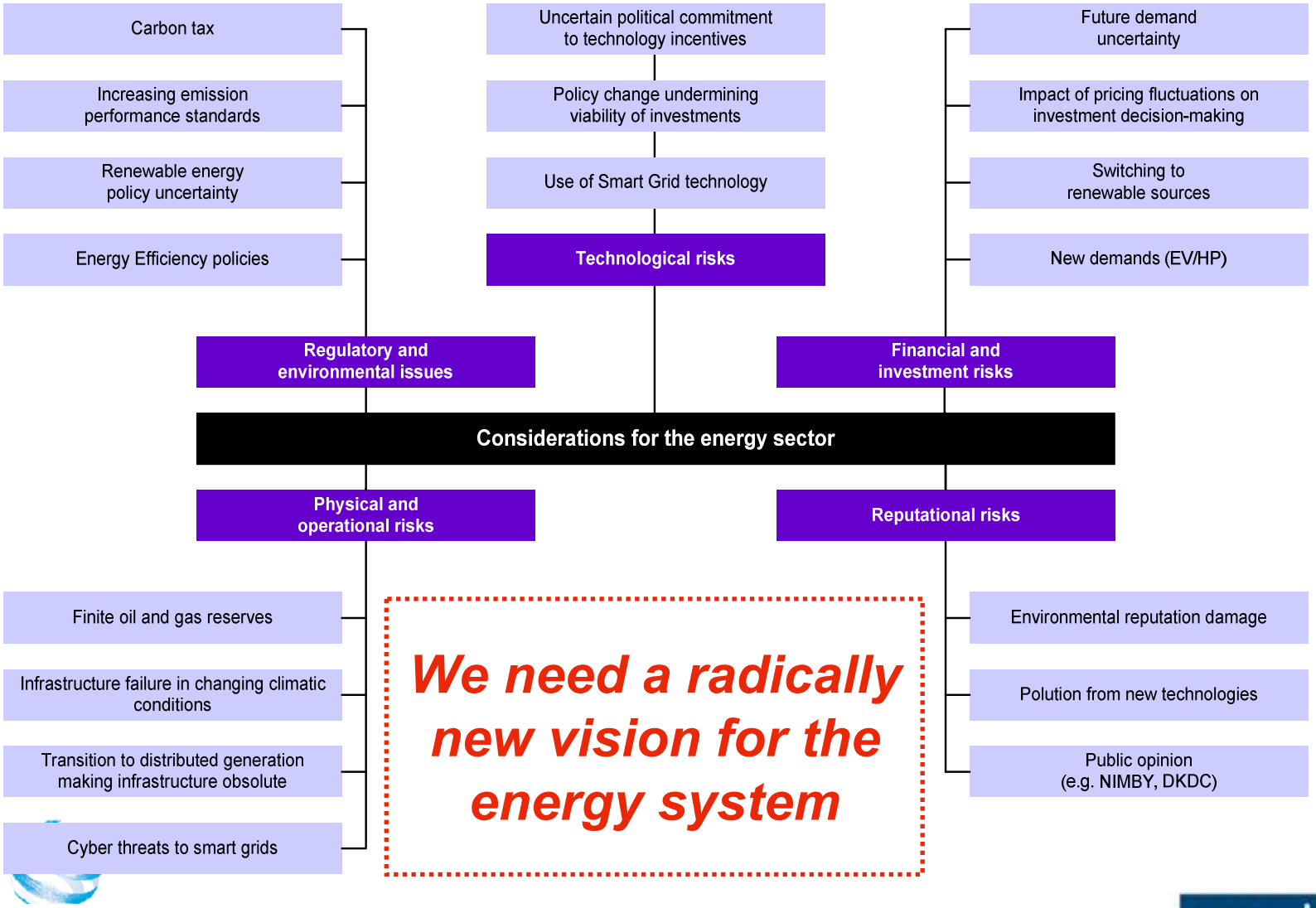
The Energy Landscape



Source: based on Lloyd's 360° Risk Insight

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Few Recent Quotes

- ‘Ringing the alarm bells’- Fatih Birol, chief economist of the IEA in latest WEO 2010
- European Commission unveils EUR 1 trillion Energy 2020 strategy
- The infrastructure package presented by Günther Oettinger – EU Energy commissioner – showed with regard to electricity the “4 electricity corridors”:
  - Connect onshore wind power of the North sea and the hydro-storage site in Scandinavia and the Alps with the main consumption centers in the heart of Europe
  - Connect RES in the South of Europe with the North
  - Achieve better East-West and North-South connections
  - Complete the Baltic Energy Market integration plan

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Let’s focus on Europe first

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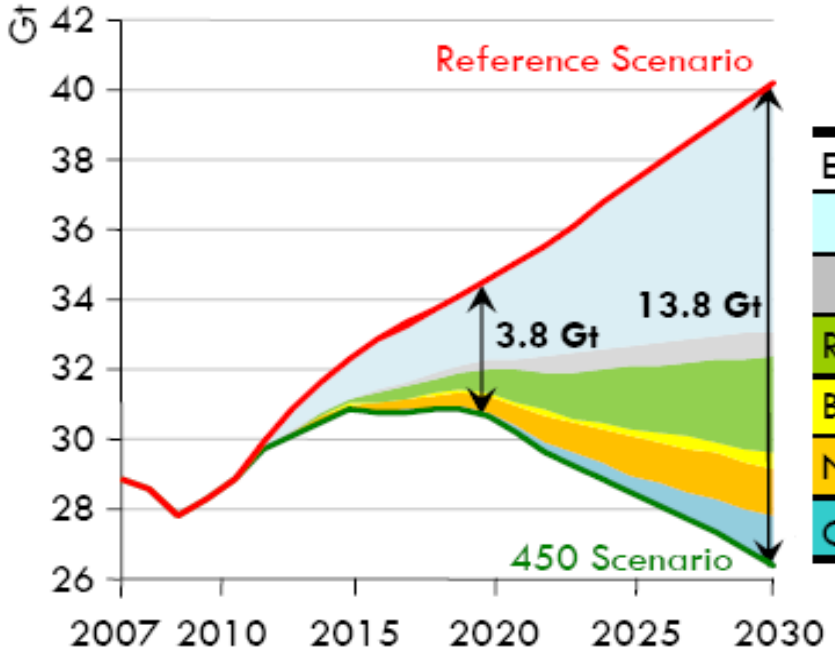
Sustainable Power Generation is becoming a significant player in the energy mix …

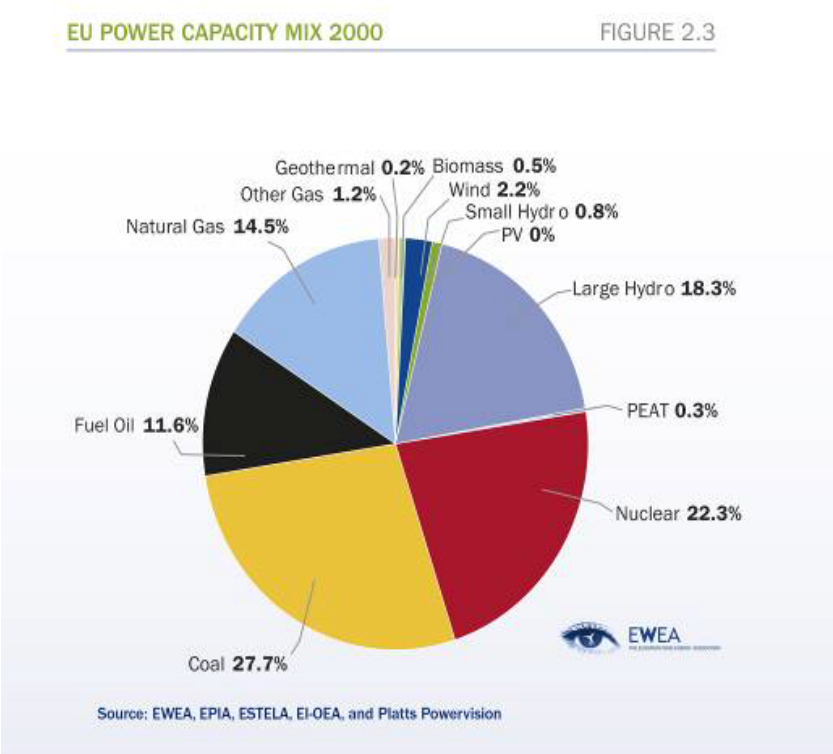
- Europe shows active energy policy (20-20-20)
- Transition to renewables has started

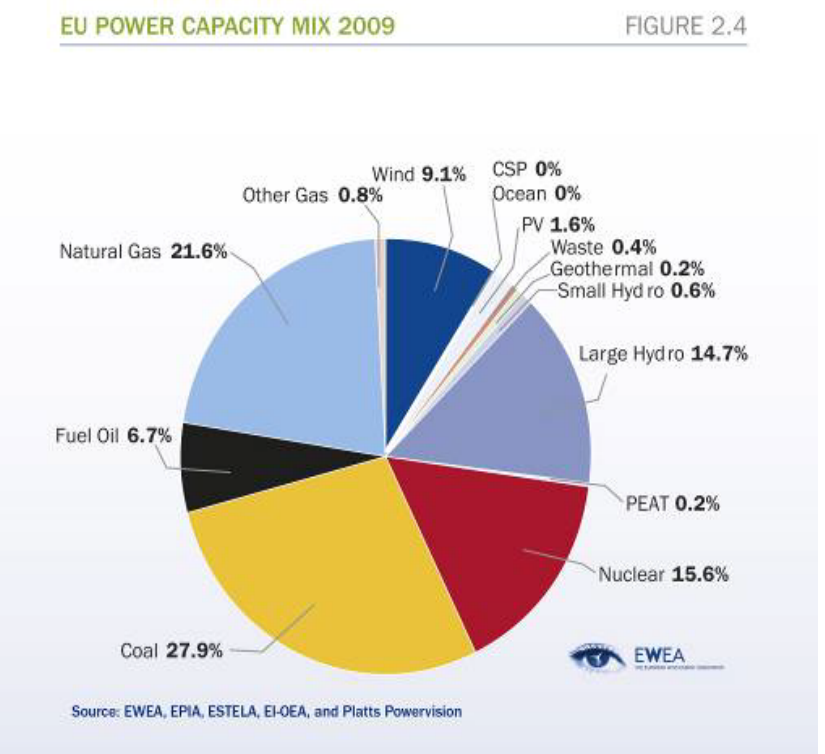


Share of abatement %	2020	2030
Efficiency	65	57
End-use	*59*	*52*
Power plants	*6*	*5*
Renewables	18	20
Biofuels	1	3
Nuclear	13	10
CCS	3	10

Source: IEA/OECD World Energy Outlook 2009

… as the transition to a sustainable energy system just started …





Source: EWEA, EPIA, ESTELA, EI-OEA, and Platts Powervision

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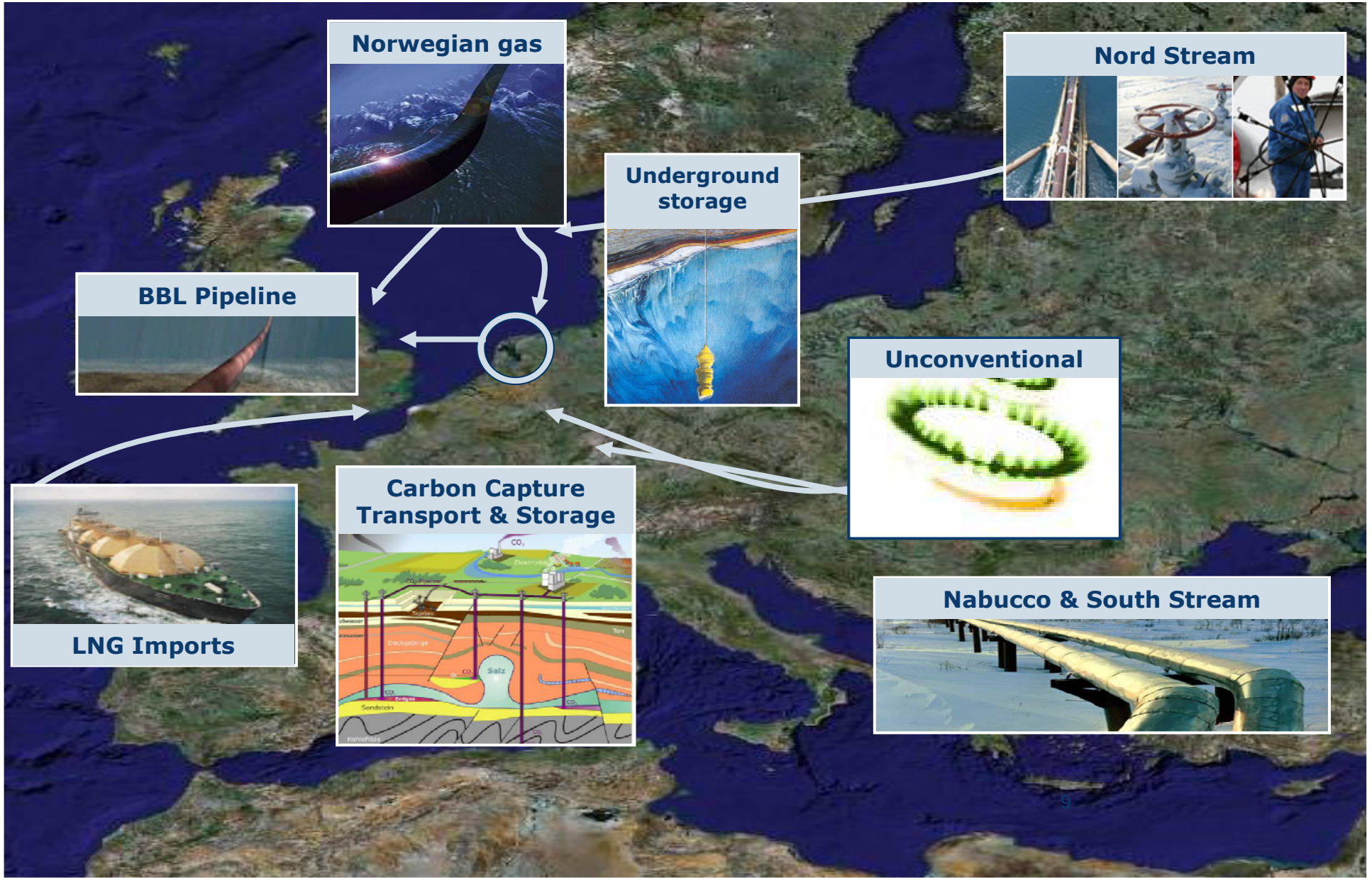
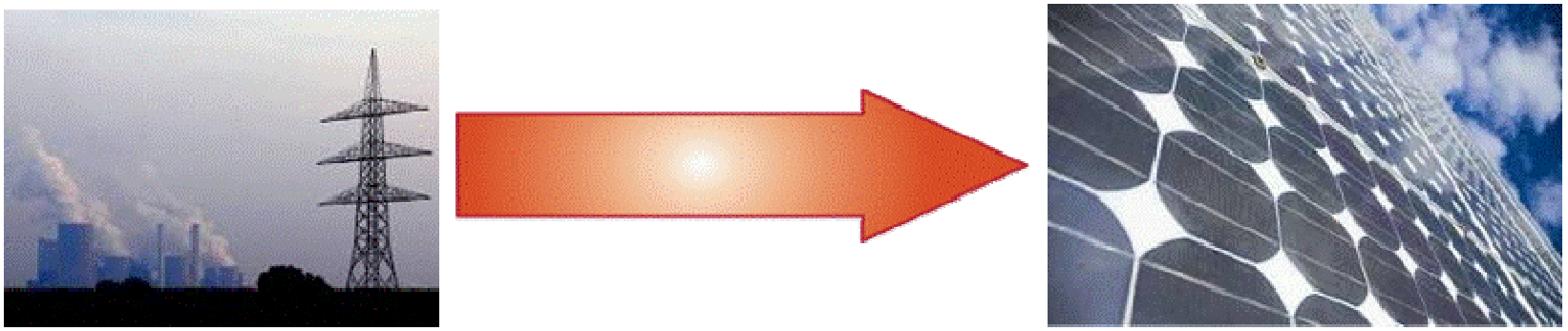
… with gas being a transition fuel



The energy transition will cause major changes in the power system …

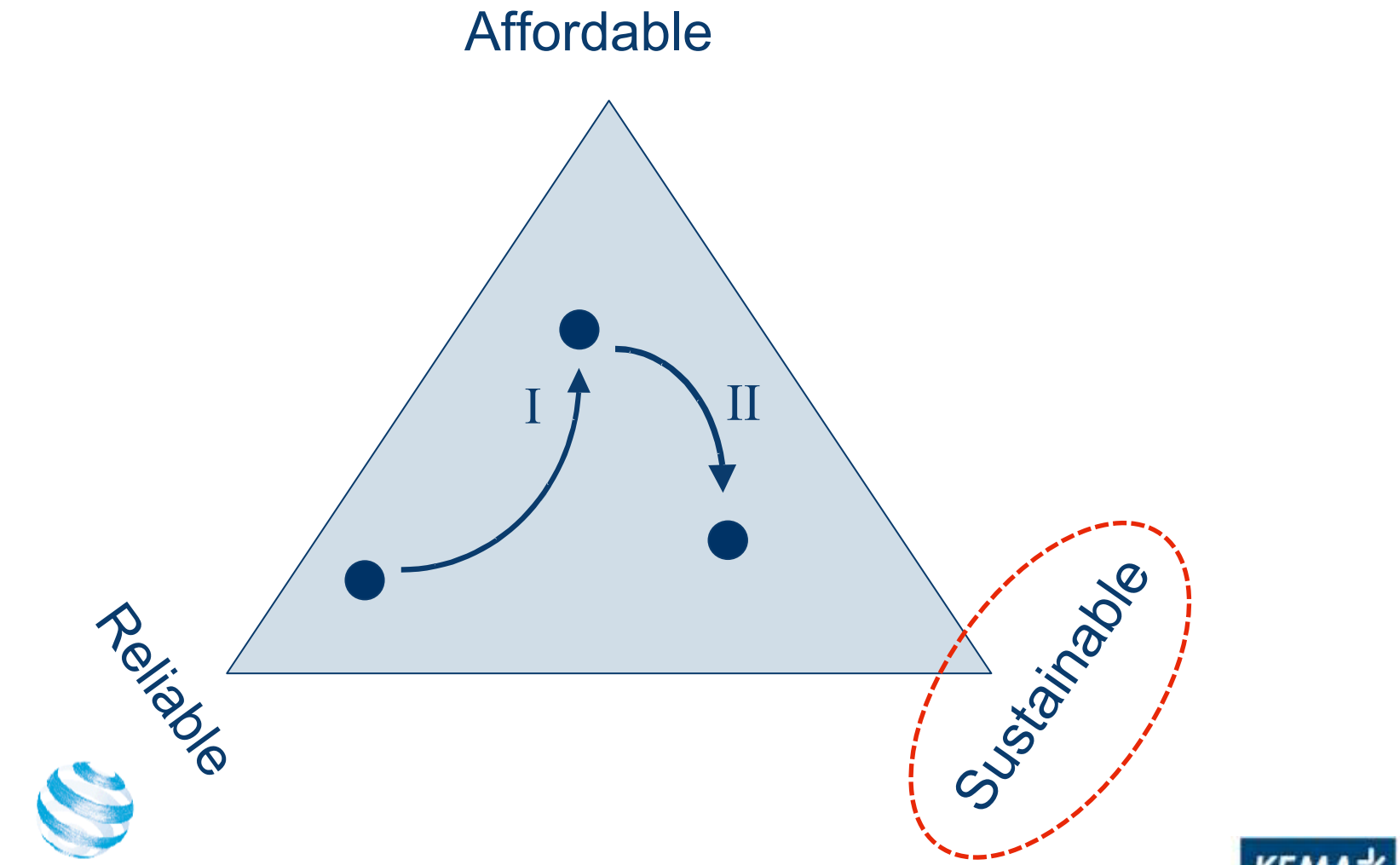
- Many small scale (renewable) power generators will be added to fewer large scale power plants
- Increased local matching of demand and supply → smart distribution grids
- In Europe large power plants will move to the coast and away from load centers → more cross border transmission for which multi-national thinking is needed
- Addition of RES will result in the creation of integrated/inter-connected supergrids



… and will result in more uncertainty, everywhere

- More fluctuation in supply and in demand → less predictability
- Fuel shift (oil for electricity)
- ‘Electrification’ of energy demand → greater dependence on power quality and security of supply
- Consumers become producers → effect on power flow as well as energy market, and therefore need to develop new market mechanisms

Focus in the energy market is changing …



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… but how to keep the ‘triangle’ in balance?

With billions of end-users, having different needs …

… which might change during the energy transition phase?

More flexibility is needed
some alternatives

1.

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 mgt, and an active participation of end-users
5. Energy storage

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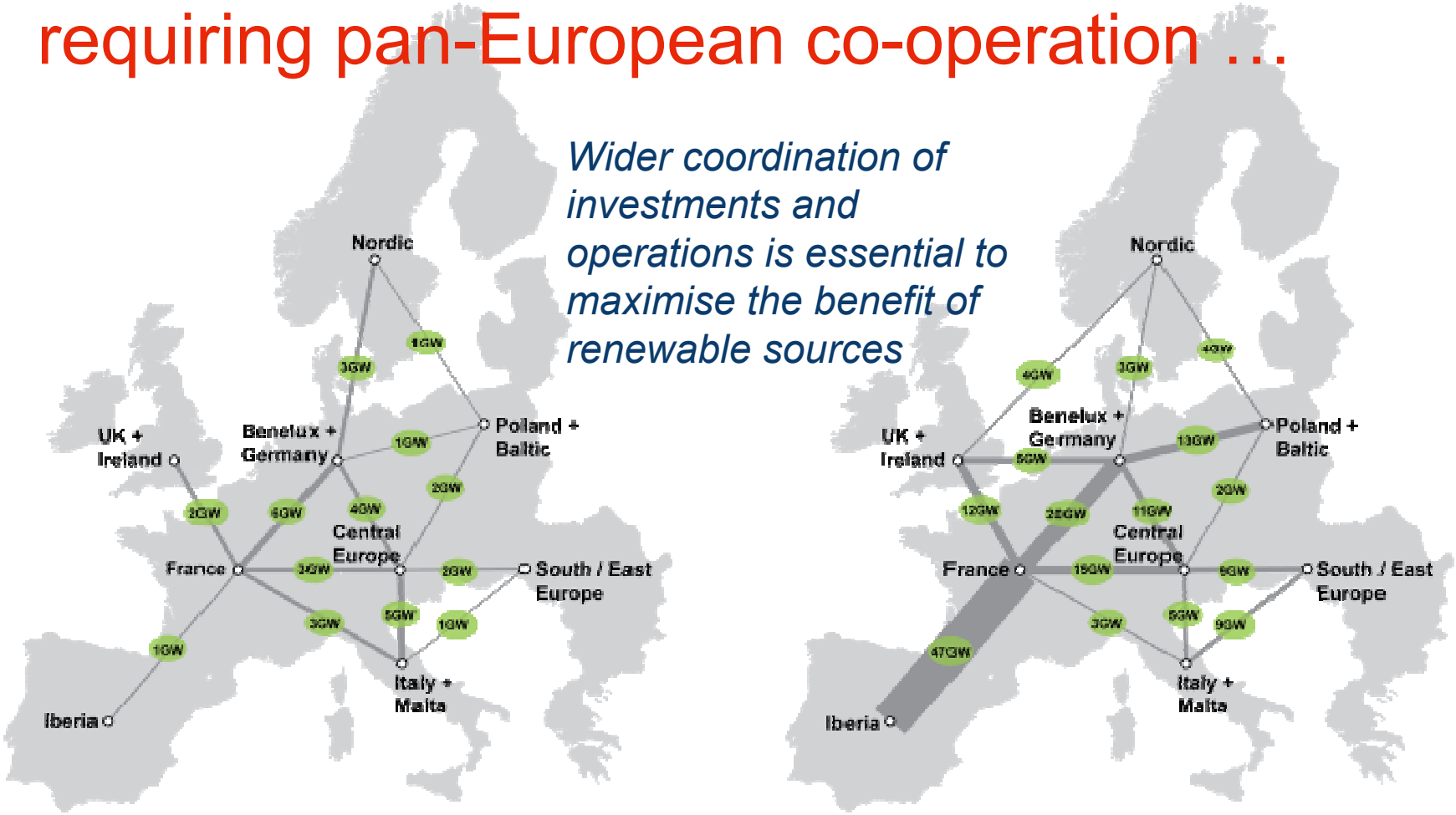
2. Increase of interconnection capacity, requiring pan-European co-operation …

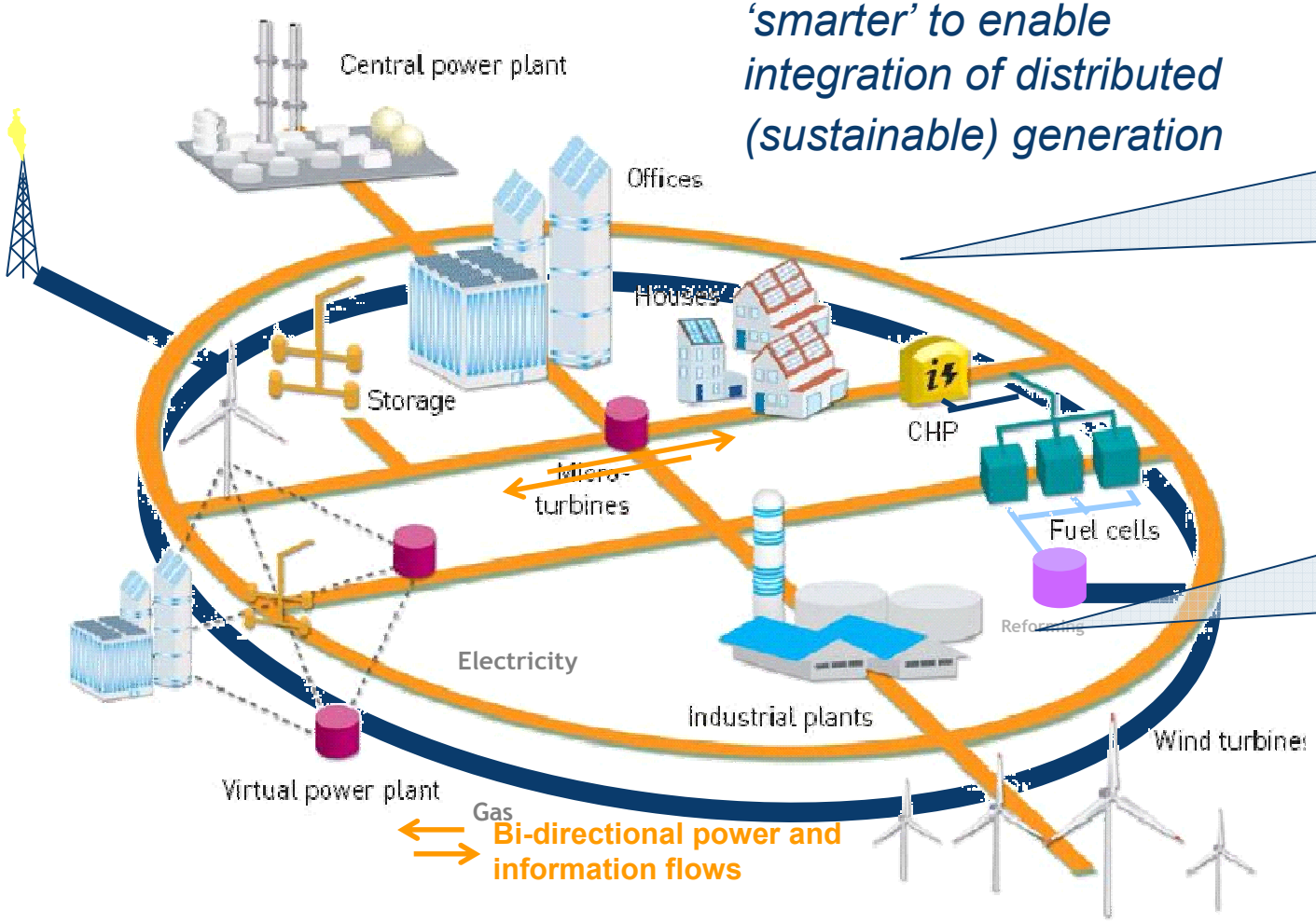
Wider coordination of investments and operations is essential to maximise the benefit of renewable sources



Source: ECF – Roadmap 2050, A practical guide to a prosperous, low-carbon Europe

3. Smart integration of distributed generation and new services locally …

Distribution grids should be 'smarter' to enable integration of distributed (sustainable) generation



Some challenges: less predictable generation, less predictable load, network overload risk, …

New services can be offered: real time pricing, local energy storage, smart charging, …

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4. Demand response, and active participation of end-users

Prosumers.

Passive consumers become participating producers what will affect power flow and the energy market, requiring development of new market mechanisms

5. Existing and new types of E-storage

- Electricity storage is well-established practice …

- … but is developing fast in new markets

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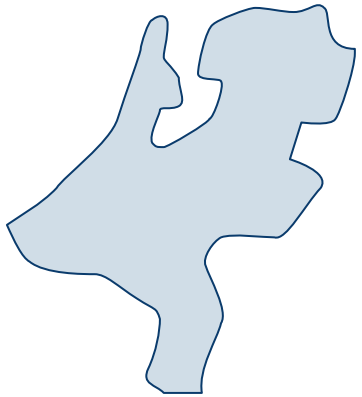
What is happening in the Netherlands



‘Klein, maar fijn’

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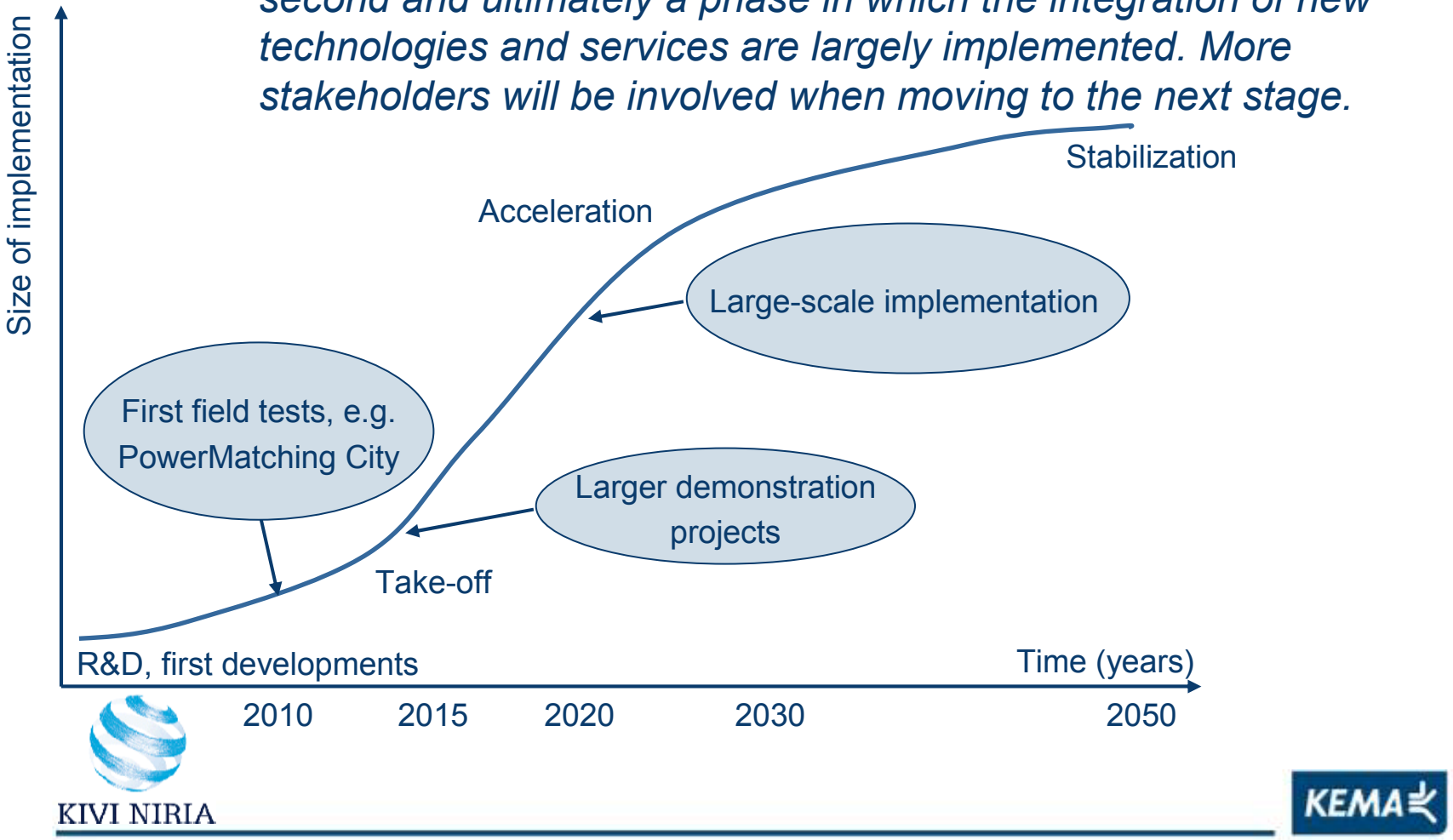
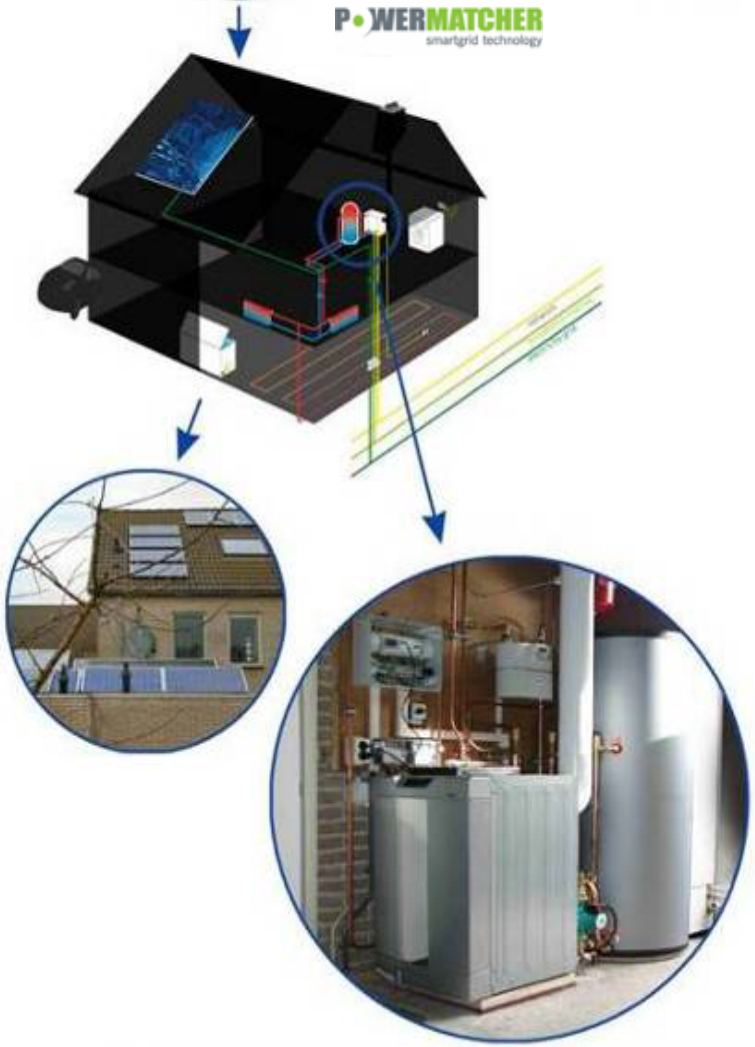
Moving from R&D to commercial application

A typical transition towards smart distributed energy systems needs small-scale field tests first, large demonstration projects second and ultimately a phase in which the integration of new technologies and services are largely implemented. More stakeholders will be involved when moving to the next stage.



PowerMatching City – Hoogkerk (Groningen)



First Full Scale Dutch Smart Grid Living Lab Demo

25+ regular Households

- 50% µCHP
- 50% Hybrid Heat Pump Systems
- Solar-PV
- Wind (Kreileroord)
- Electric Cars
- Smart Appliances (Washing Machines, Smart Freezer)
- mini Gas Turbine

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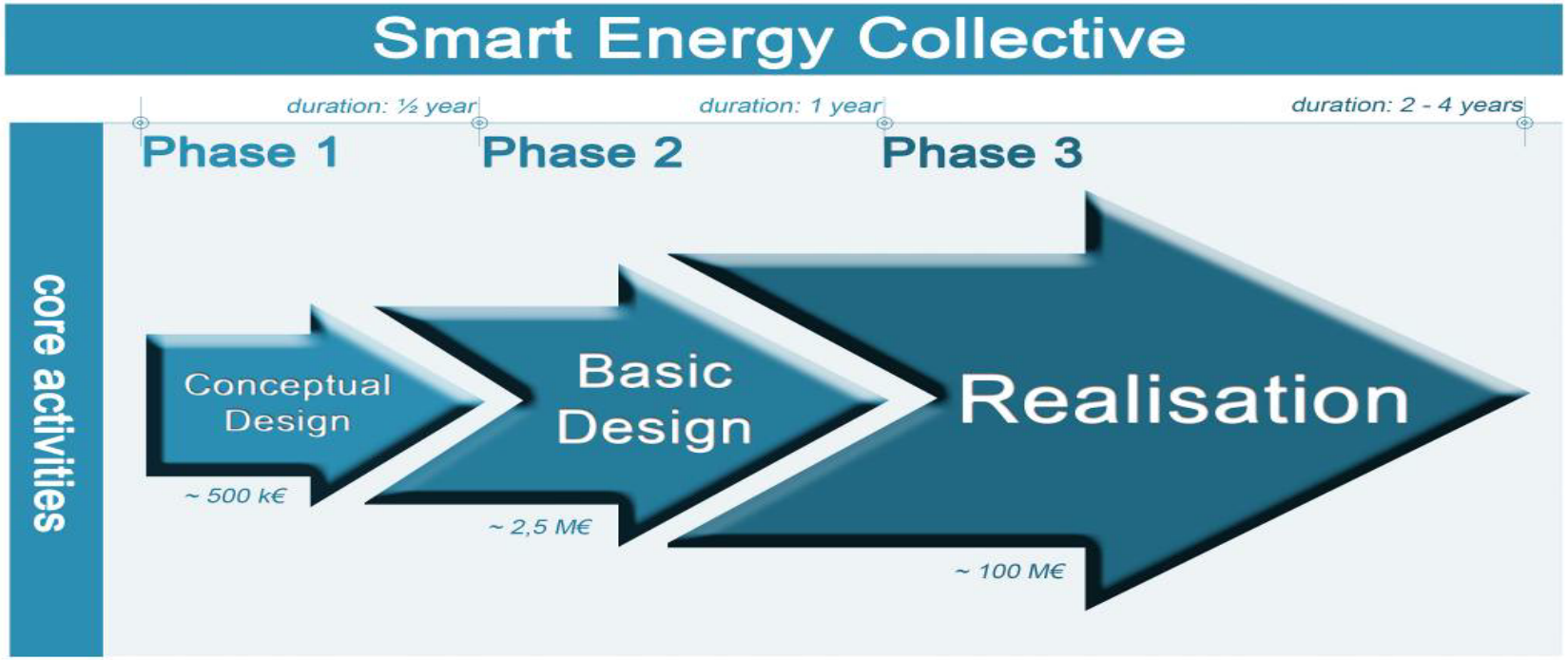
Full-scale demonstration of 5,000 Smart Grids connections in three phases

Smart Energy Collective



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NXP · PHILIPS sense and simplicity · Rabobank · SIEMENS · smartdutch · STEDIN · TenneT Taking power further · unica installatiegroep

Concluding remarks

Energy Transition

- From a centralized, one-directional energy system …
- … To a partly decentralized, two-directional system

Energy Sector

- The future energy system will embrace
  - Automotive industry and transportation sector
  - Building industry
  - End-users, and its behavior

'Soft' Enablers

- A common vision
- Collaboration, and open innovation
- Societal permission

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Happy New Year

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