The importance of markets for the emergence of SmartGrids

Pier Nabuurs

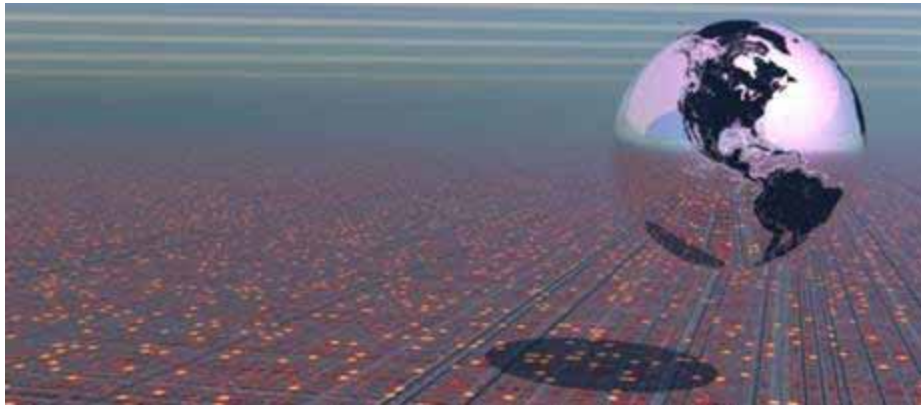
i-SUP 2008

April 22-25, 2008, Bruges, Belgium

Overview

- Rise of “Smartgrids”
- Technical developments
  (context EU, national and local markets)
- Changes needed in regulation to integrate DER/RES and influence of support schemes on their integration
- Investments needed in the EU (ageing) network and business models for DER integration

Rise of “Smartgrids”



There are remarkable changes ahead…

… a paradigm shift

…the Third Industrial Revolution

Prof Jeremy Rifk

A definition for a Smartgrid?

A Smartgrid facilitates generation and distributes electricity more effectively economically, securely, and *in a sustainable way.* It integrates innovative tools and technologies, products and services, from generation, transmission and distribution all the way to and from consumer appliances and equipment using advanced sensing, communication, and control technologies." (EPIC, San Diego, adapted)

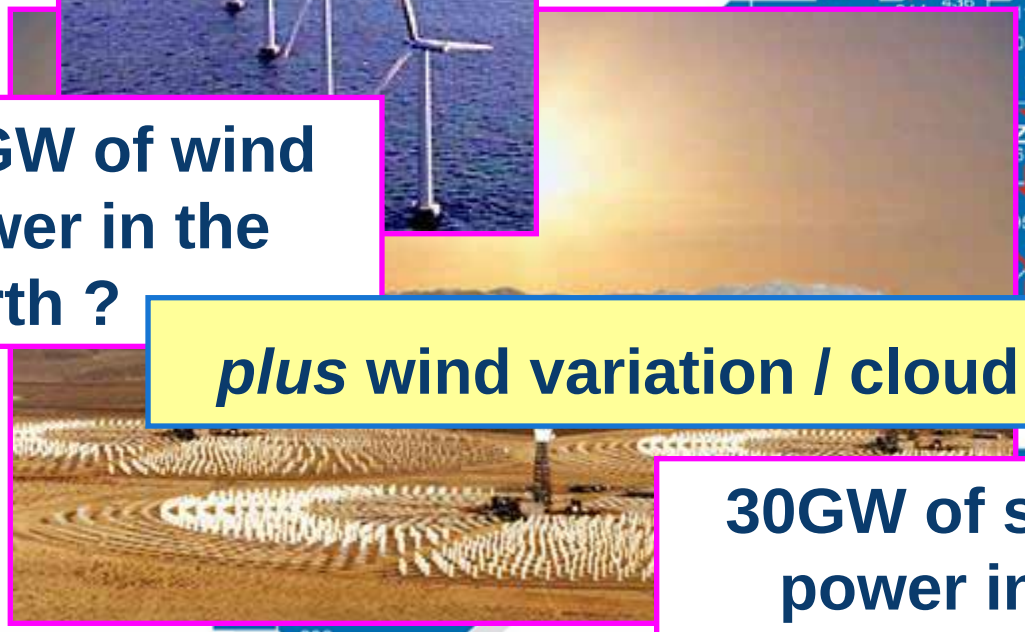
Characterised by:

- Two-way distribution flows
- Less distinction between T & D
- Customer information
- Customer participation
- Variability & intermittency
- 'Internet-like'

Utilising:

- Renewable Energy Sources
- Micro-generation and CHP
- ICT & Power Electronics
- Energy storage
- Transport integration

/here will power flow in 2020 & beyond ?



Customer Interaction and Intelligent Appliances

GW of wind ower in the orth ?

***plus* wind variation / cloud cover / customer choice…**

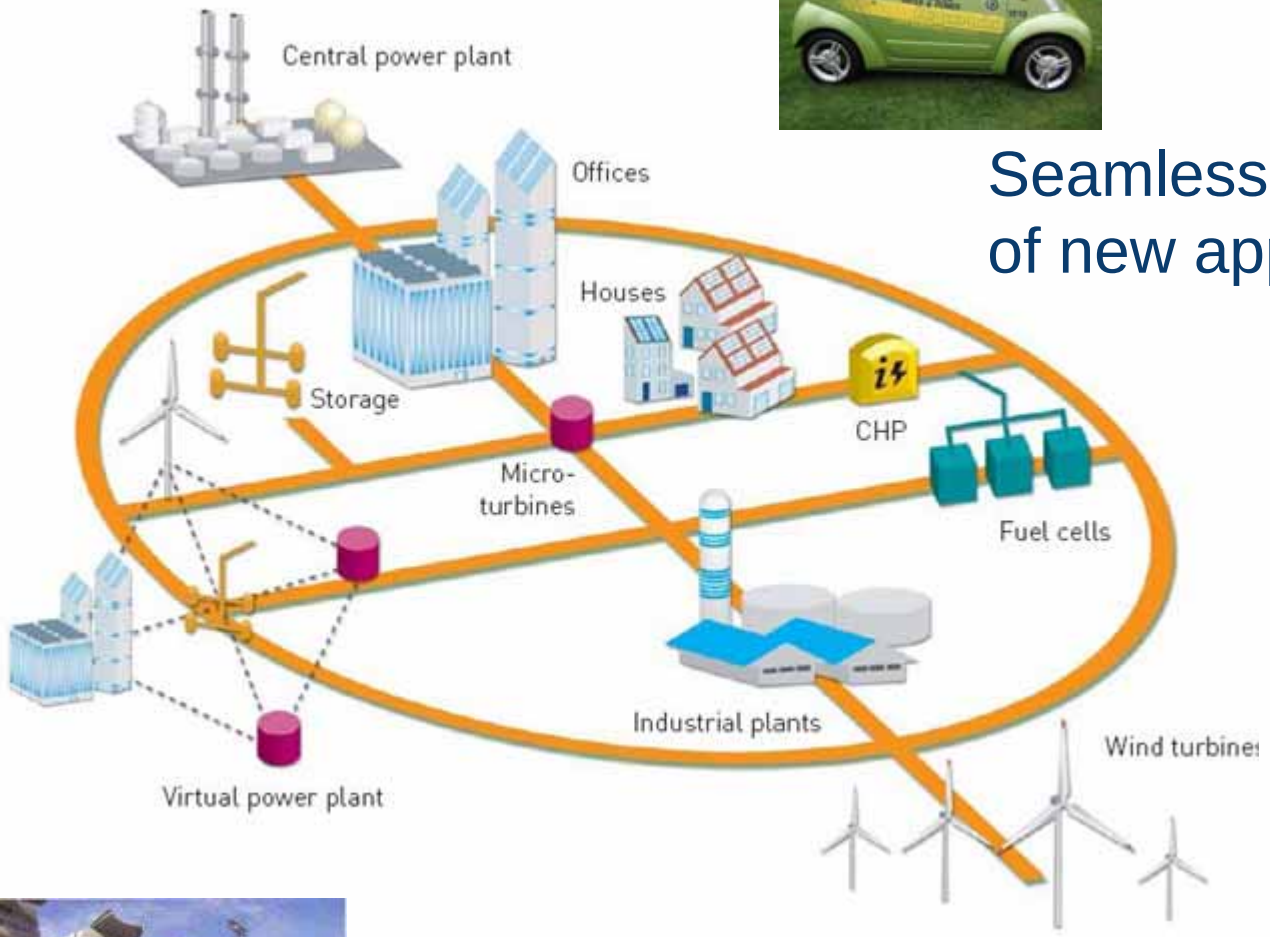
30GW of solar power in the South ?

MicroCHP and PV

A more Internet-like power grid emerges

End user real time
Information & participati

Seamless integration
of new applications



Central & Dispersed
intelligence

Smart power
electronics

Central & Dispersed sources

KEMA

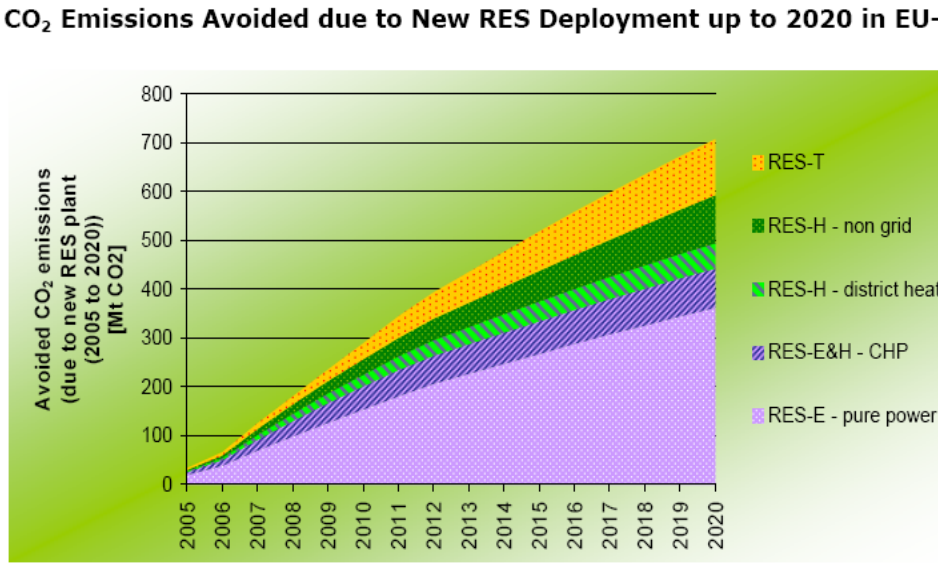
Technical developments

Electric utilities are cautious in the use of new technology

- Long term investments
- Limited competition (grid companies)
- Liberalisation has made utilities more reluctant towards innovation
- Lock-in
  - Distribution companies
  - Regulators
  - Technology supplier
- Lack of incentives

Changes needed in regulation to achieve EU/national 2020 targets

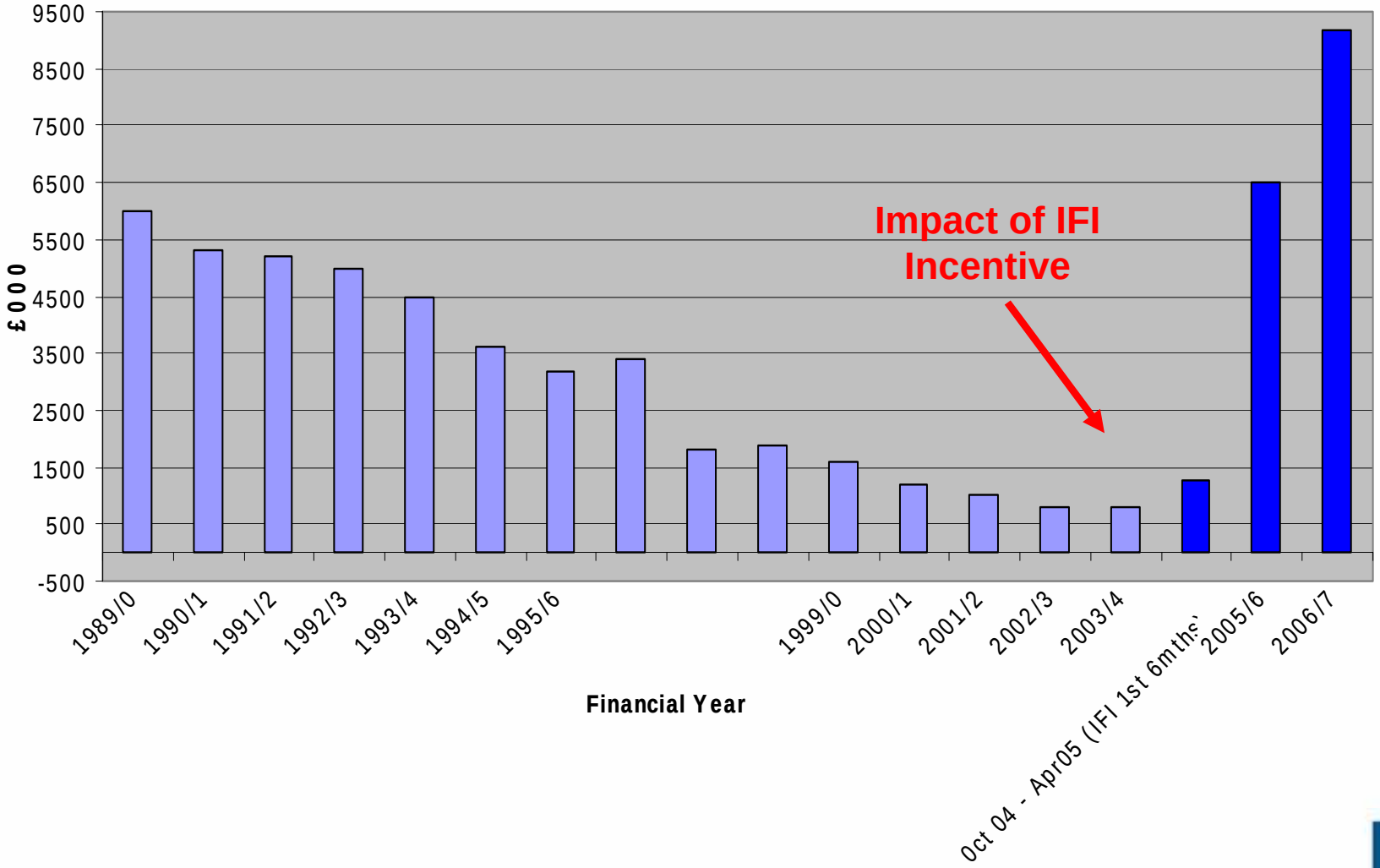
- CO_2 reduction
  - example: carbon credits
- Innovation Incentives
  - Example OFGEM
- Energy saving
  - example: smart meters
- Integration of renewables
- Management of Demand
  - Example Load Shedding



UK Distribution Company R&D trend

Impact of new incentives

Privatisation

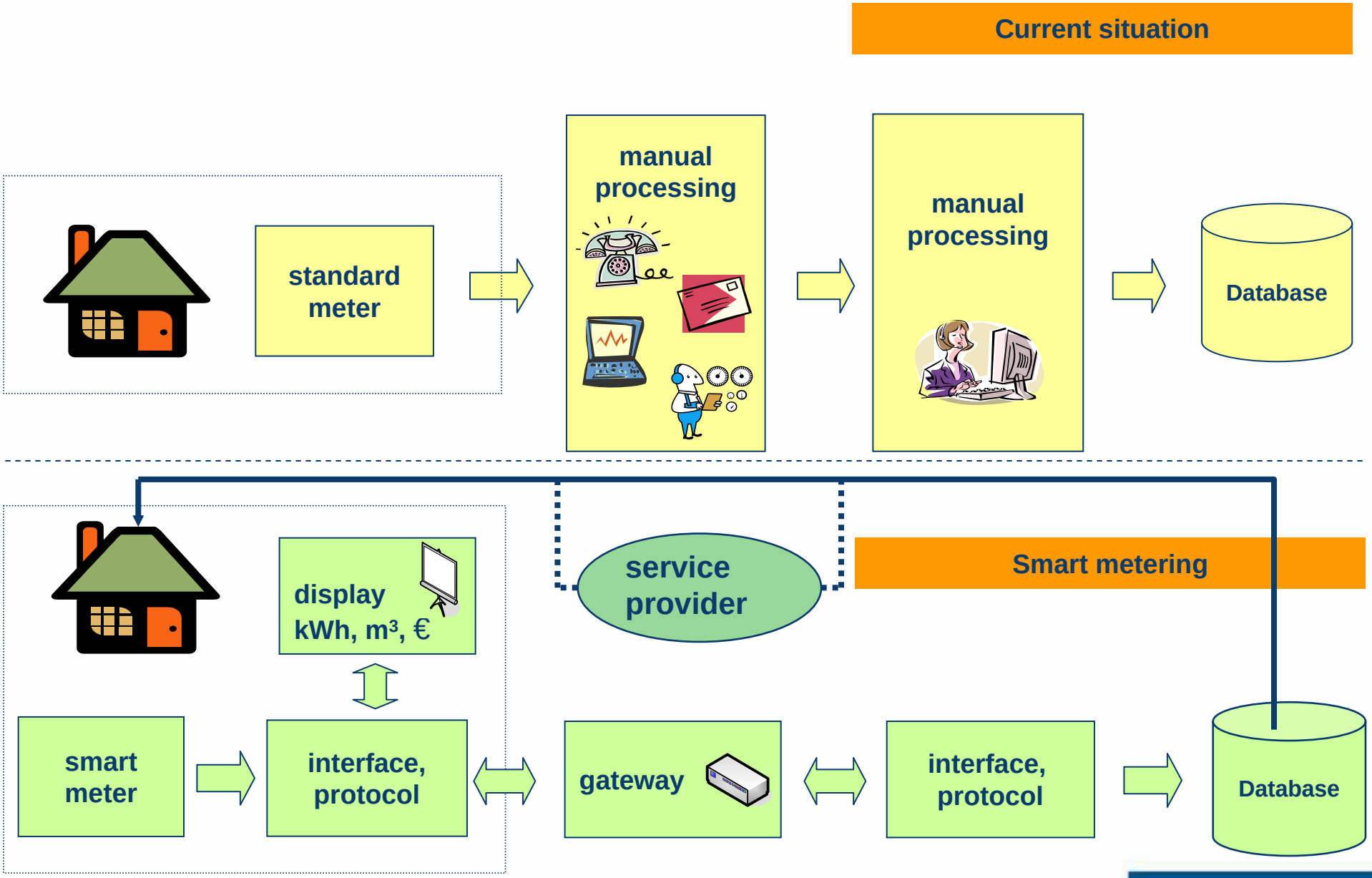


- c.180 projects
- Projects are initiated by the companies
- Ofgem does not 'approve' each project
- Only one compa is spending to i cap
- Av. intensity is 0.27%
- Forecast benefi total €70m (NPV

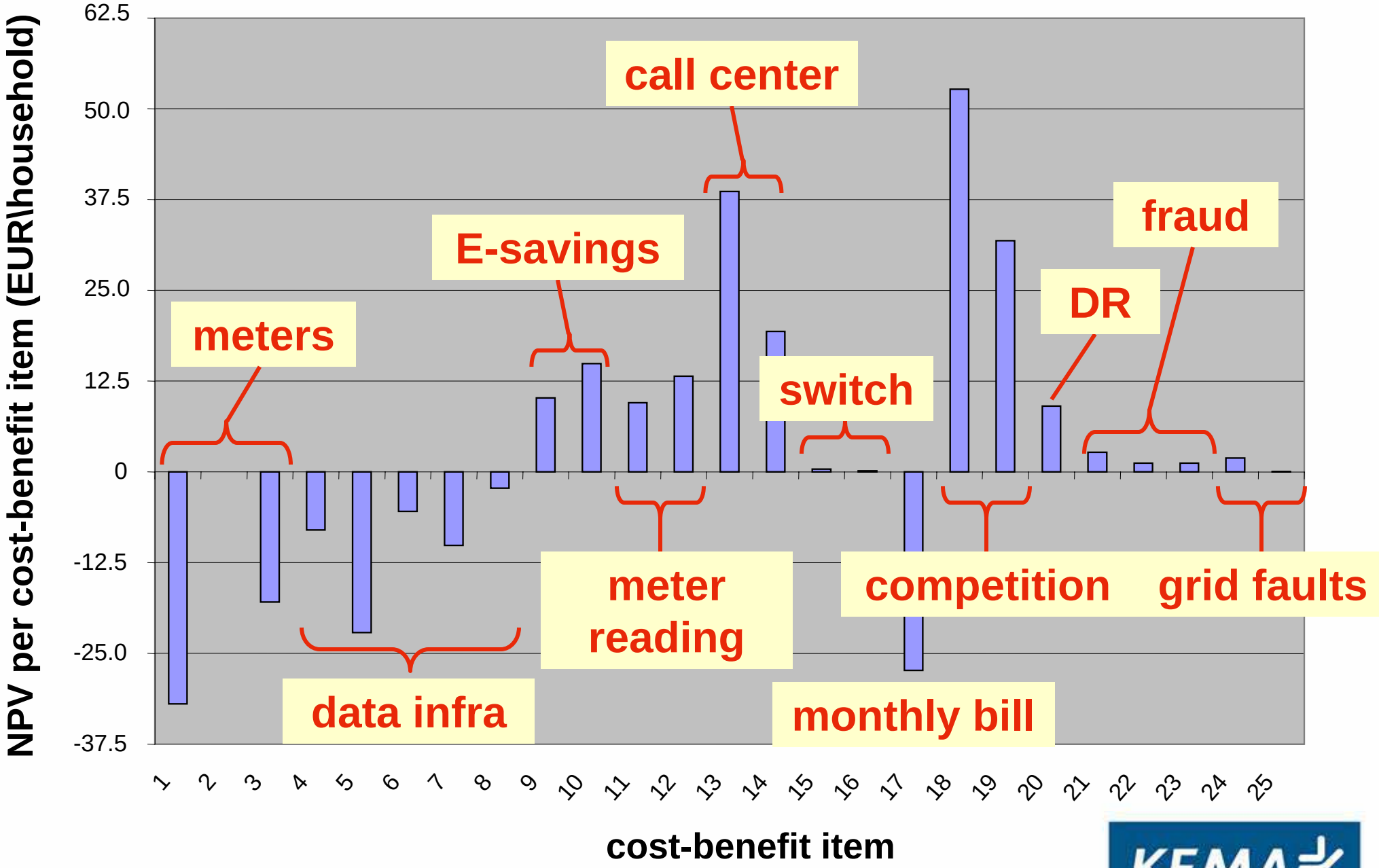
* Data from 1989/1990 to 2003/2004 is the collaborative spending on R&D amongst the DNOs through a single provider.
* Data from Oct 2004 - April 2005 and the last financial year (2005/2006) shows reported total IFI spend.

KEMA

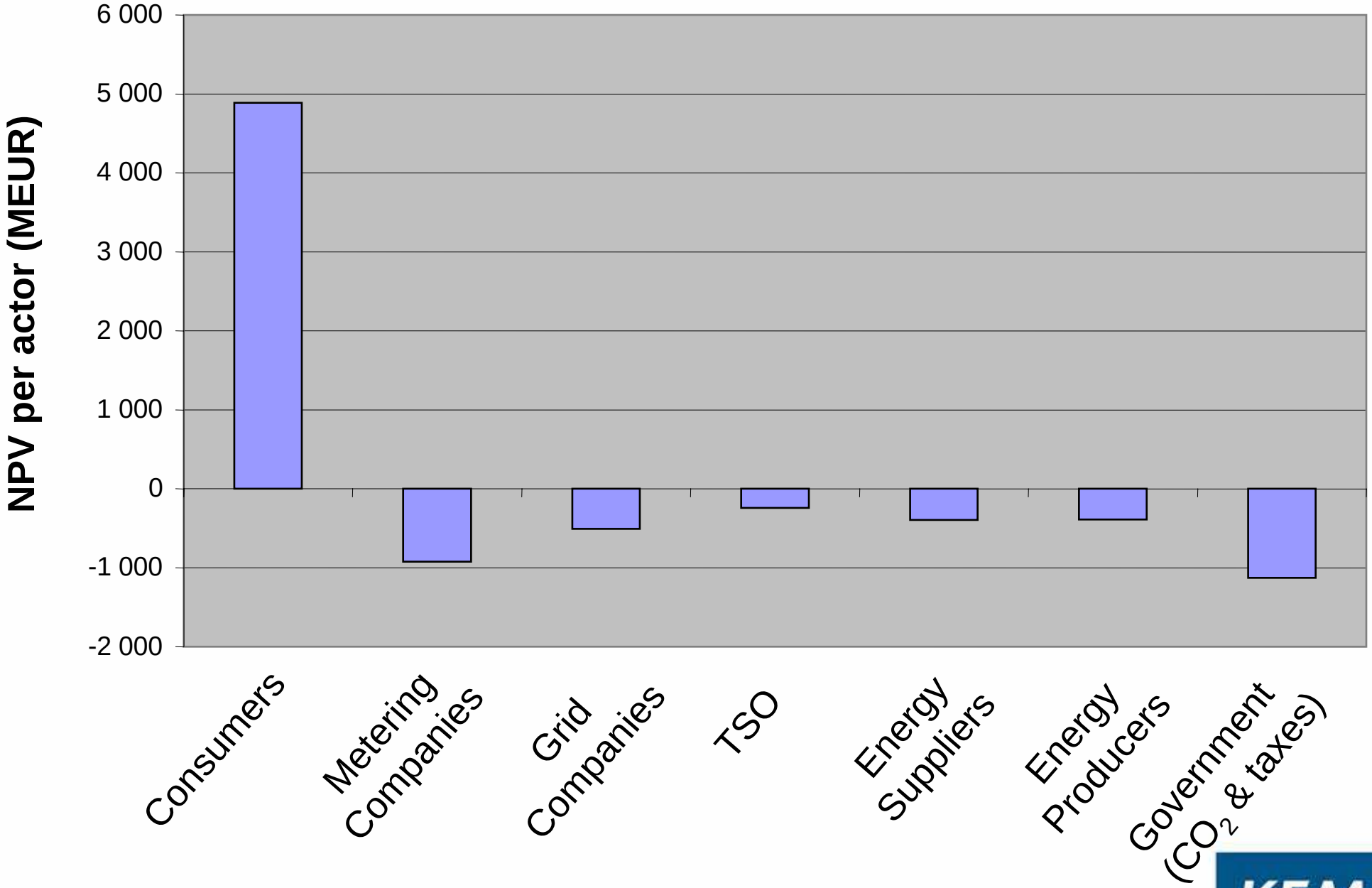
Smart metering for households



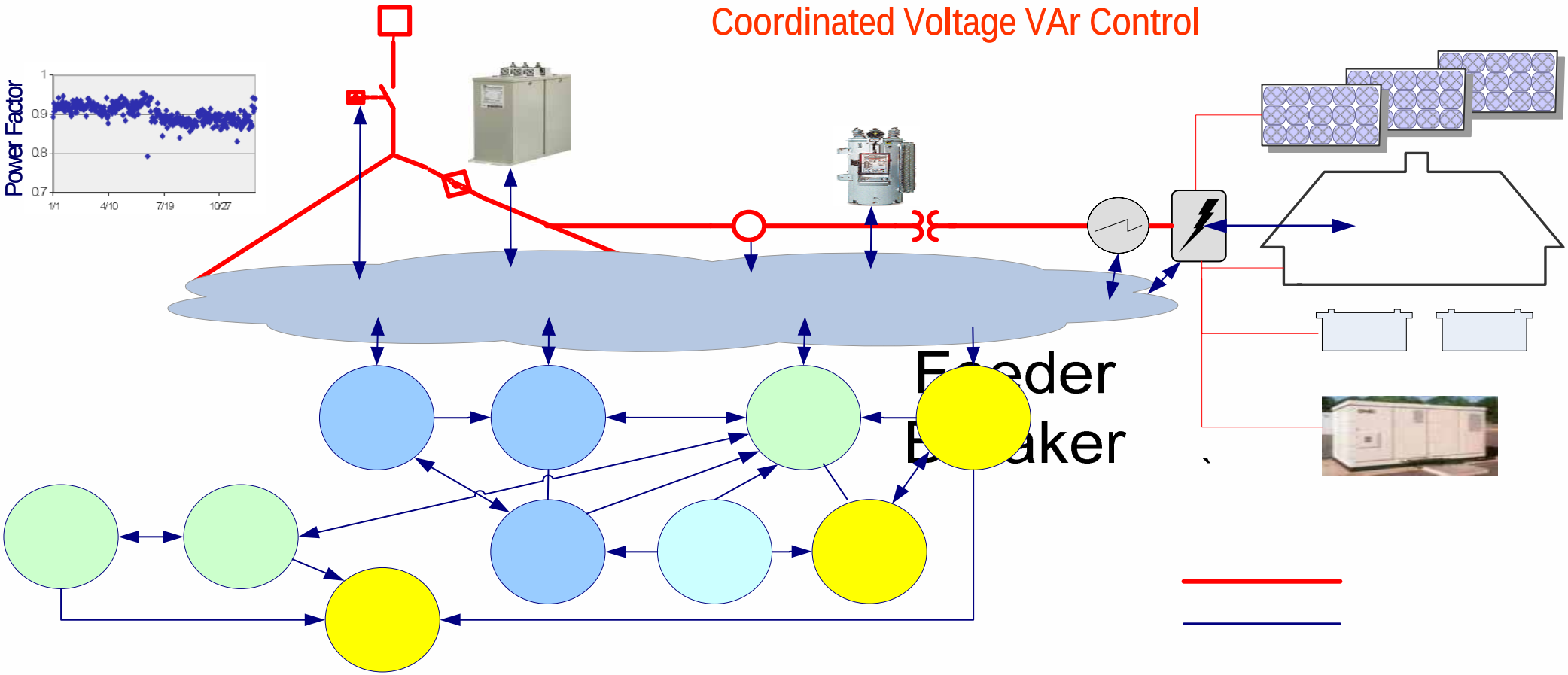
Example costs and benefits in NL (G+E)



Costs and benefits per actor

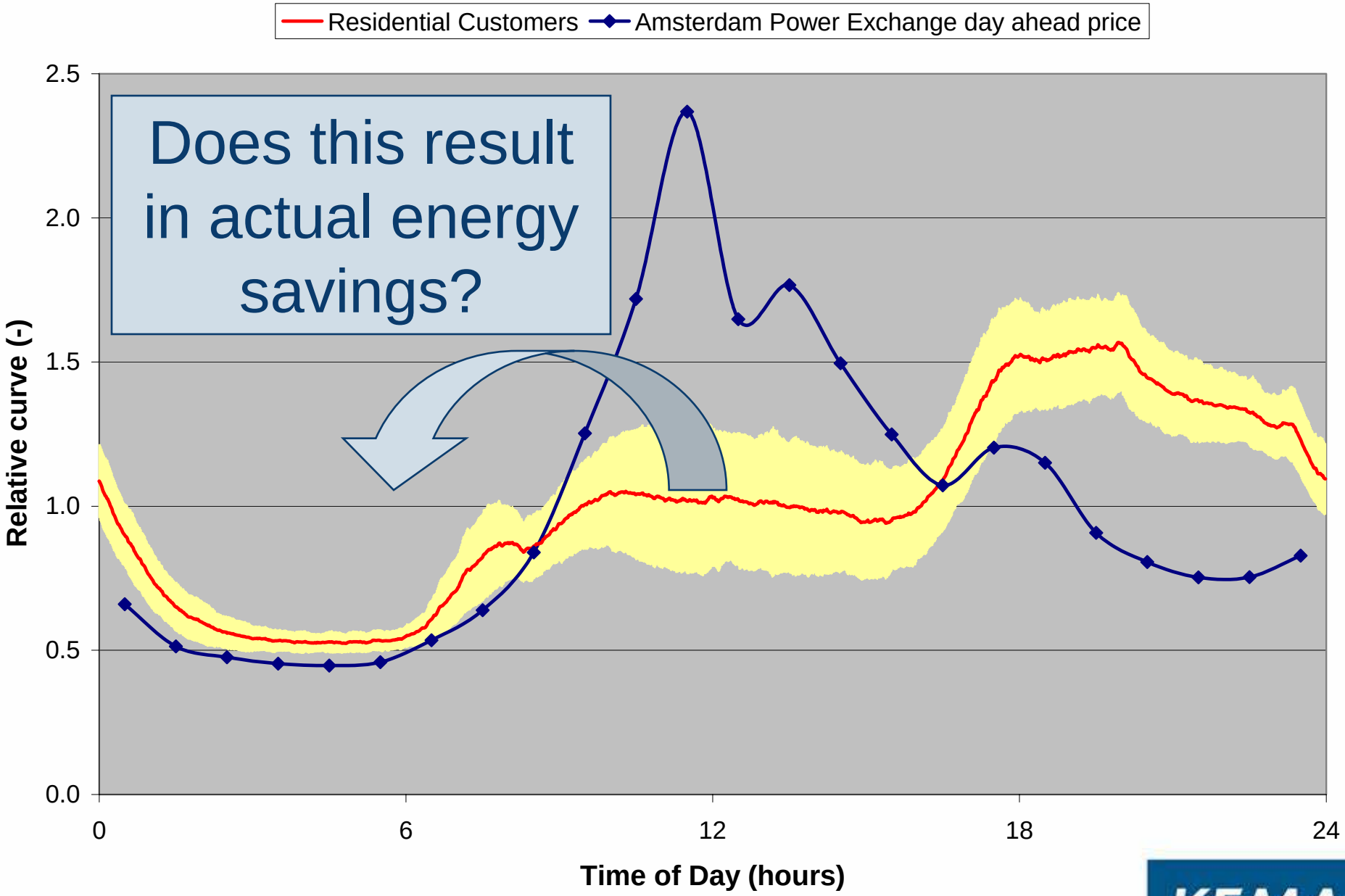


Distributed & Demand Side Resources

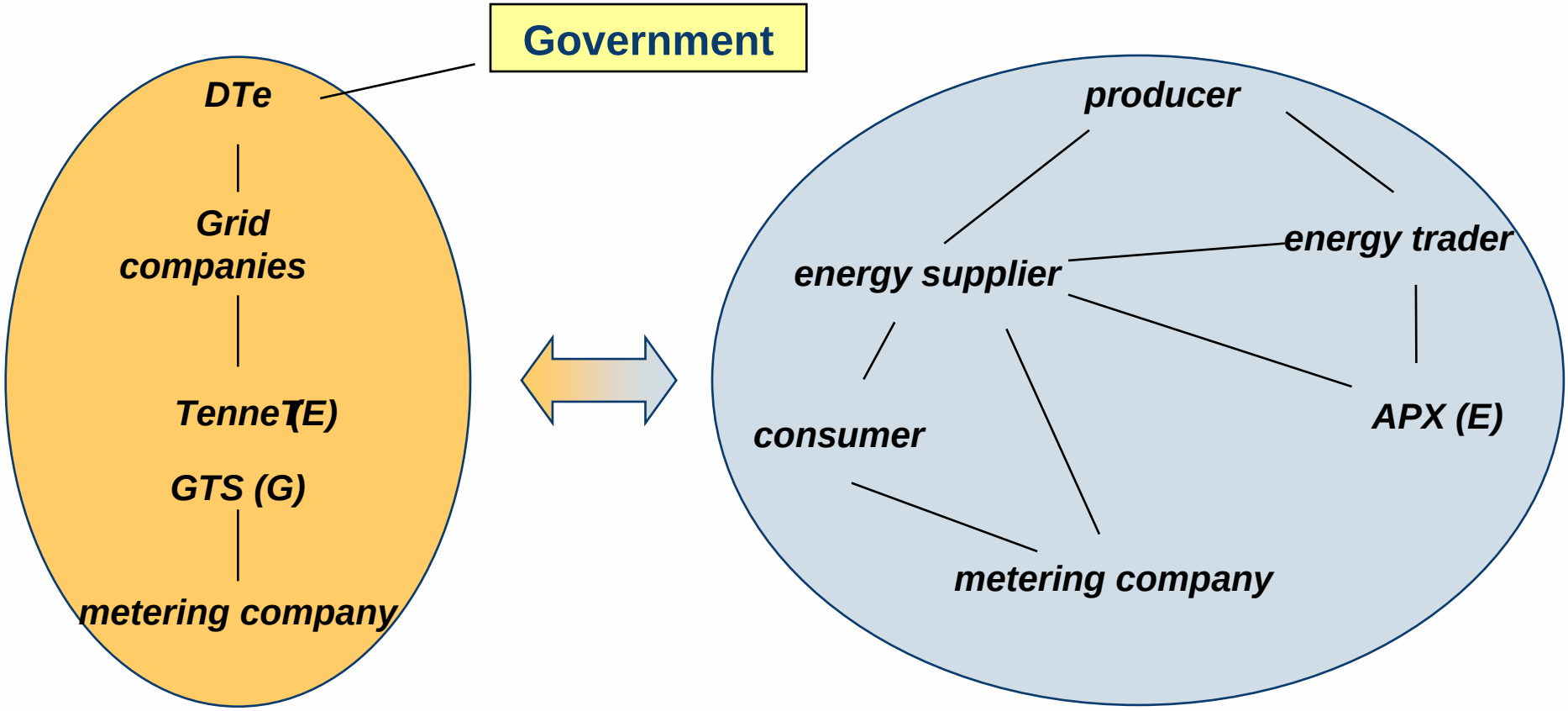


- Large penetration levels require significant data management
  - Aggregation, scheduling, market operations, billing and settlements
  - Distribution voltage and power quality management, distribution automation
  - Islanding and micro-grid operations

Load shifting based on energy price



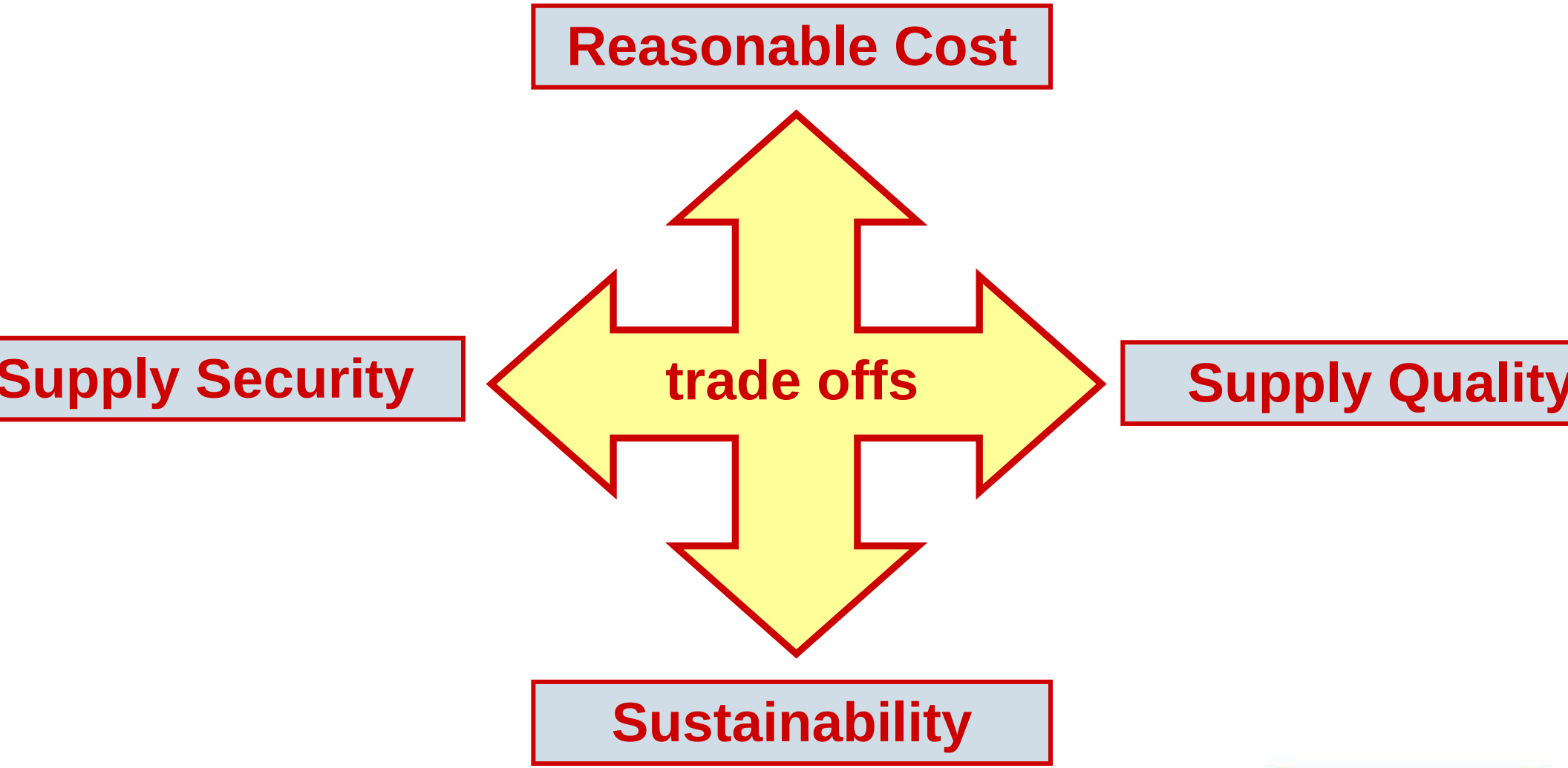
➔Changes in Markets (Dutch case)



regulated market (fixed rates)

unregulated market (commercial rates)

Engagement & commitment stakeholders: a new balance to be struck



EU investment until 2030: 1000 billion €

- Demand
  - Growth 2%/year = +1250 TWh by 2030
- Generation
  - Replacement & expansion 900 GW needed by 2030
  - RES 500 GWpeak needed by 2030
- Transmission & Distribution
  - Ageing assets, expansion and RES+DG integration
  - 500 billion € until 2030 needed
- Markets & Regulation
  - Data + information need > 20 billion € investment (conservative figure based on 100€ per connection)

The Transition to Smart Grids is not a simple A → B !

There is no blue print for Point B

… but there is an emerging shared Vision

The task is Europe-wide and beyond

… and has considerable export potential

Every network has technical variations

… but 'country specials' are inadvisable

The Transition from the Classical Grids of today to the Smart Grids of tomorrow

….. also true for regulation!

KEMA

Changes Ahead:

MORE

- Cost for oil & gas, and concerns for their security
- Grid congestion & costs, and potential loop flows
- At risk to the actions of our neighbours
- NIMBY–ism and challenge to developments
- Value and capability for bulk electricity storage

LESS

- Inherent energy security and reserves
- Waste and Losses, and Carbon release
- Taking energy (and the sector) for granted
- Passive, demand only, consumers
- Certainty: no longer a familiar path

KEMA

The Elements for Change

- Technology
- Standards & Open Systems
- Commercial Arrangements
- Manufacturers & Supply Chain
- Demonstration & proving
- Regulatory Frameworks

The Transition from the Classical Grids of today to the Smart Grids of tomorrow

- a Common Vision
- Collaboration
- 'Societal permission'

The greatest business challenge?

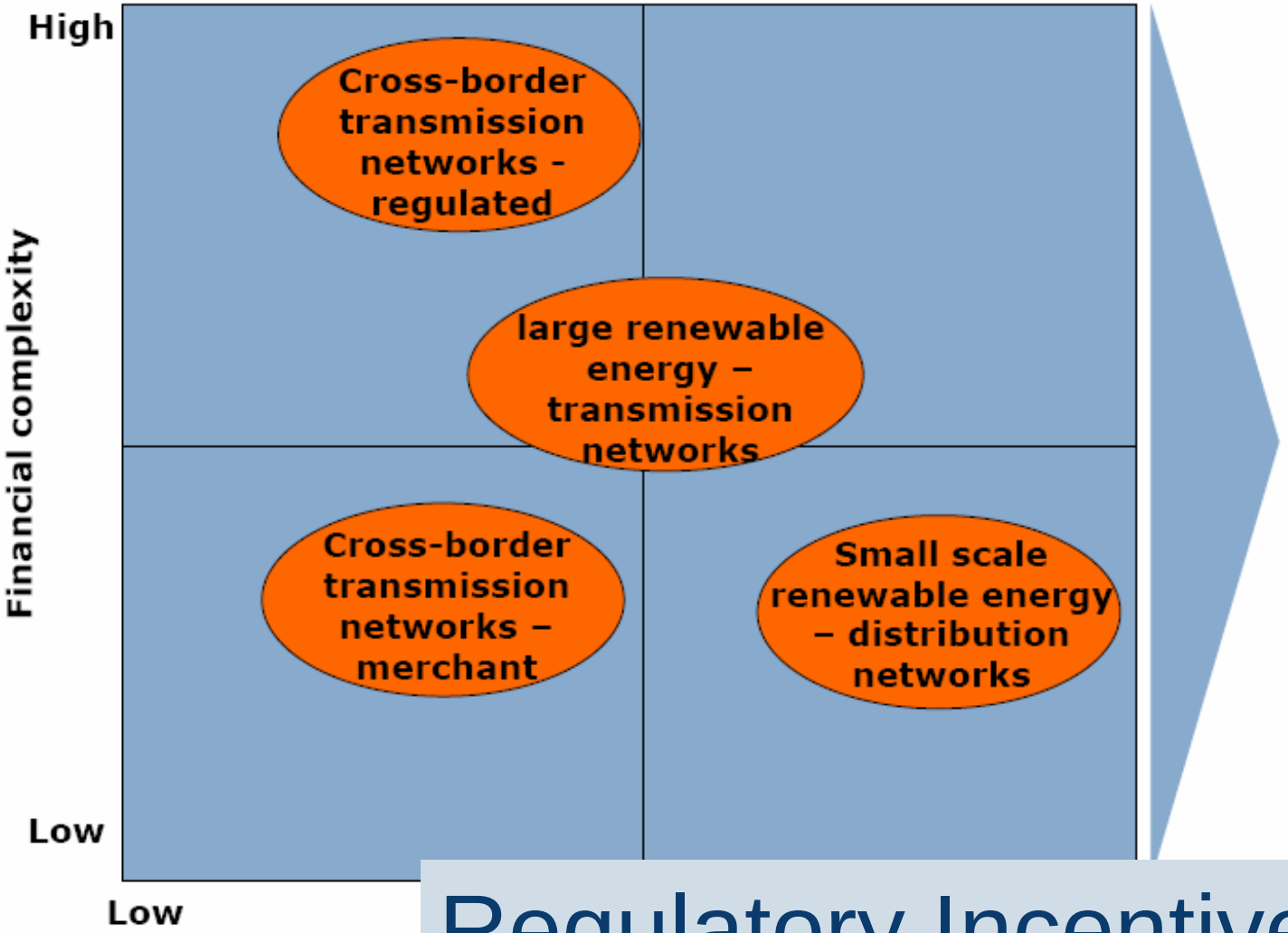
A new emphasis:

- **Domestic Customers**
- **Transport interaction**
- **The Built Environment**
- **The public at large**

Issues for society, policy makers and regulators, not just the sector

KEMA

Investment willingness is risk averse



Investors want to be remote from technological risk

Regulatory Incentives?

Mansour, Rabobank 2007

Funding for SmartGrids Developments

- EC Research & Development funding
  - Seventh Framework Programme
  - ERA-NET
- National Funding opportunities
  - Varies, according to each MS (numerous)
- Regulator allowances for innovation
  - UK; the IFI (innovation funding initiative) and RPZ (registered power zone)
- Private Funding options (business models)
  - Industry, pension and investment funds (banking)

Alignment of EU, national and regional research programs

- European Technology Platform SmartGrids
- ERA-net SmartGrids because 80% of the public RTD budgets come from these national programs and:
  - the grid issues have no MS-borders
  - grid issues are dealt with differently in each MS (often resulting in a limited effort to solve it)
  - the grid is key (facilitator) to an affordable, reliable and sustainable energy supply
- SmartGrids Association

SMARTGRIDS

KEMA

Summary and Conclusion

- Large impact of RES on grid structure and operation
  ➔ SmartGrids challenge

- New technology and increasing engagement and commitment of stakeholders is needed:
  – adequate regulation
  – establishment of funding / support mechanisms
  – new business models for investment
  – demonstration & deployment

… on the *FLY*…

Thank you for your attention.

KEMA
Utrechtseweg 310
PO box 9035
6800 ET ARNHEM
The Netherlands

pier.nabuurs@kema.com