

SmartGrids

A Vision For Intelligent Electrical Grids
Serving the Energy User... including E-vehicles

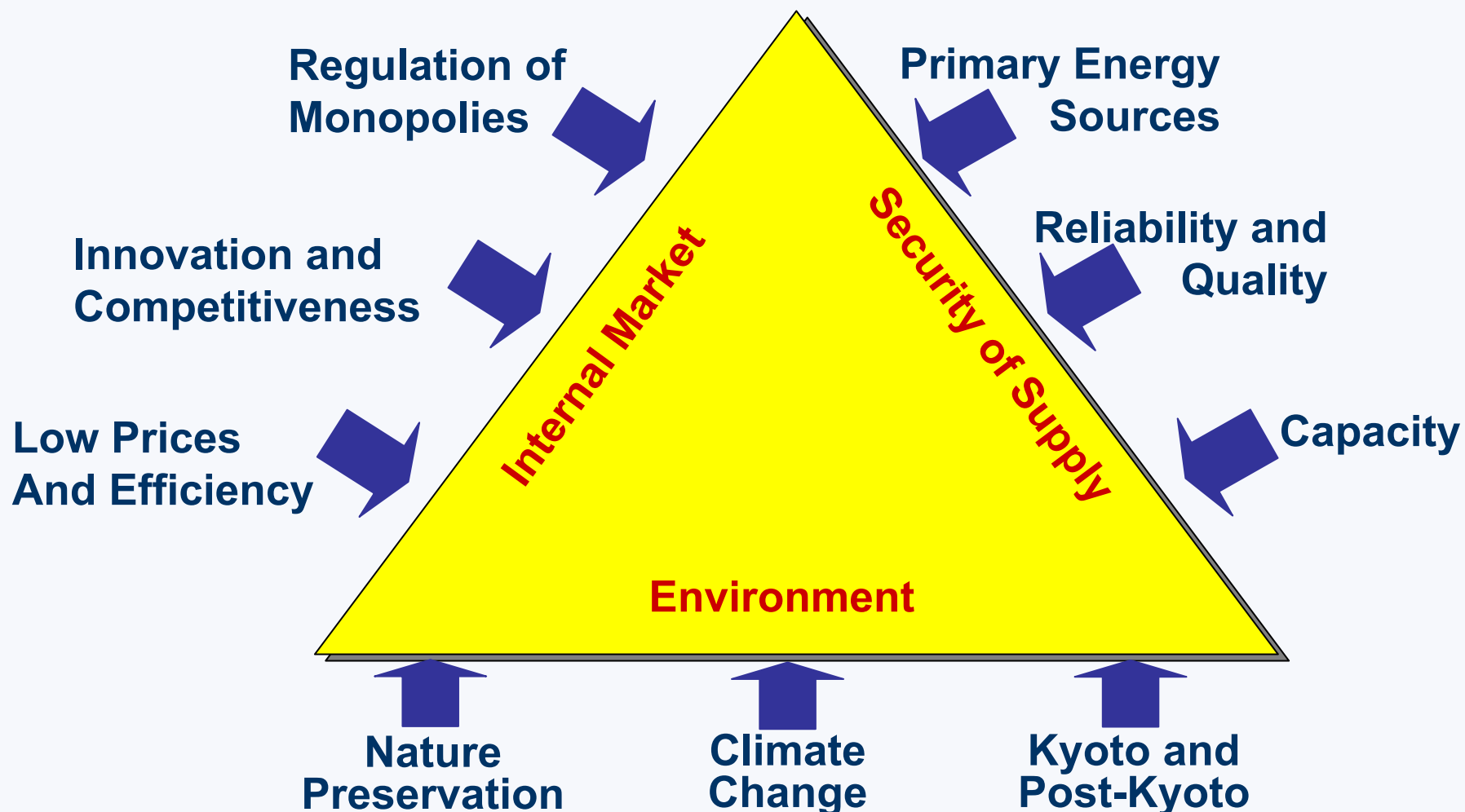
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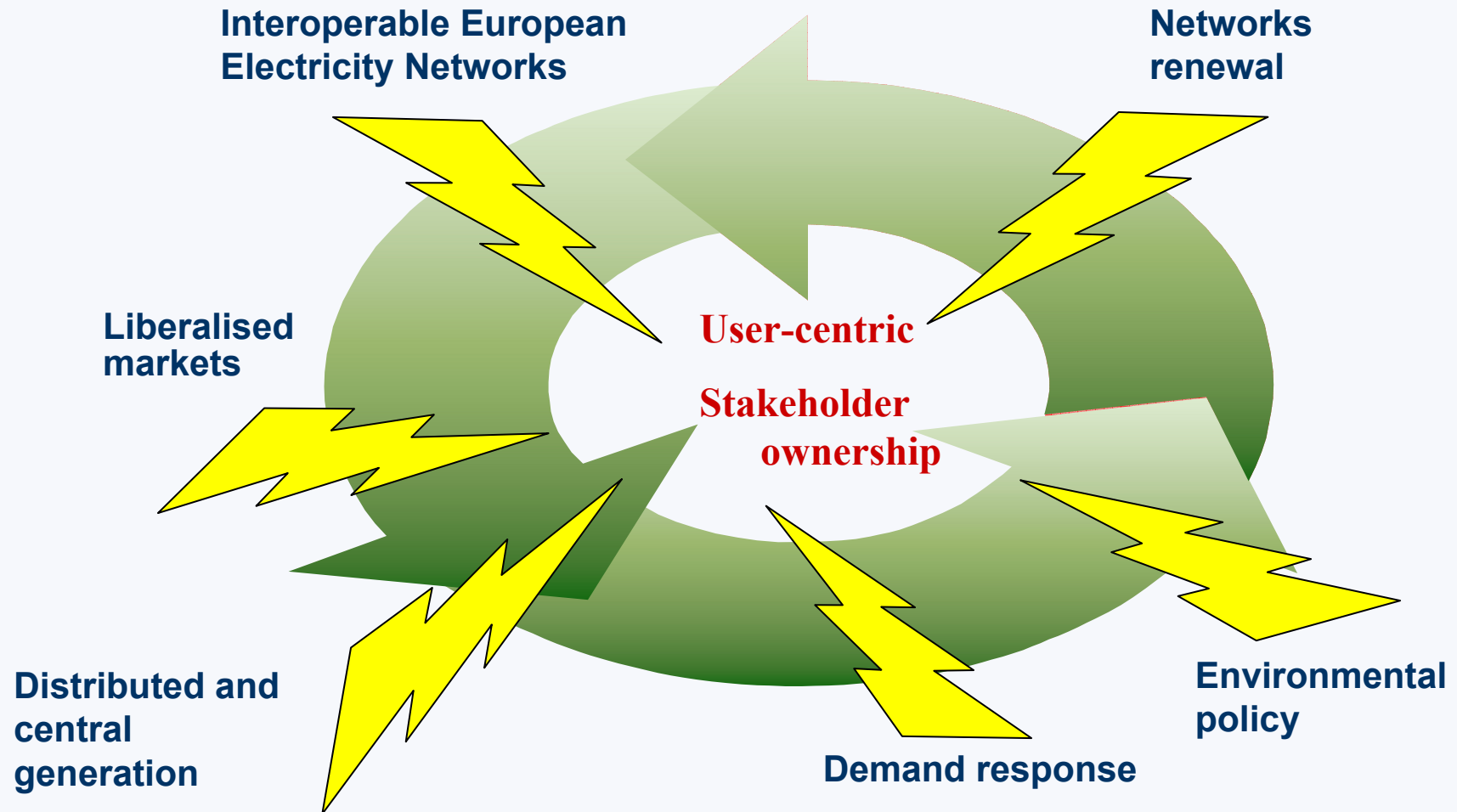
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Drivers towards SmartGrids



Why SmartGrids?



50GW of wind power in the North ?



Ackgt TechFreeep



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Smart Grids will be needed to ensure **supply security**, connect and operate **clean and sustainable energy**, and give **value for money**

plus wind variation / cloud cover / customer choice...

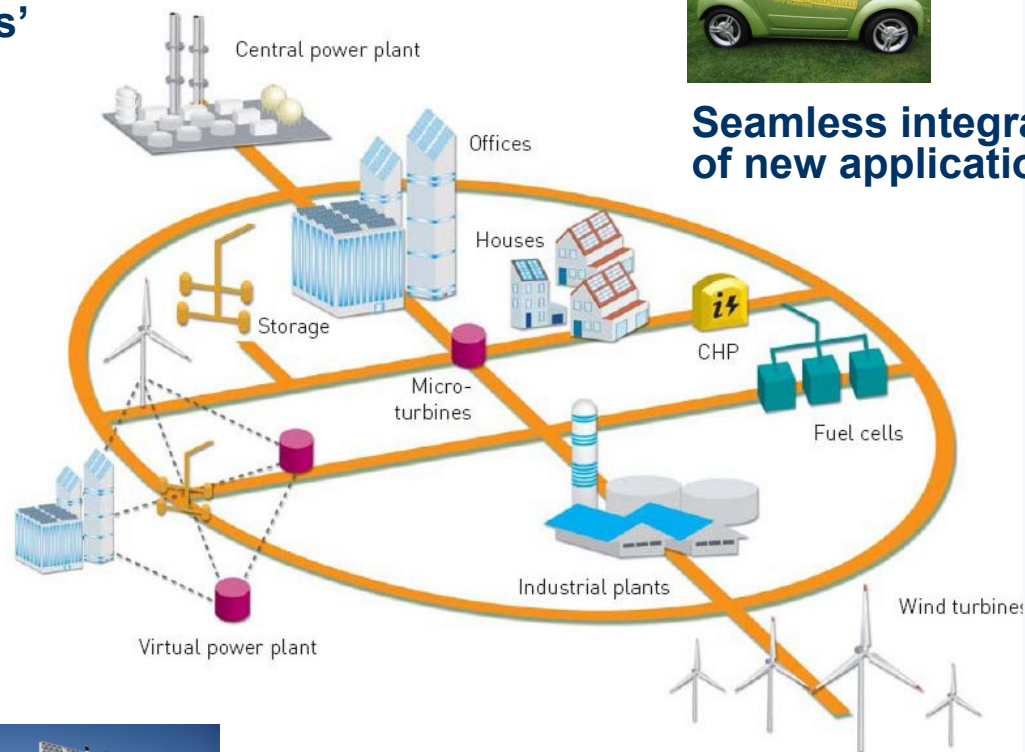


30GW of solar power in the South ?

New DC Links and Interconnections



**Multi-directional
'flows'**



**Seamless integration
of new applications**

**End user real time
Information & participation**



**Central & dispersed
intelligence**



Central & dispersed sources



**Smart materials
and power
electronics**

a smart metering revolution?

a networks perspective

“an RTU at every service head”

the portal to demand & micro-gen services

operational visibility of local networks

losses management & rewards



Load-limiting & remote disconnection

intelligent demand control in emergencies

local network also the comms channel ?

new services to delight customers....

What is a SmartGrid?

A SmartGrid is an electricity network that can **intelligently** integrate the actions of all users connected to it - generators, consumers and those that do both – in order to **efficiently deliver sustainable, economic and secure electricity supplies.**

A SmartGrid employs innovative products and services together with intelligent monitoring, control, communication, and self-healing technologies to:

- better facilitate the connection and operation of **generators** of all sizes and technologies;
- allow consumers to play a part in optimizing the operation of the **system**;
- provide **consumers** with greater information and choice of supply;
- significantly reduce the **environmental impact** of the whole electricity supply system;
- deliver enhanced levels of **reliability and security of supply.**

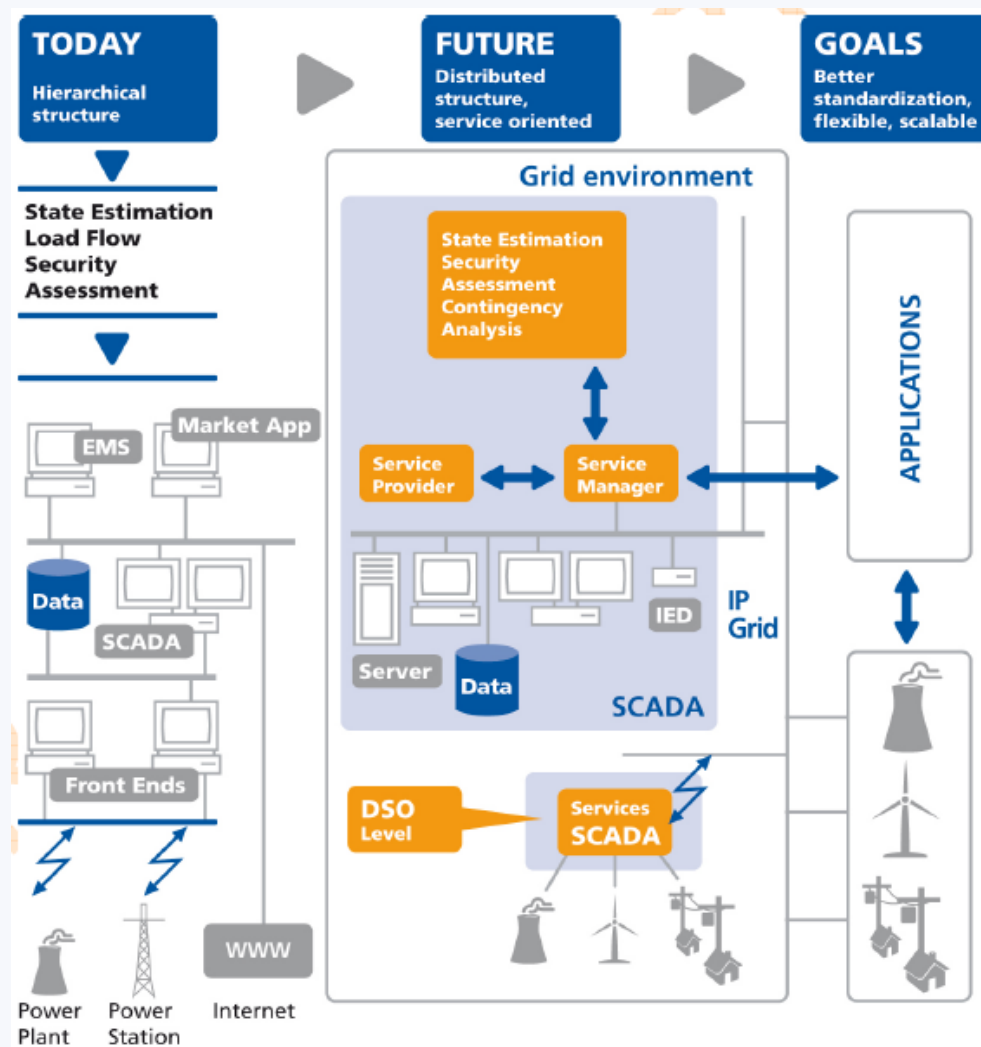
SmartGrids deployment must include not only technology, market and commercial considerations, environmental impact, regulatory framework, standardization usage, ICT (Information & Communication Technology) and migration strategy but also **societal requirements and governmental edicts.**

The Key Challenges for SmartGrids

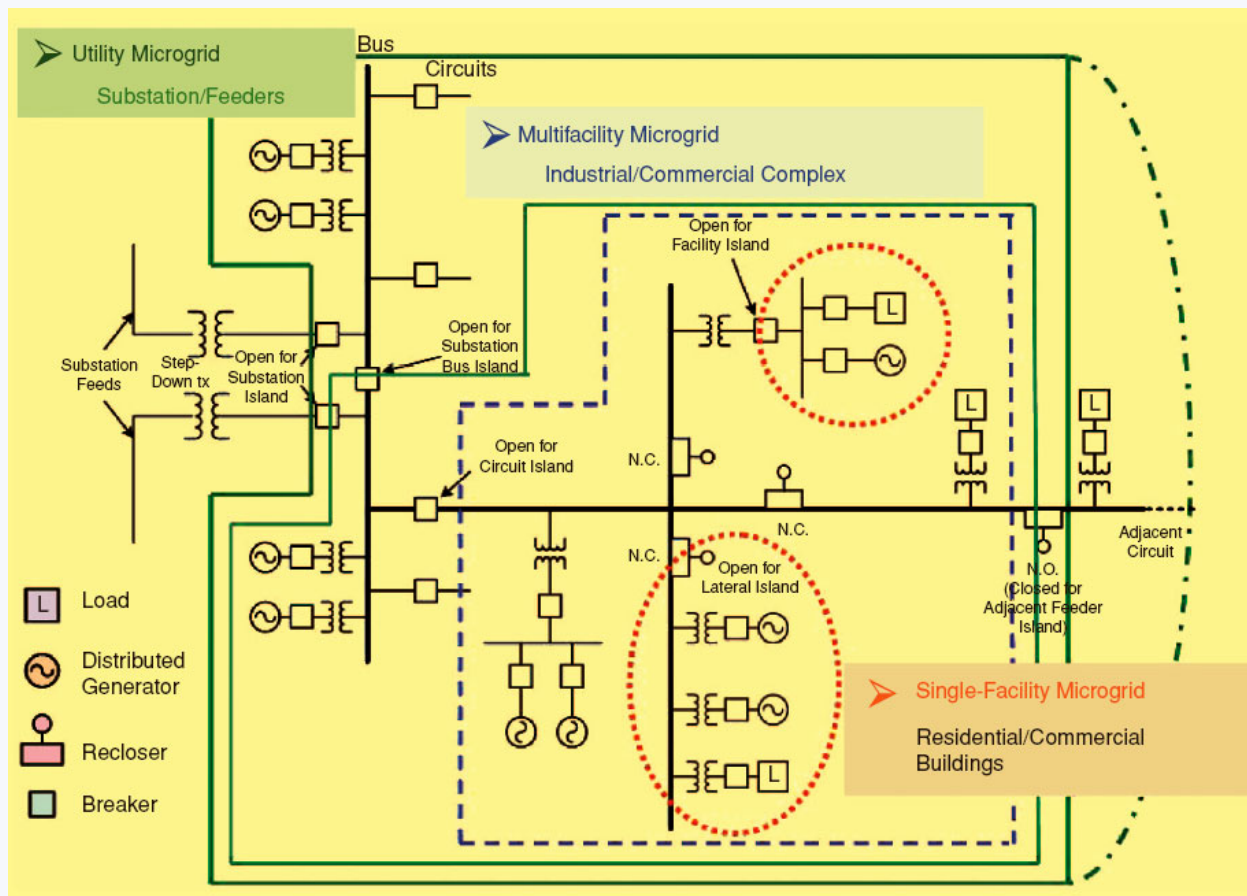
- **Strengthening the grid** – ensuring that there is sufficient transmission capacity to interconnect energy resources, especially renewable resources, across Europe;
- **Moving offshore** – developing the most efficient connections for offshore wind farms and for other marine technologies;
- **Developing decentralized architectures** – enabling smaller scale electricity supply systems to operate harmoniously with the total system;
- **Communications** – delivering the communications infrastructure to allow potentially millions of parties to operate and trade in the single market;
- **Active demand side** – enabling all consumers, with or without their own generation, to play an active role in the operation of the system;
- **Integrating variable generation** – finding the best ways of integrating intermittent generation including residential microgeneration;
- **Enhanced intelligence** of generation, demand and most notably in the grid;
- **Capturing the benefits of DG and storage**;
- **Preparing for electric vehicles** – whereas SmartGrids must accommodate the needs of all consumers, electric vehicles are particularly emphasized due to their mobile and highly dispersed character and possible massive deployment in the next years, what would yield a major challenge for the future electricity networks.

Active distribution system has three layers

1. Copper based energy infrastructure (electricity)
 - Optimized topology
 - Power electronic devices
2. Communications layer
 - requirements of speed, quality, reliability, dependability with costs
 - different communication technologies at the same time
3. Software layer
 - multiple software functions for normal operation: doing locally and independently the maximum number of functions, reporting/requesting from the upper level the minimum possible information necessary
 - network reconfiguration
 - self-healing procedures
 - fault management
 - forecasting, modeling and planning.



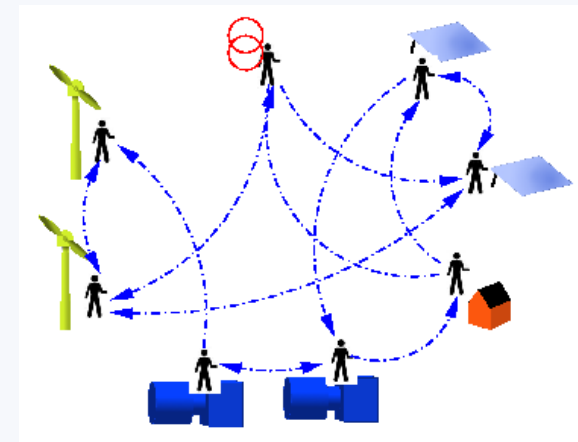
Microgrids



(Source: IEEE 1547)

- Local balance** between energy (heat/electricity) generation and load, at the level of
- A single customer
 - An industrial/commercial complex
 - A distribution grid subsystem

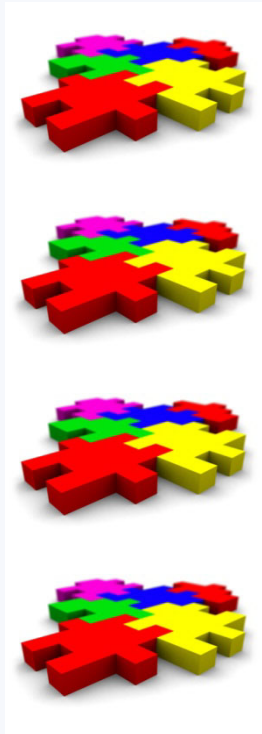
- IEDs (intelligent electrical devices)
 - connected to grid via power electronics (inverter front-ends)
 - interconnected via communication network
- distributed control of DER
 - optimize voltage level (*secondary* control)
 - optimize production costs (*tertiary* control)
 - data aggregation, system monitoring etc.
- layout of communication architecture
 - point to point infrastructure vs. overlay network
 - distributed agents vs. centralised control
 - + **small capital investment**
 - + **no single point of failure**
 - **security more difficult**



- Charging P(H)EVs on the grid will not go unnoticed
 - Different approaches: slow/fast, battery swap, at home or service-station, ... have different impact
 - Accumulated peak powers may cause local power overloads
 - Controlled charging is a necessity
 - Need smart meters as interface
 - New business models at hand?
- New opportunities for V2G



Smart Grids will require



Customer Acceptance and Participation

...Intelligent Appliances & Demand

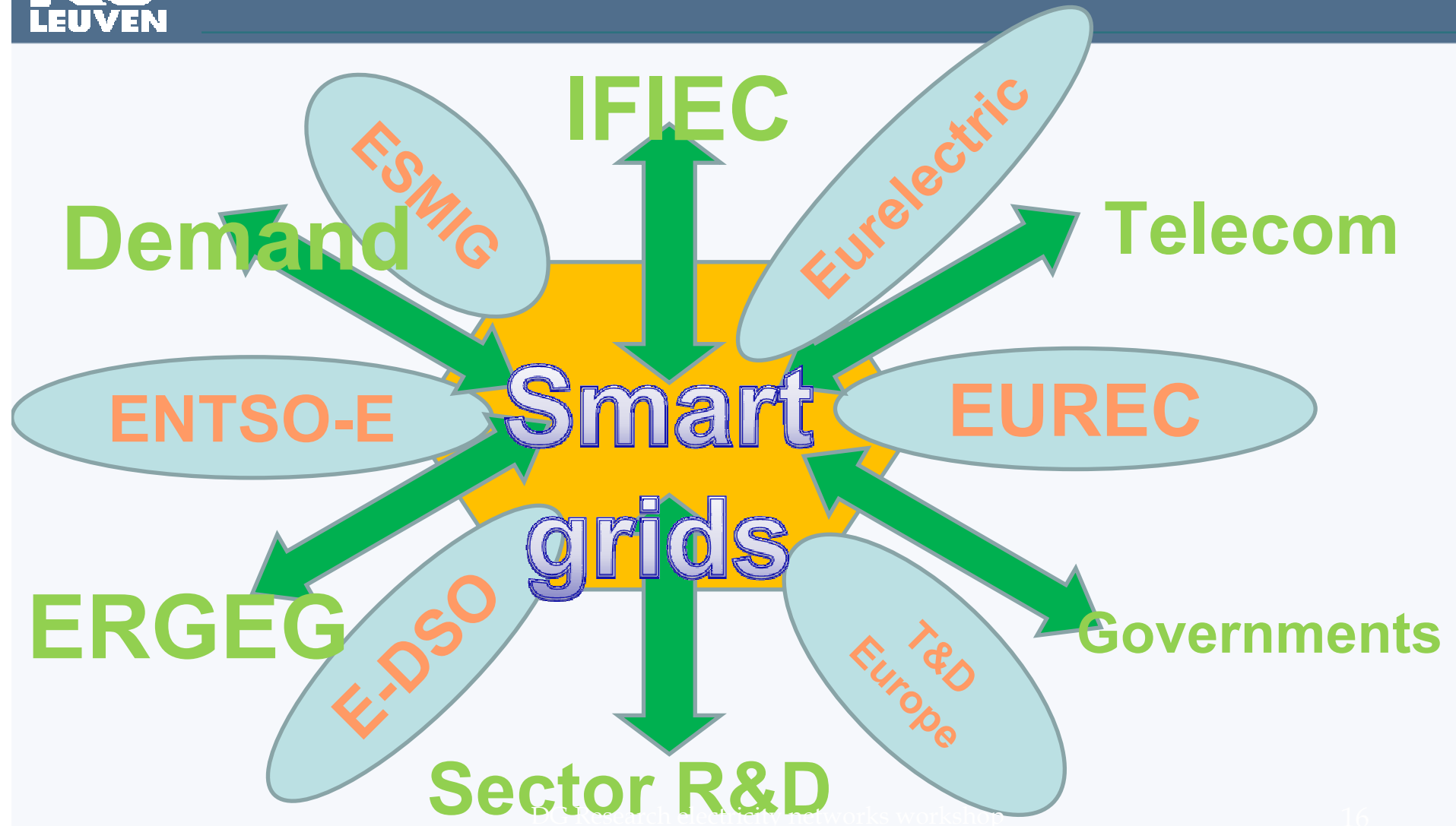
...Smart metering with 2-way

communications
...Micro-generation providing grid services



- The Platform brings together key EU stakeholders
- Vision document published
- Strategic Research Agenda published
- Smart Grids short video is available on the website
- The **Strategic Deployment Document** is in final drafting





© research electricity networks workshop



Thank you
for your attention !

<http://www.smartgrids.eu>

<http://www.esat.kuleuven.be/electa>

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EUROPEAN TECHNOLOGY PLATFORM FOR THE ELECTRICITY NETWORKS OF THE FUTURE

