

# Smart Grids

## Part 1



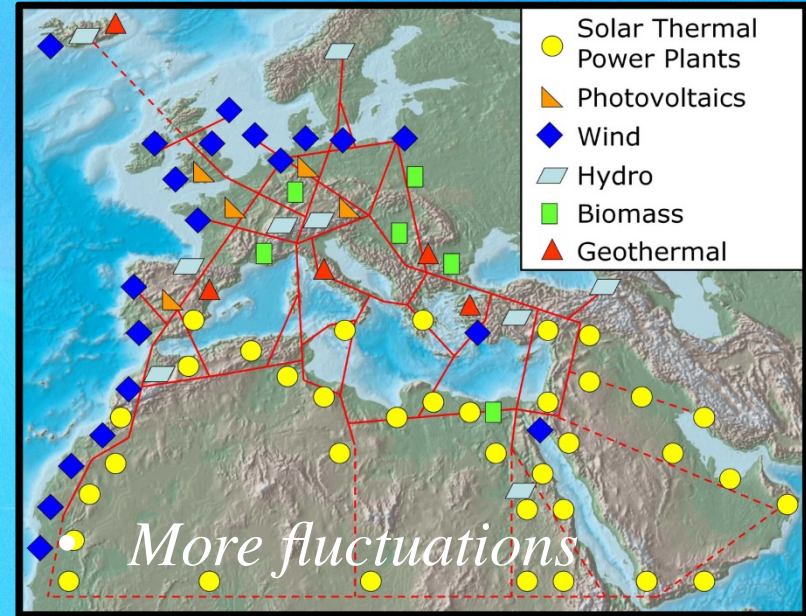
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# Conventional



# Future



# Old



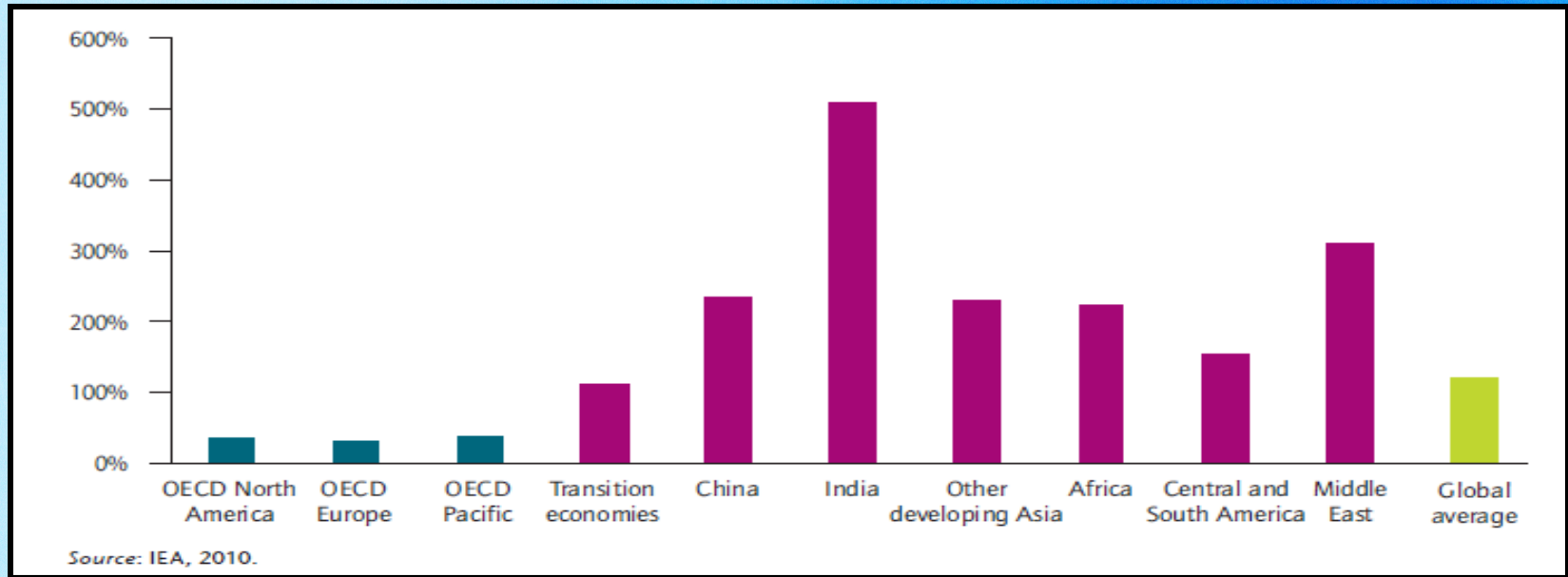
# New

Sustainable Secure Affordable



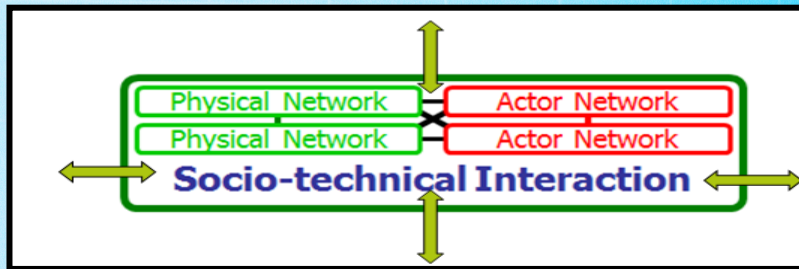
# Future energy systems

# Electricity consumption growth 2007-2050 (IEA, 2010)

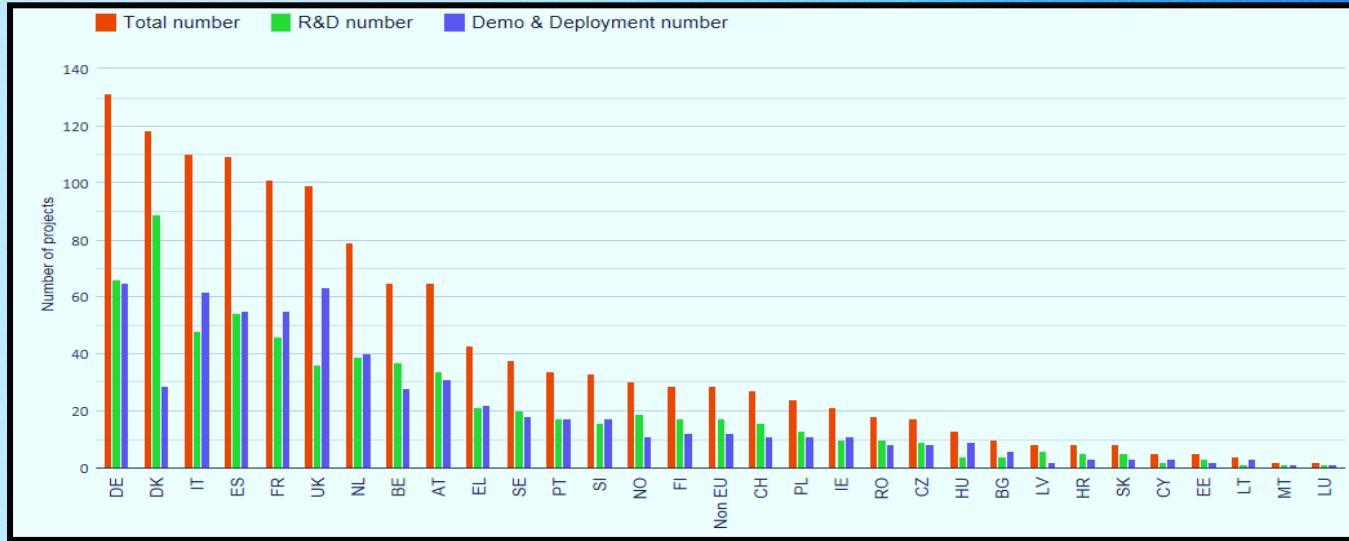


# Smart Grids – a hot topic

- Hot topic for scientists, business, government, media: ‘how to integrate unconventional distributed energy’
- How to design, manage and operate qualitatively new complex socio-technical system of smart grids?



# Smart grids projects Europe (2014)



# Google image search “Smart Grid”

7.040.000 results (0,17 seconds)



# What is the 'smart grid' ?

No single meaning:

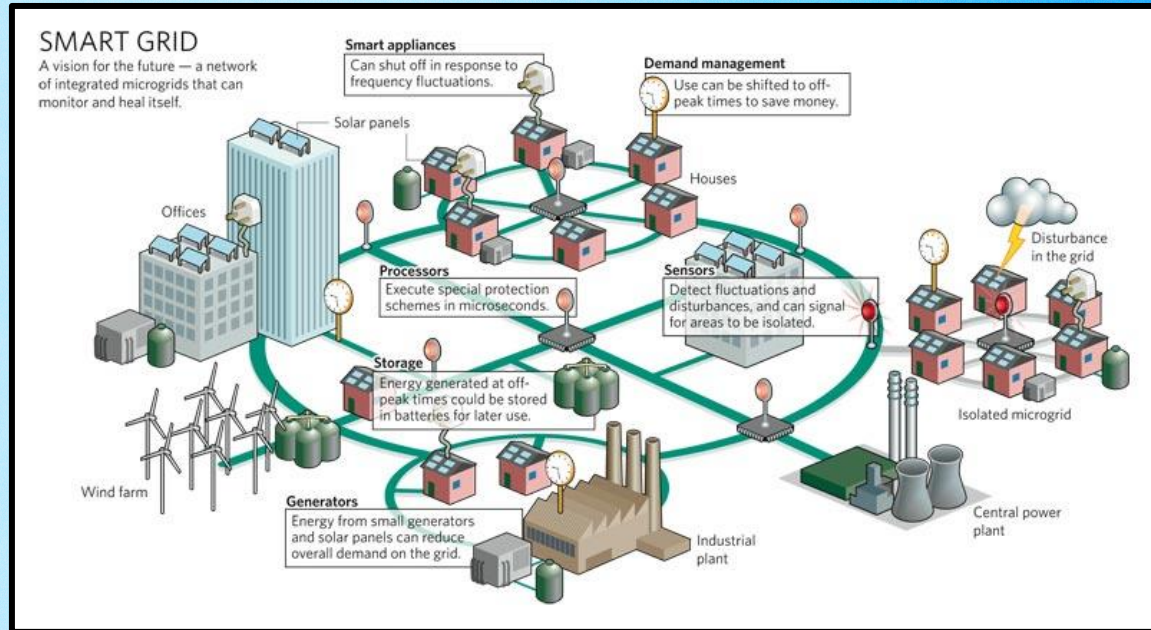
*'A smart grid is neither a clearly defined single concept nor a single technology. Rather it is like a basket containing various combinations of balls. The context and the interpretation depend upon the user.'*



# Smart Grid – EC definition

- Electricity network that can cost efficiently **integrate the behaviour and actions of all users** connected to it (generators, consumers and those that do both)
- Economically **efficient, sustainable power system** with low losses
- High levels of quality and security of supply and safety

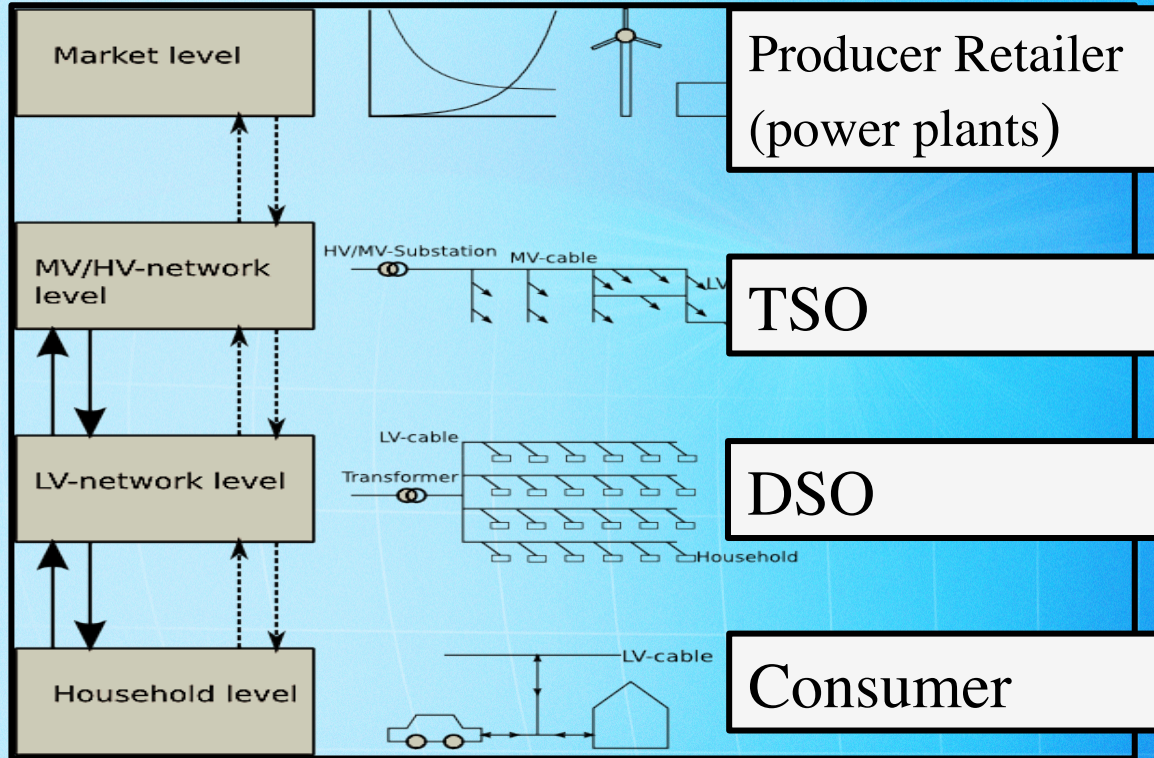
# Model SG network



# Smart Grid - actors

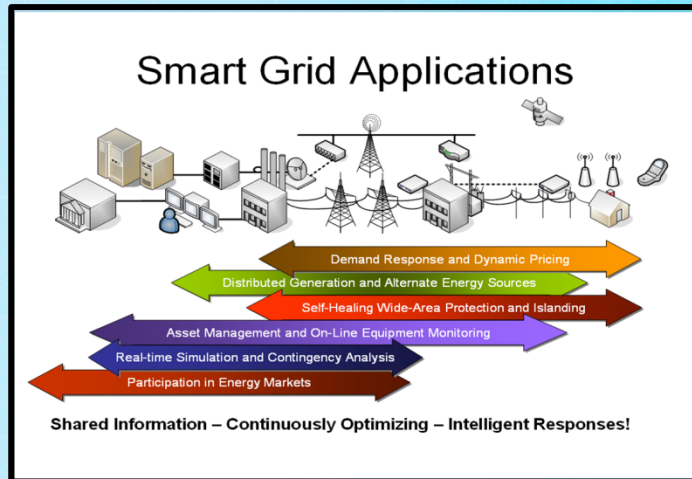
- *Network operators*: transmission and distribution system/network operators (DSOs/DNOs).
- *Grid users*: generators, (mobile) consumers, storage owners.
- *Other actors*: suppliers, metering operators, ESCOs, aggregators, applications and services providers, power exchange platform operators.

# Power sector: Complex socio-technical system



# SG paradigm for future energy systems

- Significant penetration of IT
- Additional IT layer for Demand Side Management, balancing and billing
- Facilitating on-line coordination of the backbone network and the micro-grids for reliability



# SG capabilities

- Can repair itself.
- Encourages consumer participation
- Ensures consistent, secure and high quality power supply
- Allows electricity markets to grow and make business.
- Improves efficiency



# Key challenges SG

- Integration of intermittent generation
- Decentralized architecture to enable small-scale distributed power generation
- Enhanced intelligence of supply, demand, storage and the transmission and distribution networks
- ICT infrastructure for many new parties to operate and trade on the market
- Implementation of Smart Metering Systems
- Active demand side
- Preparing for electric mobility

# Thank you for your attention!

Please post any questions you may have on our discussion forum.