EUROPEAN COMMISSION
Community research

MICROGRIDS – Novel Architectures for Future Power Systems
Paris, France, 29 January 2010

MICROGRIDS Workshop

Microgrids in the EU TP SmartGrids Context

Maher Chebbo

ETP SmartGrids Advisory Council
VP, Head of EMEA Utilities & Communications Industries, SAP

maher.chebbo@sap.com

European Energy policy goals (20/20/20) for 2020 : The roadmap of ETP SmartGrids

Energy efficiency “first fuel” choice

Regulation of Monopolies

Primary Energy Sources

Innovation and Competitiveness

Reliability and Quality

Low Prices And Efficiency

Cross Border Support

Internal Market

Security of Supply

SMARTGRIDS

20/20/20

Environment

Amenity Preservation

Climate Change

Kyoto and Post-Kyoto

European SmartGrids 20/20/20 in 2020

Energy trends

Huge market transformation – similar to telecom 20 years ago

Changed Market Structure

- EU Market liberalization (since July 2007)
- European Energy targets 2020+
- Financial crisis and GDP fluctuation

Globalization & Diversification

- M&A, regional expansion
- M&A, Value Chain expansion
- Cleaner Portfolio of Power generation

Investment in SmartGrids technologies :

Virtual Power Plants

Microgrids

DER Grid connection

DSM and eEnergy

Technological Transformation

- European **"SmartGrids"**
- Meaning Energy to Information shift **: the Digital Era**

Increased Competition

- Customer centric
- Differentiate with new products & services
- Retain and win customers

SmartGrids Research Areas and Strategic Deployment programs

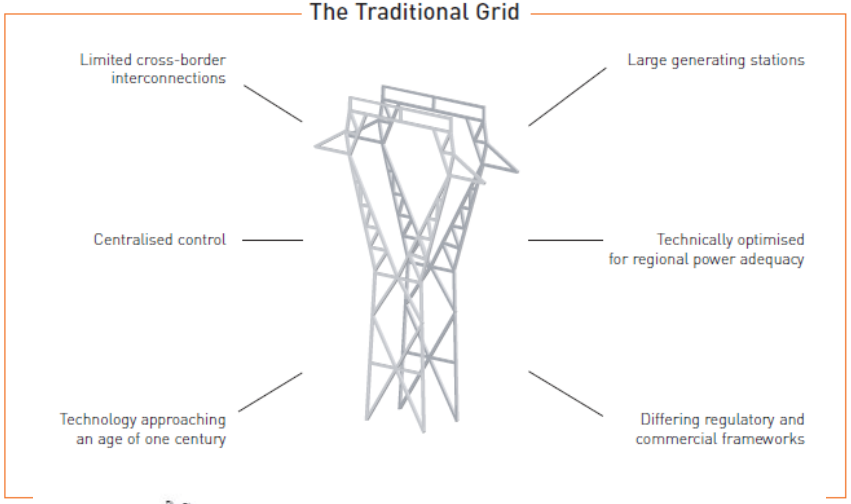
Research Agenda

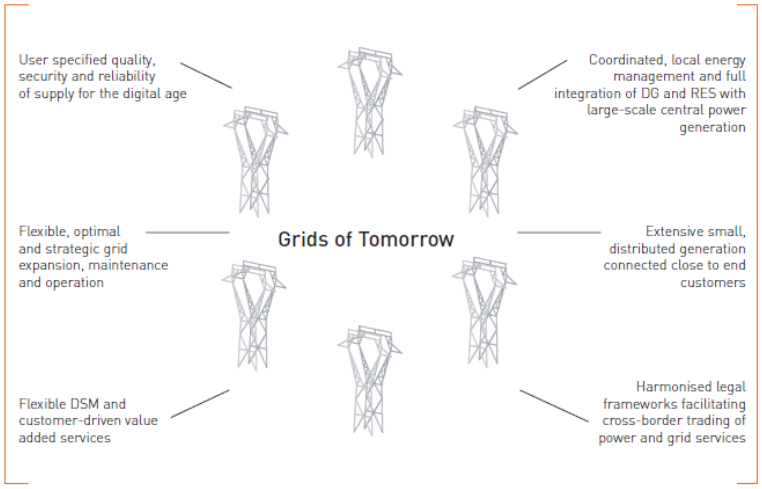
1. Smart distribution infrastructure (small customers and network design)
2. Smart operation, energy flows and customer adaptation (small customers and networks)
3. Smart grid assets and asset management (transmission and distribution networks)
4. European interoperability of smart grids (transmission and distribution)
5. Smart Grids cross-cutting issues and catalysts

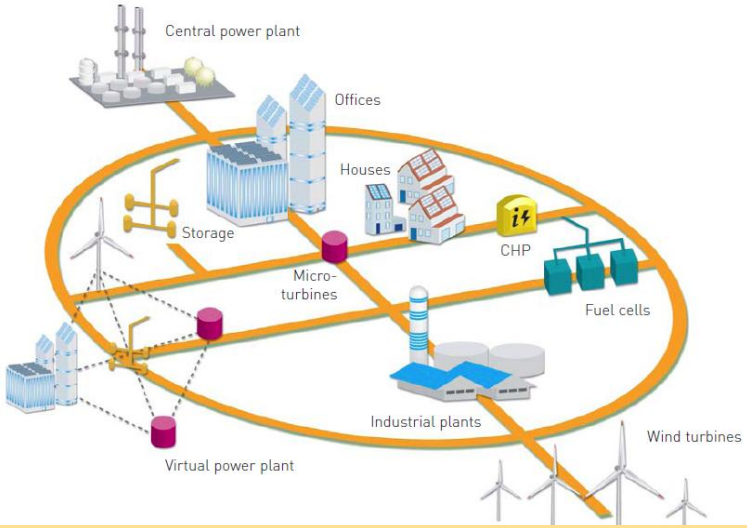
Deployment

1. **Optimizing Grid Operation and Usage**
2. **Optimizing Grid Infrastructure**
3. **Integrating Large Scale Intermittent Generation**
4. **Information and Communication Technology**
5. **Active Distribution Networks**
6. **New Market Places, Users and Energy Efficiency**

Future requirements for SmartGrids and Microgrids







Operation of system will be shared between central and distributed generators. Control of distributed generators could be aggregated to form microgrids or 'virtual' power plants to facilitate their integration both in the physical system and in the market.

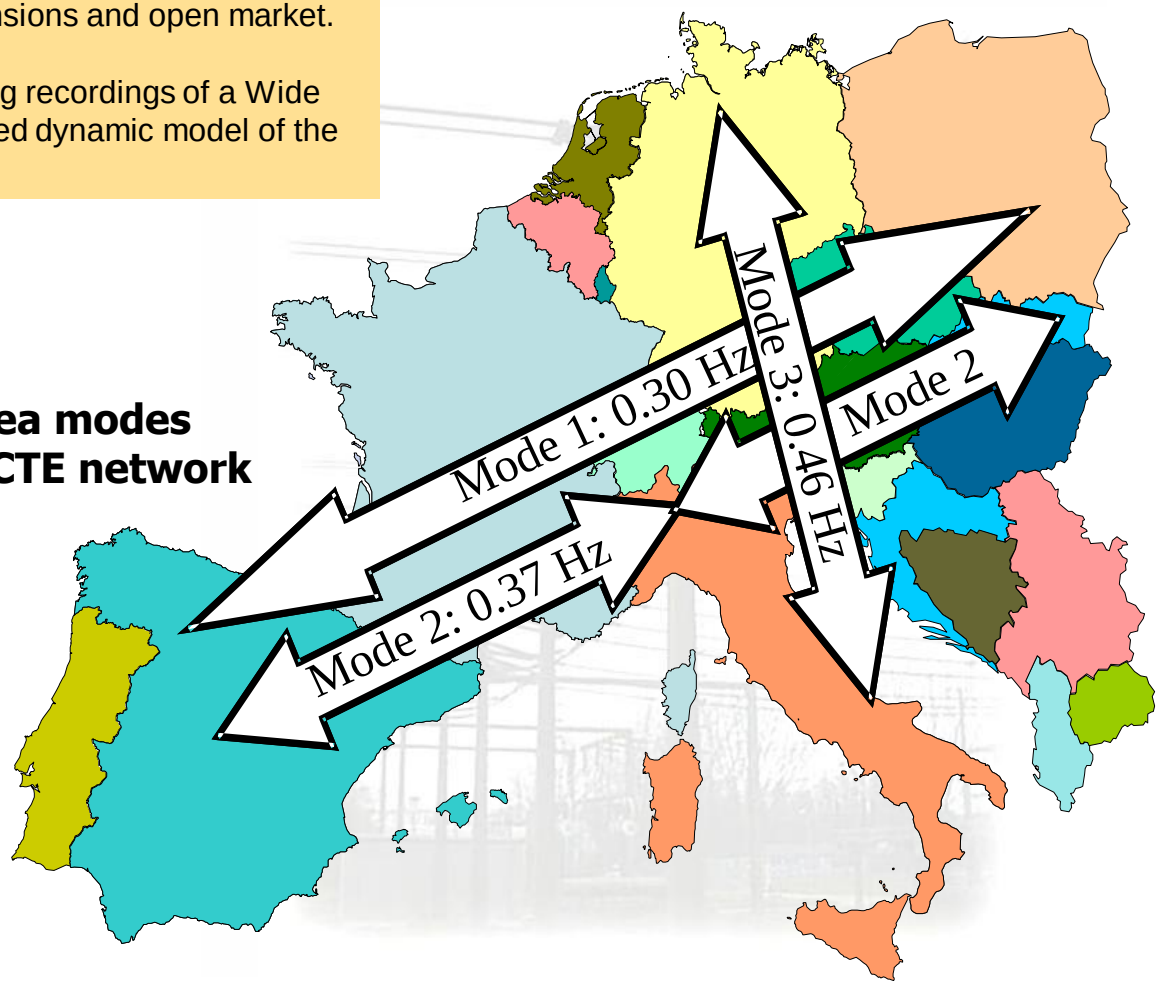
Flexible	• user-centric and based on an electronic market place
Accessible	• connect all users
Reliable	• security of supply in the digital age
Economic	• best value -> innovation, efficiency and competition

1. Optimizing Grid Operation and Usage

Steady state stability of the UCTE/CENTREL power system in order to maintain reliability of system operation in the future environment of the electricity sector given by further system extensions and open market.

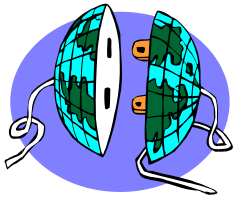
Inter-Area Oscillation analysed in general using recordings of a Wide Area Measuring System (WAMS) and a detailed dynamic model of the UCTE/CENTREL power system.

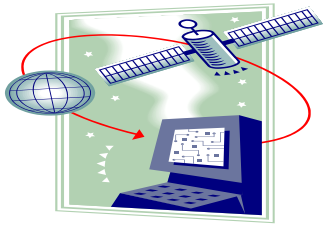
Inter-area modes in the UCTE network



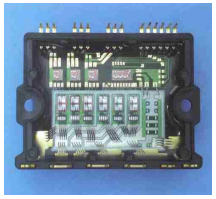
2. Optimizing Grid Infrastructure

Active Distribution Networks

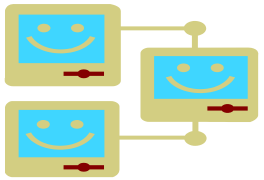




Improved power flows: FACTS, WAMS, WAPS



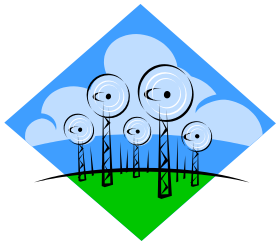
Power electronics technology



ICT & embedded systems

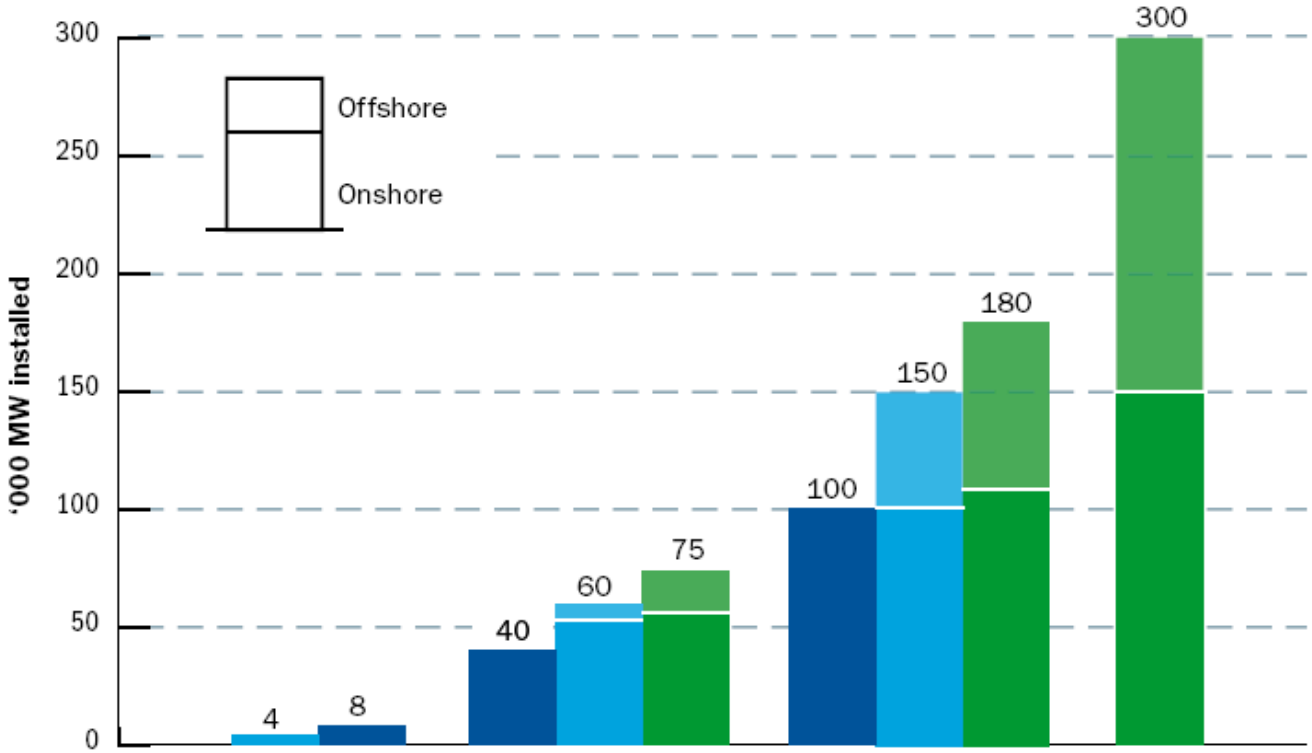
Smart Metering

Stationary energy storage



Communication for DSM / DR, on-line services, energy management

3. Integration of Large Scale Intermittent Generation



	Set in 1991	Set in 1997	Set in 1997	Set in 2000	Set in 2003	Set in 1997	Set in 2000	Set in 2003	Set in 2003
onshore	4,000	8,000	40,000	55,000	65,000	100,000	100,000	110,000	150,000
offshore	-	-	-	5,000	10,000	-	50,000	70,000	150,000

4. Information and Communication Technology

European SmartGrids 20/20/20 in 2020

Generation Operation

CO2 Emission Management,
Demand Side Management,
DER

Transmission and distribution

Interoperable SCADA and Business systems
Service Monitoring
Large scale DER grid connection
Energy Data Management and Smart Metering

Retail operations

Demand Side Management, Smart metering,
Innovative Enenrgy Efficiency products and services

Customers

Smart Homes
Customers active participation (Demand Response)
eEnergy Marketplace

Large deployment of RES

Mini and micro Turbines

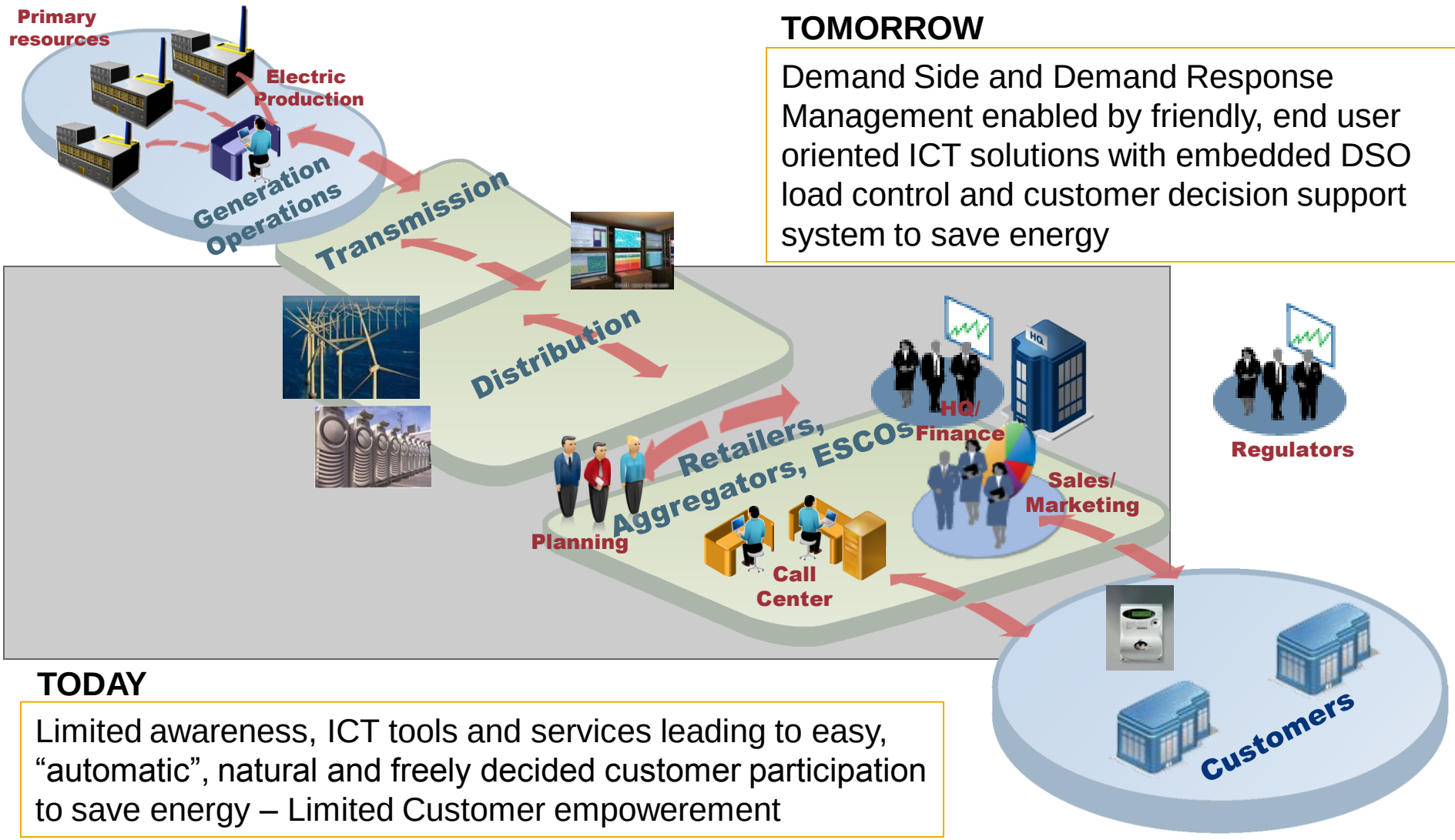
Large sidtributed generation

Sensors, monitoring, RFID

Power electronics technology

ITC & embedded system

Demand Side Integration



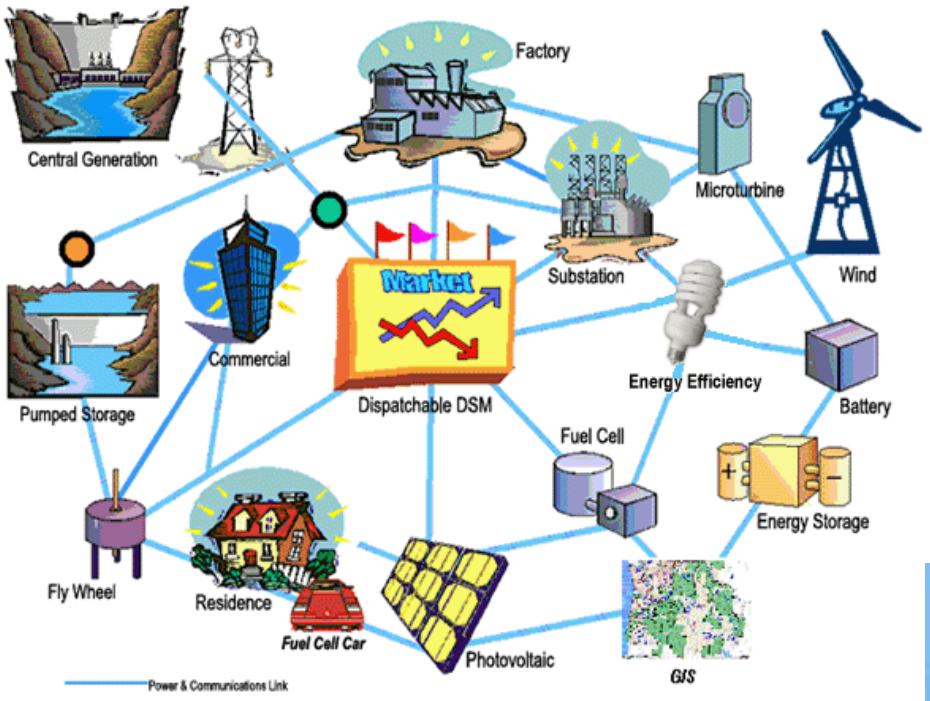
TOMORROW

Demand Side and Demand Response Management enabled by friendly, end user oriented ICT solutions with embedded DSO load control and customer decision support system to save energy

TODAY

Limited awareness, ICT tools and services leading to easy, “automatic”, natural and freely decided customer participation to save energy – Limited Customer empowerement

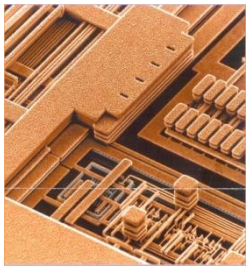
5. Active Distribution Networks

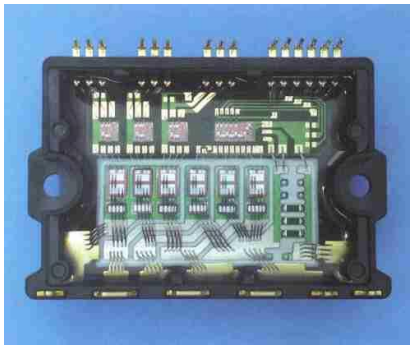


Energy Web

Mini and Micro Turbines

Higher currents,
lower voltages



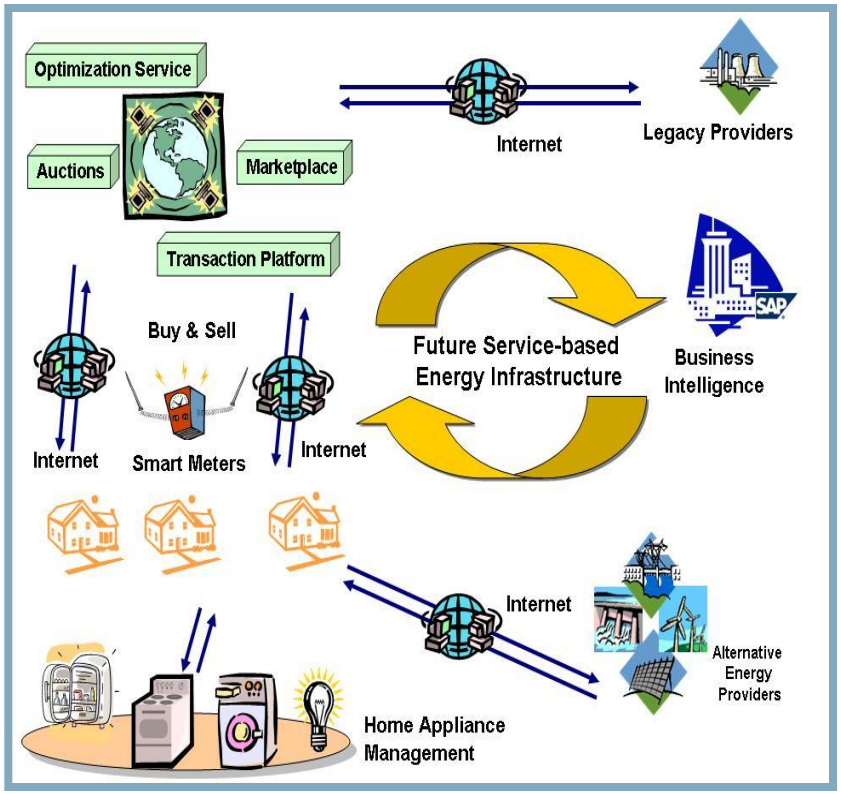


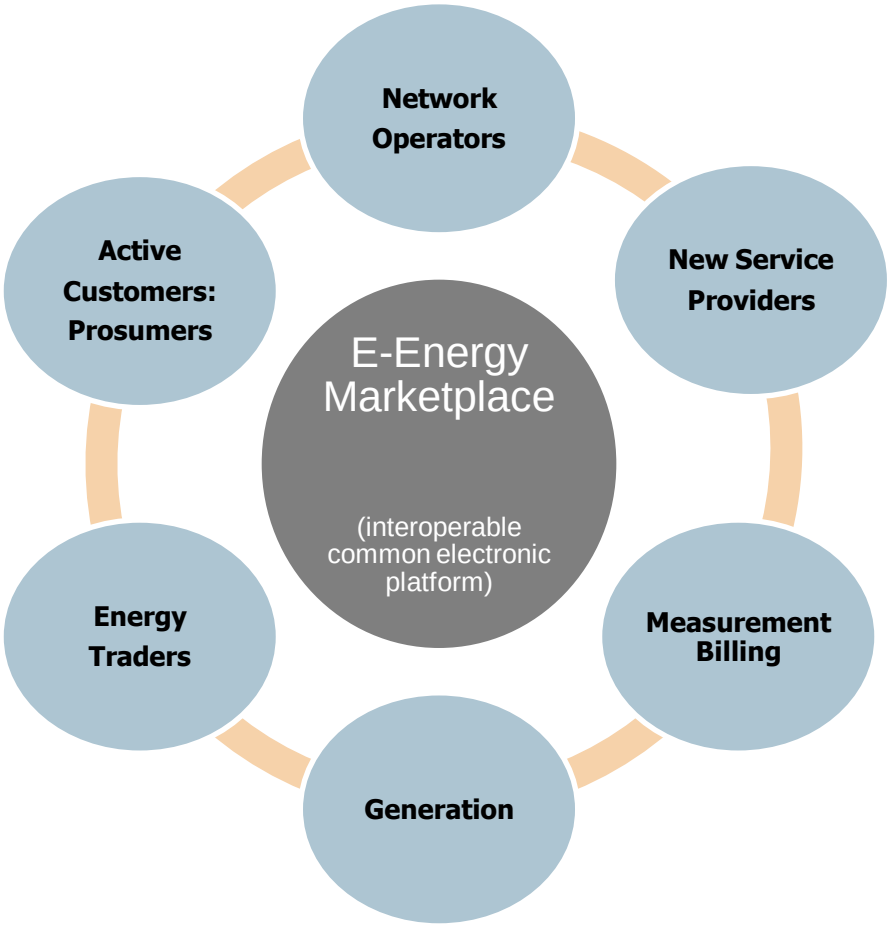
Intelligent
Power Electronics

Topics:

- Distribution
- Supply quality
- Renewable energies
- Flexibility
- Energy Management

6. New Market Places, Users and Energy Efficiency





DSO SmartGrids model (EEGI)

(according to DSO group of ENEL, EDF, Iberdrola, Vattenfall, CEZ, EON and RWE)

Smart Metering

SMART GRIDS *Functional level*

Level 5: Smart Customers

Customers aware and actively participating

Level 4: Smart Energy Management

Management of end-use energy efficiency, aggregation, retail

Level 3: Smart Integration

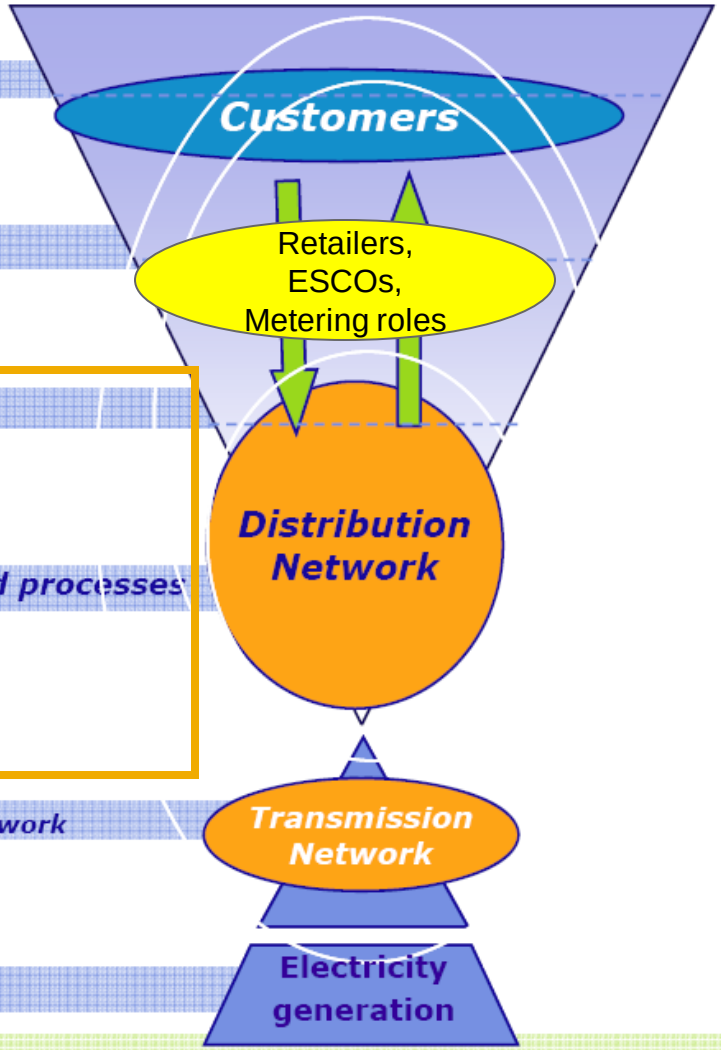
Renewable energy, DG, electric vehicles, electricity storage and aggregation

Level 2: Smart Distribution network and processes

More automated MV distribution networks with self healing capabilities.
Monitored and controlled LV networks
IT supported monitoring process

Level 1: Smart Pan-European Transmission network

Level 0: New generation technologies

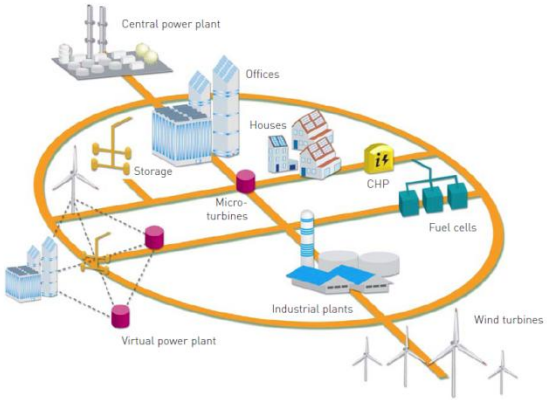


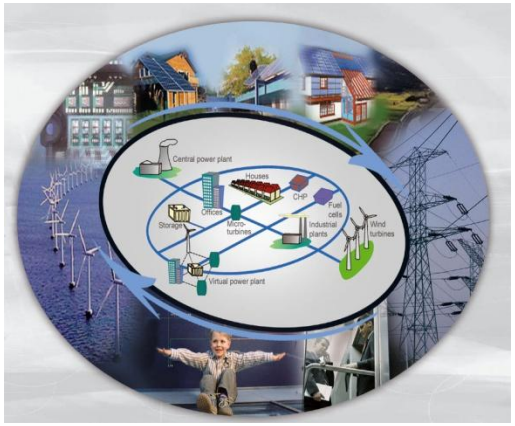
Microgrids predictions

Microgrids will become the incubator and operational test bed for innovative smartgrid soltutions and vendors.

Timely and cost-effective microgrid implementations will facilitate full smart grid development and integration, and forecasts the microgrid market will grow 13% from 2009 to 2014 and reach $7 billion by 2014.

SBI Energy study (MarketResearch) – Jan 2010



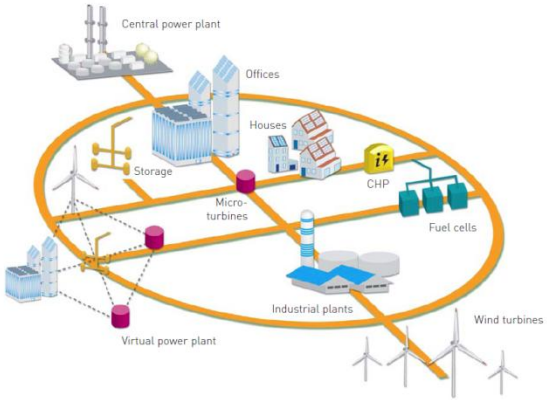


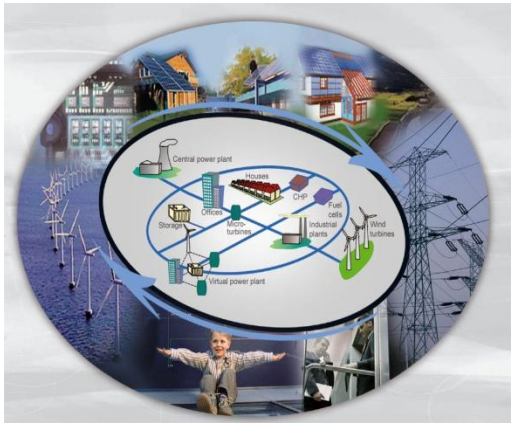
Microgrids predictions

"Regulators, industrial firms, consumers, and other stakeholders will test, evaluate, and begin to identify the technologies that will develop in a new era of electric generation, delivery, consumption, and cost.

Coupled with worldwide electric infrastructure costs that are estimated to top $1.5 trillion over the next twenty years, there will be much activity in the electricity production and delivery area in the near future."

SBI Energy study (MarketResearch) – Jan 2010





Thank you!