How

Smart Grid

is transforming the power sector?

Global Summit on

Electronics and Electrical Engineering, 3rd Oct 2015 - Valencia

Miguel Angel Hernandez

ÅF – Mercados EMI, Director of Smart Grids & Utility Solutions

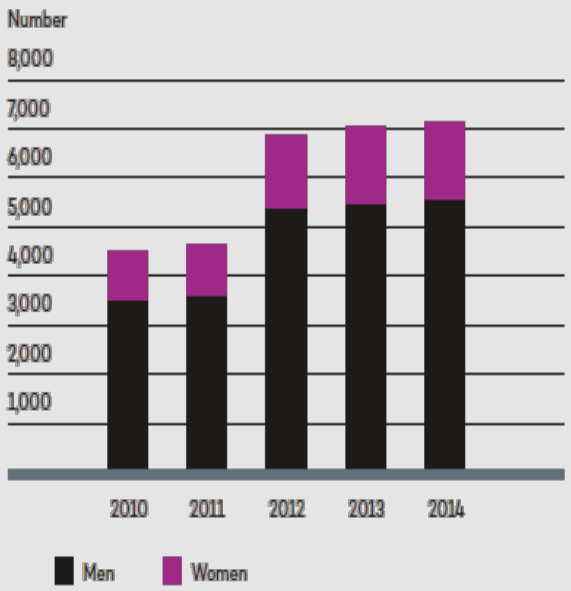
Facts at a glance

Key figures and profile

- **Headquarter** Stockholm, Sweden
- **Number of ÅF offices:** over 100 on four continents; Europe, Asia, South America and Africa
- **Number of assignments:** ÅF performs 30,000 assignments for 10,000 clients

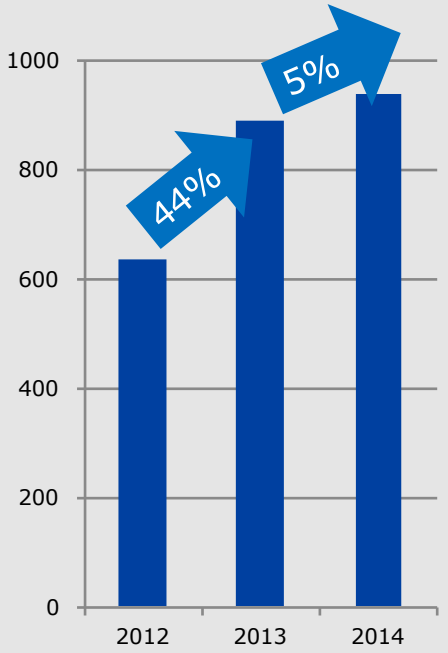
Our employees

7,117 employees



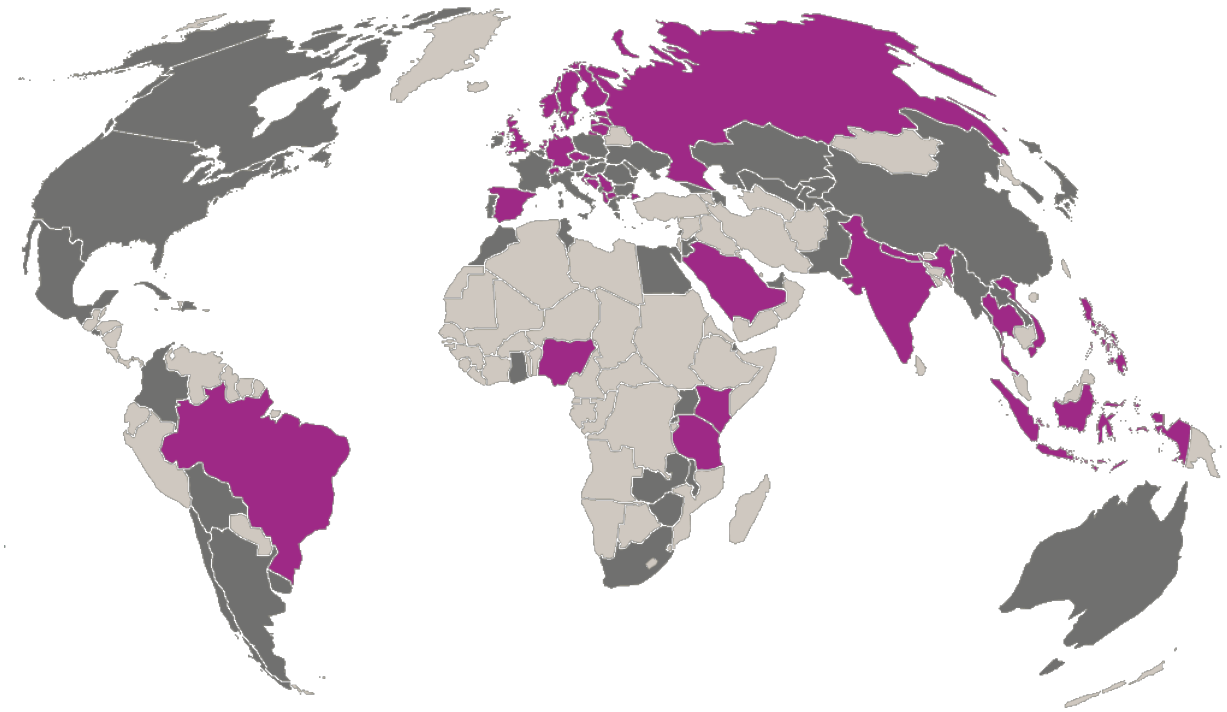
Turnover

In 2014: 939€Million



ÅF's presence worldwide

Global expertise backed by local knowledge



ÅF has offices and projects

ÅF has carried out projects

Domestic Markets:

Sweden
Norway
Denmark
Finland
Czech Republic
Switzerland
Spain

Other main offices with engineering resources:

Brazil
Estonia
Germany
India
Indonesia
Iran
Italy
Kenya
Kingdom of Saudi Arabia
Lithuania
Macedonia
Nepal
Nigeria
Russia
Serbia
Tanzania
Thailand
The Netherlands
Turkey
United Kingdom
Vietnam

Our offering







Offering

Full scale of technical and financial advisory services:

- Hydro Power
- Thermal Energy
- Nuclear Energy

Further fields of activities:

- Renewable Energy
- Power Distribution
- Smart Grids
- Market Modeling Studies
- Energy Policy Issues

Clients

- Power utilities
- Energy related industry
- Government/municipalities
- Local authorities
- Transmission/Distribution companies
- International funding institutions
- Construction companies
- Industrial companies
- Regulation Authorities

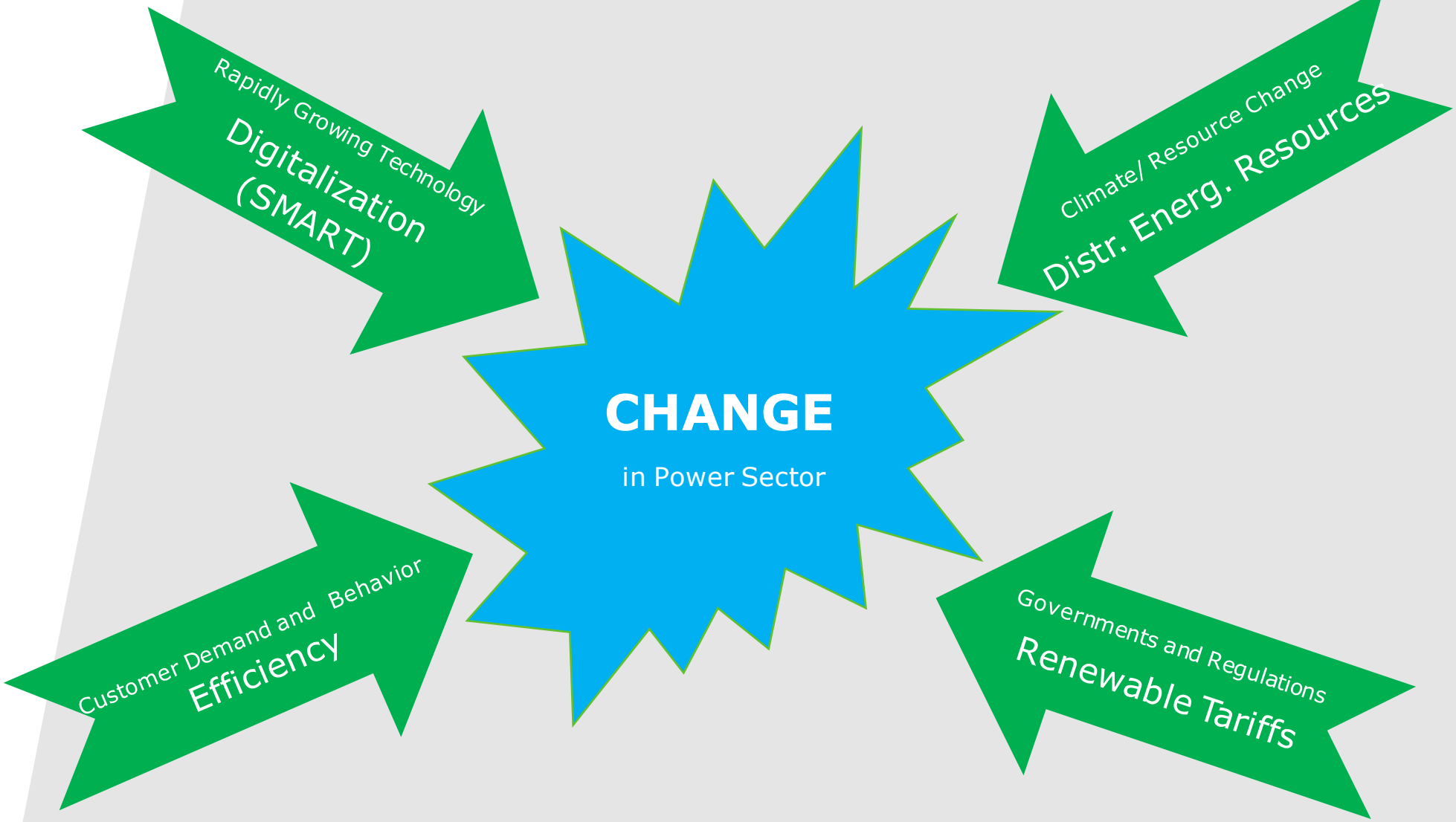
Competences

Feasibility Studies	Project Development	Implementation	Operation & Maintenance
Consulting studies	Project management, Contractor supervision		Expert services
	Basic design, Design review		
	Engineering management, Supervision and Design review		
	Detail engineering		

*"Smart Grid is an electricity network that can **cost efficiently integrate the behaviour and actions of all users connected** to it in order to ensure economically efficient, sustainable power system with low losses and high levels of quality and security of supply and safety*

European Commission

Mega-Trends in Power Sector



Smart Grids Elements

- Smart Meters
- Network Automation
- Advanced forecasting Tools
- Real Time Sensors

Participation of Smart Grids in Changes

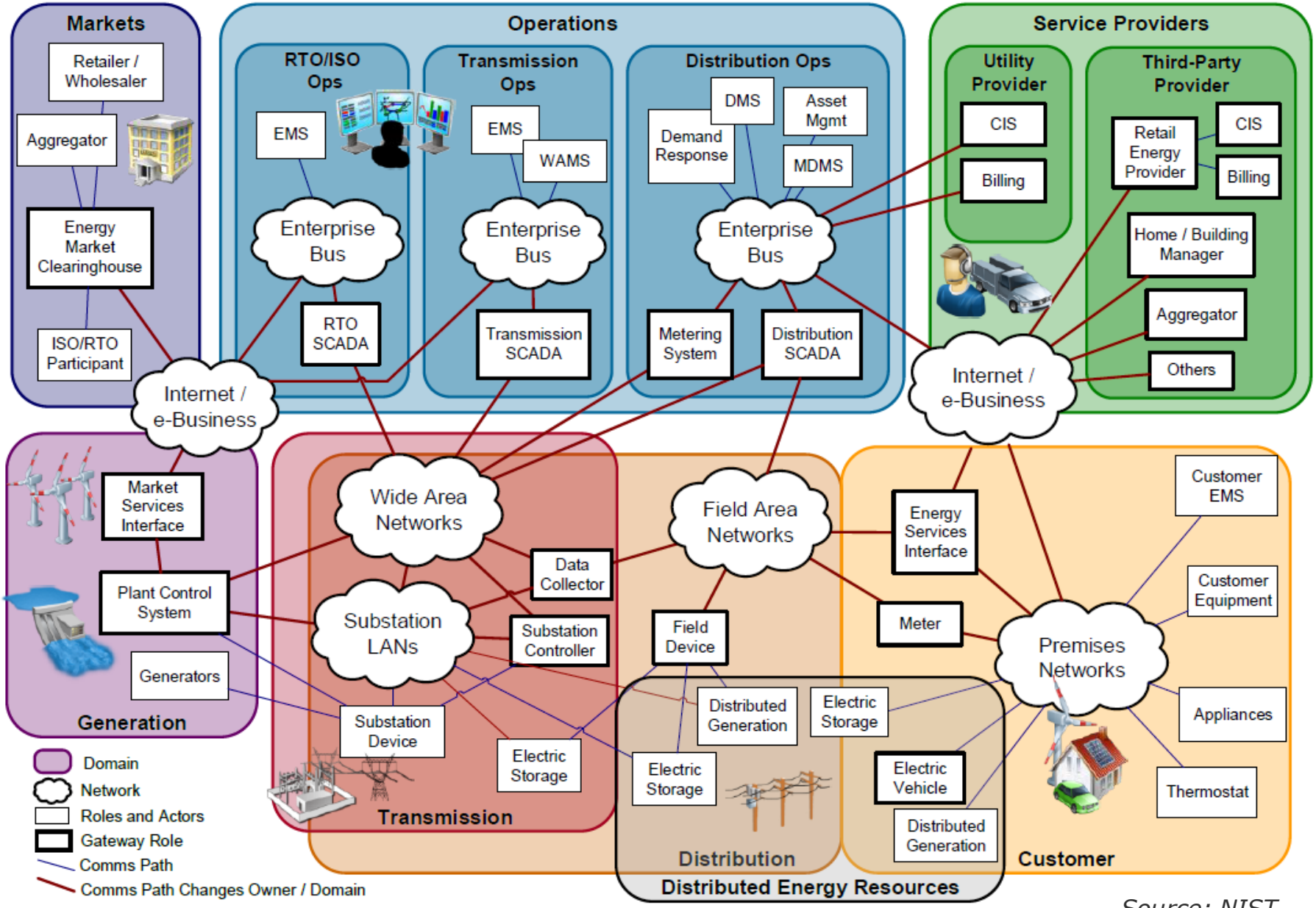
Mass Introduction of Technology:

- Software
- Hardware
- Communications



- Reshaping the Energy Grid (Meshed) & Network Self Healing
- Facilitation of Penetration of Renewable Energy
- Exponential Increase of data availabilty for decision making processes.
- Availability of New Services (Demand Side Response, etc)

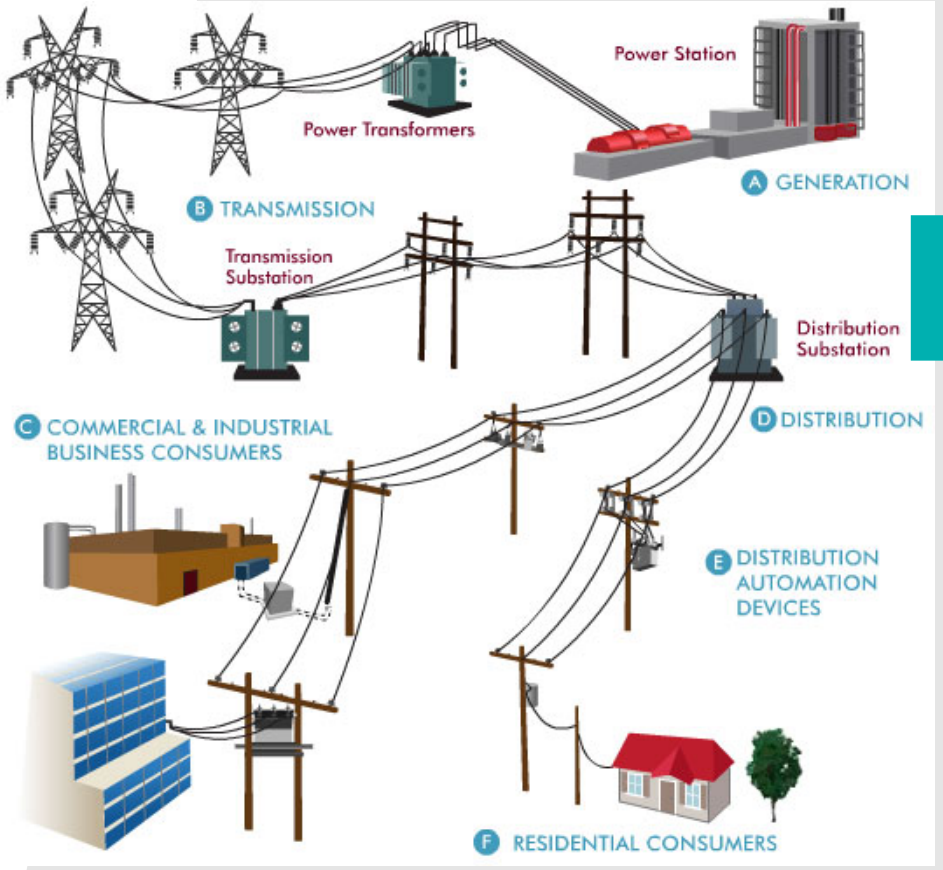
Technology and Communications



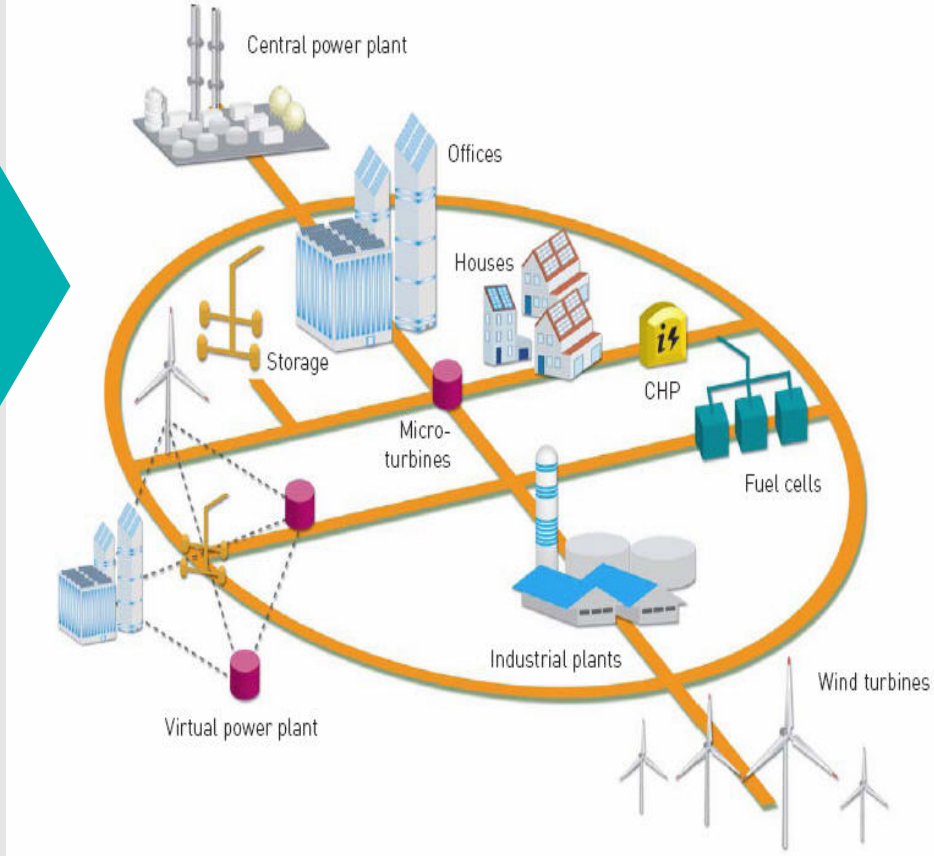
Source: NIST

Reshaped Energy Grid & Network Self Healing

Radial



Networked



Renewable Integration Challenges

RE Variability Challenge

- Reserve sizing
- Upwards and downwards ramps
- Forecast errors
- System backup power (energy niche for conventional power plants)
- Cost allocation
- Spilled energy

Measures

- Flexible units, (fast gas turbines, hydro, etc.)
- **Dedicated control centre (observe-control)**
- **Demand Side Management**
- Storage (hydro pumping, batteries, …)
- **Specific operation tools (i.e. adequate forecast, reserve optimization, …)**
- Regulatory measures (i.e. capacity payments)

Technological Challenge

- Voltage Control
- Frequency-Power control
- Transient stability
- Disconnection control

Measures

- Real-time Reactive absorption/injection
- Power factor rate
- Ancillary services
- Fault-ride-through capability
- Disconnection schema

Operational Challenges

- Real-time communication
- Real-time measurements
- Production Intermittency
- Protections

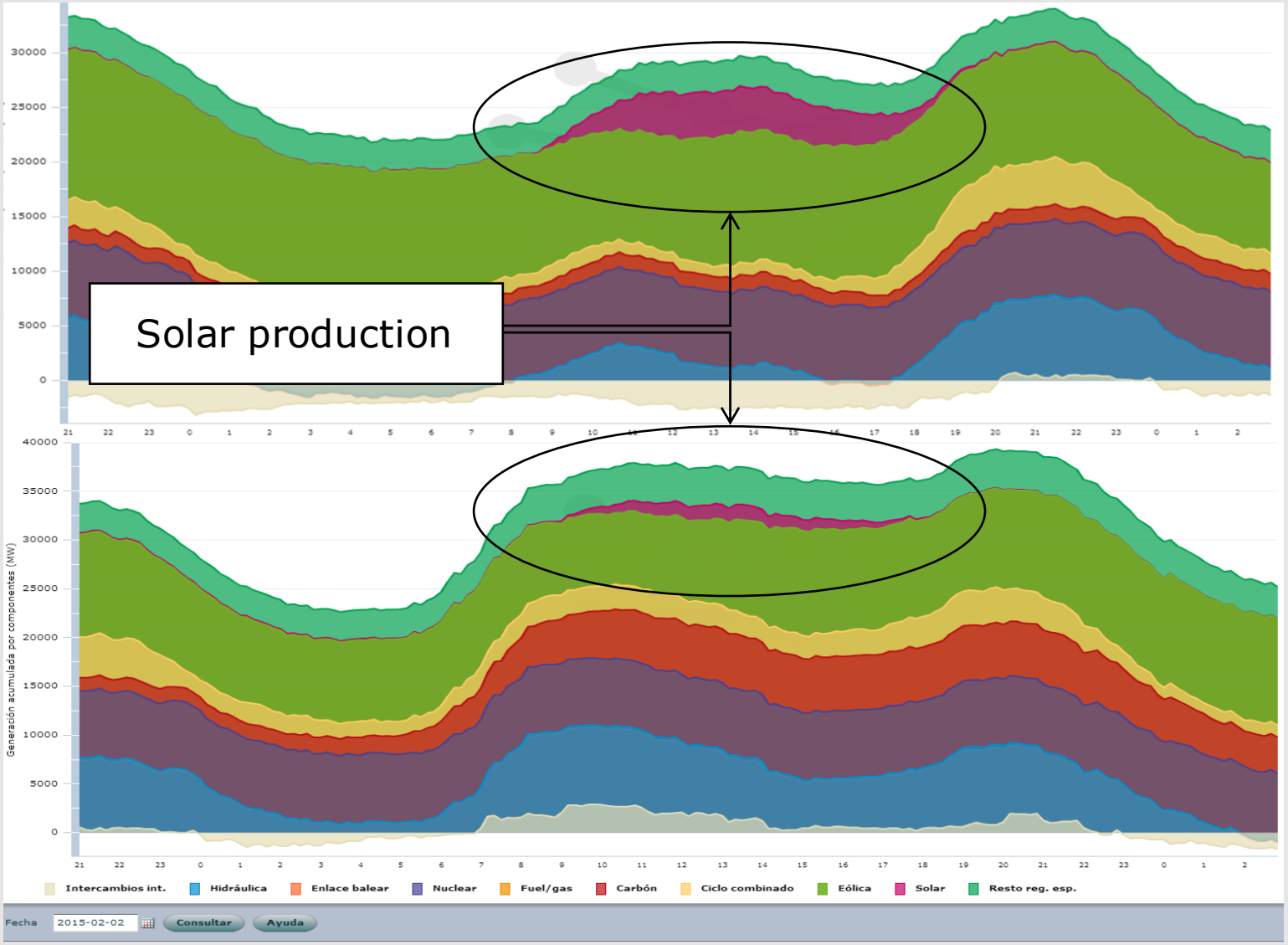
Measures

- **Specific operation tools (i.e. adequate forecast, reserve optimization, …)**
- Additional Ancillary Services Dynamic response
- Set-point values

Solar Power Variations

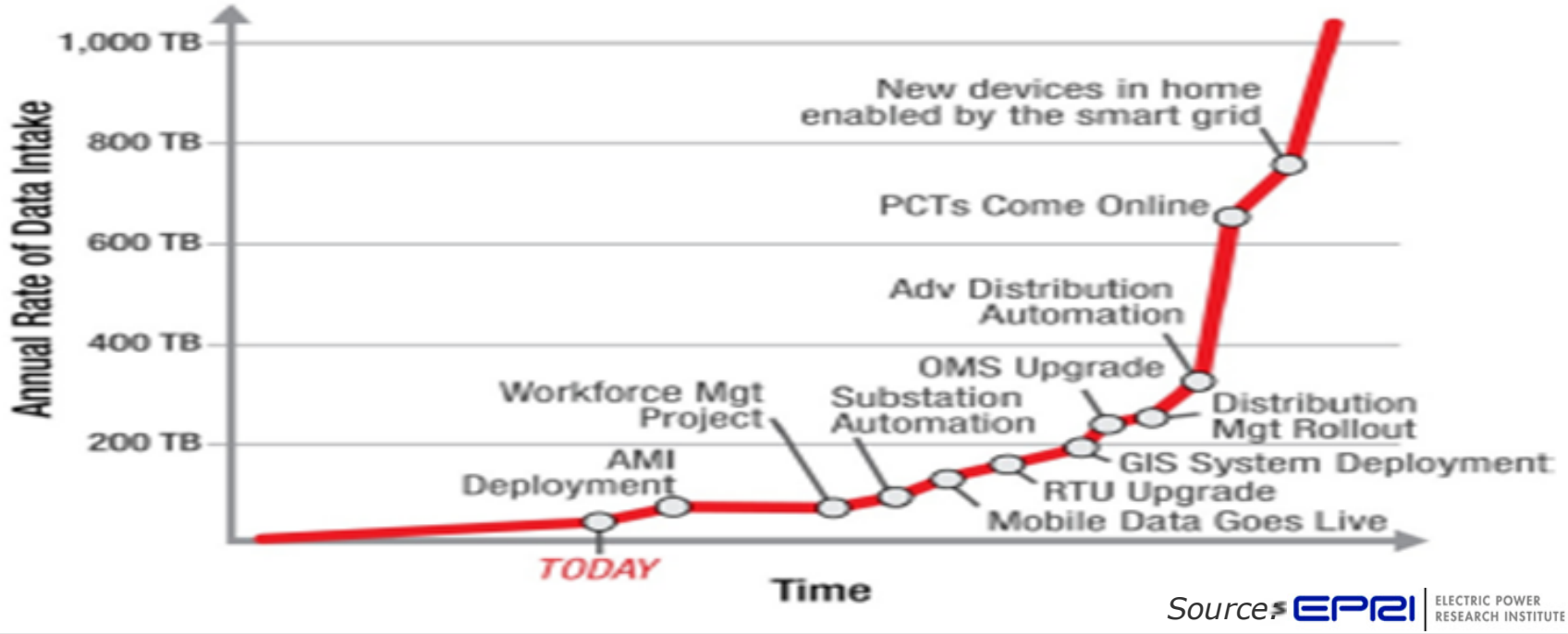
1st- February 2015

2nd- February 2015



Data for Decision Making Process

Data Availability from Smart Grids



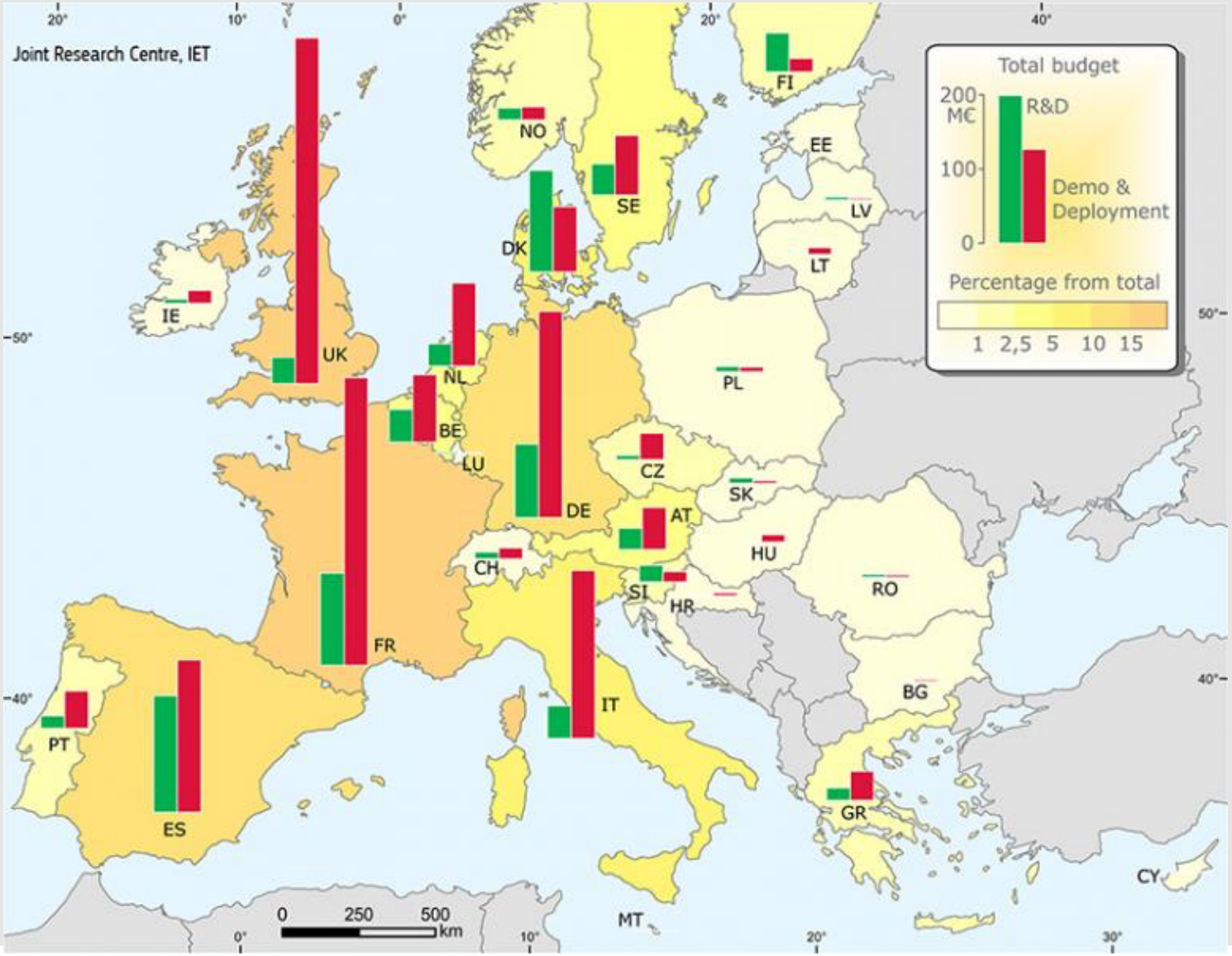
Source: EPRI ELECTRIC POWER RESEARCH INSTITUTE

Availability of New Services

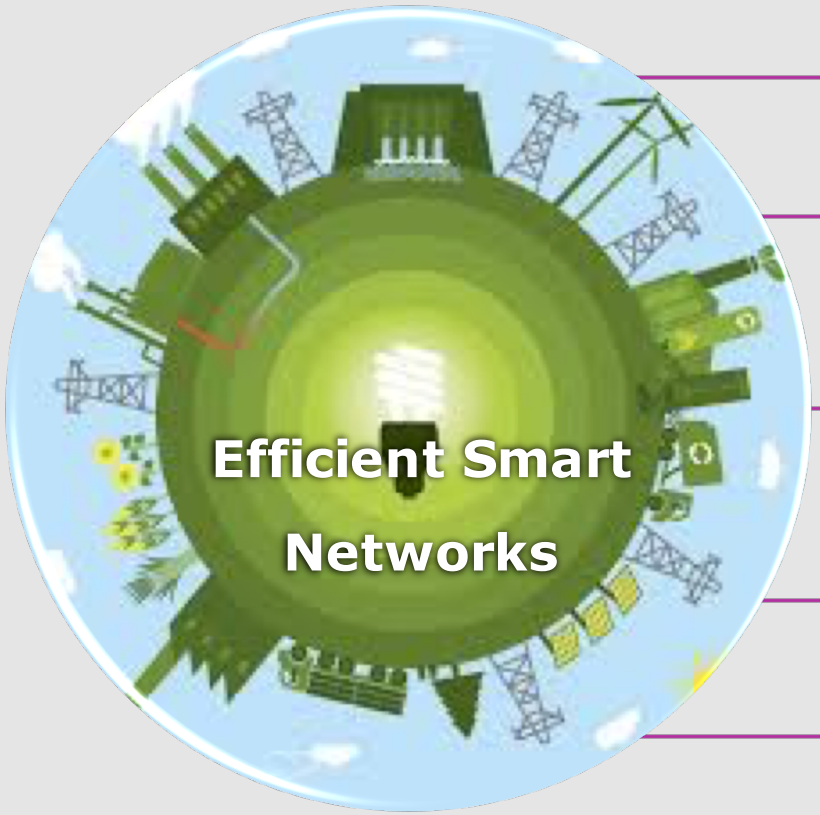
European Comission Recommendations for Smart Metering Functional Requirements

Consumer	• 1. Provide readings directly to the consumer and/or any 3th party • 2. Update readings frequently enough to use energy saving schemes
Metering Operator	• 3. Allow remote reading by the operator • 4. Provide two-way communication for maintenance and control • 5. Allow frequent enough readings for network planning
Commercial Aspects of Supply	• 6. Support advanced tariff system • 7. Remote on/off control supply and/or flow or power limitation
Security and Data Protection	• 8. Provide secure data communication • 9. Fraud prevention and detection
Distributed Generation	• 10. Provide import/export and reactive metering

Smart Grid Investment Status Europe 2014



Our 360º Vision at ÅF





Social
Conditions



Cost/Benefit
Analysis



Technical
Solutions



Regulatory
Framework



Company
Organisation

Contacts



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thank you
danke
謝謝
gracias
obrigado
dziękuję
bedankt
merci
go raibh maith agat
teşekkür ederim
ngiyabonga
شكرا
спасибо
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Баярлалаа
dank je
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mochchakkeram
sukriya
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merci
سپاس
مرسی