

IEEE Technology Time Machine

Symposium on Technologies Beyond 2020

Smart Grids: Enel Experience and Projects

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Head of

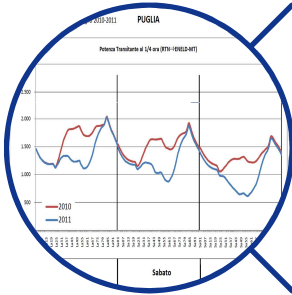
Engineering & Standardization

Enel Distribuzione spa

Summary



Enel Group & Enel Distribuzione



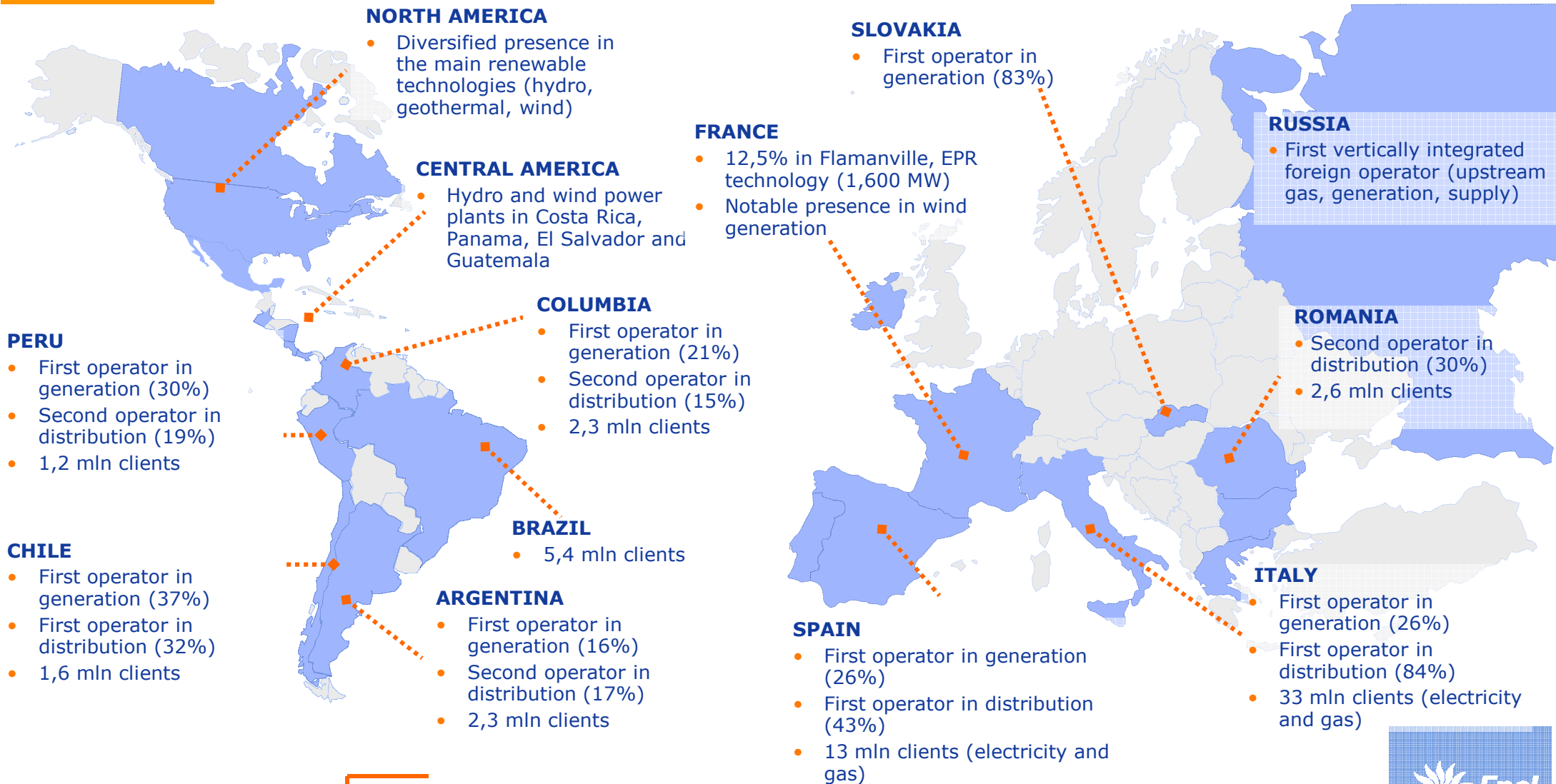
The Challenges



Smart Grids as a solution

Enel: a World dimension

Focus on major areas of presence



A fully integrated global energy player



Infrastructure and Network Division

Main Business Areas and Figures

Electricity networks Business Area

- 4 Macro-Regions
- 11 Local Branches
- 11 Control Centers
- 115 Offices
- 19.000 Employees
- Over 1.100.000 km lines
- About 2.000 HV/MV Substations
- Over 400.000 MV/LV Substations
- 32 million customers

Public lighting Business Area

- 5 Local Branches
- 330 Employees
- 1.925.000 Spot-lights
- 4.000 Municipalities served

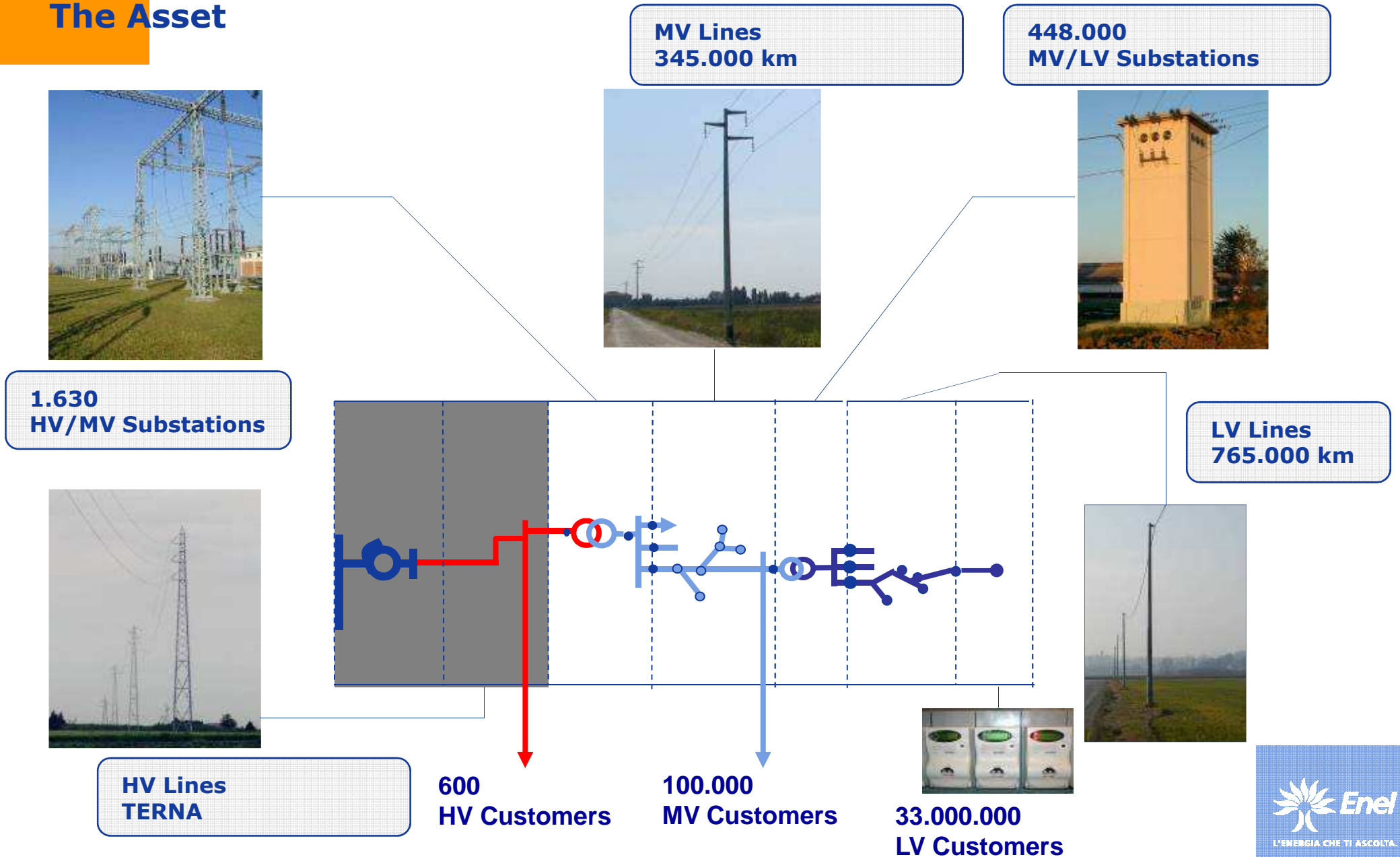
Gas network Business Area

- 4 Local Branches
- 21 Control Centers
- 1.300 employees
- 630 Primary Plants
- About 30.600 km gas pipelines
- 2 million customers

The 2° largest Distribution Operator in Europe

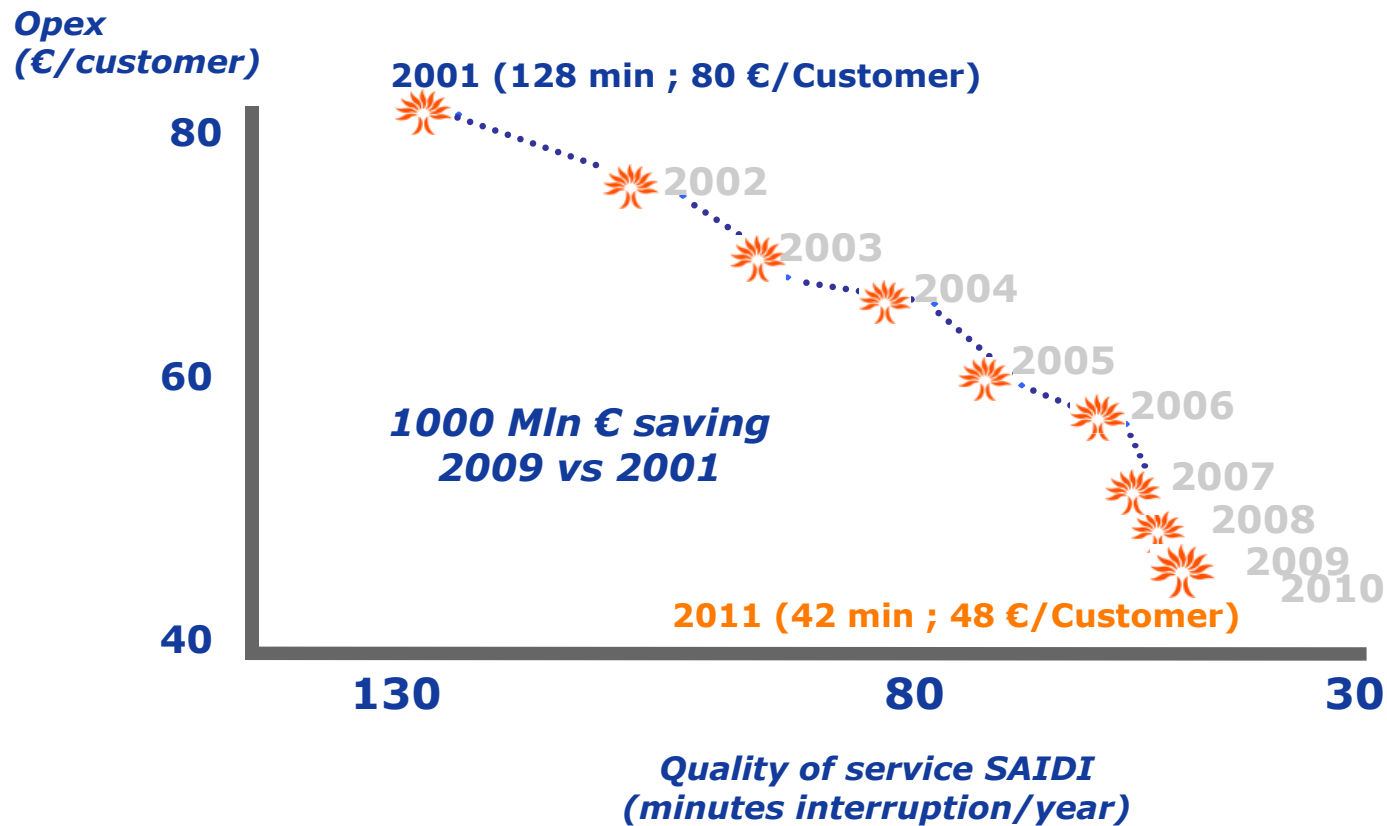
Enel Distribuzione's Network

The Asset

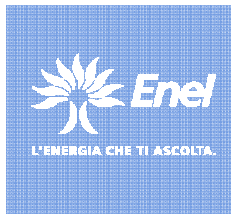


Enel Distribuzione's Excellence

(Performance VS Cost Efficiency) or (Performance AND Cost Efficiency) ?



**European Benchmark for distribution
Quality of Service and OPEX**



Enel Distribuzione's Excellence

Enel and its "first generation" of Smart Grid



Automatic Meter Management

- ▶ Telegestore is fully operational on > 32 Mln Customers
- ▶ Leading Technology
- ▶ Excellence in operation



Network automation

- ▶ HV and MV network remotely operated
- ▶ More than 100.000 MV substations (25%) remotely controlled
- ▶ Automatic fault clearing procedures (self-healing network)



Work Force Management

- ▶ 5.200 vehicles equipped
- ▶ Logistic support to Enel crews
- ▶ ENEL cartographic available on board
- ▶ All processes through mobile applications
- ▶ Connection from field to the centre for Enel crews



Asset Management

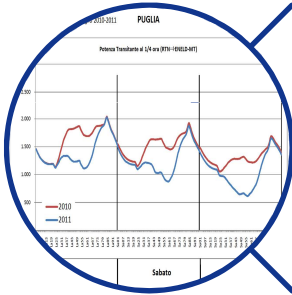
- ▶ Cartographic census of network assets
- ▶ Database of network events (power outage notification, fault detection, etc.)
- ▶ Optimization of network investments based on a risk analysis.

Investment exceeding € 2,5 bn
Dramatic reduction of cash-cost per customer

Summary



Enel Group & Enel Distribuzione



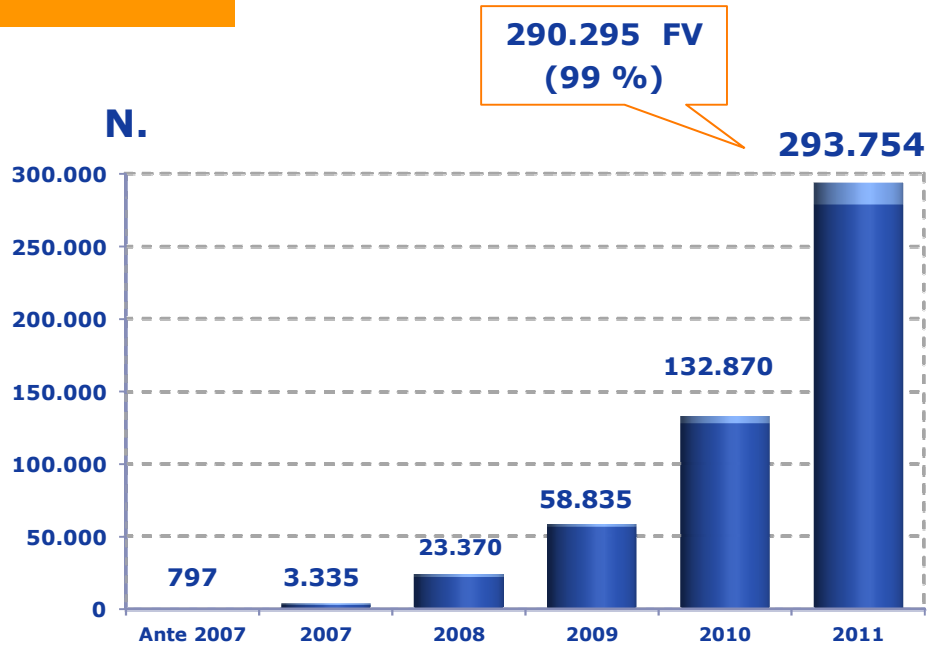
The Challenges



Smart Grids as a solution

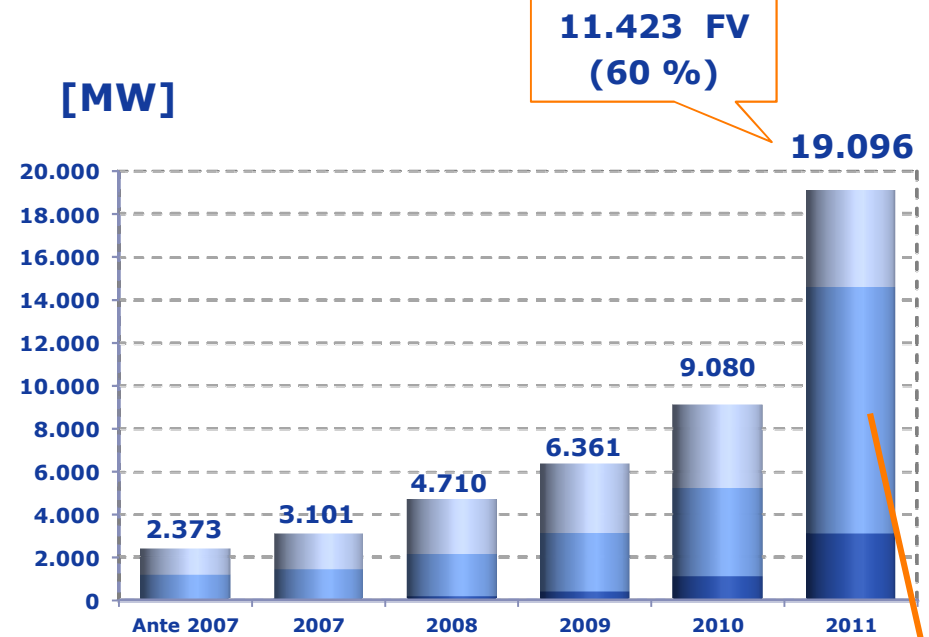
The Development of Renewables

Connections to Enel Distribuzione's Network



LV+MV+HV Connections [No.]

Cumulative Data



Connected Power LV+MV+HV [MW]

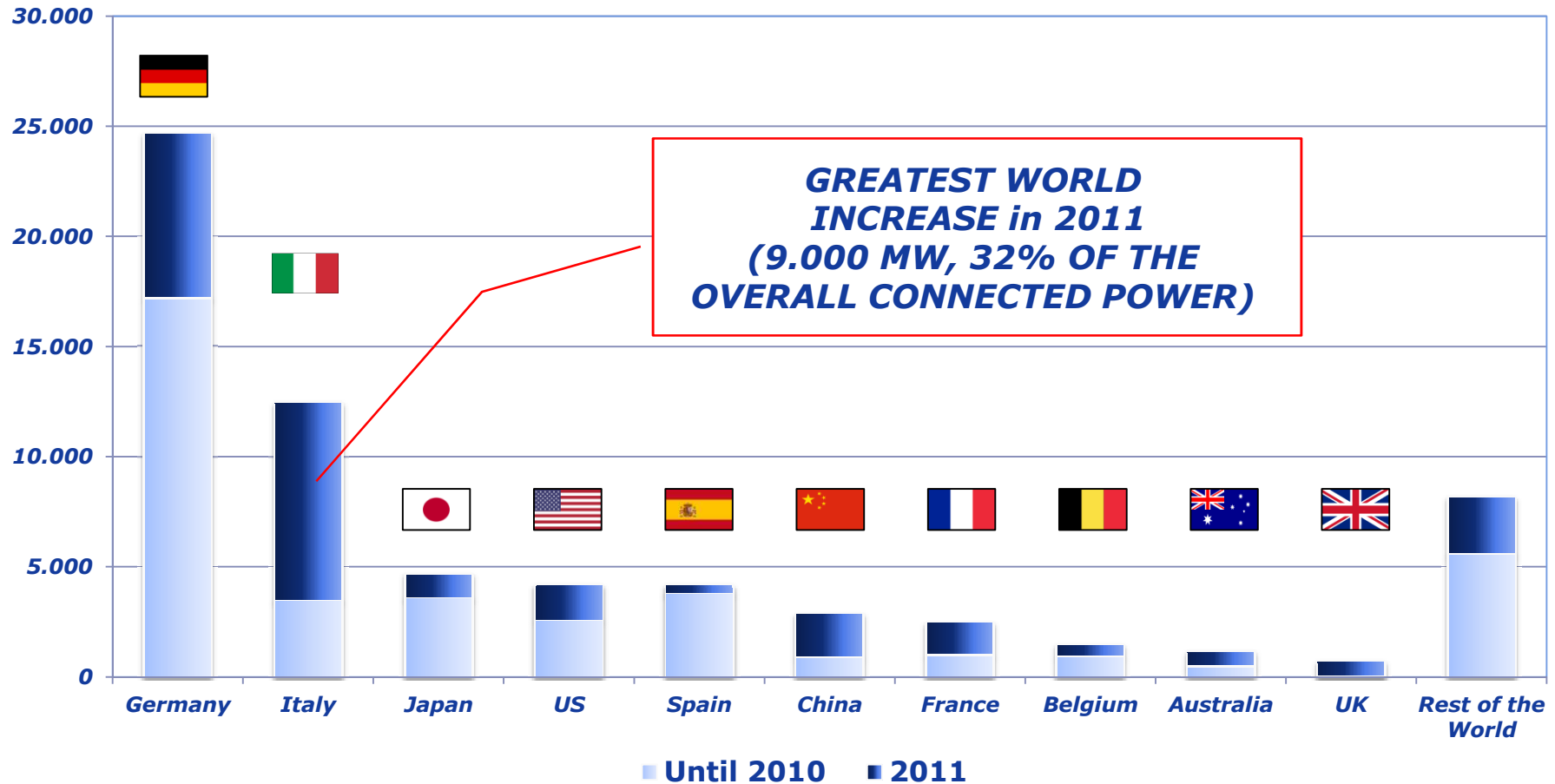
Cumulative Data

Most RES-Power is connected to MV Network



PV Growth in 2011

International Benchmark

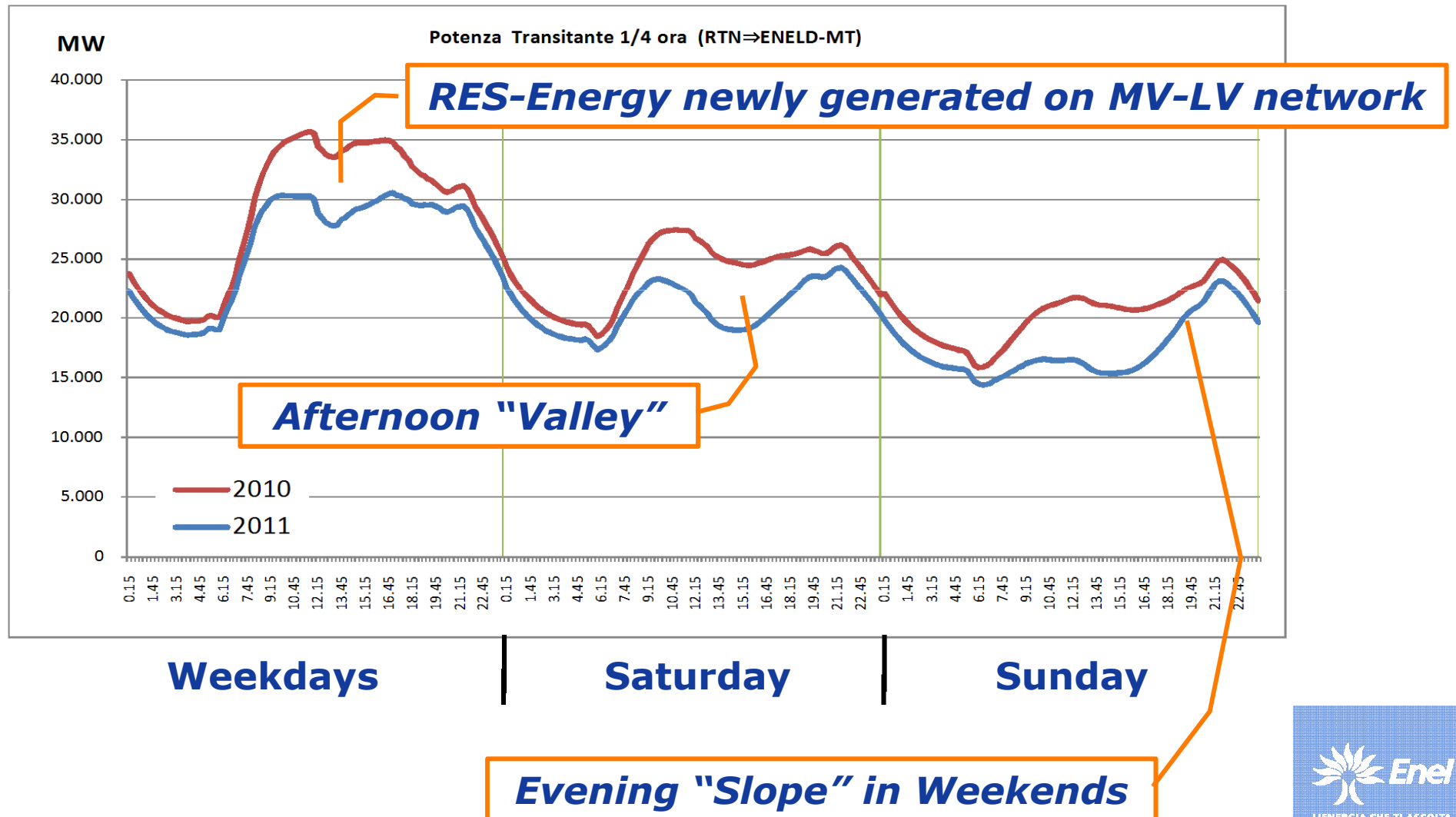


Impact of Distributed Generation

Energy Flow at TSO-DSO boundary: Avg. Load Curves (July 2011 Vs 2010)

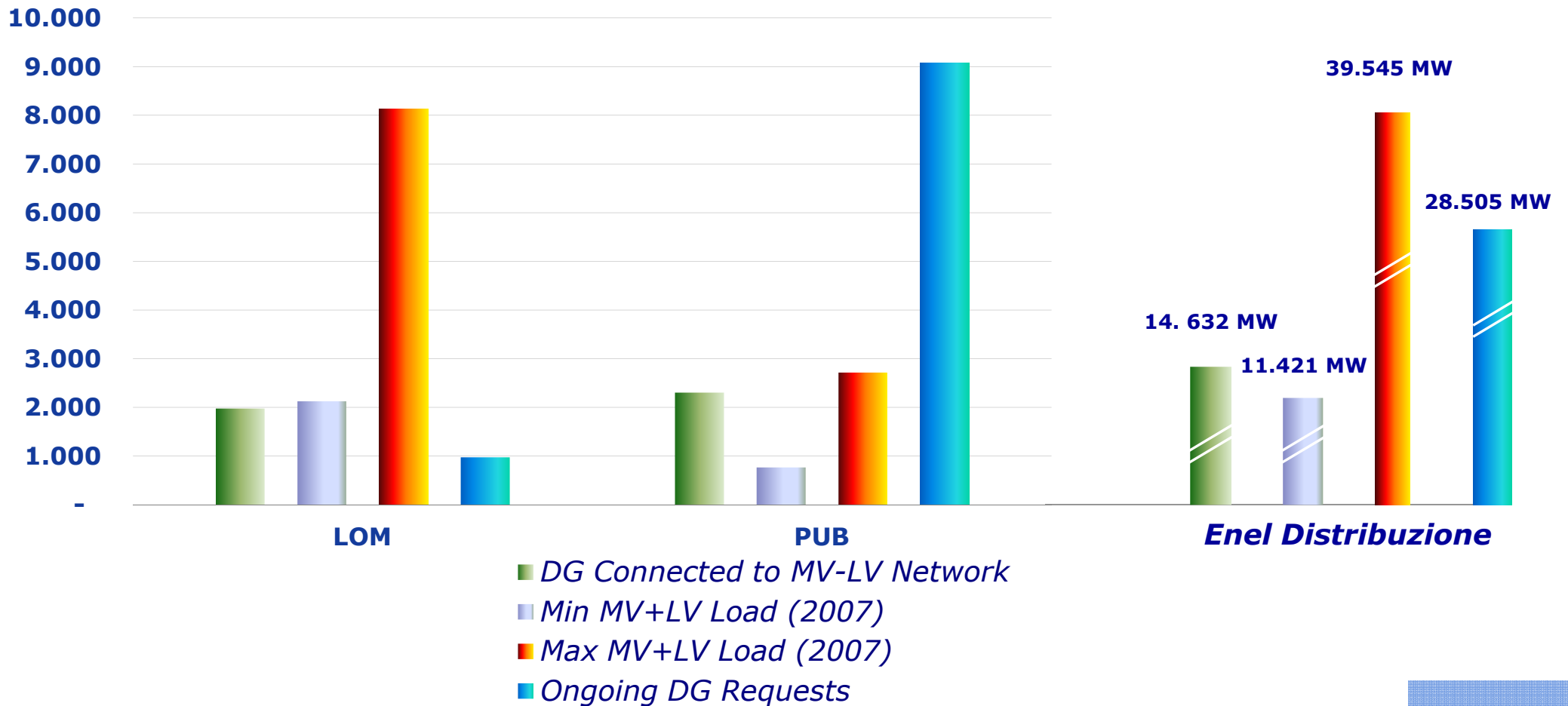
ENEL Distribuzione

Valori MEDI



Impact of Distributed Generation

Connected DG vs Load at MV+LV Level



Data Source: Enel Distribuzione

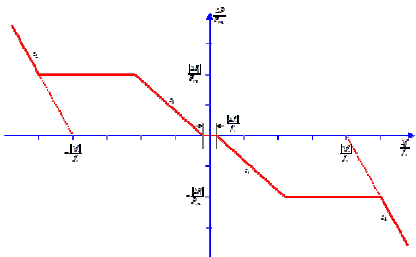
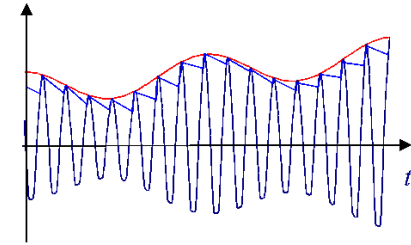


The "Game rules"

Consequences of present rules at system level

Current rules imply:

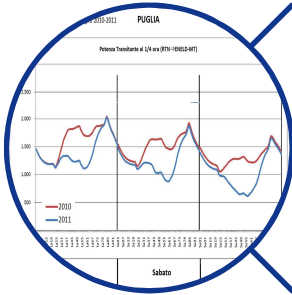
- ✓ network design based on peaks (min load + max DG; max load + min DG);
- ✓ (up to 2012 31st March) no contribution to frequency regulation;
- ✓ possible unintentional islanding;
- ✓ voltage levels along feeders depend on DG and network operators can't manage them.



Summary



Enel Group & Enel Distribuzione



The Challenges



Smart Grids as a solution

The Evolution of the electricity system

Main European Strategic Drivers

Strategic Drivers

- ✓ Climate Change European Goals
- ✓ Large increase of unpredictable renewable energy sources
- ✓ Market liberalization
- ✓ Change in electricity consumption
- ✓ Replacement of ageing infrastructures

Distribution System Operators Goals

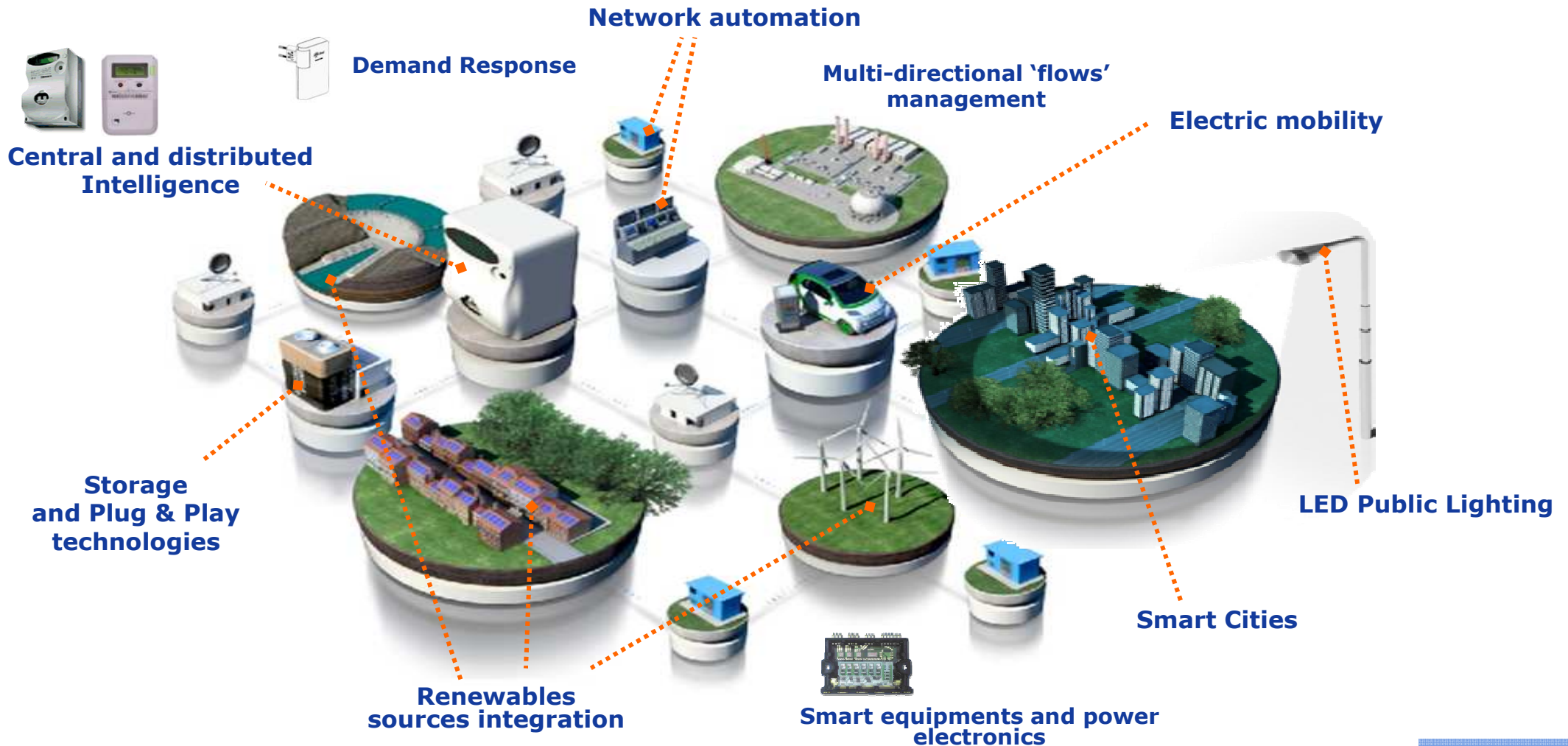
- ✓ Quality and security of supply
- ✓ Energy flow management and renewables integration
- ✓ Energy Efficiency
- ✓ Enable the active participation of customers to the energy market
- ✓ Support energy efficient demand side technologies
- ✓ Increase the network flexibility to face future scenarios

Networks are strategic enablers of a low carbon future



The Evolution of the electricity system

Smart Grid vision



An electricity network that intelligently integrates all actors for a sustainable, reliable and efficient electricity supply

From Vision to Reality

Smart metering in Spain: Cervantes Project



13 million installed Smart meters
2,000 new jobs

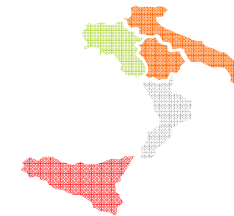
From Vision to Reality

Enel Smart Grid Projects: Integration of Renewables



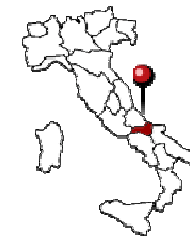
Improving Southern Italy Grid

- Advanced voltage regulation
- Distributed Generation Dispatching
- Increase of hosting capacity for RES connection
- Meshed network operation



Smart Grids Isernia Project

- Testing new technologies for Distributed Generation Management
- Ensuring high QoS and safety level
- Testing Energy Storage Systems



GRID4EU

- Large-Scale Demonstration of Advanced Smart GRID Solutions with wide Replication and Scalability Potential for EUROPE
- Enel demo aims at increasing increase MV network hosting capacity through active control and active demand response



From Vision to Reality

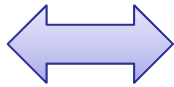
Enel Smart Grid Projects: Active Demand Management



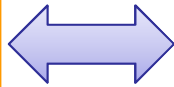
Enel Technology



Telegestore



Smart Info



Consumers



Smart Appliances



Smart Meter Role



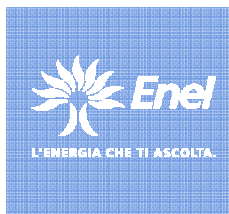
- The meter is an access point to all the metrological
- Provides information about the consumption history and habits

Ongoing Projects

- Address
 - Develop and test technical solutions for customers and the electricity network to enable "Active Demand"
 - Identify market, regulatory and contractual mechanisms to facilitate the development of Active Demand and the penetration of distributed generation and renewable sources.
- Energy@Home
 - Development of a communication platform which enables value added services based on exchange of energy consumption information within the Home Area Network (HAN)

address
interactive
energy

 **Energy@home**



From Vision to Reality

Enel Smart Grid Projects: Electric mobility

e-mobility Italy in Italy

Roma



Pisa



Milán



Movele, Carrefour, Green eMotion in Spain



EV charging infrastructure:

- ✓ Innovative and economic solution
- ✓ Innovative technologies, compliant to regulations
- ✓ Solutions ready to support Smart Grids functionalities (charging and storage management)



1,000 Points of Recharge
Infrastructure Development for large scale electric mobility

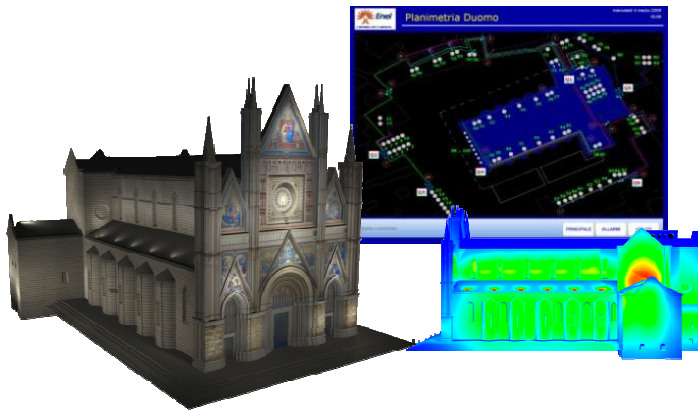
From Vision to Reality

Public and artistic lighting

Enel Sole Archilede

First european illumination product with Led technology

- ✓ > 80,000 LEDs sold
- ✓ Average energy saving -55%
>12,800 tons of CO₂ avoided
- ✓ Artistic lighting development
(average energy saving -40/60%)



Innovation, energy saving, security and lighting culture

Smart Cities

The cities: the cause and the solution



- ✓ Cities averagely consume 60-80% of the World's energy production
- ✓ Cities are responsible for most of the Greenhouse Gas emissions
- ✓ 50%-59% of the World's population will live in cities within the next 20 years

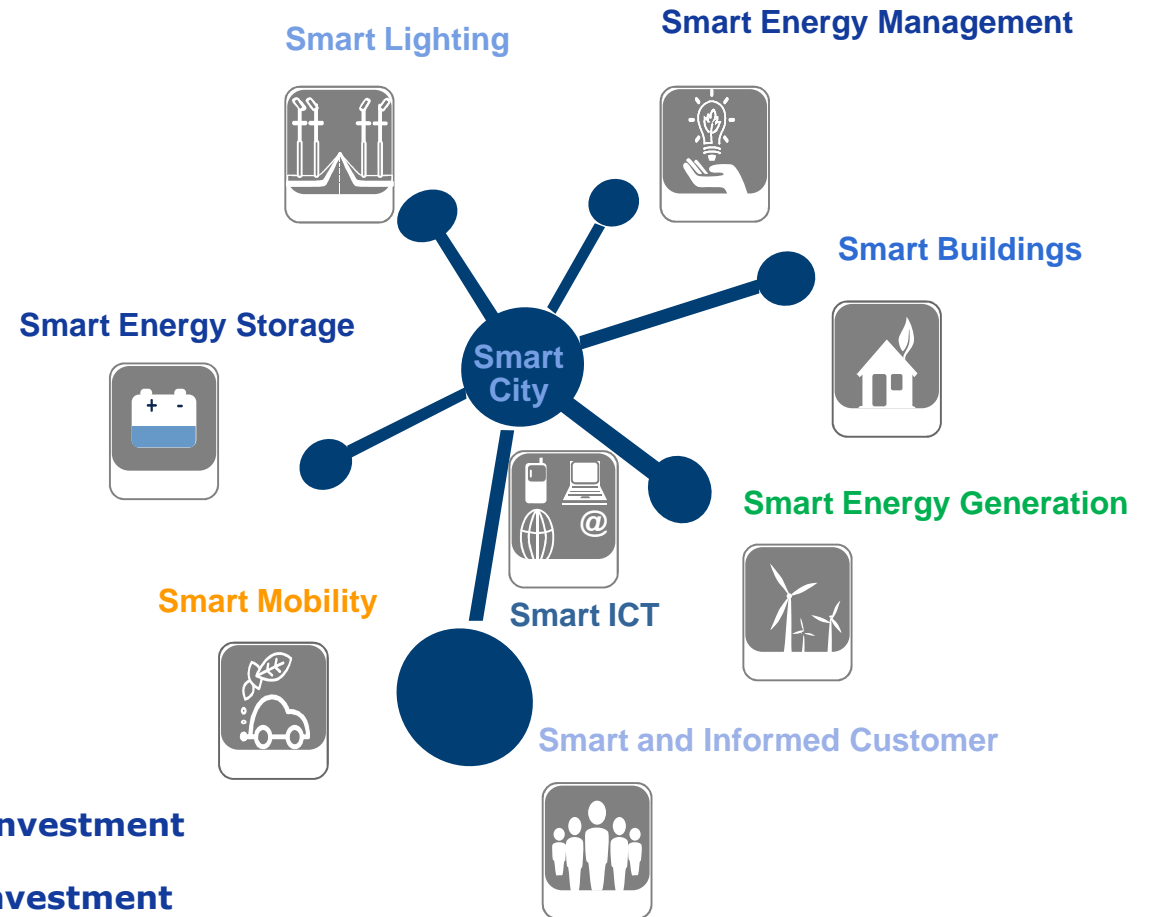
While most of the CO₂ emissions are produced in the cities, cities can also represent a solution. Energy Efficiency can be dramatically improved in a city.

Smart Cities

Smart Grid as enabler: the new role of DSO towards Smart Cities

“Smart” measures on electricity grid represent a cross element to the “Smart Cities” concept and they are the enabling factor for the development and implementation of various measures related to energy efficiency and CO₂ emissions reduction.

- ✓ DSO capex(*) for a city: ≈15% of project total investment
- ✓ European contribution expected: 7% of total investment
- ✓ New green jobs expected(*): 10.000

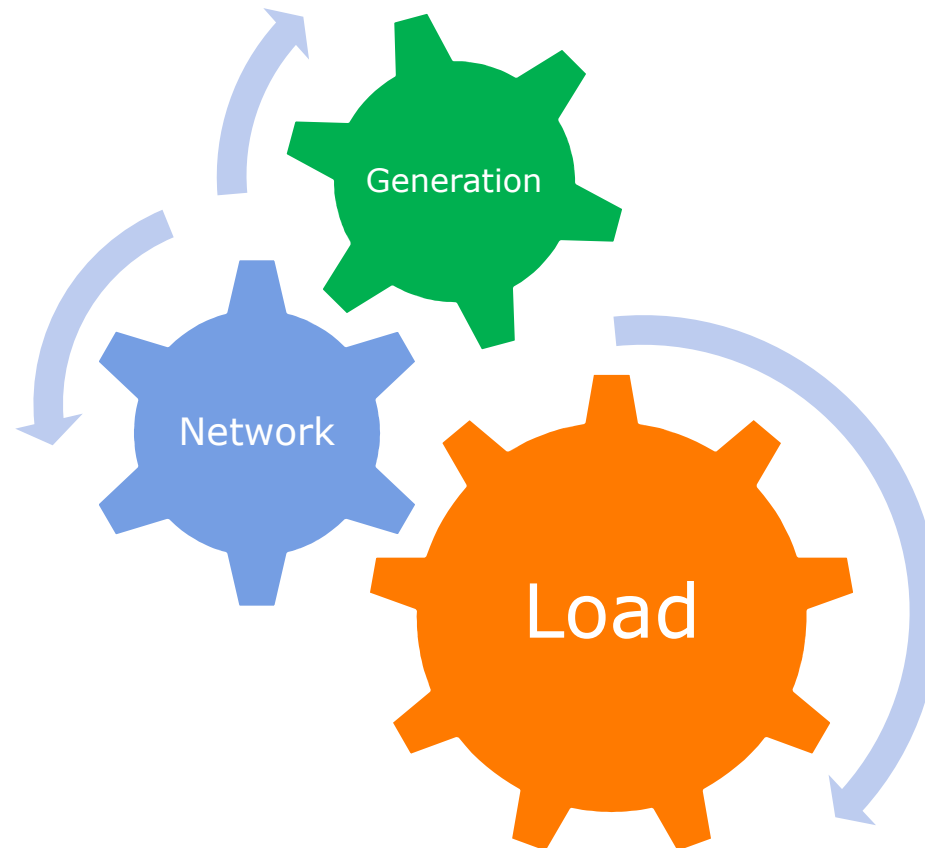


DSO contribution to CO₂ emissions reduction is 30% related to Municipality target

Smart Systems

A Question

Who should be following **who ...**



...to optimize the system ?



.... Any Questions...?



Thanks for your attention !