Smart Energy Systems

Strategic vision, technology developments, best practices

Lilia Consiglio
Enel Distribuzione
Enel's global presence

- **Italy**
  - 1° in generation (27%)
  - 1° in distribution (85%)
  - Capacity: 36.8 GW (of which 3.1 GW)
  - 30.7 M customers power-gas
  - Upstream gas activities

- **Central America**
  - Capacity: 0.8 GW

- **Colombia**
  - 1° in generation (21%)
  - 1° in distribution (22%)
  - Capacity: 3.0 GW
  - 2.8 M customers

- **Peru**
  - 1° in generation (22%)
  - 2° in distribution (31%)
  - Capacity: 1.9 GW
  - 1.3 M customers

- **Chile**
  - 1° in generation (27%)
  - 1° in distribution (33%)
  - Capacity: 6.8 GW (of which 0.5 GW)
  - 1.7 M customers

- **Brazil**
  - Presence in generation
  - 0.7 GW (of which 0.3 GW)
  - Presence in retail

- **Argentina**
  - 1° in generation (11%)
  - 2° in distribution (17%)
  - Capacity: 4.4 GW
  - 2.5 M customers

- **Rest of Europe**
  - Presence in generation
  - 0.7 GW (of which 0.3 GW)
  - Presence in retail

- **Iberia**
  - 1° in generation (24%)
  - 1° in distribution (42%)
  - Capacity: 23.5 GW (of which 1.8 GW)
  - 12.5 M customers power-gas

- **Slovakia**
  - 1° in generation (82%)
  - Capacity: 4.9 GW

- **Romania**
  - 1° in distribution (36%)
  - Capacity: 0.5 GW
  - 2.7 M customers

- **Russia**
  - Presence in generation (5%)
  - Capacity: 9.1 GW
  - Presence in retail

- **Indonesia**
  - 1° in generation (1%)
  - Presence in distribution (7%)
  - Capacity: 1.3 GW (of which 0.4 GW)
  - 6.4 M customers

- **USA and Canada**
  - Capacity: 2.1 GW

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  - Capacity: 2.1 GW

1. As of 31st December 2014
2. Among private operators

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**Global diversified player in more than 30 countries**

**Enel presence**
- Enel Green Power presence
- Market position
- Market share
- GW

**Enel Green Power Capacity**
Innovation at Enel

**Conventional generation**
Improvement of operational and environmental performance, reducing emissions

**Renewable energies**
Improvement of performance of all the available technologies, integration of storage and research in new technologies

**Infrastructures and networks**
Continuous development of smart grids to manage distributed generation, electric mobility and increase the electric system reliability

**New products and services and e-mobility**
Development of new business models, to increase people’s quality of life and to propose innovative solutions for companies, through the launch of new products and services mainly electricity based

Innovation as a basis for growth and consolidation of our leadership
Infrastructure and Networks Italy
2014

The Company
- Headcount: 16,890
- Blue Collars: 6,972

Business Size
- Customers: 31,6 Million
- DG Connected: 592,000
- Market share - Customers: 85%

The Network
- 1,130,000 km lines: MV 350,000 km; LV 780,000 km
- 2,100 HV/MV substation, 100% all remote controlled
- 430,000 MV/LV substation, 30% remote controlled

Second largest DSO in the world
Smart Grid and Smart City Vision

- **Smart Metering**
  - Electricity
  - Gas
  - Heat

- **Electric Mobility**
  - Vehicle-to-Grid
  - Fast-Charge
  - Load Shaping
  - Storage Distribution

- **Renewables Integration**
  - Dispatching
  - Network Automation
  - Forecast
  - Storage

- **Secondary Substations as Data Hub**
  - Sensor Networks
  - Big Data
  - Urban, Environmental and Energy Data

- **Renewables Integration**
  - Dispatching
  - Network Automation
  - Forecast
  - Storage

- **Big Data**

- **Cloud Computing**

- **Broadband Communication**

- **Smartphone Wearable device**

- **Active Demand**
  - Market Services
  - Smart-Info
  - Energy-Box
  - Load Balancing

**New strategic role of the Infrastructure**
Smart Grid: where we started…
Isernia Project (Delib. AEEG 39/10)

Integration of Smart Grid key elements

- DG Management
- Energy Storage System
- Smart Info
- Electric Vehicles

Voltage control, anti-islanding, DG Power regulation, network monitoring, …

First ESS on MV network installed in Italy

First large scale field test (8000 customers)

Integration of EV recharging infrastructure with a solar power plant and ESS; usage test of EV for Enel field crews
Grid4EU

Large-Scale Demonstration of Advanced Smart Grid Solutions with wide Replication and Scalability Potential for EUROPE

Smart Grid: where we started...

6 DSOs (covering more than 50% of EU customers)

27 partners (Utilities, Energy Suppliers, Manufacturers, Research Institutes)

54M€ /51 months (Nov. 2011 – Jan. 2016)

Project Coordination: ERDF

Technical Direction: ENEL Distribuzione
“Reti, Edifici, Strade Nuovi Obiettivi Virtuosi per l’Ambiente e l’Energia”: Research project in Smart City area of interest, financed by the Italian Ministry of Education and Research (MIUR);

Enel Distribuzione is the Leading partner among 8 participants (e.g. IBM, Enea and CNR, POLIBA, Università della Calabria).
Expo Milano 2015

- Innovative control and fault detection system for the electricity distribution network
- Storage System and integration of renewable energy sources
- Enel electric mobility infrastructure (with Pole Charging Stations)
- 8,500 lighting points LED technologies with high efficiency
- Operation Center to monitor and control all the electrical parameters
Expo Milano 2015
Configuration

10 substations feeding 10 meshed ring among
20 “secondary” substations
The Puglia Active Network project

- management of the network with large penetration of Distributed Generation
- new services for end-users
- foster the creation of a sustainable urban model

Thanks to PAN - NER 300 Project, Apulia region will be the first Regional Smart Community in the world

SMART INFO
SMART INFO APPLICATION
DONGLE WIFI
8,000 KITs
22,000 KITs

Enel

RTSI Turin, 16 09.2015

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USE: Public
Issuing: I&N Italy
Integration of Renewables
2014 – Connections and Power

NORTH-WEST
137,865 connections
5,551 MW

NORTH-EAST
194,341 connections
6,483 MW

CENTRAL
149,850 connections
6,178 MW

SOUTH
109,911 connections
8,028 MW

ITALY
591,967 connections
26,240 MW

DGS as 2014

Non-RES 26,2 GW
Hydro 2,5
Bio&Waste 1,1
Solar 16,5
Wind 3,9

Connections per year (GW)

Cumulative connections (GW)

USE: Public
Issuing: I&N Italy
Operational data

### Key indicators

| Infrastructure & Networks | 61 mn end users  
37 mn smart meters |
|---------------------------|------------------|
| Retail                    | 56 mn power customers  
5 mn gas customers |
| Renewables                | 9.6 GW of installed capacity |
| Conventional generation  | 86 GW of installed capacity |

### Enel and European peers

| Customers [mn] |  
Enel | EDF | E.ON | EDF | E.ON |
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<td>39</td>
<td>33</td>
<td>23</td>
<td>20</td>
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| Installed capacity [GW] |  
Enel | EDF | E.ON | EDF | E.ON |
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<td>140</td>
<td>96</td>
<td>81</td>
<td>60</td>
<td>49</td>
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| EBITDA [€bn] |  
Enel | EDF | E.ON | EDF | E.ON |
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<td>17.3</td>
<td>12.1</td>
<td>15.8</td>
<td>8.3</td>
<td>7.1</td>
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**Leadership along the various segments of the value chain**

1. Data as of 31st of December 2014
2. Including non-recurring items

**Enel and European peers**

- Enel
- EDF
- E.ON

**Key indicators**

- Infrastructure & Networks: 61 mn end users, 37 mn smart meters
- Retail: 56 mn power customers, 5 mn gas customers
- Renewables: 9.6 GW of installed capacity
- Conventional generation: 86 GW of installed capacity

**Enel and European peers**

- Customers [mn]: Enel 61, EDF 39, E.ON 33, EDF 23, E.ON 20
- Installed capacity [GW]: Enel 140, EDF 96, E.ON 81, EDF 60, E.ON 49
- EBITDA [€bn]: Enel 17.3, EDF 12.1, E.ON 15.8, EDF 8.3, E.ON 7.1, EDF 7.0
Enel Distribuzione - Smart Energy Partner

- 100 secondary substations, 75 MW power demand
- Innovative automatic control system and fault detector
- 270 kW Storage integrated with RES
- EV infrastructure with 100 Pole Charging Station
- Energy Management System
- Operative Center for the control of all electrical parameters

Smart Grid at the forefront
High Quality of Service for Expo