Enel Smart Grid experience
Lessons Learned in European Deployments

Enel
Green Power

Enel Group
Overview

Presence in
40 countries
4 continents

Installed Capacity
98,900 MW

Customers
61 million

Annual Production
296 TWh

Employees
71,300

EBITDA
23 billion USD

CAPEX 2013-2017
36.6 billion USD

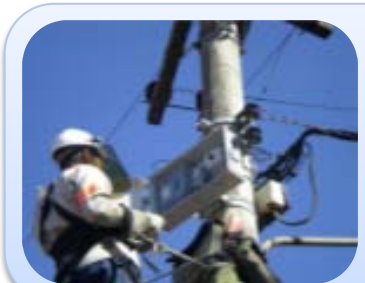
Upstream Gas → **Generation** → **Distribution** → **Sales**



Enel is a global corporation among the largest utilities in the world leader in generation, distribution and sale of electricity and gas

Data as of 4Q end FY 2013 (company's preliminary consolidated results, released FebMarch. 2014)

Enel Group
Distribution Business






- **1.1 M miles** electricity lines
- **435 TWh** Energy Distributed
- **61 M** customers
- **Over 45 M** smart meters installed*





** as of Dec 2013*

Utility new challenges across 21th century

Grid reliability
quality of service

Energy surety
disaster recovery

Replacement of **ageing infrastructures**

Operational **cost-effectiveness**

Integration of **Distributed Generation**

New services
(i.e. EV, storage)

Changes in consumption behavior and
Increases in peak-demand

Smart Grids are a key element in facing those challenges

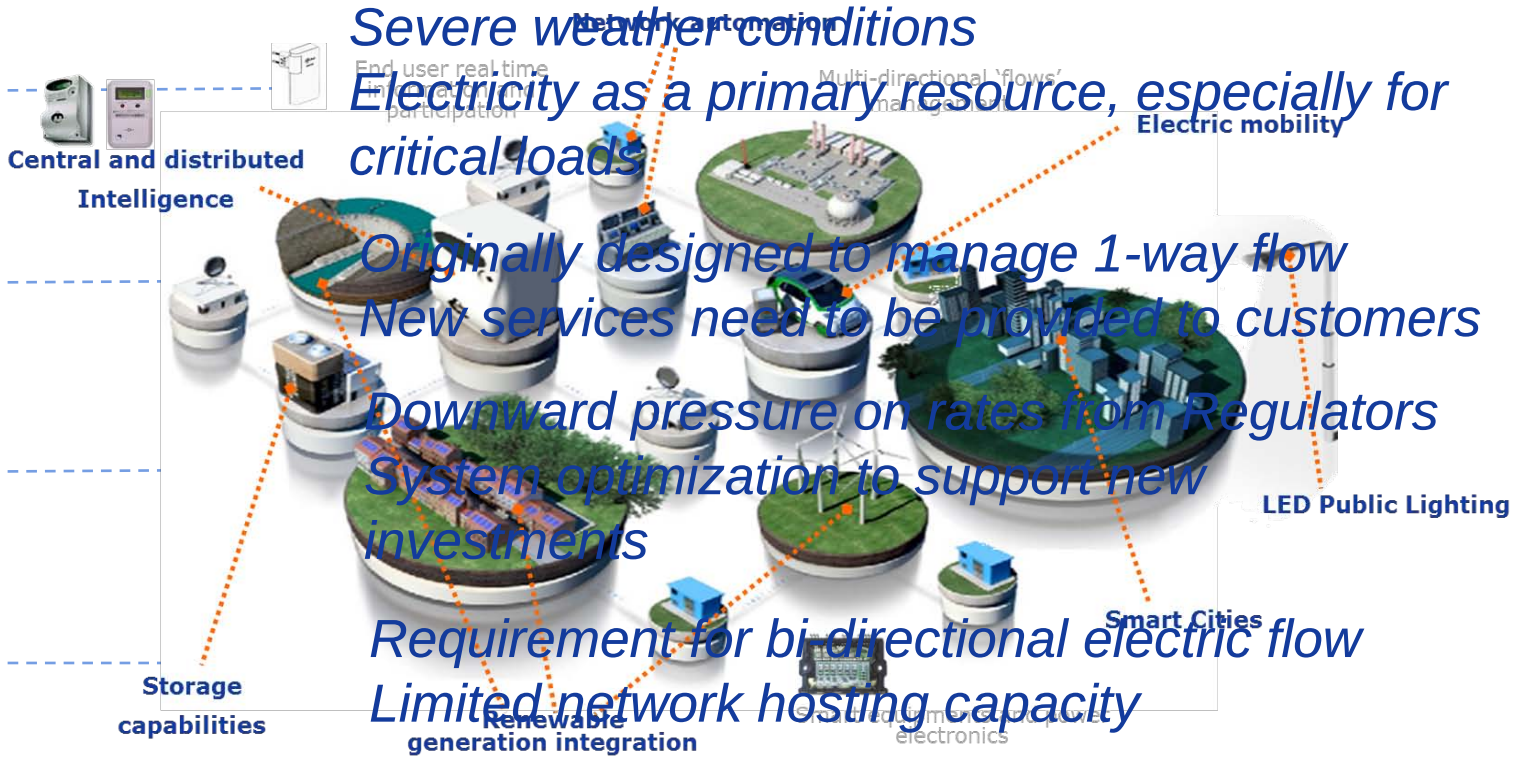
Severe weather conditions
Electricity as a primary resource, especially for critical loads

Originally designed to manage 1-way flow
New services need to be provided to customers

Downward pressure on rates from Regulators
System optimization to support new investments

Requirement for bi-directional electric flow
Limited network hosting capacity

New loads to be incorporated to the system
Unknown impact on the network



Enel network innovation
The success-case in Italy

Replacement of **ageing infrastructures**

Enel Green Power



2001 - 2012



Automatic Meter Management

- Deployed in 5 years from 2001 **without any obligation by local Authority**
- Fully operational on more than **33 million Customers**
- Leading Technology adopted by other 4 million customers of different utilities



Network control and automation

- HV and MV network remotely operated
- **>3,000 HV substation fully automated**
- **>100,000 MV substations remote controlled**
- Automatic fault clearing procedures



Work Force Management

- **5,500 vehicles equipped**
- Enel cartographic available on board
- All processes through mobile applications
- Connection from field to the centre for Enel crews



Asset Management

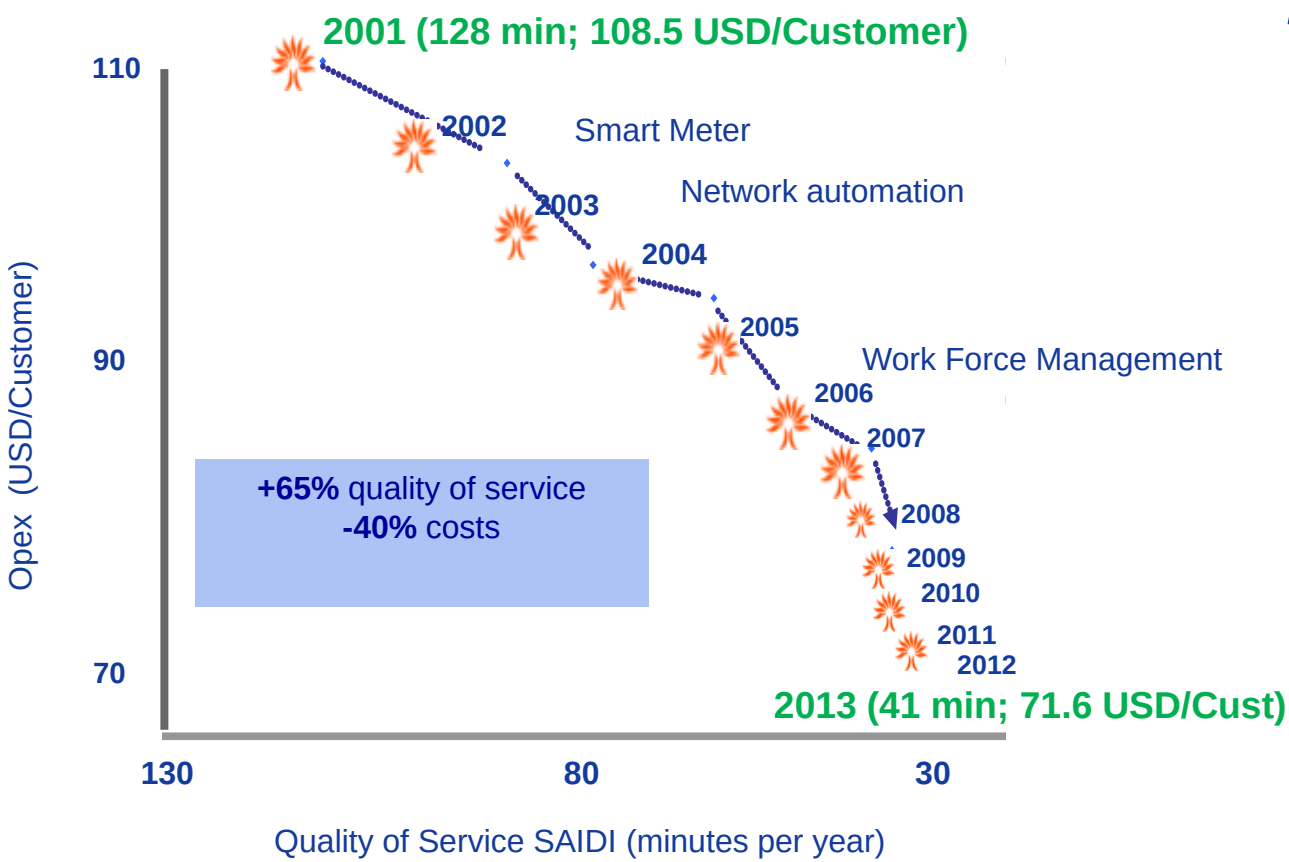
- Cartographic census of network assets
- Database of network events (power outage notification, fault detection ,etc)
- **Optimization of network investments** based on a risk analysis.

Technology innovation is not enough
***Benefits** have been achieved **thanks to** a deep **process and organization** reengineering*

Achieved results
12 years of Smart Grid operation

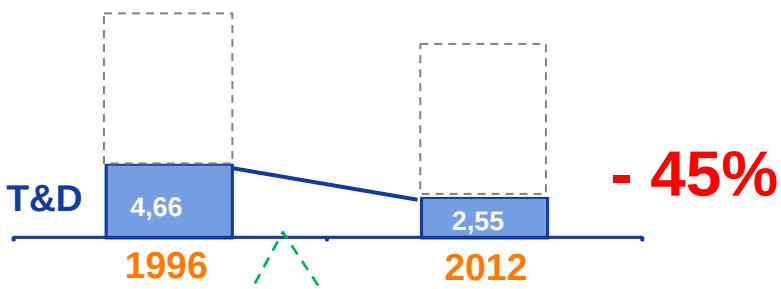
Grid reliability *quality of service*

Operational **cost-effectiveness**



Impact on electricity rate

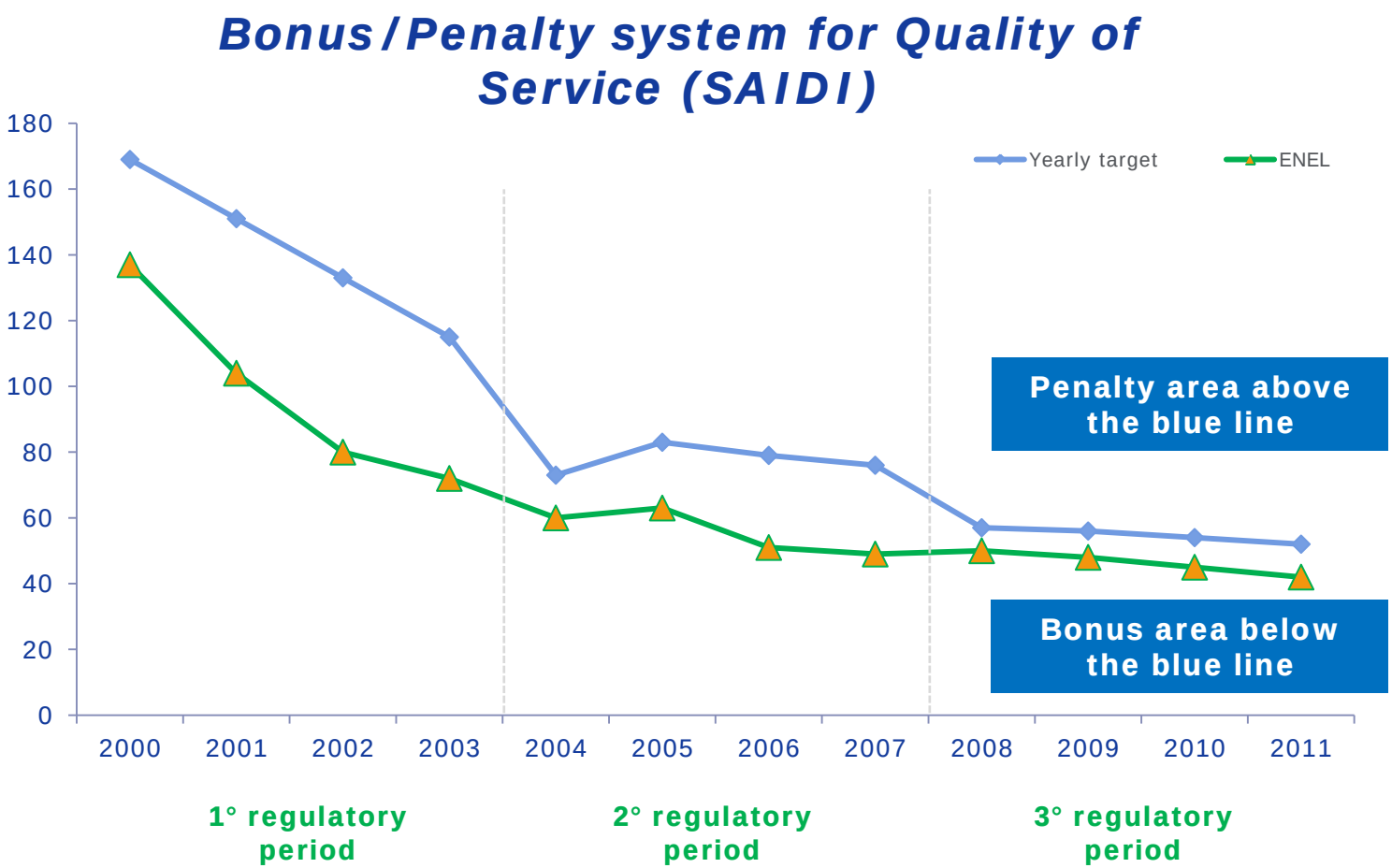
Average price *(c€/kWh)*



*Dramatic **reduction** in the **operative costs** allows a **neutral impact of new Capex** in the rate*

Operation efficiency** through **new technologies** allows regulator **reducing rates

Incentivizing Quality of Service
Bonus/Penalty system



Continuous improvement approach
applied by Regulatory period and Regions

Quick response to natural disaster
2012: Earthquake and snow storm emergency

Energy surety
disaster recovery

Enel Green Power

20th May 2012
Earthquake time- **04:04**

Magnitude: **5,9**

Customers outages (Max): **50,000**

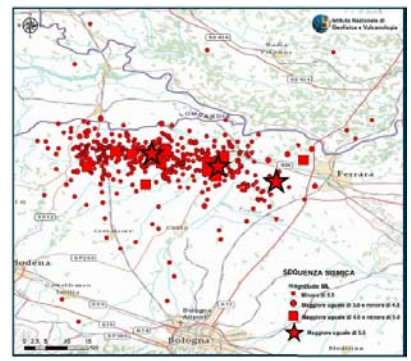
29th May 2012
Earthquake time- **09:00**

Magnitude: **5,8**

Customers outages(Max): **38,000**

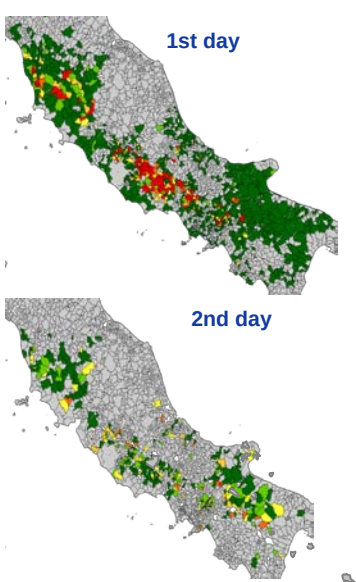
>90% of the customers re-supplied in 1 hour

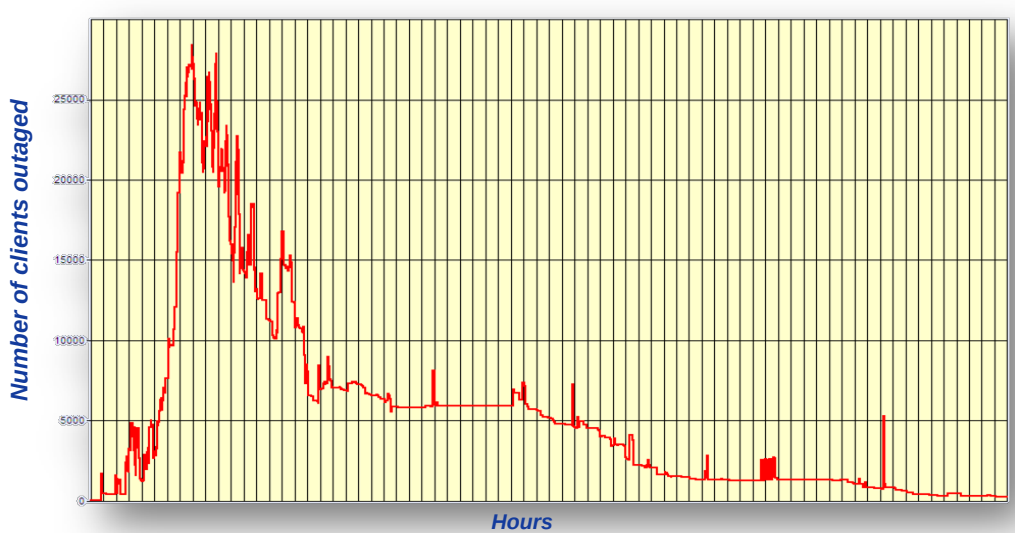
- ✓ Blue-collar sent to the affected area: **equivalent to 350 men/day**.
- ✓ Powering of areas for **evacuated people** (Aprox 5,500 kW).
- ✓ **Inspection** of all the Primary Substations and plants in the affected areas.
- ✓ Stability checks of the most affected Secondary Substations.



Epicenter at:
- Finale Emilia (MO)
- Mirandola (MO)
- S. Agostino (FE)

Most affected towns are those with a radius of 12.4 miles from the epicenter.





Recovery within 24 hours of normal operation for the majority of customers, thanks to the use of remote control for the fast repowering of most customers.

Electric Mobility and Demand response

Enabling value added services

New services
(i.e. EV, storage)

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Normal charge



Fast-charge



Electronic Meter

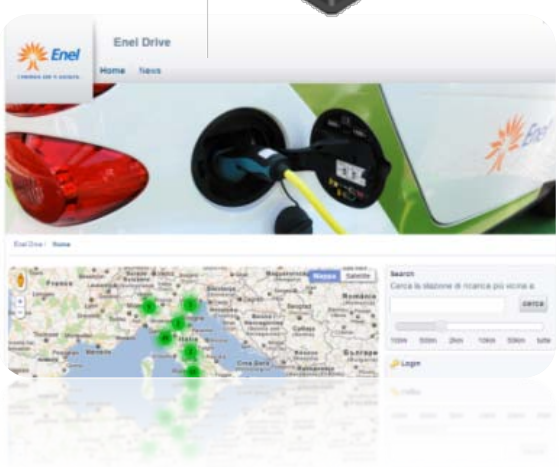


Smart Customers and Smart Appliances



Smart Info





E-Mobility Management System

- **Remote control** of recharging process to **monitor impacts** on network stability
- Enabling **advanced functionalities**: **vehicle-to-grid**, recharge schedule, car sharing
- **Integration with EV data system**
- **Diagnostic** and **alarms**

- **Bi-directionally communication** with the DSO
- Facilitate **access to data** for the customer
- **Enhanced customer awareness** for efficient energy consumptions behaviors

>1,000 Charging Points in operation

Infrastructure fully integrated into distribution systems

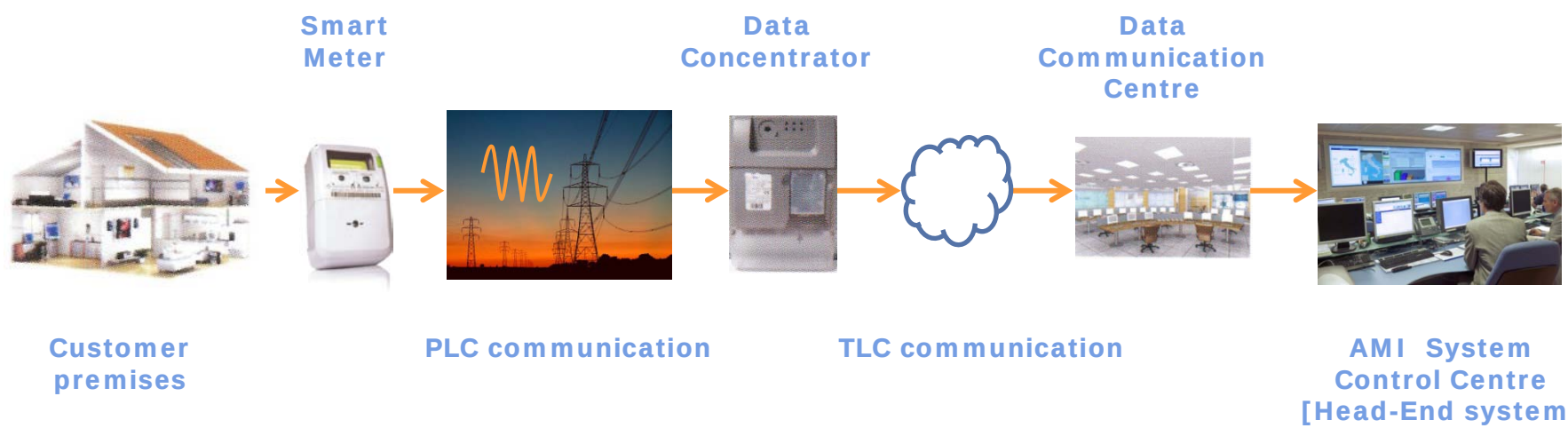
*Customer active participation supports **energy bill decrease** and **grid stability***

Regulatory framework as a driver
The Enel experience in Spain



Regulatory framework in Spain

Orden ITC/3860/2007 and Orden ITC/3022/2007:
All meters of customers < 15 kW must be replaced before: December 31, 2018.
The Smart Metering System has to start the operation: January 1st, 2014.



***13 milion smart meters** to be installed by 2018*

Largest smart metering roll out currently on going in Europe

Enel Group Smart Grid projects in Europe

	Italy	Spain	Romania	Europe (financed projects)
Smart Metering		 Proyecto Telegestión		METER ON
Integration of DER	Progetto Isernia  POI	 Proyecto Store, Gorona del viento		GRID4EU, INTEGRIS, REserviceS, iGREENGrid
Energy efficiency	Smart Info  Energy@home	 Proyecto Energrid		address, interactive energy, ADVANCED
Electric mobility	 e-mobility Italy	 Movele, Zem2all, Quick charge	 Collaboration with car manufacturers (Toyota, Renault)	Green eMotion, mobincity, Unplugged, IoE

EXPO MILANO
NUTRIRE IL PIANETA
ENERGIA PER LA VITA

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