Evolution of the European Electric System and Enabling Solutions to Foster New Business Models

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Status of the European Electric System
~207 GW REN capacity installed from 2000 up to 2013

Over 72% of all new installed capacity during 2013 in the EU was Renewable
Overview Europe: power price evolution

Evolution of residential power price
(2,500-5,000 kWh/year)

Mean power price increase for residential customers: + 25%

Evolution of industrial power price
(2,000-20,000 MWh/year)

Mean power price increase for industrial customers: + 30%
Overview Europe: power price evolution

Weight of components on average EU-28 electricity bill for household customers (2500÷5000 kWh per year) and % points variation 2012 on 2008

- 2% points
- 1% point
+ 3% points

Eurostat, Energy and Environment Data Base, retrieved 7 October 2013
Focus on Italy

REN capacity mix installed

Energy cost for average consumer (c€/kWh*)

Decree n.91/2014 (plants with capacity >200 kW)

Alternatives:

- to reformulate feed in tariff reducing of 25÷17% for 24 years (instead of 20 years)
- to opt for a voluntary reduction of 8% of the incentive
Focus on Italy: effects of renewables on grid

Examples of duck curve

March 2011

March 2013

Reverse flow on primary substation

Electricity Demand
REN generation
Residual Load**
Low residual load
High residual load

** Residual Load is the load satisfied by conventional generation

Statistics from AEEG, Terna

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**Focus on Spain**

**REN capacity mix installed**

+10.6 GW

**PV and subsidies**

*Statistics from: GME, Eurostat, EPIA, IEA*

**Energy cost for average consumer c€/kWh***

Royal Degree-Law (RDL 9/2013) stopped feed in tariff and changed remuneration structure for all REN (new and installed), based on:

- Market price
- Additional remuneration only to reach pre-defined reasonable profitability of 7.4% (remuneration parameters to be defined by Ministerial Order)

*Statistics from: GME, Eurostat, EPIA, IEA*

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Enel Case Study
Effects on conventional generation

Impact on electric system

- Progressive flexible operation request
- Startup time reduction
- High modulation and shut down during the week-ends
- Low load factor (often <75%) and reduction of operation hours

- Reduction of thermal power plants synchronized
- Load ramp rate Increase to promptly react to request: 10% of base load/minute
- Increase reserve requirement
European Strategy to Manage System Evolution
Regulatory Framework Evolution
Brief overview on energy policy in Europe

EUROPEAN COMMISSION PROPOSALS

GREEN PAPER 2030

- 40% GREENHOUSE GAS (GHG) emission reduction (vs. 1990 level): binding target
- ≥ 27% (ENERGY PRODUCTION) RENEWABLES ENERGY SOURCES (RES) at EU level on final energy consumption (vs. 1990 level)
- 30% ENERGY EFFICIENCY (vs. 2007 level projected to 2030)

EUROPEAN ENERGY SECURITY STRATEGY

To diversify and reduce energy import, based on:

- SHORT-TERM MEASURES
  - Increasing gas stocks
  - Developing emergency infrastructure such as reverse flows
  - Reducing short-term energy demand
  - Switching to alternative fuels

- MEDIUM AND LONG-TERM KEY-MEASURES (in addition):
  - Increasing energy efficiency and renewables energy production
  - Completing the European energy market and interconnecting infrastructures among Member States

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1 Source: Green Paper “A 2030 framework for climate and energy policies”, COM/2013/0169; approval by October 2014 and transposition into EU Law by July 2015
2 Discussion by 2014, not legislative
Support schemes for RES and control of capacity remuneration mechanisms modified:

- **DIRECT MARKETING** 2
  
  Premium to generators in addition to the market price for selling their electricity directly in the market

- **BALANCING RESPONSIBILITIES** 3
  
  Subject to standard balancing responsibilities

- **TOWARDS ZERO AIDS**
  
  Between 2020 and 2030 RES will become grid-competitive → degressive phase out of subsidies and exemptions from balancing responsibilities

- **AID FOR PROJECTS OF COMMON INTEREST**
  
  Smart grids, and infrastructure investments in assisted areas

- **ESTIMATED TOTAL INVESTMENT**
  
  ~ 200 billion EUR until 2020 to complete the European market, ensure security of supply and enable renewables integration

- **FLEXIBLE GENERATION**
  
  Remunerating solely the service of pure availability provided by the generator

- **SUBSTITUTABLE TECHNOLOGIES**
  
  Demand-side response or storage solutions

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1. Adopted by European Commission (into force the 1st of July 2014)
2. Direct Market & Balancing responsibility apply from 1 January 2016 to all new aid schemes and do not apply to installations with an installed electricity capacity of less than 500 KW
3. Italian Regulator Proposal (June 2014): imbalances costs extend to Renewables according to different technologies
Achieving the European Electricity Market

EUROPEAN NETWORK CODES

- SCOPE – Draft network codes for:
  - Grid connections;
  - Market–balancing, capacity allocation
  - System operations
- EFFECTS – Changes in transmission codes, cross border balancing markets
- ENTRY INTO FORCE NOT BEFORE 2016

PRICE COUPLING OF EUROPEAN REGIONS

Important target of the European Electricity Market, to be achieved BY THE END OF 2014:
- A single EU (for all Member States) algorithm to calculate energy allocation and electricity prices across Europe on the day-ahead market

HORIZON 2020 (2014÷2020)

New launched Framework Program to support Research & Innovation

Over 13 billion EUR is the Budget for Enabling Solution to foster new business models and technology solutions for EU electric system

TOPICS
- Industrial leadership in enabling and industrial technologies: ICT, nanotechnologies, material, biotechnologies
- Secure, clean and efficient energy
- Smart, green and integrated transport
Enel Group Initiatives to Foster New Technology Solutions

Scenario with Demand Response product activated to manage load curve according grid request

- Action on the operation
- Equipment modifications (Flash Tank, Deggaser, …)

Demand Response

- Battery storage system integrated with diesel engines to manage renewable installations

Power Plant Flexibility

- 13,000 customers
- 5 MV feeders (38 km)
- 72 MV/LV substations
- 70 GWh/y consumption
- Energy efficiency systems
- Renewable generators, storage systems, e-mobility charging points

Storage and island mini-grid

Enel Coal Plant example

- 13,000 customers
- 5 MV feeders (38 km)
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How Shape New Business Model for Utility Enel’s Road Map

1. Monitoring
   - Devices give feedback and information on customer’s behavior
   - Customer awareness increase

2. Data Analytics
   - Advanced services based on consumption data availability
   - Customer profiling improvement and best tariff and service offer
   - New business enabling, as energy saving & appliance selling

3. Energy management
   - Customer automation devices for optimal energy resources management
   - New Customer Acquisition through service/ product differentiation
   - New product selling

4. Demand Aggregation
   - Data Aggregation on customer groups to enable scale economies and active demand programs
   - New business opportunities in the framework of regulation scenario development

Value proposition:

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