DELIVERING THE ENERGY TRANSITION
WITH INFRASTRUCTURE INVESTMENTS, NETWORK REMUNERATION, AND TARIFFS

Co-funded by the European Union

Multiple facets are crucial to the advancement of the energy sector, and to drive the energy transition. Some of the main factors affecting them are the infrastructure, network remuneration, and tariffs that accurately reflect the costs of production, and the needs of the consumers.

Investing in the infrastructure of power and gas systems should consider all the advancements that are happening in the global energy market.

It is also important to keep an eye on the **network requirements** such as **remuneration calculation methodologies** for transmission, transport, storage, and distribution.

Additionally, as **Renewable Energy Sources (RES)** projects are under development worldwide, the requirements to connect them to the grids should be regularly updated to follow any breakthrough in the sector.

Tariffs are also an essential component in energy transition as poorly designed tariff schemes will have a big effect on the stakeholders, and might seclude a part of them if not well planned.

1. MAXIMISING THE DECARBONISATION WITH INFRASTRUCTURE INVESTMENT

1.1. PLANNING OF GAS TRANSMISSION AND DISTRIBUTION INVESTMENTS

Infrastructure is a key driver of energy transition, and it should evolve from its current form of vertical systems to an integrated and circular ecosystem.

Policy scenarios envisage a decline in natural gas demand compensated by the increase in green gas demand.

Biomethane is suitable for all energetic needs:

- It does not require switching costs for the end-users, and it can be transported in existing infrastructures.
- The EU has the potential of generating 41 bcm/y.
- REPowerEU foresees investments around 37 billion Euros to increase the production of biomethane and its use in households, industries, and agriculture.

Hydrogen has multiple benefits:

- It is a clean gas that does not emit CO_2.
- REPowerEU has set a target of 10 Mton of hydrogen production by 2030, and 200 million Euros funding to accelerate hydrogen projects.
- The European backbone for hydrogen is being developed under several targets for 2030 and 2040.

1.2. THE ROLE OF THE MEDITERRANEAN REGION IN EUROPEAN GAS SUPPLY SECURITY

The EU is urgently trying to compensate for the lack of Russian gas, and the southern Mediterranean region can play an important role.

- **In the short term**, the region can provide at least an additional 6 bcm,
- **In the mid-to-long-term**, it could provide up to 40 additional bcm (or 50 with the inclusion of the Southern Gas Corridor).

IN THE EU

- REPowerEU sets a detailed plan to end the EU's dependency on Russian fossil fuel imports.
- Gas production in the EU has been declining since its peak in 1996 from 182 bcm to 51 bcm in 2021 while imports have been increasing.
- The EU receives 2/3 of its gas by pipelines through 4 main corridors - from Azerbaijan, North Africa, Norway, and Russia.
- There are 21 large-scale Liquified Natural Gas (LNG) regasification facilities providing a capacity of 170 bcm/year.

Hence, there is an important need to enhance the coordination between the EU and the south Mediterranean region to overcome the existing challenges.

IN THE SOUTHERN MEDITERRANEAN REGION

- Since 1980, gas production has increased and surpassed 200 bcm in 2021 with Algeria and Egypt being the biggest producers.
- There is a huge potential for export that could reach 100 bcm in 2030 compared to less than 60 bcm in 2021.
- **In Algeria**, production reached a record 100 bcm in 2021, but the consumption also increased to about 45 bcm.
- **In Libya**, security and political instability led to a continuous decrease in exports during the last decade, reaching 3.2 bcm in 2021.
- **In Egypt**, LNG exports in 2021 reached 9 bcm with 8 bcm of unutilized LNG capacity.
- **In Israel**, several export solutions are under consideration, and if they are accomplished, they can further increase Israel's exports to Europe in the mid to long term.
- The Trans-Adriatic Pipeline (TAP) has a capacity of 10 bcm/year and transported 8.2 bcm in 2021.

SNAM. A LOOK AT THE ITALIAN COMPANY

EUROPE'S **LARGEST NATURAL GAS OPERATOR**

32,683 KM OF PIPES

13 COMPRESSOR STATIONS

AROUND **200** ACTIVE NETWORKS

76 BCM OF INJECTED NATURAL GAS

8 SUPERVISION AND CONTROL DISTRICTS

48 MAINTENANCE CENTRES

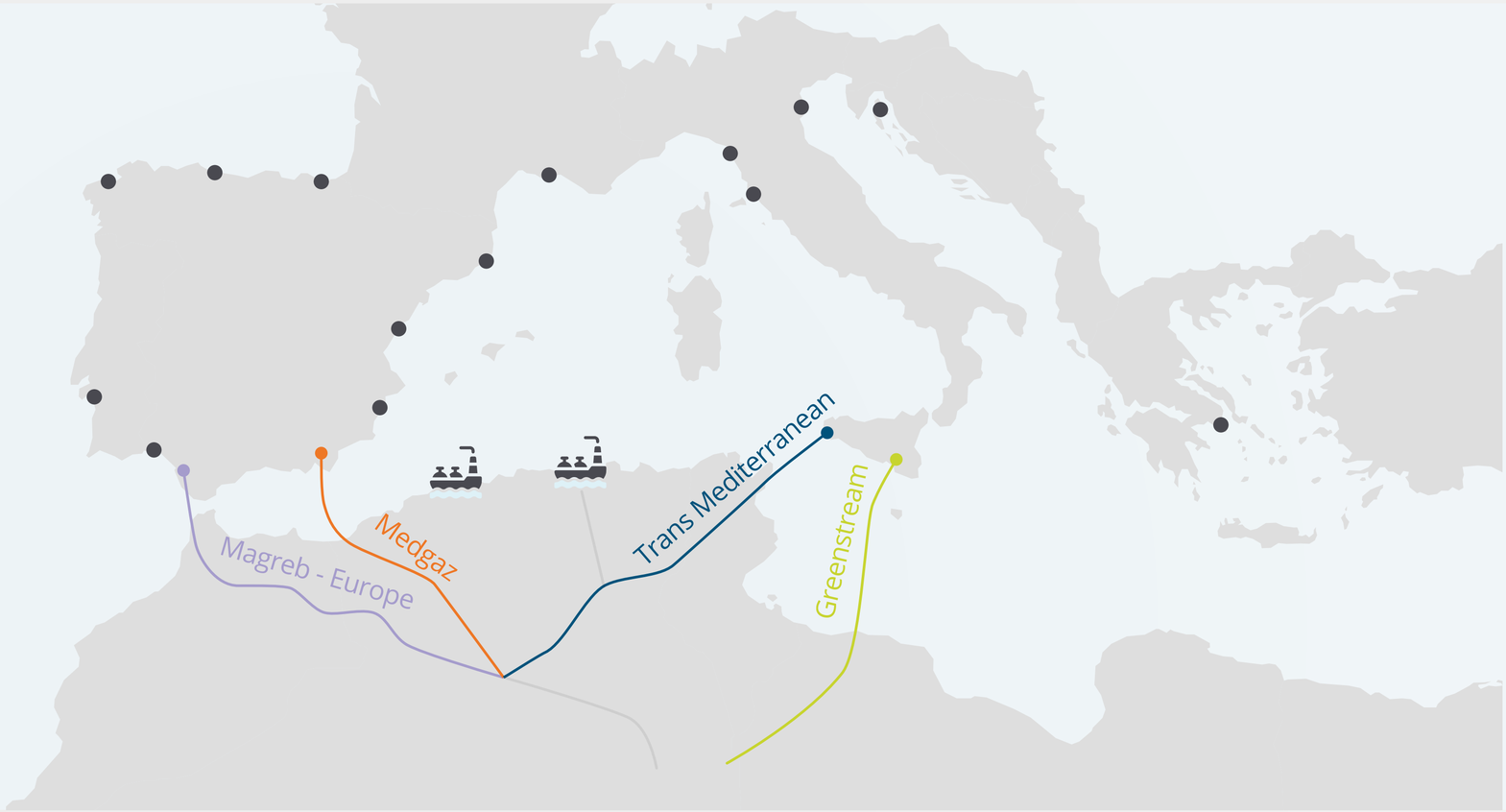
Italy has **3** LNG TERMINALS

6 POINTS OF ENTRY FOR IMPORT PIPES

FIGURE 1. AVAILABLE CAPACITIES IN ALGERIAN PIPELINES TO INCREASE THEIR GAS EXPORTS TO ITS EUROPEAN CUSTOMERS

- **Magreb - Europe**
  No signals GME pipeline *(12 bcm/y)* will be used as in the past
- **Medgaz**
  Currently fully used
  (runs above capacity at 11 bcm/y)
- **Trans Mediterranean**
  Has almost 10 bcm of spare capacity
  (33 bcm/y capacity, vs 21 bcm exports in 2021)
- **LNG import terminal**
- Large LNG export potential *(33 bcm/y)* nearly half unutilized in 2021

Source: Bruno Castellano's presentation (OME) for MEDREG Training, 19 October 2022



1.3. THE ROLE OF DISTRIBUTION GRIDS IN THE ENERGY TRANSITION: REGULATORY TRENDS

With the increasing penetration of distributed renewable energy generation such as solar rooftop, the flow became bidirectional and less predictable in the distribution grids and towards the transmission grids.

Until now, Distribution System Operators (DSOs) were responsible for distributing electricity to final consumers, monitoring consumption, and distributed generation with smart meters, managing and controlling the network, and planning network investments. Currently, its responsibilities are evolving to include near real-time monitoring and controlling of distributed generation.

To help DSOs reach their objectives, energy regulators should allow them to procure flexibility services under market-based procedures, and provide them with incentives.

The grid management is continuously increasing in complexity due to multiple contributors such as decarbonisation plans, electrification and urbanisation, decentralisation of generation, prosumers centricity, and the expanding array of digital tools and platforms. This complexity can be alleviated by opting for smart technologies such as advanced metering, grids digitalisation, and on-field activities digitalisation.

Smart metering also enhances the experience of the customers by providing them with additional data to better understand their consumption and how to lessen their energy bills.

2. REMUNERATING THE NETWORK TO ENHANCE IT

2.1. CONNECTING SMALL AND MEDIUM-SCALE RES PROJECTS TO THE GRID

The integration of a significant share of Variable Renewable Energy (VRE) into grids requires a substantial transformation of the existing networks to introduce technologies and procedures to ensure proper grid operation, stability, and control.

The three main considerations to take into account for **PV-grid interconnections** are:

- safety,
- power quality, and
- anti-islanding.

The main requirements related to the **integration of VRE into grids** are:

- Voltage control/reactive power control.
- Frequency control/active power control.
- Fault ride-through.
- Synthetic inertia.

The **European ENTSO-E network code** proposes requirements for grid connection applicable to all generators that will help simplify the interpretation of the grid codes and set the frame for national grid codes. The power generating modules are separated into 4 categories based on the voltage level of their connection point and on their maximum capacity. The code contains provisions dealing with frequency stability, voltage stability, robustness, and system restoration.

When considering the **connection modes**, two important issues must be examined:

- the **allocation of costs between Transmission System Operators (TSOs) and new and existing generators,** and
- the **ownership of the connection network.**

2.2. CALCULATING REMUNERATIONS FOR THE GAS TRANSPORT AND DISTRIBUTION: FOCUS ON SECURITY AND FLEXIBILITY

The methodologies for calculating the transmission and distribution tariff are set by board decisions covering tariff-making methodologies, analysis of the DSO investments, OPEX calculations, consumer number, and demand forecast along with other parameters.

- The **retail price of gas** is formed from the natural gas wholesale price, distribution charges, and taxes.
- **The natural gas wholesale price** by itself consists of the commodity price, transmission charges, storage charges, and taxes.
- **The tariffs** are composed of capacity and service charges and dispatch control charges that are defined in the network code.
- To determine the **revenue requirement**, several elements should be identified such as the return, depreciation, return for line pack, investment compensation, and the OPEX.
- Finally, the revenue requirements are **allocated by the regulator to consumer groups,** and the distribution charges are calculated for each consumer level.
- **Tariff revisions** are done when there is an extension of the distribution zones, when a large-scale consumer enters an existing distribution zone, when there is a need for additional investments, and when there is a significant deviation from the consumption forecast.

2.3. METHODOLOGIES TO CALCULATE REMUNERATIONS FOR THE ELECTRICITY TRANSMISSION AND DISTRIBUTION

Economic regulation

promotes resource allocation and technical efficiency, technological innovation, and preparation of the sector for future challenges. It also ensures the quality of services and their alignment with standards while giving a fair return for the companies.

Revenues

are calculated based on the costs of the regulated companies favouring efficient costs, and economic regulation helps define the amount of income allowed to these companies.

IT IS ESSENTIAL TO SECURE

- non-discrimination between users
- transparency
- cost-based tariffs
- the absence of cross-subsidies

THE AIM IS TO

- provide companies with cost recovery if they are efficient
- create incentives for investing in new infrastructure
- attract capital
- provide users with proper economic signals for efficient use of resources

Revenues are collected by the application of tariffs that are set to provide each activity with an amount of allowed revenues as per the applicable tariff regulations.

While developing the methodology for tariff calculation, the definition of each parameter should be transparent and consistent.

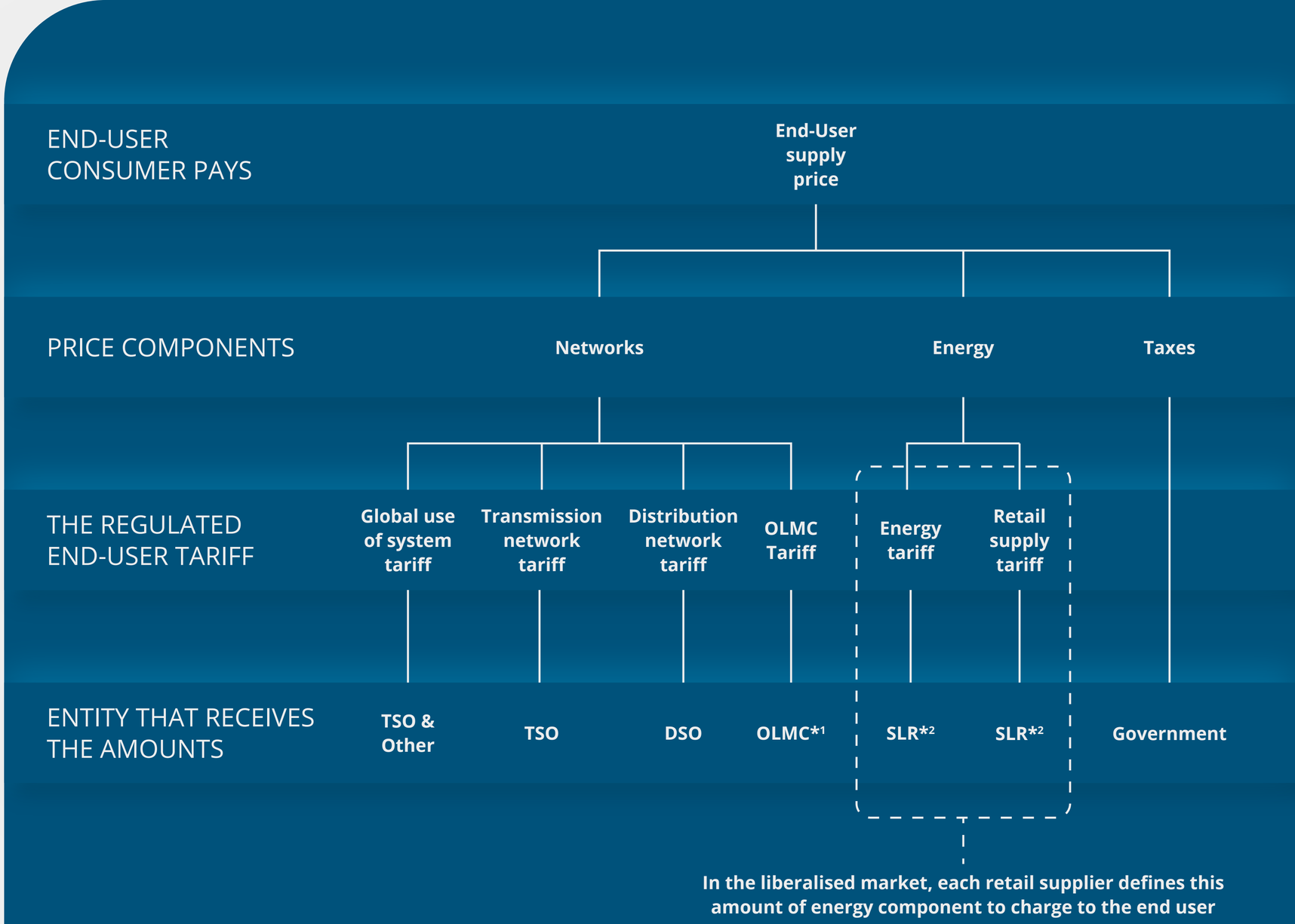


FIGURE 2. COMPONENTS OF END-USER SUPPLY PRICE

Source: Paulo Paulino's presentation (ERSE) for MEDREG Training, 19 October 2022.

**1 Logistic Operator for Switching Supplier* **2 Supplier of Last Resort*

3. SETTING FAIR AND COST-REFLECTIVE TARIFFS

3.1. HOW TO REMUNERATE THE DIFFERENT COMPONENTS OF TARIFFS

PRICING PRINCIPLES
5 MAIN AXES

- cost recovery
- cost causality
- transparency and simplicity
- efficient regulation
- non-discrimination

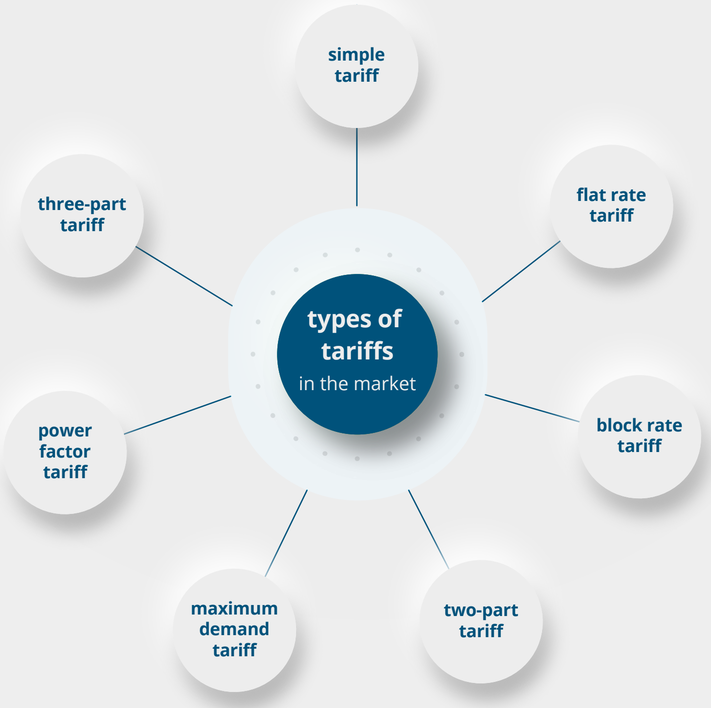
THE ALLOCATION OF COSTS FOR THE TARIFF
SHOULD TAKE INTO ACCOUNT

- the geographical locations
- different voltage levels
- time dependent pricing
- allocation to network users

Network pricing design can be based on average cost or marginal cost:

- average cost being the total costs for provision of the regulated service divided by the total demand, and
- marginal cost being the full economic cost incurred in supplying a small increase in demand of the relevant service given the demands placed on the system by all users.

3.2. REDUCTION OF SUBSIDIES IN THE DESIGN OF ELECTRICITY TARIFFS



In several countries, generators do not pay transmission fees to incentivise investments that gives them an edge in cross-border competition. For the distribution network, all users of the network are benefitting from its services, and thus should pay the distribution charges.

In Europe, different pricing models were developed depending on the local circumstances, traditions, and the market system.

Pricing has two main targets

Collect sufficient revenue to cover the companies' allowed costs

Send the right economic signals to consumers to optimize economic and social use.

3.3. MARKET ACCESS FOR DEMAND-RESPONSE MEASURES

Ancillary services are services provided by producers or consumers to the TSO and DSO to control electrical parameters. The term ancillary means auxiliary but indispensable to the main service. These services ensure an adequate level of quality of the service such as continuous delivery and voltage and frequency regulation.

In their capacities, **energy regulators should**:

- work on removing undue barriers for ancillary services market,
- build a framework to make ancillary services attractive for both producers and consumers, and
- aim for technological neutrality.

Participants in the ancillary services market are **balance service providers (BSPs)**, and they give their services through production or consumption units that are not already enabled. **BSP's resources** used in some pilot projects:

- water heaters,
- solar panels with storage,
- standalone storage,
- biomethane cogeneration,
- run-of-the-river hydroelectric power plant, and
- EV recharging stations.

FOR MORE INFORMATION ON THE TOPIC

Consult our Technical Report based on our Training on "Infrastructure Investments, Network Remuneration, and Tariffs" *of October 2022*, with the contributions of the following speakers:

- **Nicola Battilana,** Head of Asset Planning, Snam
- **Bruno Castellano,** Senior Energy Analyst, OME
- **Valeria d'Ettore,** Senior Analyst, Enel Grids
- **Andrea Galliani,** Deputy Director of the Wholesale Markets and Environmental Sustainability Department, ARERA
- **Mehmet Kurkcu,** Group Head of Foreign Relations, EMRA
- **Paulo Paulino,** Economist, ERSE
- **Konstantinos Perrakis,** Coordinator, RAE
- **Konstantin Petrov,** Head of Section Policy and Regulation, DNV
- **Andrea Rosazza,** Officer, ARERA
- **Sherif Zoheir,** Head of the Central Department of Electricity Market, EgyptERA