



*Greening Energy
Market and Finance*

Project website: <http://grenfin.eu>

Energy Actors in the Electricity Market

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2nd Summer School – Katowice

7-11 June 2021



With the support of the
Erasmus+ Programme
of the European Union



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1. Introduction

- How the electricity system work → past & future.
- Who is who in the electricity system.
- How the Electricity Market works.
- New actors in the Energy Transition



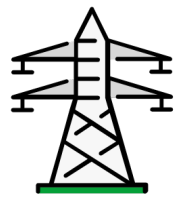


1. Introduction

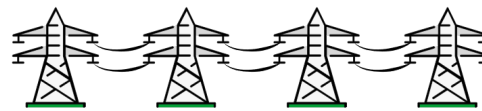
FROM:



POWER PLANT



TRANSMISSION



DISTRIBUTION



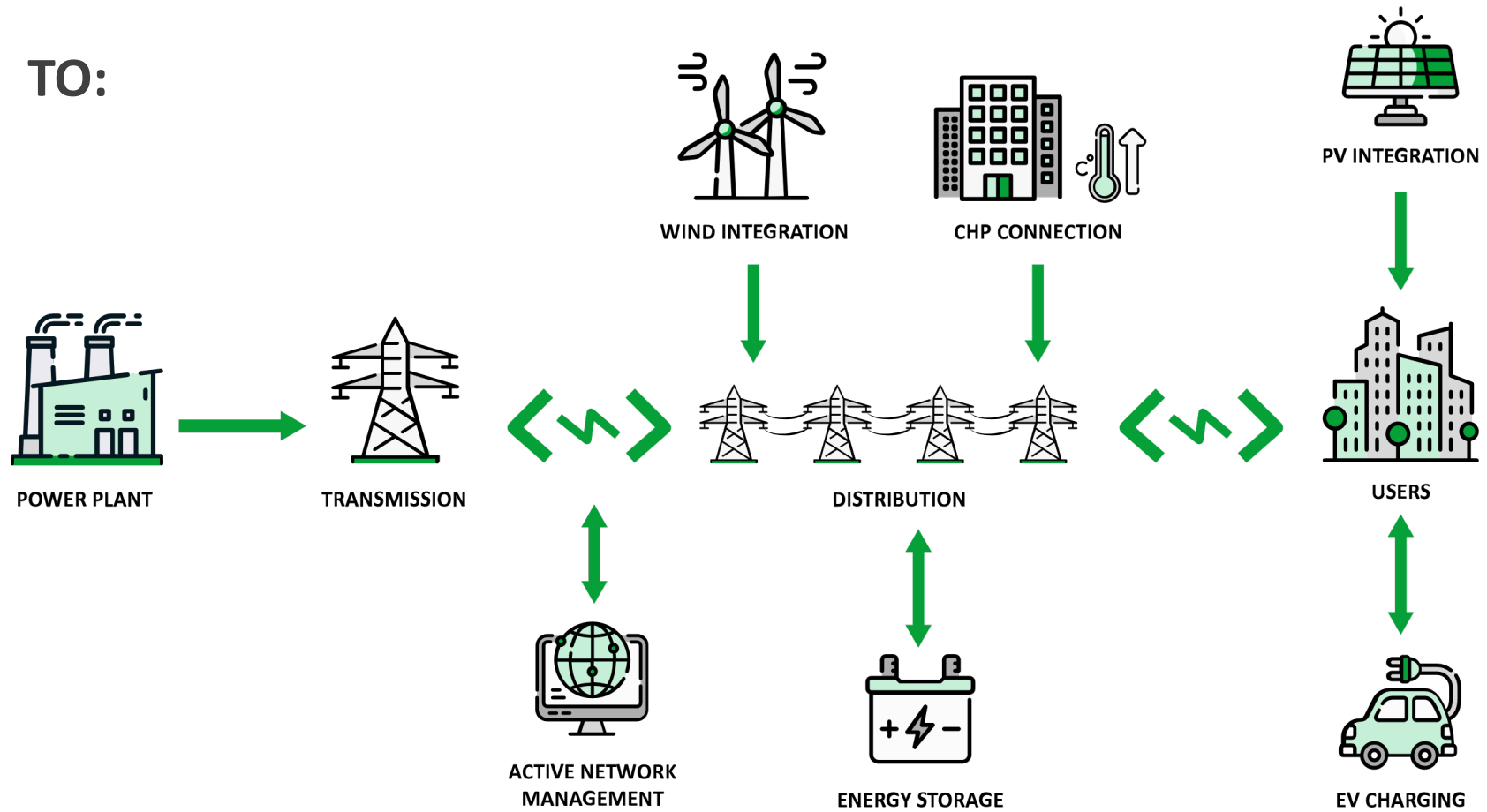
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1. Introduction

TO:





2. European Legislation & European Agencies

1. Introduction

2. European Legislation & European Agencies

3. Energy Actors

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5. New Electricity System and Actors





2. European Legislation & European Agencies

New legislation in the EU to overcome challenges of the clean energy transition: better connected & protected, more suited to integrate renewable energy, more consumer-oriented:

- Allowing electricity to move freely throughout EU.
- Enabling more flexibility
- Fostering market-based investments and decarbonisation.
- Introducing new emissions limit for power plants.
- Improving the response to electricity market crisis situation





2. European Legislation & European Agencies

- Electric Directive 2009/72/EC
- Electric Regulation (EC) No 714/2009
- Regulation on risk-preparedness in the electricity sector (EU) 2019/941
- Regulation establishing a European Union Agency for the Cooperation of Energy Regulator (EU) 2019/942





2. European Legislation & European Agencies

- Regulation on the internal market for electricity (EU) 2019/943
- Directive on common rules for the internal market electricity (EU) 2019/944.
- Regulation on Wholesale Energy Market Integrity and Transparency (REMIT)

https://ec.europa.eu/energy/topics/markets-and-consumers/market-legislation/electricity-market-design_en

<https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX%3A32011R1227>





2. European Legislation & European Agencies

- [ENTSO-E](#): European Network of Transmission System Operator for Electricity (funded in 1999)
- [EU-DSO](#): Association for the European Distribution System Operators (established by the Regulation EU 2019/943)
- [ACER](#): European Union Agency for the Cooperation of Energy Regulators (funded in 2011).





3. Energy Actors

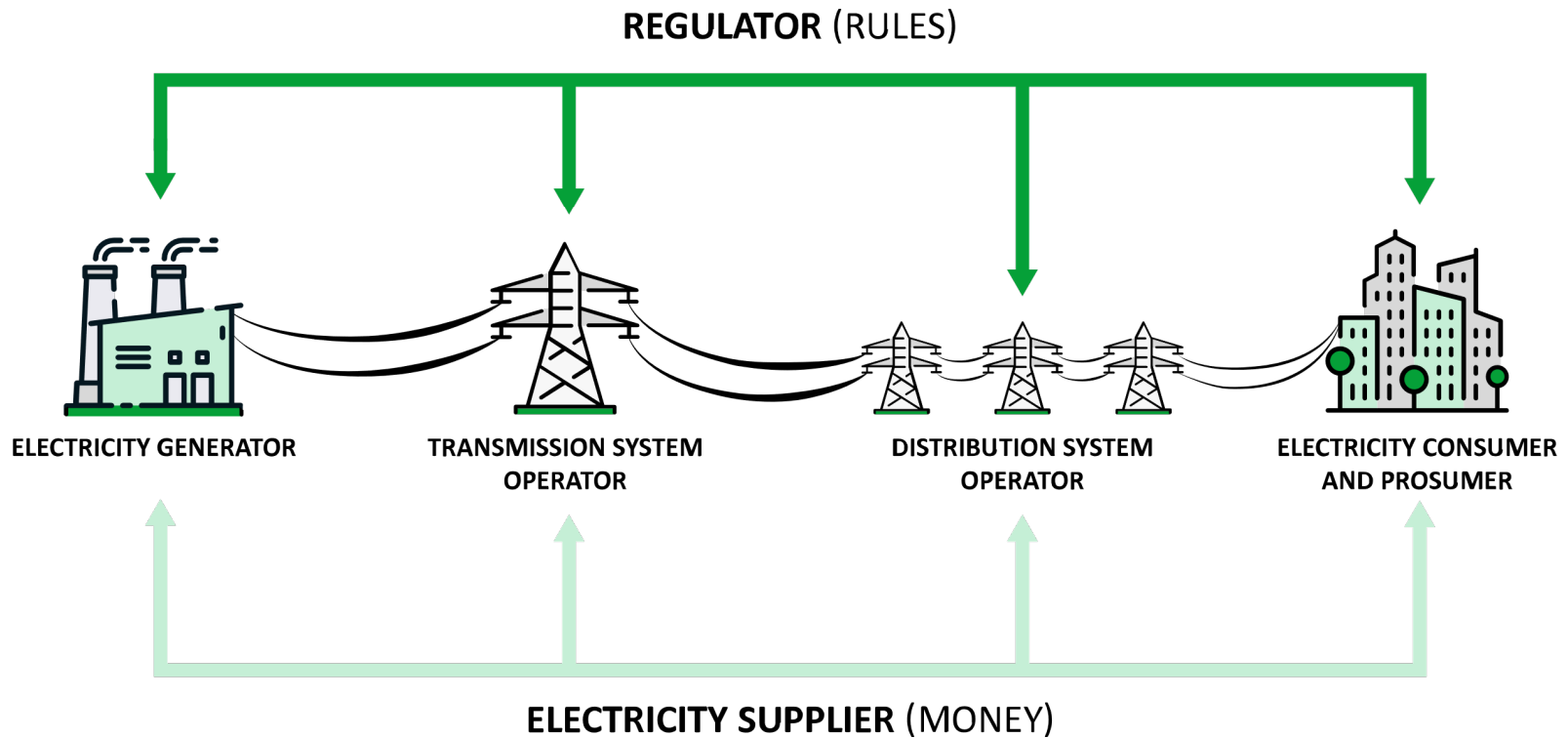
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3. Energy Actors

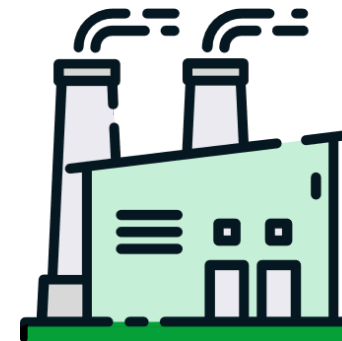
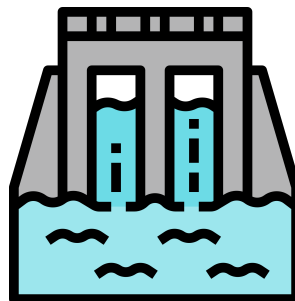
Energy actors in the electricity system





3. Energy Actors

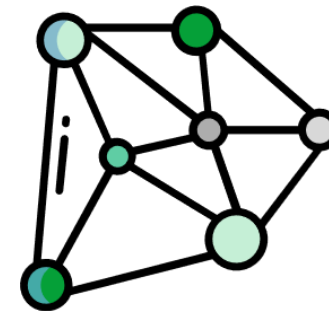
- **Electricity generator:** produce electricity (thermal power plants, nuclear plants, hydro-power, wind, PV...)





3. Energy Actors

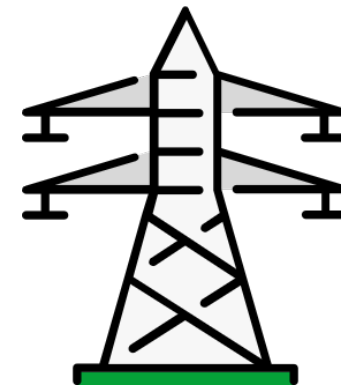
- **Electric grid:** the network that connects generators and consumers.
 - **Transmission networks:** transport electricity from the big generators. Long-distance power lines with High Voltage (up to 750 kV) run by **TSO**. <https://www.entsoe.eu/data/map/>
 - **Distribution networks:** take electricity from the transmission network to consumers. Managed by **DSO**. Smaller RES (solar and wind) fed into distribution network.





3. Energy Actors

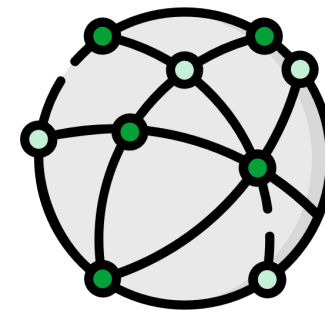
- **TSO** (Transmission System Operator): guarantees the safe technician operation of the power system and preserved the supply-demand balance.
 - Natural monopoly.
 - Frequently state-owned.
 - Independent from generation and distribution.
 - **ENTSO-E**: 42 members from 35 countries.





3. Energy Actors

- **DSO:** carried out the distribution of electricity ($V < 110$ kV) to end customers.
 - Install, maintain and operate distribution network.
 - Impartial → guarantees non-discriminatory access to third parties.
 - **EU.DSO:** 898 DSOs from 34 countries.
 - Legally separated from the free-market suppliers.
 - Supplier of last resort.





3. Energy Actors

■ Regulatory Authorities:

- Assure all stakeholders in the energy market comply with country and European legislation.
- Council of European Energy Regulators (CEER) assembled in 2000 to create a single, competitive, efficient and sustainable EU internal energy market.
- ACER decentralised agency in charge of sustain fair competition in the European Market for electricity and natural gas.

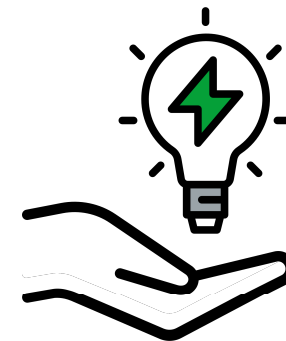




3. Energy Actors

■ Supplier:

- Buys energy from producers through bilateral agreements or through the energy market and sell the energy to their customer.
- Balance Responsible Party (BRP): balance expected demand and real consumption within its portfolio.



■ Consumer:

- Demands electricity (High or Low Voltage).
- In the past, a passive actor, now it can interact
→ **prosumer.**





4. Energy Market

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2. European Legislation & European Agencies
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5. New Electricity System and Actors





4. Energy Market

- European objective: **liberalisation** of the **internal Energy Market** for gas and electricity (not fully completed yet).
- **Retail market:**
 - Actors: suppliers and consumers.
 - Relation through electricity contracts
 - Price in the electricity bill includes costs of energy production, costs of transmission and distribution network maintenance, taxes and levies.





4. Energy Market

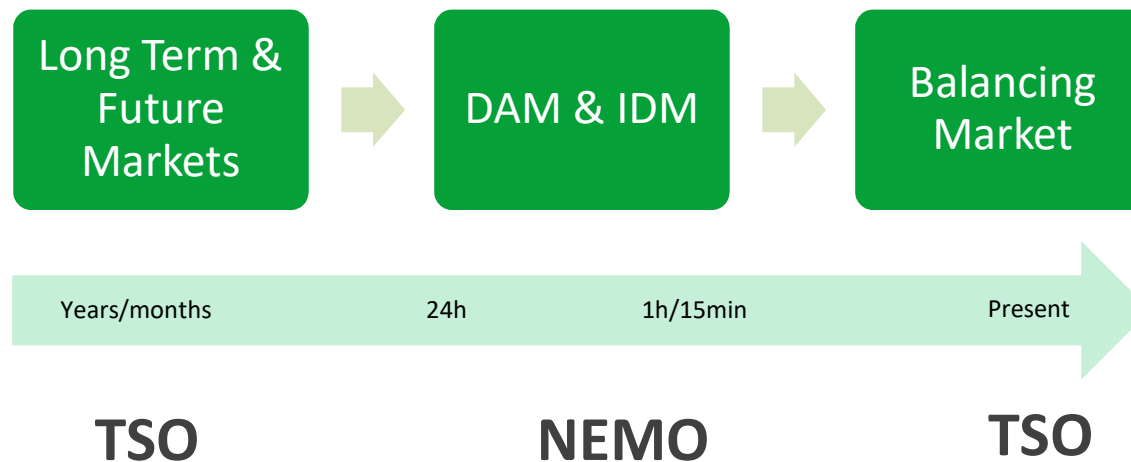
- **Wholesale Market**
- Actors: generator, electricity suppliers and large industrial consumers.
- Types:
 - Long term contracts: up to 20 years or more.
 - Forward and future markets: weeks to years in advance.
 - Day-ahead market (DAM): 12-36 hours prior operation hour.
 - Intra-day market (IDM): several auction with different time-frames.
 - Balancing market: real-time balancing of supply and demand





4. Energy Market

- Wholesale Market



NEMO: Nominated Electricity Market Operator. Organizations mandated to run the day-ahead and intraday integrated electricity markets.





4. Energy Market

- **Day-ahead Market (DAM):**
 - Blind auction once a day all year round for each hour.
 - Market participants send the volume of energy they want to buy or sell and the maximum/minimum prices.
 - Algorithm matches the demand curve (buy orders) with the supply curve (sell orders) → final price for each hour.

http://www.nemo-committee.eu/aggregated_curves

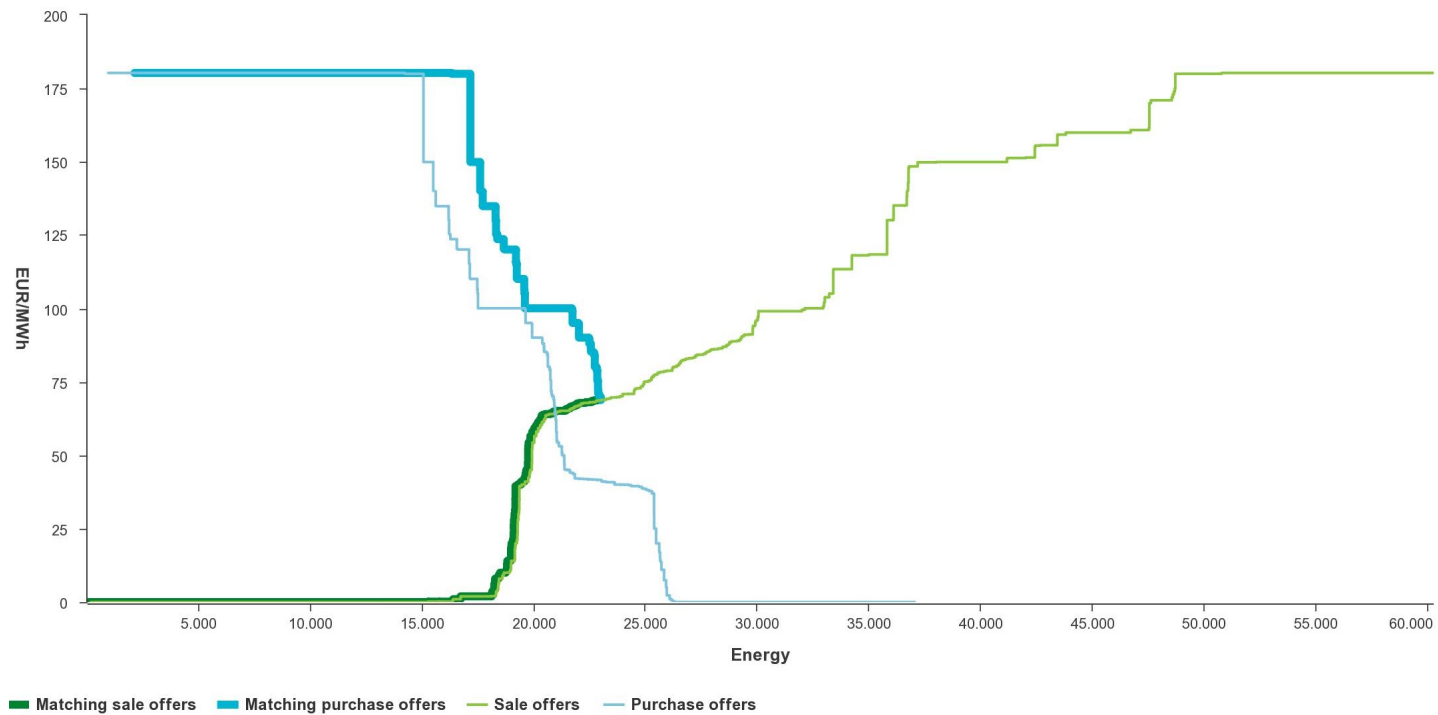




4. Energy Market

■ Day-ahead Market (DAM). Example Spain - OMIE

Aggregate supply and demand curves MIBEL
Hour 1 - 11/05/2021





4. Energy Market

- **Intraday Market (IDM).**
 - Allows to correct expected deviations.
 - Two approaches:
 - Continuous Auction Model: auctions take place on a continuous basis.
 - Hybrid Model: continuous matching combine with several auctions similar to DAM.



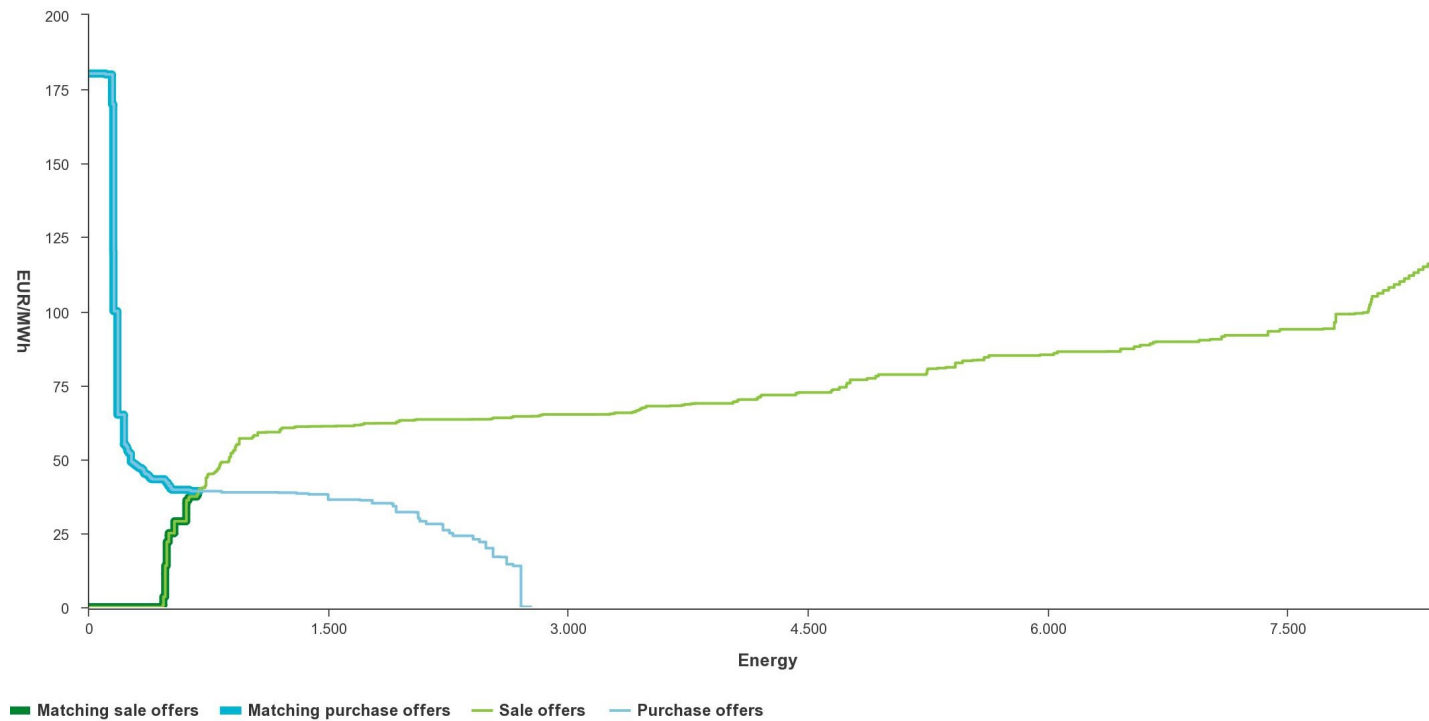


4. Energy Market

■ Intraday Market (IDM). Example Spain - OMIE

Aggregate supply and demand curves

Hour 5 - Session 4 - 11/05/2021





4. Energy Market

- **Balancing Market / Ancillary Market**
 - Guarantee and maintain power quality and frequency at the lowest cost.
 - Due to deviation on the BRP scheduled production or consumption.
 - Balancing services:
 - Frequency ancillary services
 - Voltage control
 - System restoration services or black-start capacity.





5. New Electricity system and actors

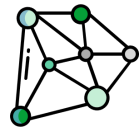
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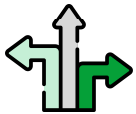


5. New Electricity system and actors

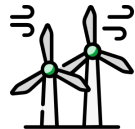
Energy transition aims to transform the market:



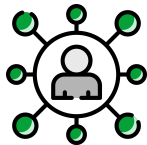
Interconnected.



More flexible.



Fostering Renewables Energy Sources.



Consumer-oriented



5. New Electricity system and actors

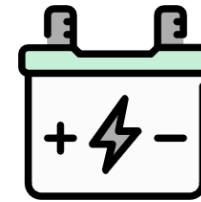
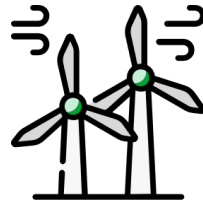
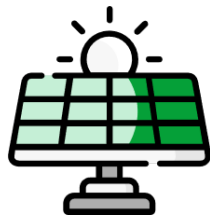
- **Smart grids:** energy networks that can automatically monitor energy flows and adjust changes in energy supply and demand accordingly. Real-time information about consumption.
- **Smart metering:** electronic system capable of measuring electricity supply and demand providing more information than conventional meters → hourly or quarter-hourly consumption.





5. New Electricity system and actors

- **Distributed Energy Resources (DER):** any electricity resource or controllable load (small-scale) connected to the local distribution system.
 - **Distributed Generation (DG):** power generating technologies in distribution grid such as cogeneration units, PV plants or wind generators.
 - **Energy storage facility (ES):** batteries, including electric vehicle charging stations.
 - **Demand Response (DR).**





5. New Electricity system and actors

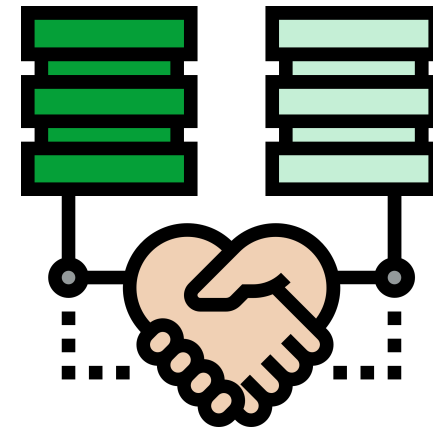
- **Demand Respond (DR):** change of electricity load by final customer from their normal or current consumption patterns in response to market signals. Use of demand flexibility as an energy resource.
 - Implicit DR: actions as a response to time-variable electricity prices.
 - Explicit DR: actions as a response to incentive payments.





5. New Electricity system and actors

- **Aggregator.**
 - Market actor who combines multiple loads of generated electricity (mostly DER) for sale, purchase or auction in any electricity market
 - Independent aggregator: market participant not affiliated to the customer's supplier.





5. New Electricity system and actors

- **Prosumer.**
 - Active energy consumers that not only consume but also produce electricity or provide flexibility.
 - Residential, energy communities, commercial or public buildings.
 - Use of RES or flexibility through DR actions.





5. New Electricity system and actors

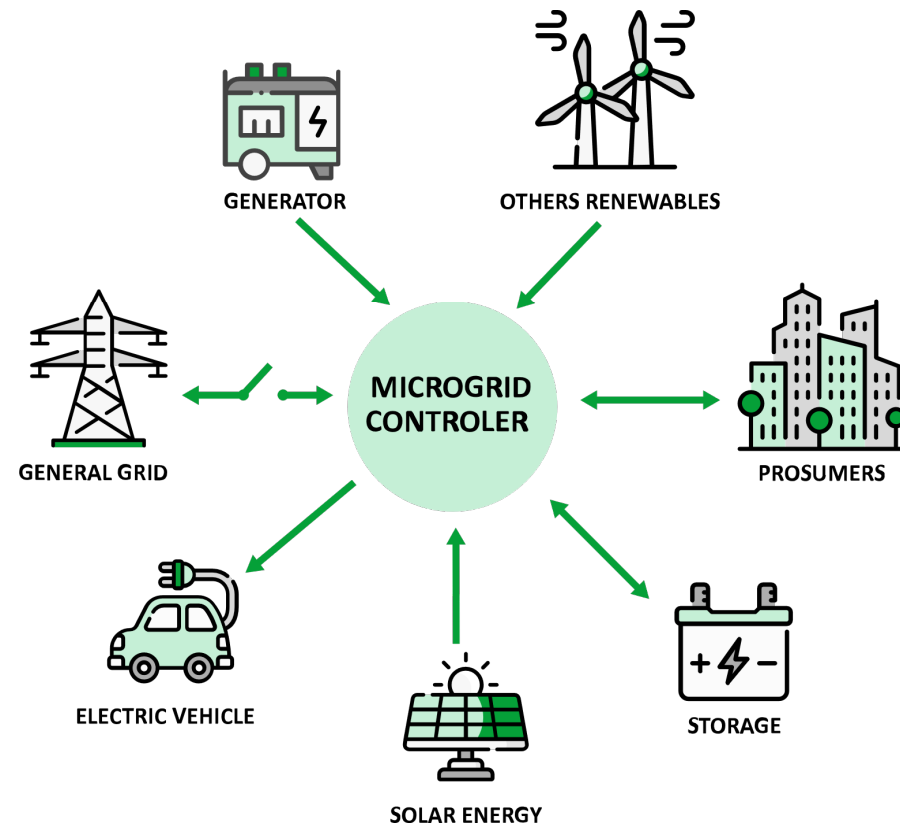
- **Energy Communities.**
 - Partnership of **citizens** on collective energy actions.
 - **Non-commercial entities** which main purpose is to provide environmental, economic or social community benefits rather than profit making (REScoop.EU, 2019).





5. New Electricity system and actors

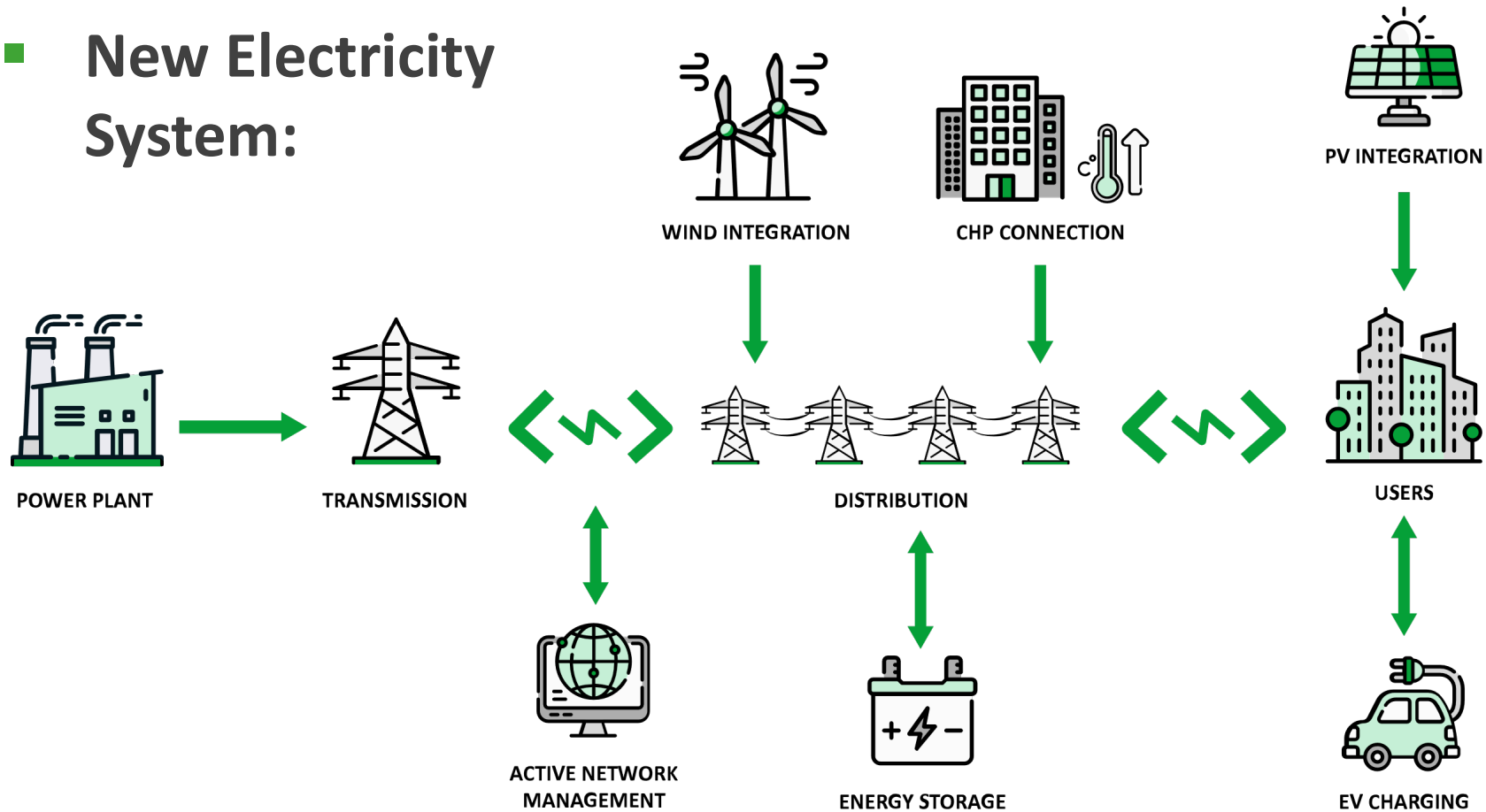
- **Microgrids:** group of interconnected loads and DERs within a clearly defined electrical boundaries that acts as a single controllable entity. Can work grid-connected or island-mode.





5. New Electricity system and actors

■ New Electricity System:





THANKS FOR YOUR ATTENTION

ANY QUESTION?

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[MIWenergía](#)

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