Balancing a decentralised and renewable supply with an adapted demand

The key role of citizen cooperatives in the energy transition

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Energie: Société et environnement - Sustainable energy - Ressource management

Abstract

- The energy transition aims to achieve carbon neutrality by 2050.
  Many paths and scenarios.
  Common point: substantial increase of renewables and central role of energy efficiency.

- A sectorial technological approach: A flexible balance of sectoral demand with a limited renewable supply.

- An integrated territorial and societal approach: To adapt demand and to apply democratic governance to organise the flexible balance.

- The transition is not only a techno-economic topic. It is also non-technological: Redesign lifestyles, production methods; Change context (material, social, individual) to lead behaviours.

- Citizen cooperatives give a social added value to energy systems (local territorial anchoring, involvement and acceptability of change/redesign by citizens and companies, democratic management of the common good, diversification of actors).

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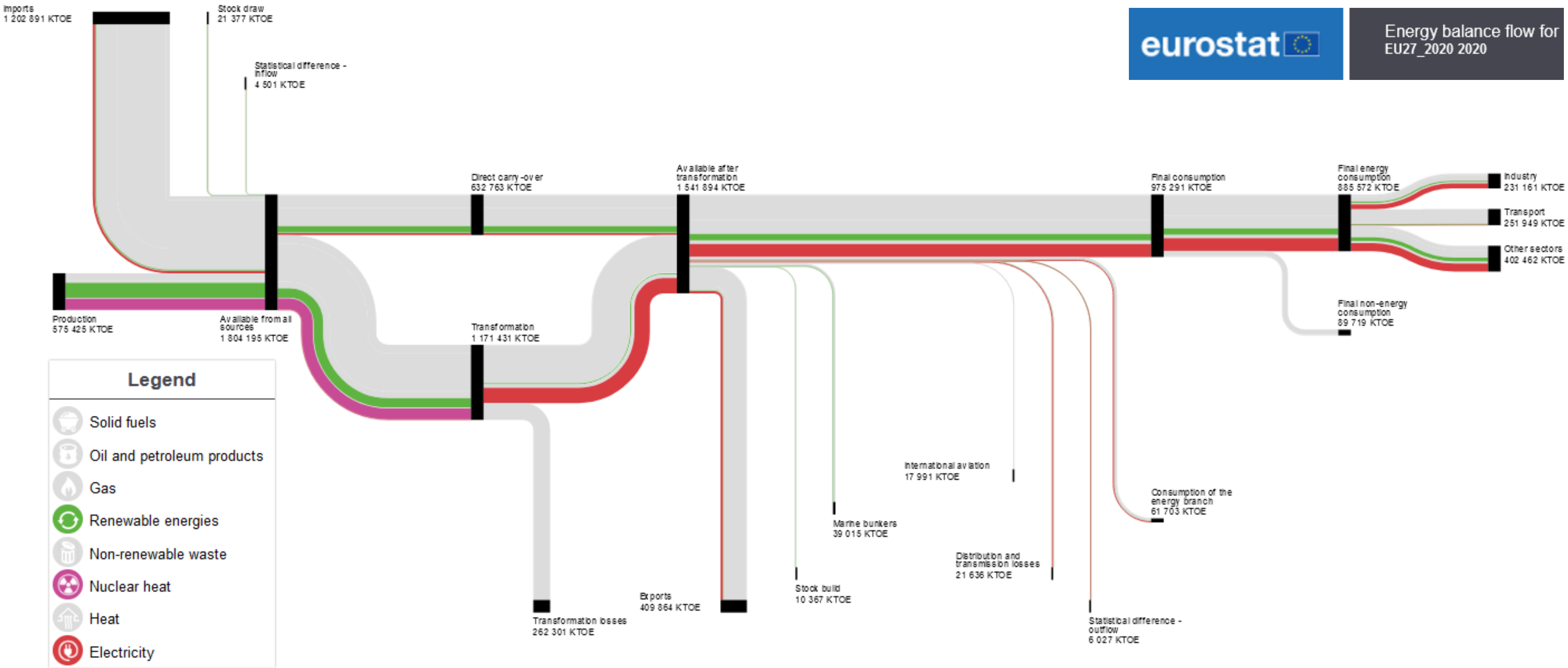
Energy transition

Moving from one state to another. This energy flow chart gives the today situation of Europe



The path to transition aims at

- Drastic reduction of fossil fuels
- Substantial increase of renewable energies
- Improving energy efficiency (using less for the “same” result)

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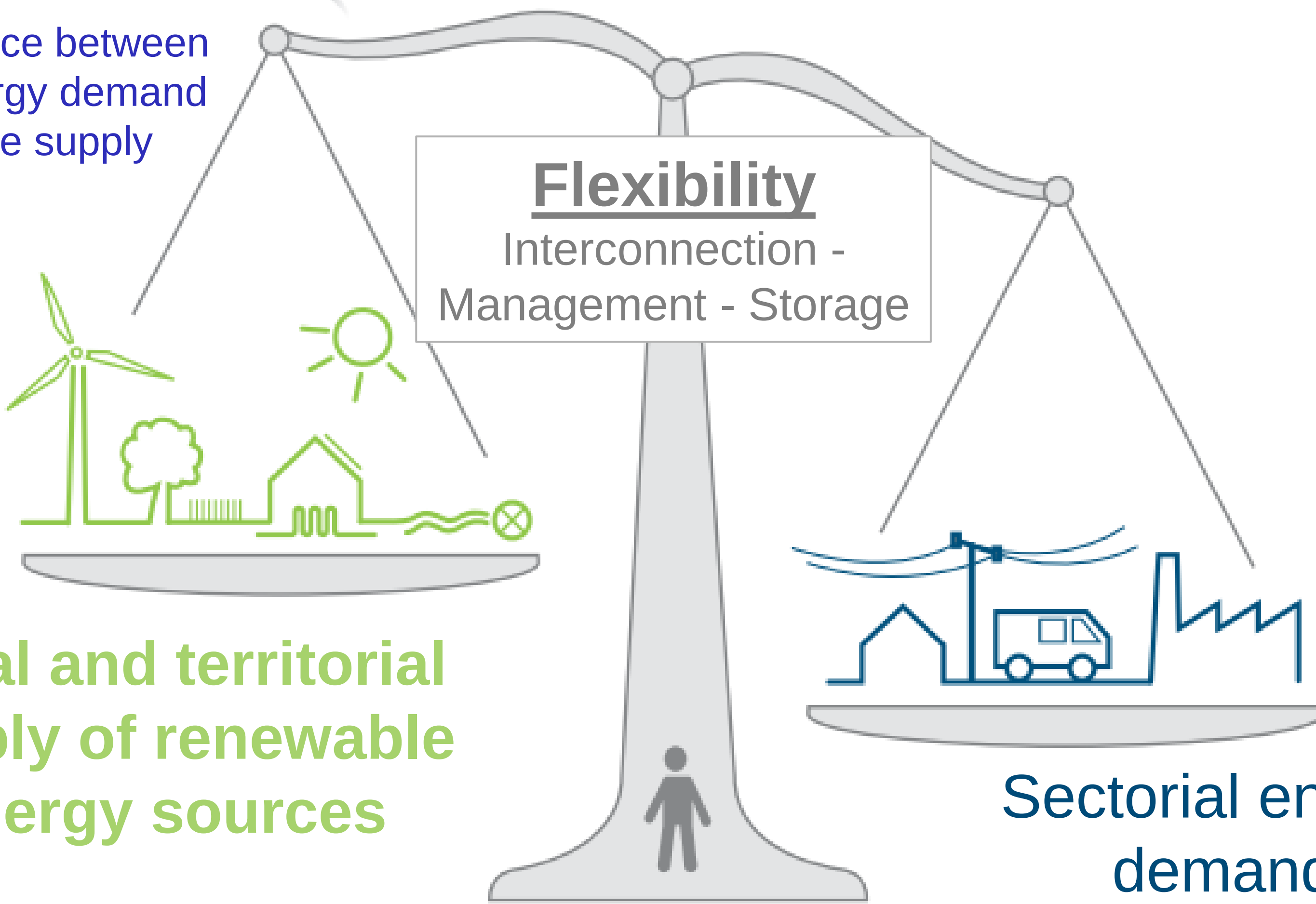
100% RE

A flexible balance between
a sectorial energy demand
by renewable supply

A sectorial technological approach



Local and territorial supply of renewable energy sources

- Sun
- Wind
- Rivers and water currents
- Biomass
- Natural heat

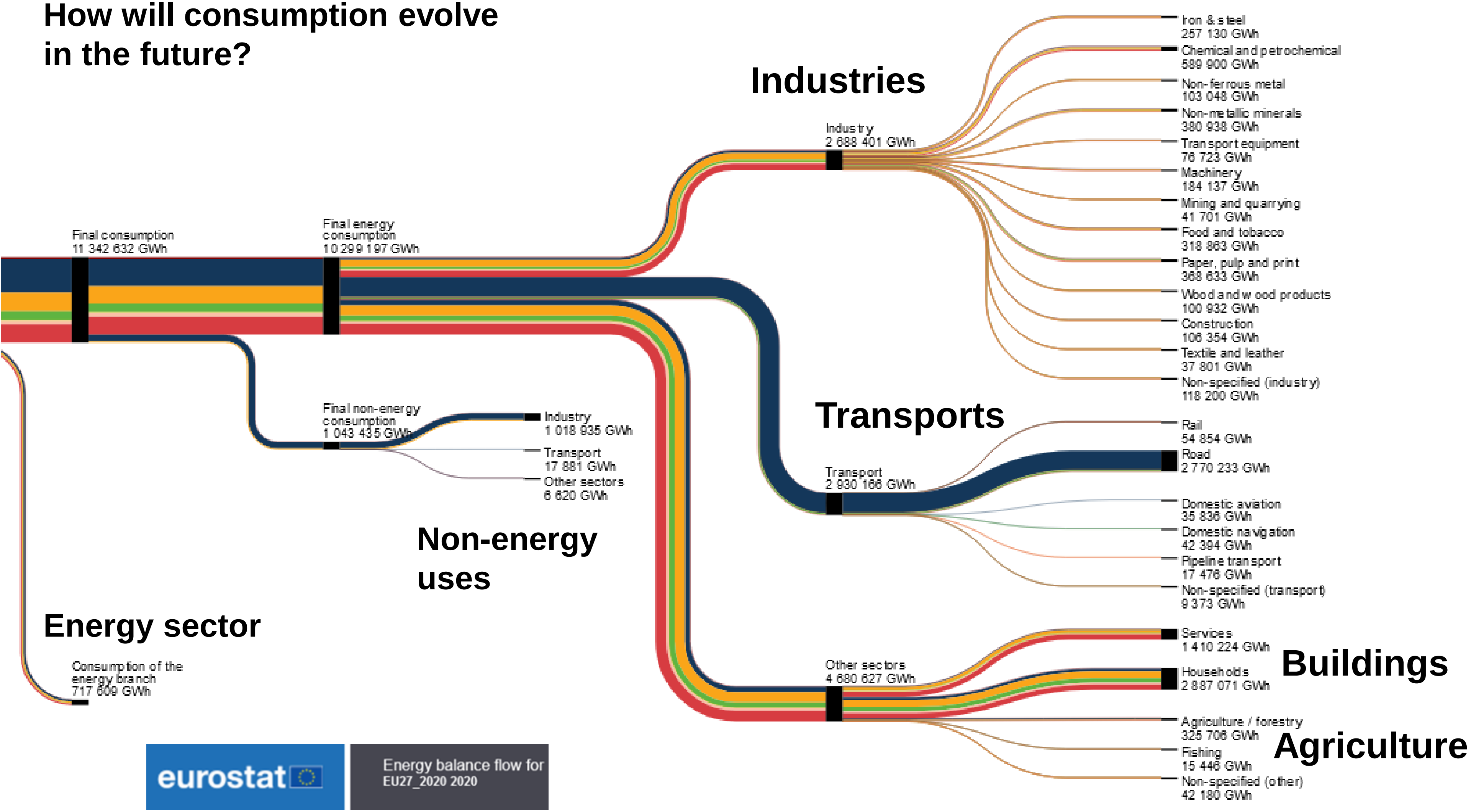
Sectorial energy demand

- Buildings
- Transports
- Industries
- Agriculture
- Energy

Final energy demand- Eurostat

Energy flow. EU27, 2020

How will consumption evolve in the future?



Eurostat- https://ec.europa.eu/eurostat/web/energy/energy-flow-diagrams

Annual energy resources per km²

Renewable energy potential is a question of available space

Source	Gross resource	Final energy resource from current systems (2016)
Sun	1,000 GWh/km² Variability: Daily, cloud cover and seasonal	Heat (Low t°): 200 [100–500] GWh_{th}/km^2 Electricity : 100 [50 –200] GWh_e/km^2
Wind (onshore)	Depends on the height of the rotor and the roughness of the land Variability: Meteorological cycle (depression - anticyclone)	Electricity : 30 [20 – 40] GWh_e/km^2
Wind (offshore)		Electricity : 45 [30 – 60] GWh_e/km^2
Rivers	Specific to watersheds Variability according to rainfall regime (regularity and intensity)	Electricity : 350 - 600 GWh_e (Belgian land)
Ocean currents and waves	Under study (North Sea currents: 800 GWh/km²) (Waves 4-5 MW/km)	Under study (Elec – sea current: 50-100 GWh_e/km^2). (Elec – waves : Annual load factor of 6%).
Natural heat (air, water, ground)	Heat reservoir renewed by the sun and derivate flows (wind, rain)	Depends on the size of the heat exchanger, the requested t°, the t° of the source and its renewal capacity.
Geothermal heat	Heat reservoir renewed by a thermal conduction flow of the basement rocks ≈ 0.110 W/m² (1 GWh / km²)	Under study
Biomass	6 GWh/km² (Energy stored by photosynthesis in average Belgian conditions)	Heat (high t°) : 4 [3 – 5] GWh_{th}/km^2 Electricity : 1.5 [1 – 2] GWh_e/km^2

Belgian renewable energy resource

The Belgian resource is measured from the areas made available for the exploitation of renewable energy flows.

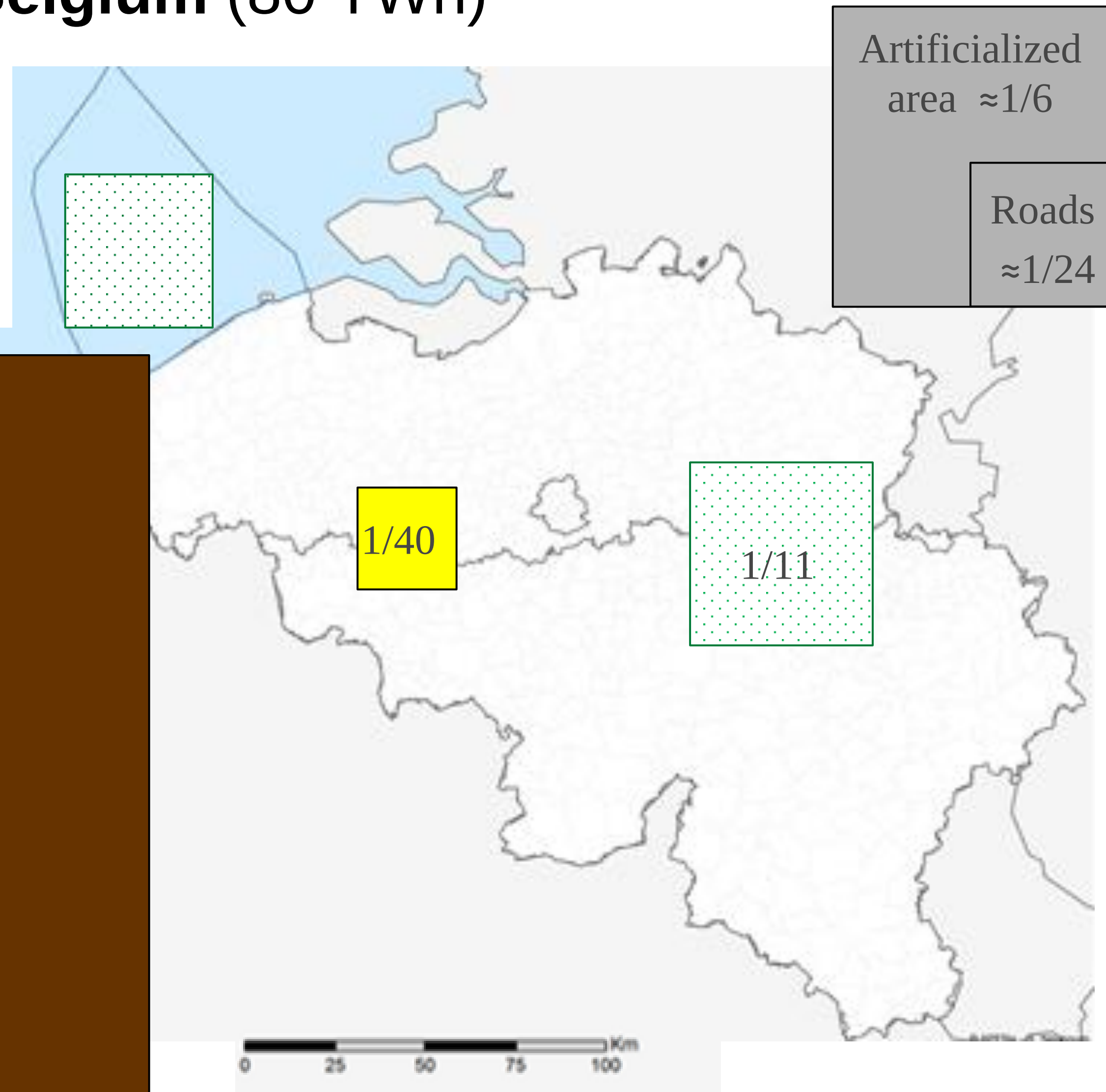
The amount of locally available renewable energy depends on
- the areas dedicated to the exploitation of renewable sources,
- the local energy characteristics of the sources,
- the performance of the conversion systems.

Large-scale exploitation requires space where the source is available.

However, in Belgium,
- high population density;
- scattered settlement.

Land requirement for electricity today consumption of Belgium (80 TWh)

- ➜ **Solar PV (alone)**
- ➜ **Wind onshore (alone)**
- ➜ **Wind offshore (alone)**
- ➜ **Biomass (alone)**



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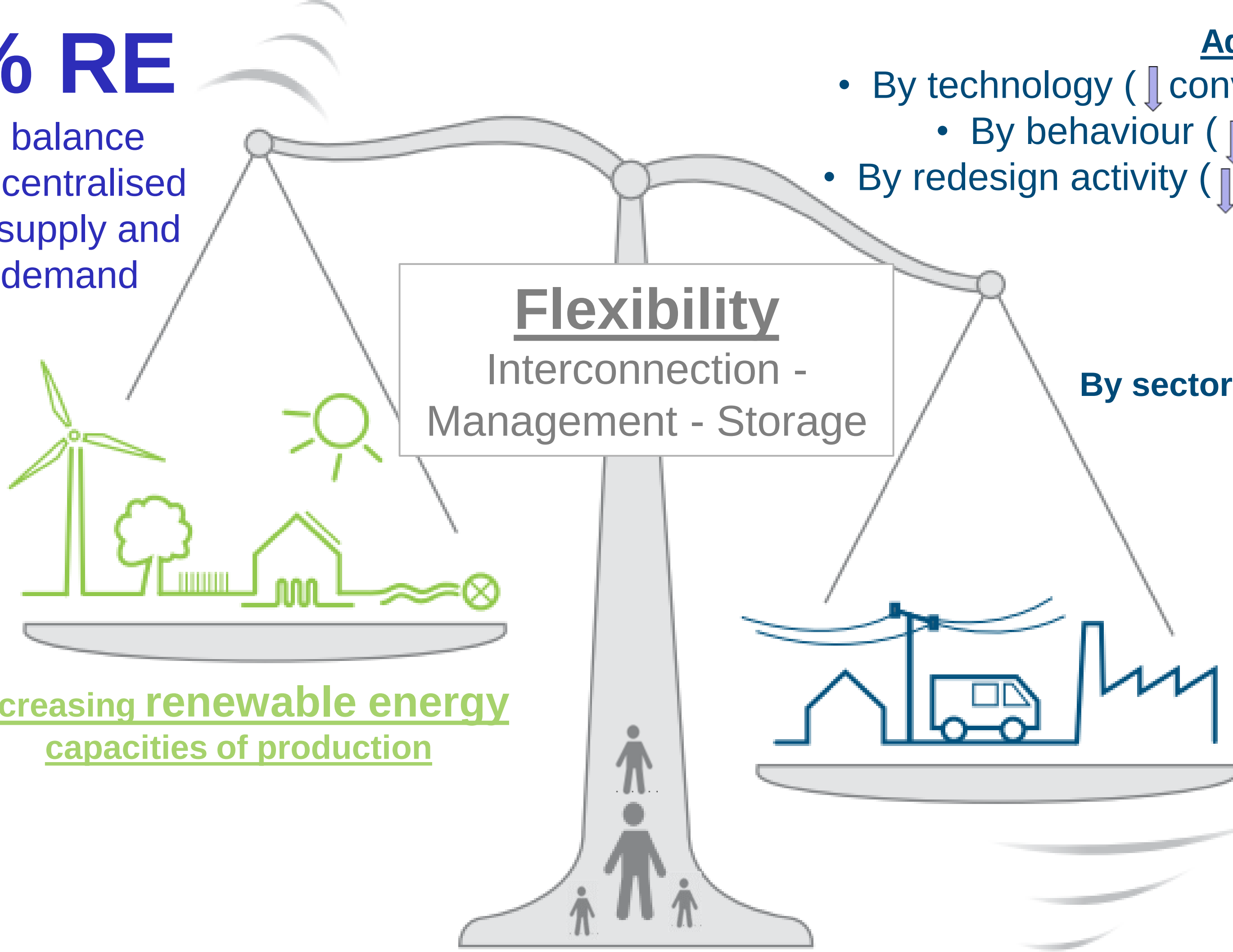
100% RE

A flexible balance between decentralised renewable supply and adapted demand

Adapting Demand

- By technology (↓ conversion losses)
- By behaviour (↓ usage losses)
- By redesign activity (↓ intensity level)



Increasing renewable energy capacities of production

Planning

By sectors and territories

- Building
- Transport
- Industry
- Energy
- Agriculture

Approach by

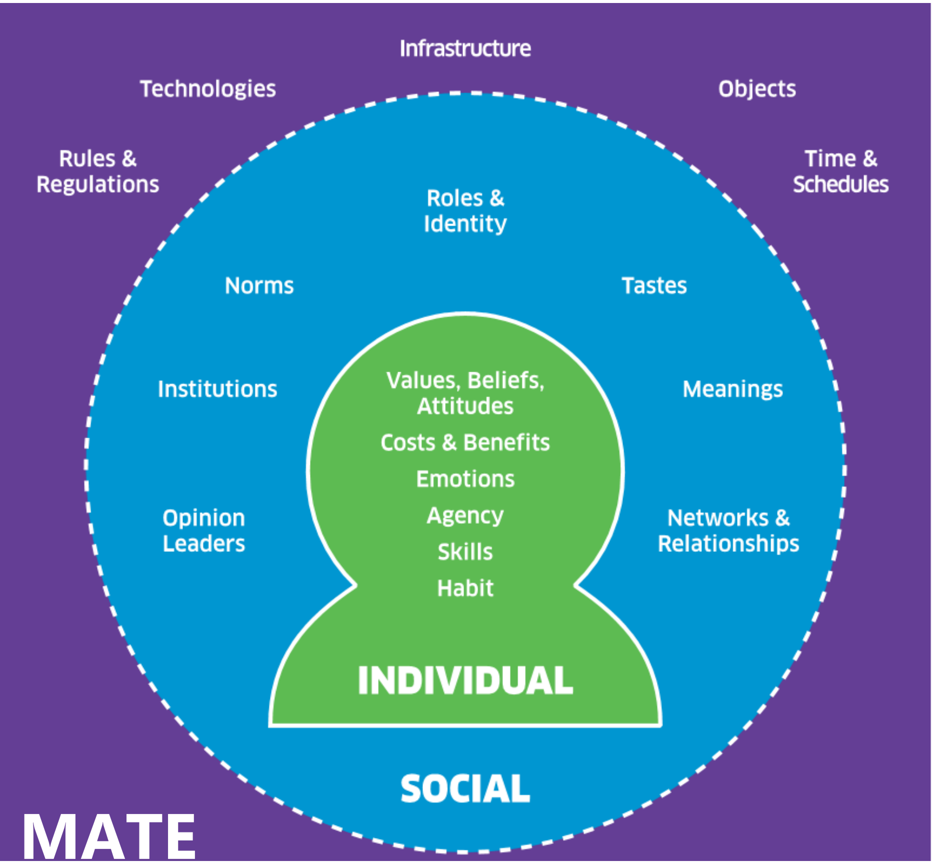
- Territories
- Communities

Organising : Lifestyle – Productive methods

Efficient / Saving / Flexible / Not in excess/ Sober

- By the material framework (infrastructure, equipment, technical norms)
- By social framework (formal and informal norms)
- By the individual context (desires, costs/benefits, skills)

ISM model: Factors that influence behaviour (based on social practices)



THE INDIVIDUAL CONTEXT

This includes the factors held by the individual that affect the choices and the behaviours he or she undertakes. These include an individual's values, attitudes and skills, as well as the calculations he/she makes before acting, including personal evaluations of costs and benefits.

THE SOCIAL CONTEXT

This includes the factors that exist beyond the individual in the social realm, yet shape his or her behaviours. These influences include understandings that are shared amongst groups, such as social norms and the meanings attached to particular activities, as well as people's networks and relationships, and the institutions that influence how groups of individuals behave.

THE MATERIAL CONTEXT

This includes the factors that are 'out there' in the environment and wider world, which both constrain and shape behaviour. These influences include existing 'hard' infrastructures, technologies and regulations, as well as other 'softer' influences such as time and the schedules of everyday life.

The ISM model, DARNTON Andrew and HORNE Jackie (2013)

https://www.gov.scot/publications/influencing-behaviours-moving-beyond-individual-user-guide-ism-tool/pages/2/

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Key role of citizen cooperatives

Citizen cooperatives give a social added value for transition

- local territorial anchoring,
- diversification of actors in the energy sector,
- democratic management of the common good,
- involvement and acceptability by citizens and companies in change of context (material, social, individual) and redesign activities.

The European and Belgian regulatory context must guarantee access to energy communities. (e.g. citizens' cooperatives) in offshore wind farms.