TELOS TOPIC 04

Energy

Content development led by
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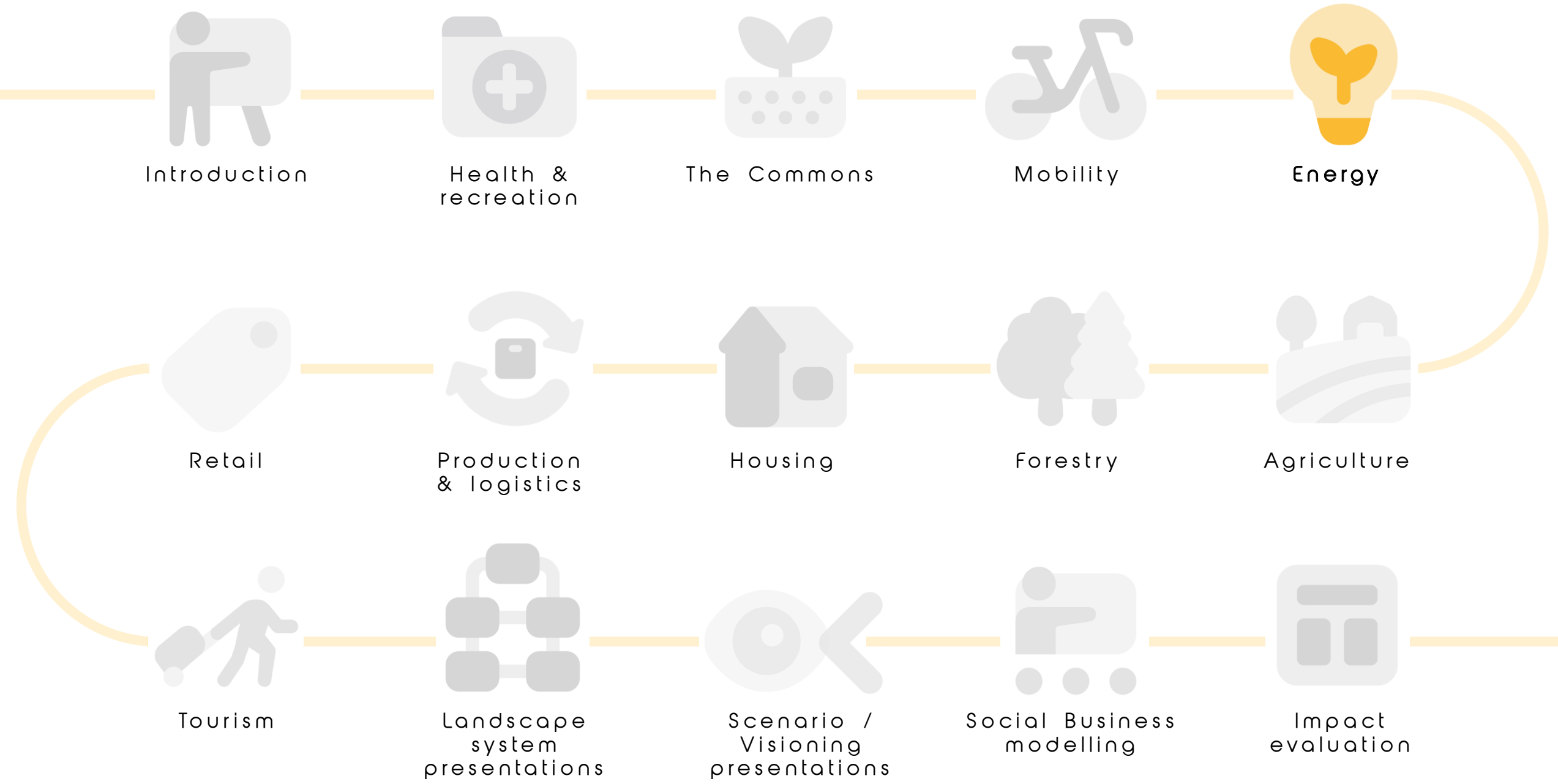
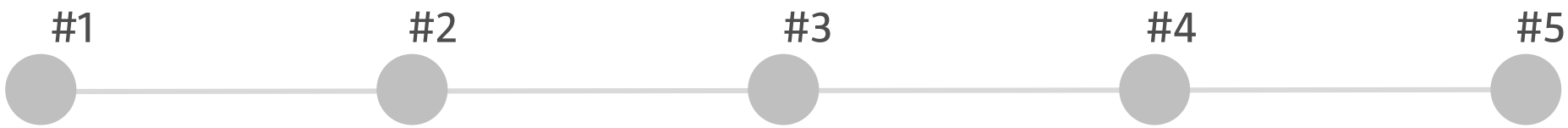
Sapienza Università di Roma
LE:NOTRE Institute
Linking Landscape Education, Research and Innovative Practice
ULB Faculté d'Architecture La Cambre Horta
Politechnika Gdańska
Co-funded by the Erasmus+ Programme of the European Union


Introduction
Health & recreation
The Commons
Mobility
Energy
Retail
Production & logistics
Housing
Forestry
Agriculture
Tourism
Landscape system presentations
Scenario / Visioning presentations
Social Business modelling
Impact evaluation



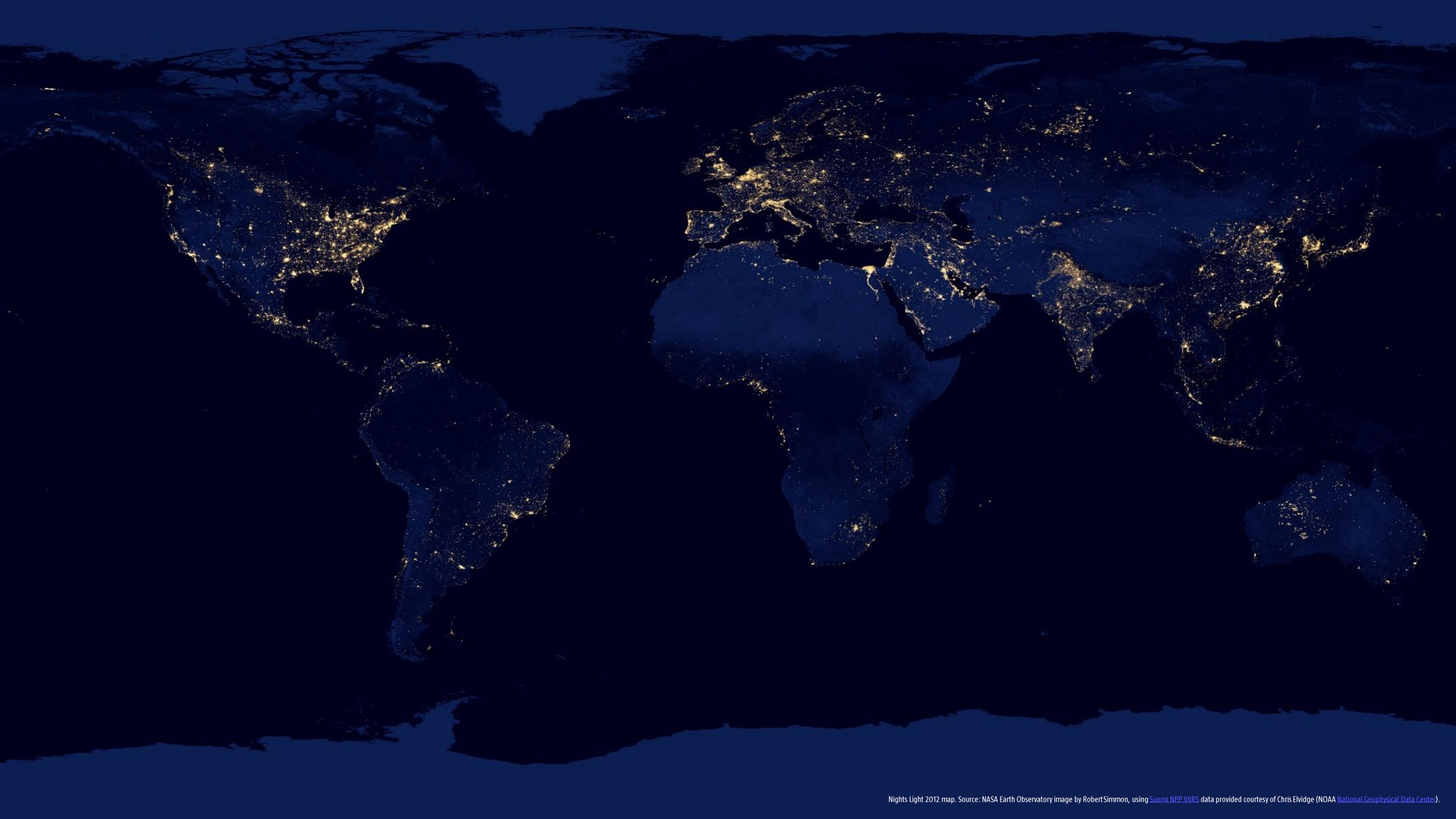
Background

Energy system

Multi-level governance

EU & City level

Energy justice



Nights Light 2012 map. Source: NASA Earth Observatory image by Robert Simmon, using Suomi NPP VIIRS data provided courtesy of Chris Elvidge (NOAA National Geophysical Data Center).

Background: Why is energy such a relevant topic?

Very energy intensive way of living

Background: The CO_2 clock is ticking...

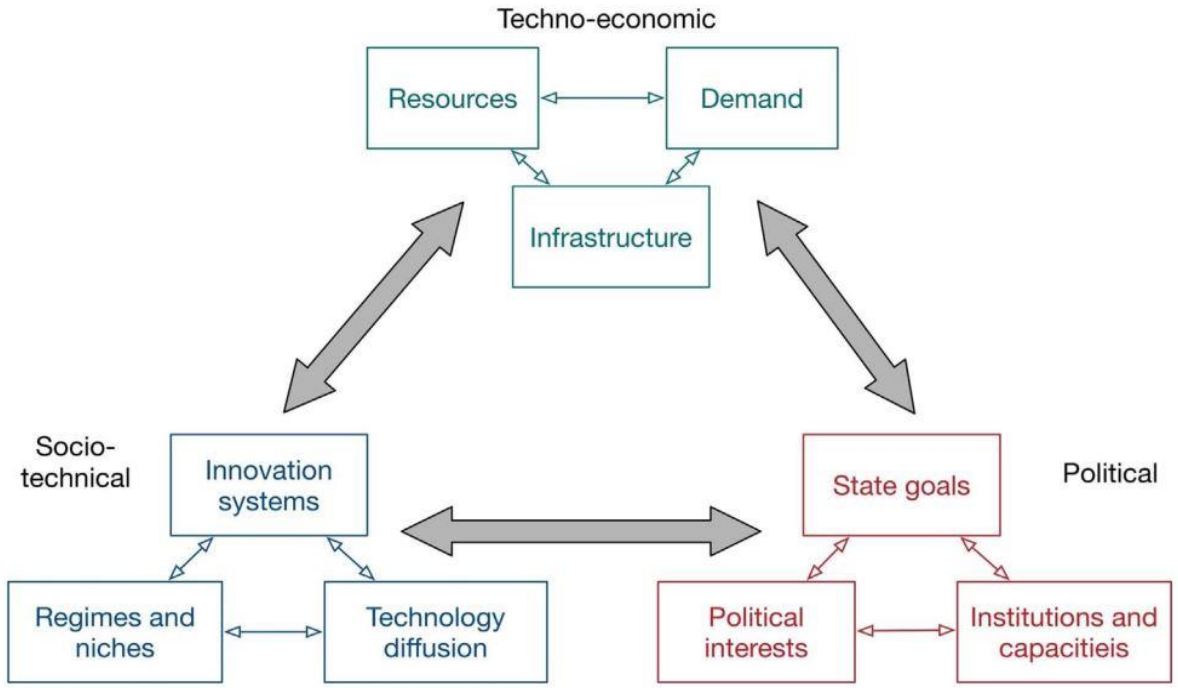
Very energy intensive way of living

reflected in the way cities and space are planned and organized

Energy systems

What is actually meant by energy system?

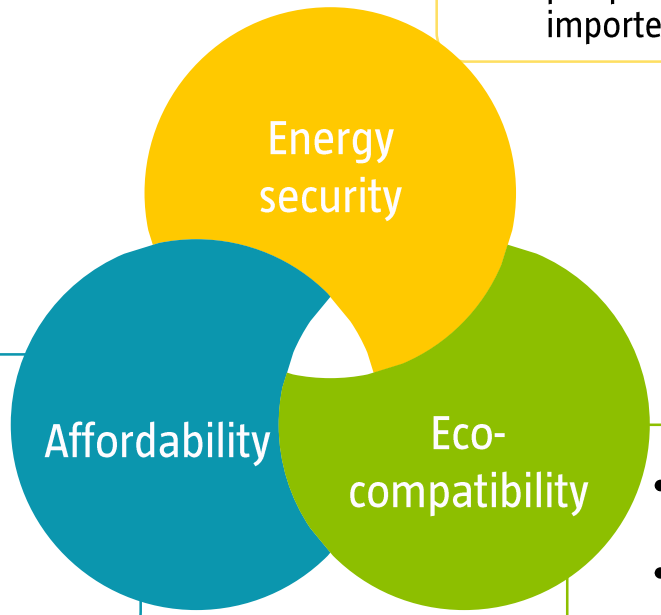
Energy system



Three dimensions of national energy transitions. Source: Cherp et al. (2018)

Energy system: goals

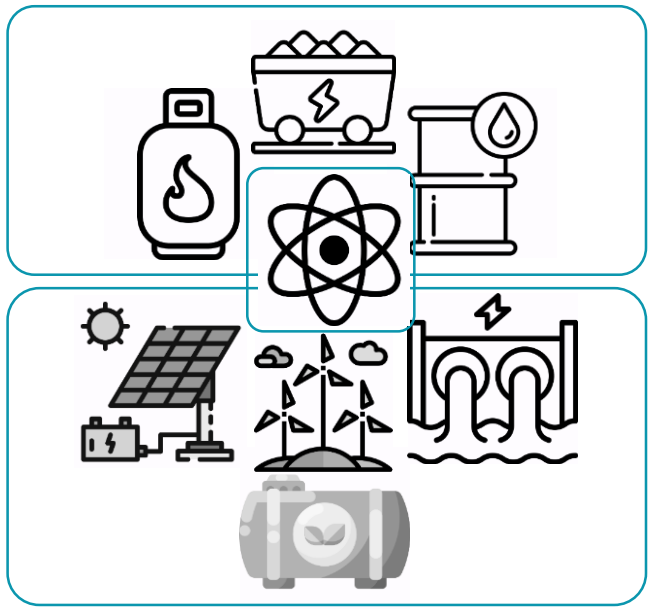
- internal system perspective: stable supply of customers
- external system perspective: variety of importers



- Prices based on costs
- Competitive prices
- Fair prices

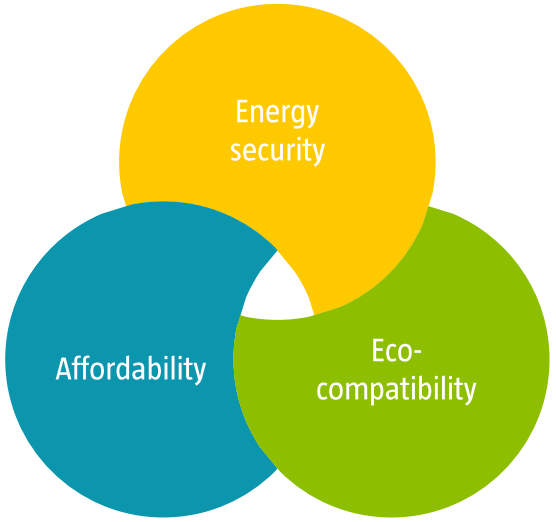
- No environmental impact (water, soil, air etc.)
- Climate mitigation requirements (CO_2)
- Local pollutants

Realization of goals (… physical)



Electricity
Heat/Cold
Fuels

Realization of goals (… requirements)



Holistic decision-making

Rigorous planning

Smart technologies

Energy transition

12 BRIEF LESSONS

ON EUROPE'S ENERGY TRANSITION

1 Energy has historically been a key driver of European **COOPERATION**. But current EU proposals are not enough. To comply with the Paris Climate Agreement, we **MUST GIVE UP** fossil fuels altogether by 2050.

2 A **100 %** renewable energy system in Europe is now technically possible using existing **STORAGE** and **DEMAND RESPONSE** technologies.

3 Stronger **INTERCONNECTIONS** of markets and infrastructure across Europe will make the energy transition cheaper for all Europeans.

4 The biggest potential lies in **INCREASING EFFICIENCY**. Europe-wide we could reduce our energy demand by half by 2050.

5 A switch to 100% renewables in Europe will trigger **SYSTEM CHANGE** – away from centralized, monopolistic utilities to decentralized, community power projects and innovative business models.

6 Framed by smart strategies and legislation, this system change can be driven by **CITIZENS, CITIES AND ENERGY COOPERATIVES**, leaving much more wealth in communities.

7 Digitalization can make this transformation more **DEMOCRATIC AND EFFICIENT**, and can reduce the bill for the end consumer.

8 The European energy transition promises to increase **PROSPERITY** in a sustainable way (creating more local jobs) and boost Europe's global **LEADERSHIP** in green innovations.

9 Since 2013, renewables have helped **SLASH** Europe's import bill for fossil fuels by more than a third, **CUTTING ITS DEPENDENCY** on unstable and unpleasant regimes.

10 **A SOCIALLY JUST TRANSITION** is both essential and viable: all over Europe, the renewables sector already provides more well-paid, secure local jobs than the coal industry.

11 **ENERGY POVERTY** is being tackled by pioneering community power projects, acting in solidarity with those in their own community addressing this challenge.

12 Europe's Neighbourhood Policy should **INSPIRE AND SUPPORT** other countries to decarbonize their economies. A socially just energy transition in Europe's neighbouring regions can stimulate their progress and stability.

How to realize the energy transition?

→ decarbonize our systems
→ energy efficiency
→ energy sufficiency

Efficiency

“efficiency” = ratio btw. a particular benefit and the effort required to obtain it

Questions: How can we produce the same or more with less energy

→ Processes and products which require fewer resources and less energy to produce

Sufficiency

“sufficiency” = “to be enough”

Questions: How much do we need for a good life? And how much is superfluous?

→ reduce consumption of raw materials and energy as far as possible by reducing the demand for goods and services, especially those requiring high levels of resource use

The energy transition is a project for society as a whole

Politics, industry, business and society

Transitions operate at all levels of societal domains or functions: transport, housing, agriculture and food, communication, …

Three main features of energy transitions…

1. Change in socio-technical systems
   - Development of technologies and their use
   - Adaptation by consumers and societal embedding

2. Multi-actor processes
   - Interactions between actors
   - Social groups, businesses, different user groups, scientific community, social movements, policy makers

3. Long-term processes
   - Break through of innovations ~ 10 years
   - Emergence 20-30 years

>14 GW
Installed capacity worldwide

1700 GW
Potential in Germany

3000+
Installations in Japan

Source: Fraunhofer ISE

Example agro photovoltaic
first introduced in 1982
2022: small-scale

How to steer the energy transition?

Multi level governance: various actors, perspectives and objectives

Governance = all forms of collective action coordination

The energy transition is a **spatial** field of action, integrated in **complex multi-level governance**, characterized by **spatial differentiation**

Multi level governance: various actors, perspectives and objectives

- Governance by **institutions**: territorial framework conditions, apply to the entire territory (EU, national, regional)
- Governance of **formal sites**: Planning process and approvals, yet integrated into national and EU legislation; different depending on energy source and infrastructure
- Governance of **conflicts**: Differing interests and conflicts between stakeholders over land and site development decisions

Multi level governance: various actors, perspectives and objectives

- Governance of **organizations**: Project-related networking of actors (cities, villages, regions)
- Governance of **new regional spaces of action**: development plans, project investments, experiences, networking, modes of citizen participation
- Governance of **concepts**: analysis of relevant data, definition of relevant goals, stakeholders, scale (neighborhood, city, regional, national)

Principles of energy governance

- All societal actors are aware of **opportunities and restrictions**
- **Top-down planning** and market dynamics only account for parts of change
- Network dynamics and **bottom-up approaches** account for the rest
- Societal change is a **process of searching, learning and experimenting**
- Relationship between **specific societal domains** and **effective forms of governance**
- Influencing factors: individuals, external influences, lobby groups

Multi level governance: governance by institutions

EU

national
(Germany)

regional
(Baden-Württemberg)

local
(City of Nürtingen)

Multi level governance: governance by institutions

EU

national
(Germany)

regional
(Baden-Württemberg)

local
(City of Nürtingen)

Multi level governance: governance by institutions

EU

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(Germany)

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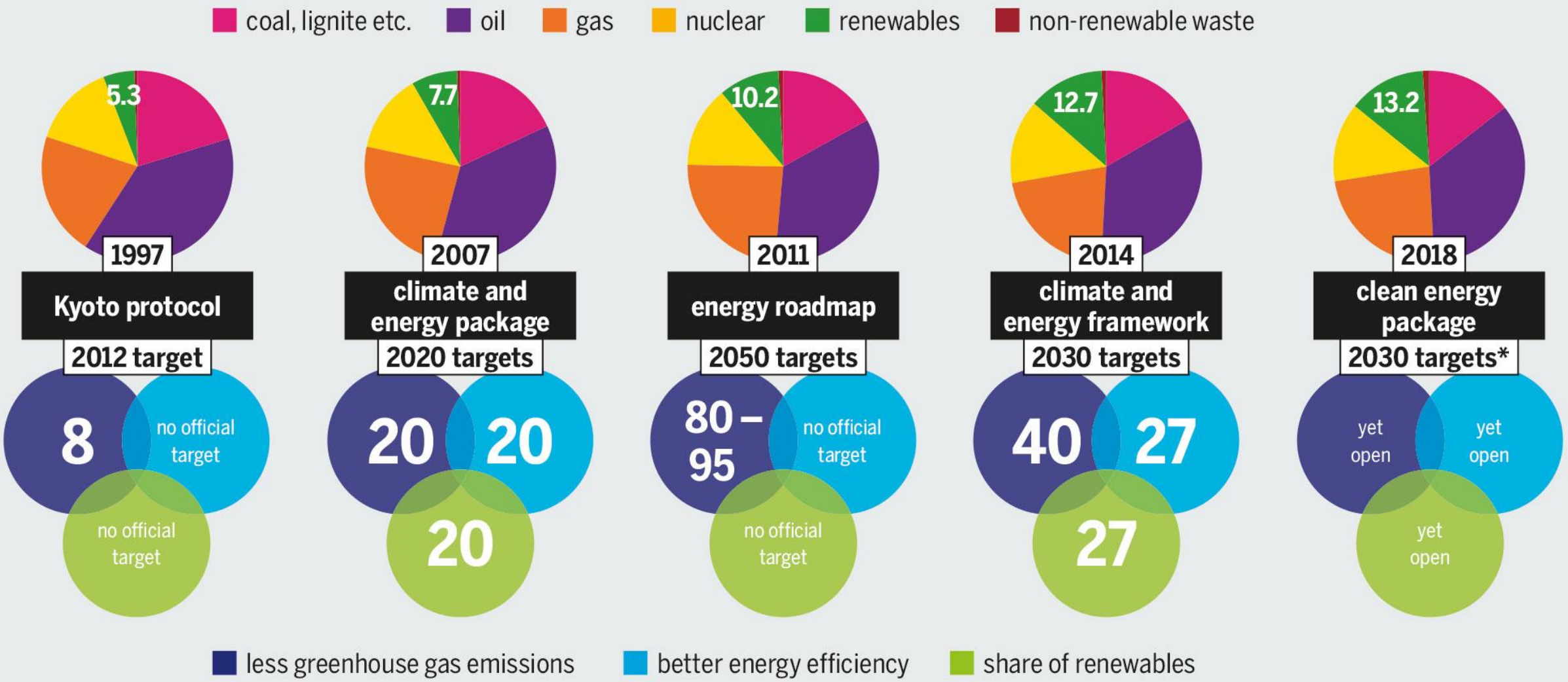
local
(City of Nürtingen)

Internal energy market: from 1996, liberalization of electricity and gas supply

STEPS TOWARDS DECARBONIZATION

Major EU programmes, energy mix in the year of adoption, improvements for the target year, in percent



Targets compared to 1990 levels. All data recalculated for EU28 *Clean energy package targets projected by the European Commission's REmap analysis, February 2018

European energy policy

Until **Lisbon Treaty** (2007): No EU energy competence

EU Treaty Art. 194 (Lisbon) with **joint competence** for objectives:

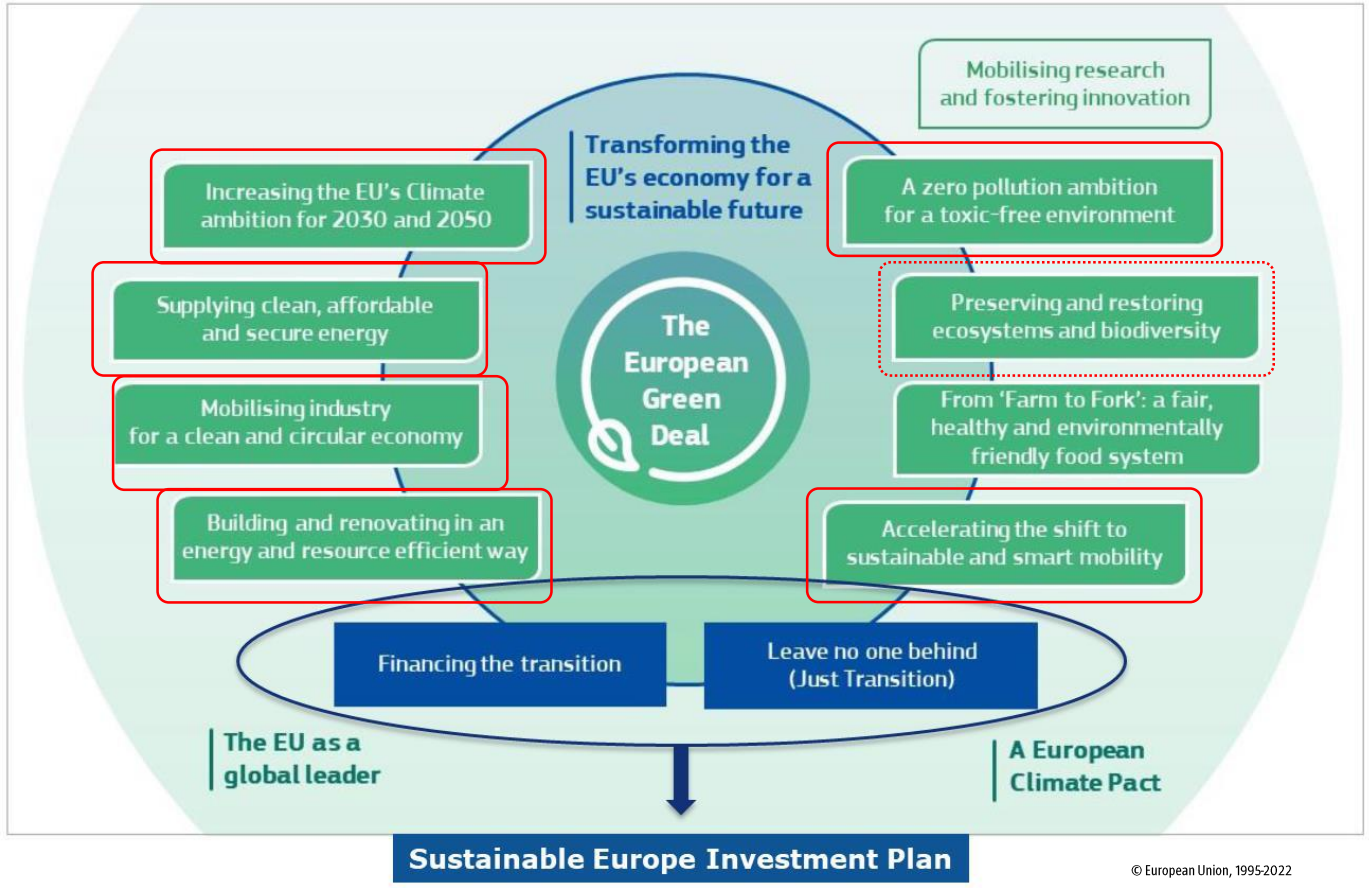
- Ensuring the functioning of the **internal energy market**;
- Ensuring **security of energy supply** in the Union;
- Promoting **energy efficiency, energy reductions** and development of **new and renewable energy** sources;
- Promoting the **interconnection** of energy networks

- Structure: Directorate-General for Energy of the European Commission (plus subordinate authorities)
- Decision-making: Commission, member states & European Parliament (co-decision)

→ **Energy mix is a matter of the member states**

European energy policy

European Green Deal (2019):



European energy policy

Key targets for 2030:

- At least 40% cuts in **greenhouse gas emissions** (compared to 1990),
- At least 32% share for renewable energy,
- At least 32.5% improvement in energy efficiency,
- EU member states set their own targets.

Key target for 2050:
President Ursula von der Leyen:
*"We are acting today to make the EU the world's **first climate neutral continent by 2050** (...)"*

Funding: 2021-2030 at least 1 trillion €
(1.000.000.000.000.000.000 = 10^{18})
of sustainable investment (increasing the resources devoted to climate action under the EU budget,& additional public and private financing).

Enabling framework: mix of regulation and incentives.

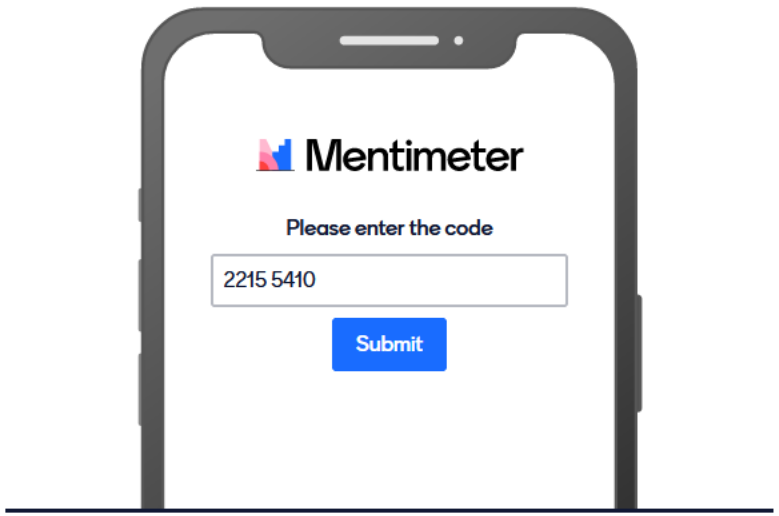
Support for implementation: Advisory and technical support to public administrations and project promoters.

Short energy facts about Europe.

Do you know ...?

Go to

www.menti.com



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Or use QR code

European energy policy

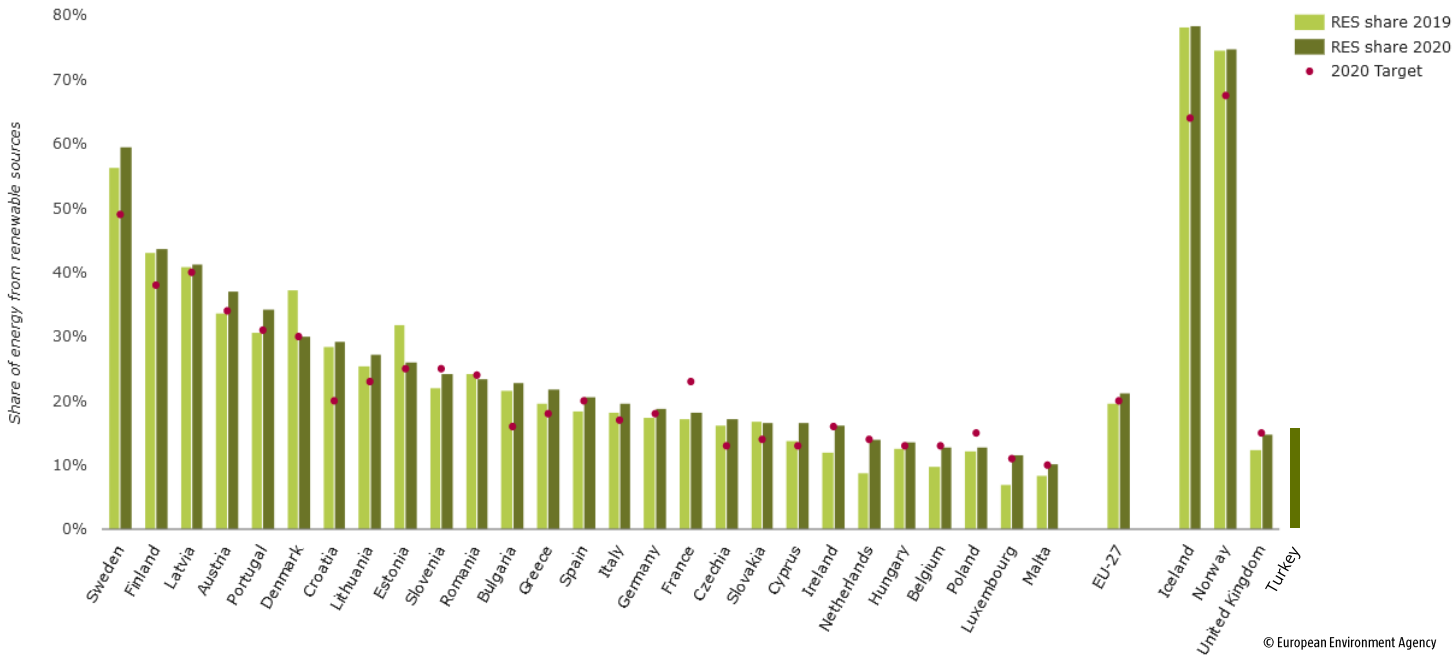
Actual performance?

Key targets for 2020:
At least 20% share for renewable energy

Key targets for 2030:
At least 32% share for renewable energy

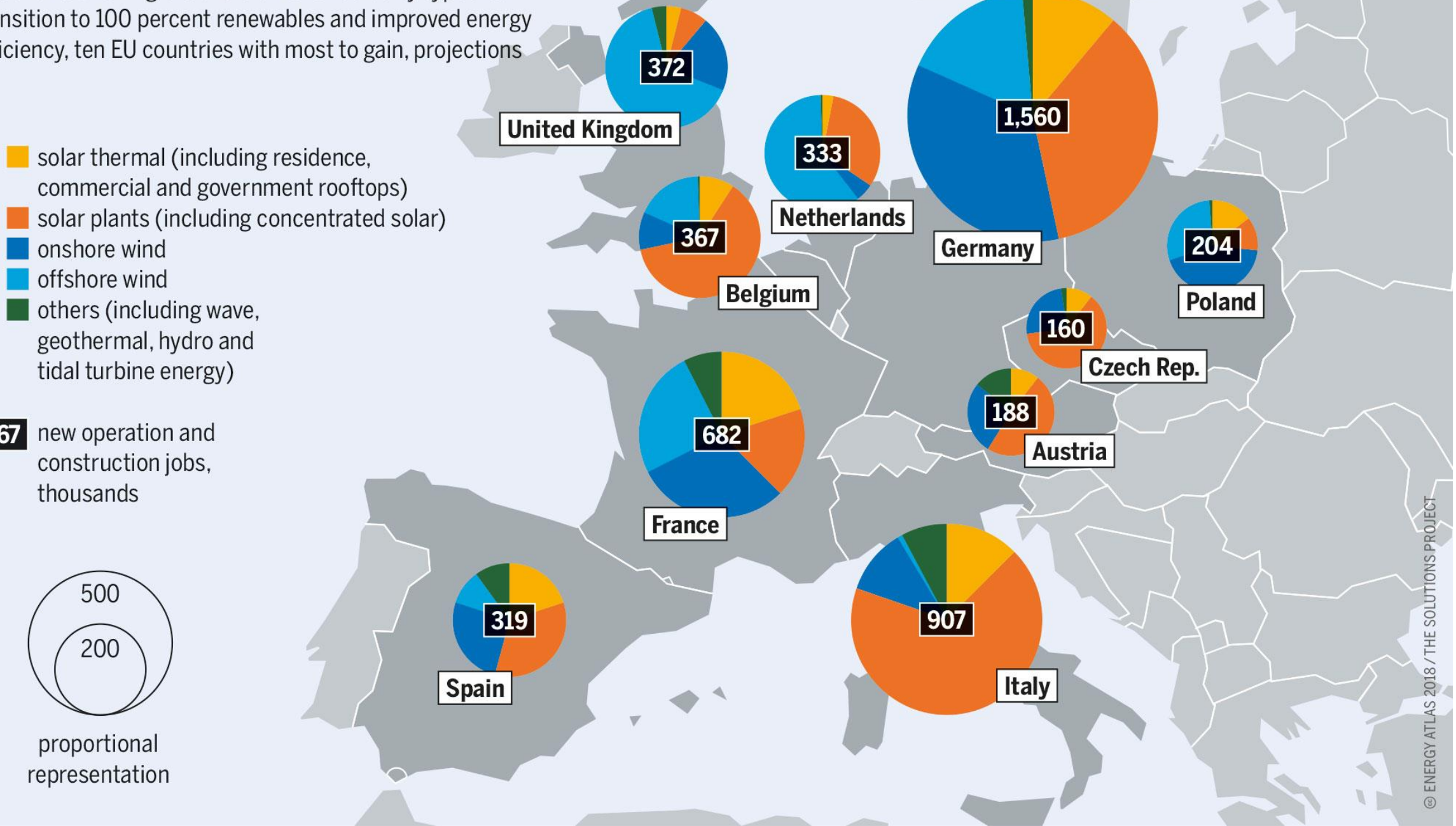
Key targets for 2050:
"climate neutral continent"

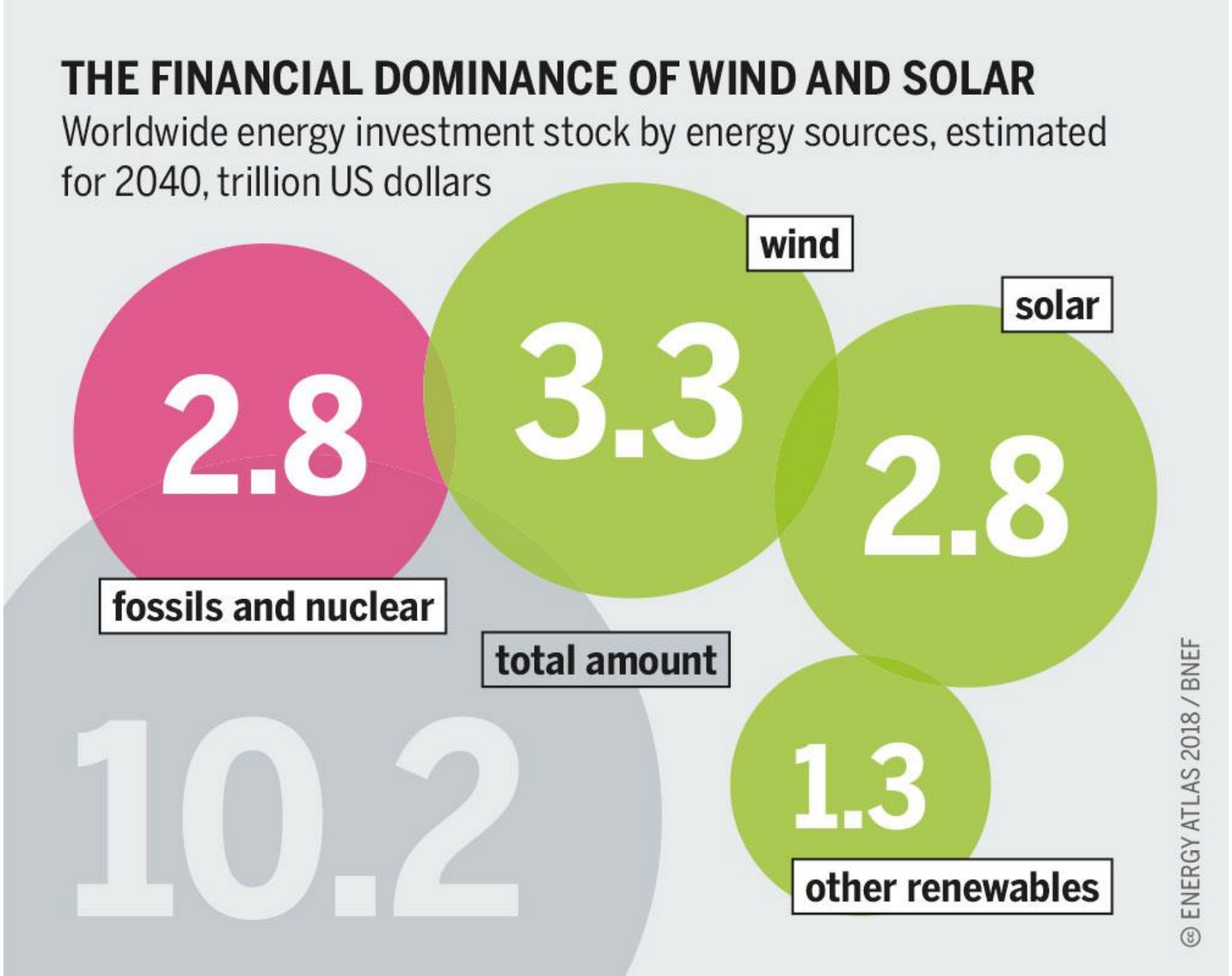
Progress towards renewable energy source targets, by country



2050 ENERGY MIX

A scenario showing the share of renewables by type after transition to 100 percent renewables and improved energy efficiency, ten EU countries with most to gain, projections

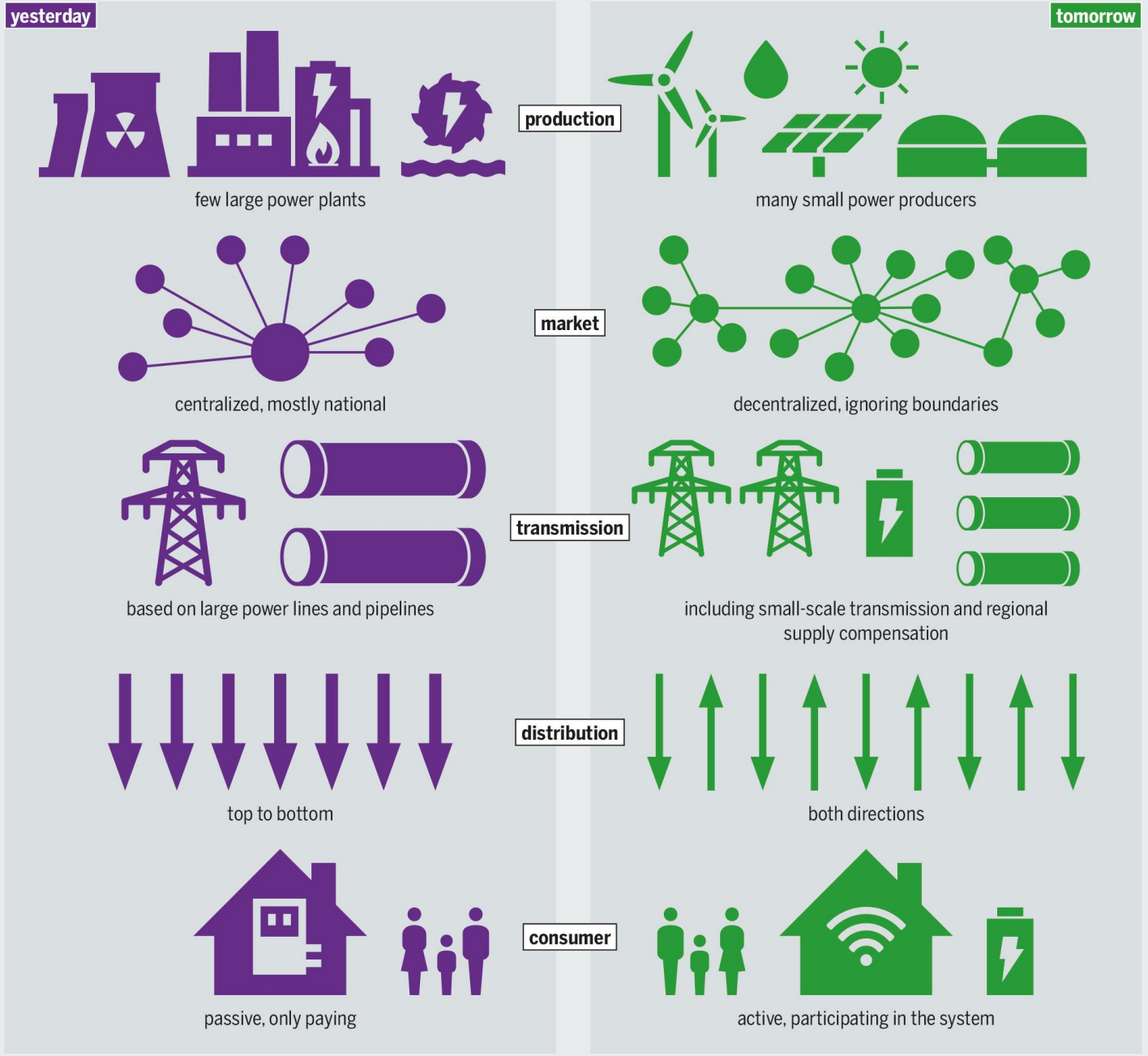




7,4 trillion in renewables (73%)

STAYING BIG OR GETTING SMALLER

Expected structural changes in the energy system made possible by the increased use of digital tools

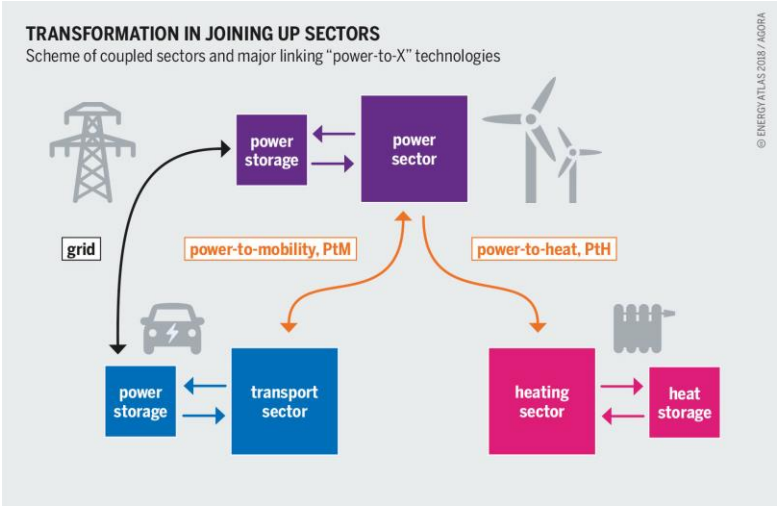


Challenge: sector coupling

What does sector coupling actually mean?

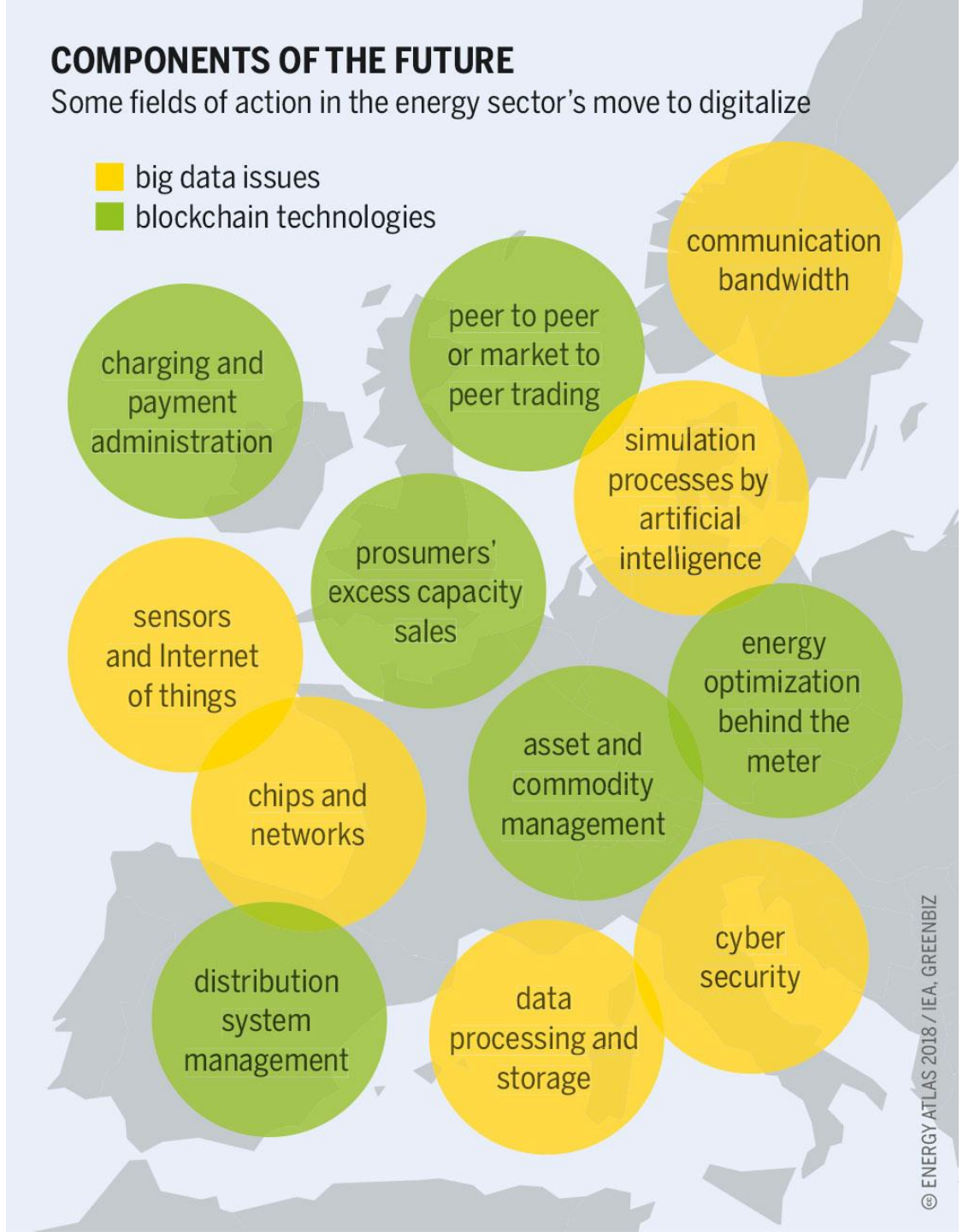
- Wind power plants produce electricity and, when it is not hydrogen, which is used by industry as a basic material and by and by households for heat or power supply.
- E-vehicles serve as a networked storage system consisting of individual batteries for intermediate storage of electricity
- Integrated heat grids use surplus electricity, industrial and heat from solar thermal and PV systems are fed into integrated are fed into the grid.

→ Electricity and heat are always used to generate the product that is cheapest at the time. The sectors serve each other as storage and buffers and use a common infrastructure.



COMPONENTS OF THE FUTURE

Some fields of action in the energy sector's move to digitalize



Where do we encounter/ experience energy?

→ local level & in daily live

Energy at the local level: region of Stuttgart

Automotive and machinery industry

Stuttgart: Germany's capital of traffic jams

Limited space

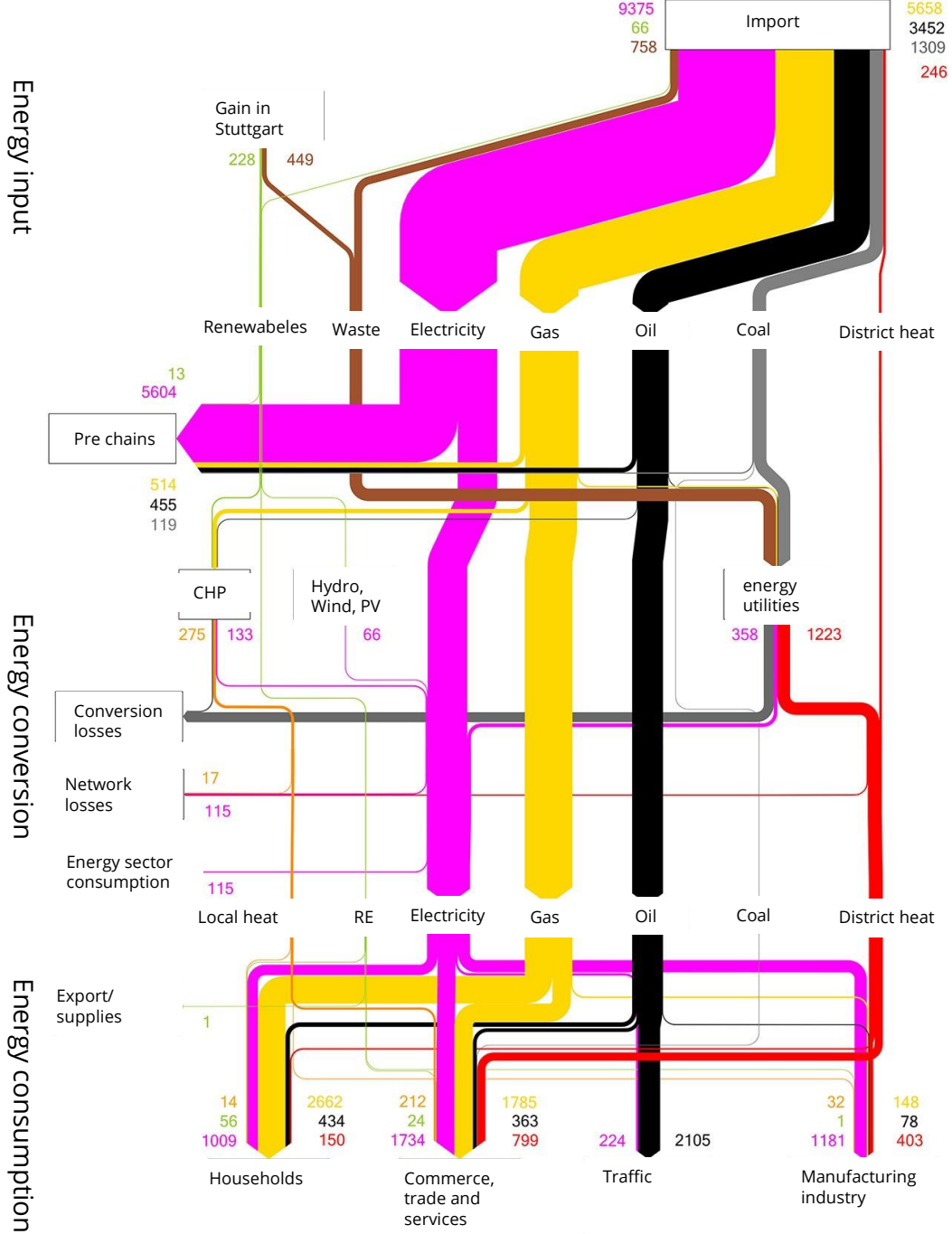
New Stuttgart train station

Until 15.09.2022: Largest solar thermal plant in Germany (city of Ludwigsburg)

2021: 20 wind turbines in the larger region of Stuttgart

Coal and gas-fired power stations

Citizen energy projects



Where to start? Energy transition as a challenge for urban development…

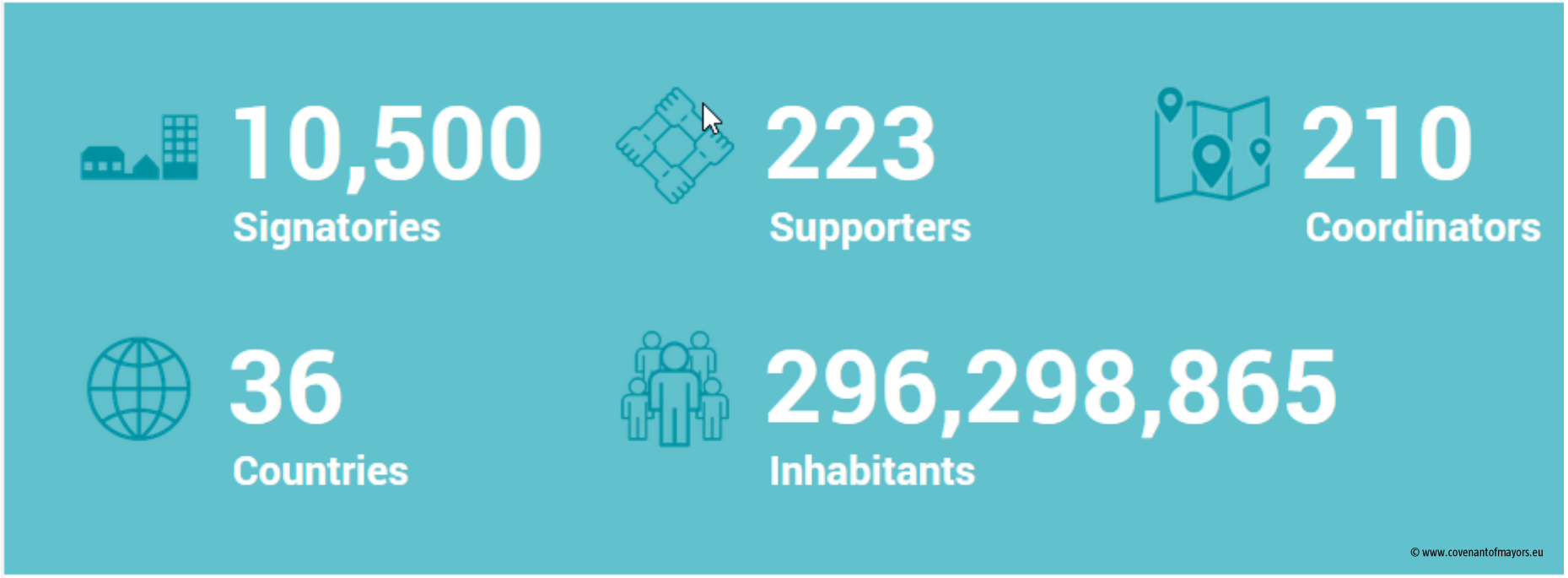
European cities going green

Convent of mayors

"We, Mayors from all over Europe, hereby ***step up our climate ambitions and commit to delivering action*** *at the pace that science dictates, in a joint effort to keep global temperature rise below 1.5°C - the highest ambition of the Paris Agreement.*

Our vision is that, by 2050, we will all be living in decarbonised and resilient cities with access to affordable, secure and sustainable energy*. As part of the Covenant of Mayors - Europe movement, we will continue to (1) reduce greenhouse gas emissions on our territory, (2) increase resilience and prepare for the adverse impacts of climate change, and (3) tackle energy poverty as one key action to ensure a just transition."*

Convent of mayors



Belgium: 561
Germany: 87
Italy: 4901
Poland: 84
Turkey: 42

More information: https://www.covenantofmayors.eu/

Energy governance in Stuttgart

Municipal properties/public buildings	Buildings, housing and citizens	GHD and other industry	Transport	Energy master plan and energy supply	Citizen and stakeholder involvement
• Energy management • Renovations • Energy requirements • In-house contracting • Renewable energies • Plus-energy buildings • User awareness	• Household survey and consulting • Round table of housing companies • Renovation and contracting • Consulting services and subsidy program • Energetic specifications for new buildings • Expansion of renewable energies	• Energy efficiency measures • Networks for energy efficiency • Energy efficiency measures funding program • Renewable energies • Energy specifications for new buildings	• Clean air plan • Noise reduction plan • Climate mitigation concept • Local transport plan • Traffic development concept • Urban development concept • Campaign „Sustainable mobility in Stuttgart “	• Efficient generation facilities • Combined heat and power generation • Network optimization and expansion • Renewable energies • Energy master plan • Energy concepts for urban quarters	• Participation • District activities • Surveys on the energy sector • Information and public campaigns

Source: Energy concept "Urbanization of the energytransition in Stuttgart", 2016

Governance by **institutions**, Governance of **formal sites**, Governance of **conflicts**, Governance of **organizations**, Governance of **new regional spaces of action**, Governance of **concepts**

Energy governance in Stuttgart

Municipal properties/public buildings	Buildings, housing and citizens	GHD and other industry	Transport	Energy master plan and energy supply	Citizen and stakeholder involvement
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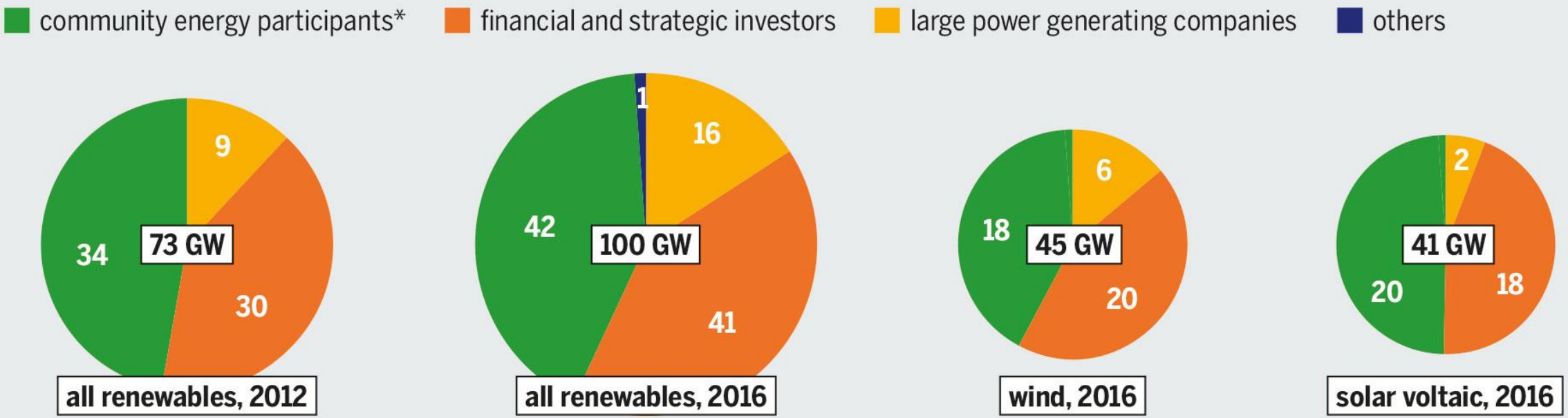
COMMUNITY ENERGY: A BIGGER SLICE OF THE PIE. THE CASE OF GERMANY

Installed renewable energy capacity for power generation, by type of owner and sector, 2012 and 2016, gigawatts (GW), estimated

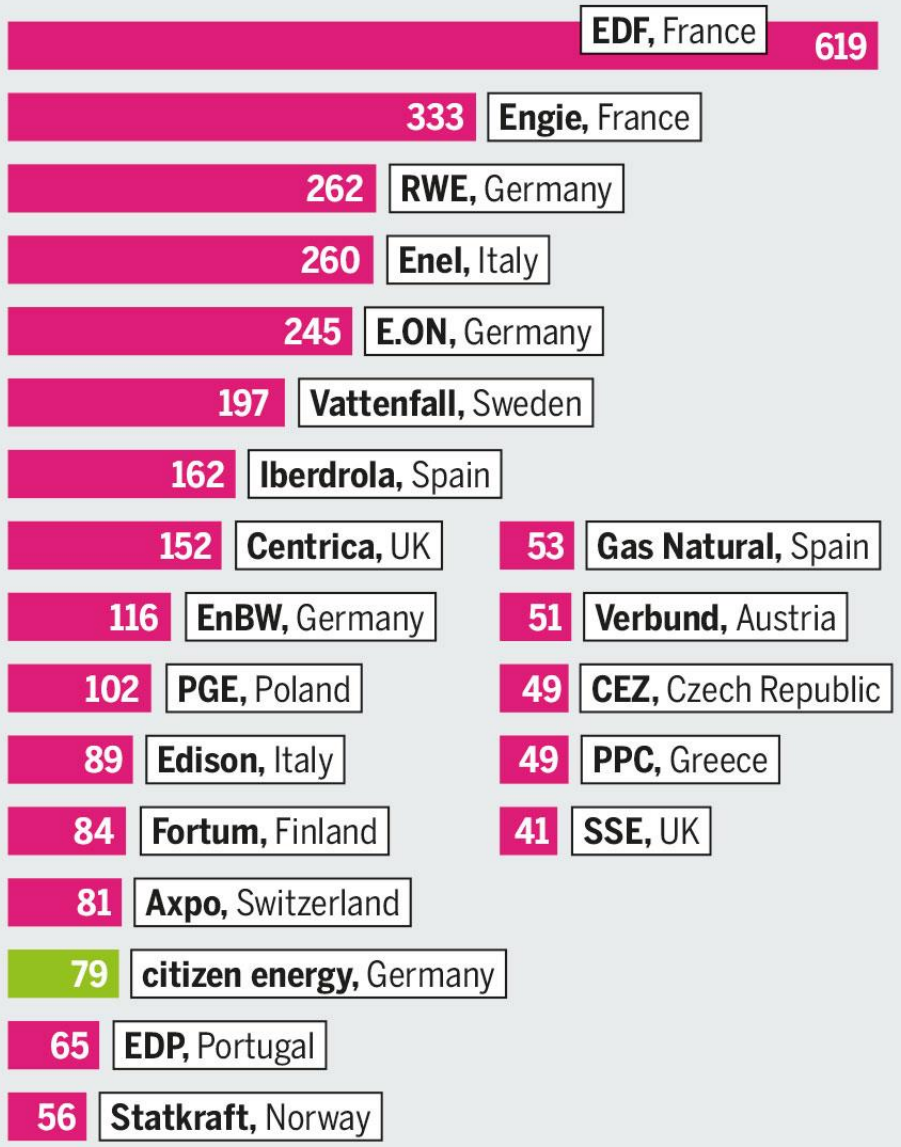


* community energy participants include the following:
Citizen participation (e.g., fund investments, minority interests in operating companies)
Community-owned producers (e.g., regional energy cooperatives and majority interest in operators)
Individual owners (e.g., individuals, farmers and farm cooperatives)

Terminology based on Renewable Energy Agency, Germany. Does not include pumped storage power plants, offshore wind turbines, geothermal or biological waste. Differences due to rounding

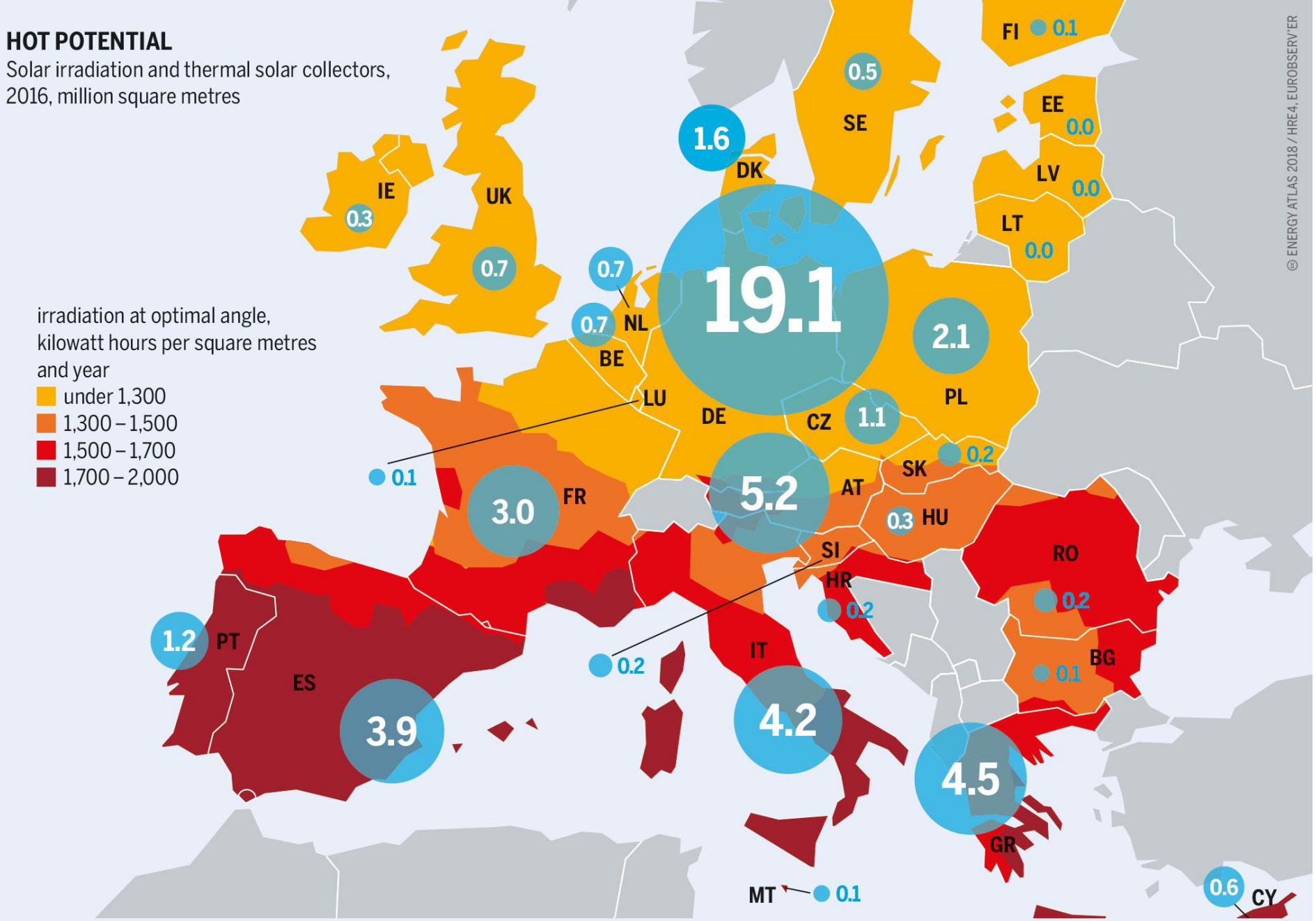
EUROPE'S LARGEST ENERGY RETAILERS

Sales in terawatt hours, 2015 and Germany's citizen electricity sales for comparison, 2016



HOT POTENTIAL

Solar irradiation and thermal solar collectors, 2016, million square metres



AT: Austria, BE: Belgium, BG: Bulgaria, CY: Cyprus, CZ: Czech Republic, DE: Germany, DK: Denmark, EE: Estonia, ES: Spain, FI: Finland, FR: France, GR: Greece, HR : Croatia, HU: Hungary, IE: Ireland, IT: Italy, LT: Lithuania, LU: Luxembourg, LV: Latvia, MT: Malta, NL: Netherlands, PL: Poland, PT: Portugal, RO: Romania, SE: Sweden, SI: Slovenia, SK: Slovakia, UK: United Kingdom

Energy Justice

distributional

unfairness in the process of sharing costs and benefits

procedural

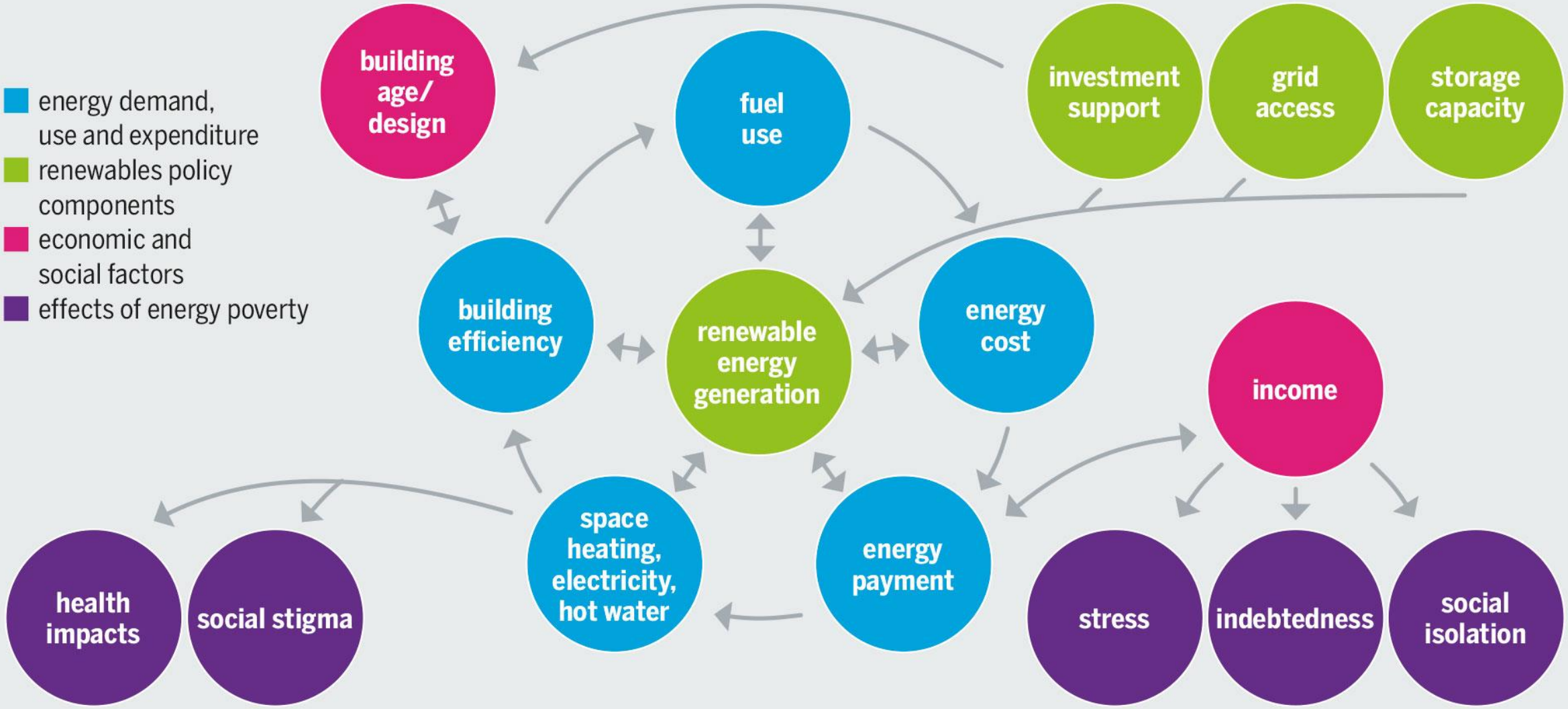
equitable and democratic involvement of all stakeholders in energy decision-making

recognition

different types of vulnerability and specific needs associated with energy services among social groups (especially marginalized communities)

HOW RENEWABLES COULD HELP FIGHT ENERGY POVERTY

A conceptual map of interconnected causes, effects and measures



Questions for working groups:

- Have a look at the UN SDGs: Can you identify sustainable development goals in conflict with SDG7 “energy”?
- Let's assume we are in the year 2032, can you imagine these conflicts/challenges in your home town?
- Which roles does energy already play in your study area? Think about different stakeholders, roles, interests…
- Which are the main energy consumers in your study area?
- How to rethink the stock of built structure?

THANK YOU

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Politechnika Gdańska

Hochschule für Wirtschaft und Umwelt Nürtingen-Geislingen

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