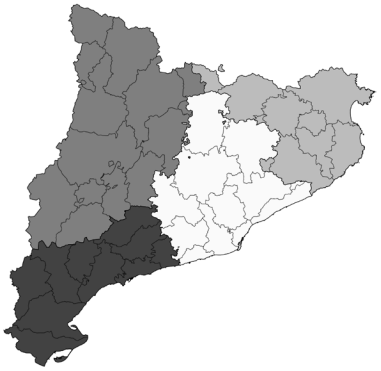
MAGIC multiscale analysis

Regional level case study: Catalonia



Aim of the case study: This case study shows how structural and functional elements of the energy system can be aggregated and scaled to move from a description of power plants to a description of the electricity sector, using the tool of proces-

Innovative results

The pilot study analysing the electriciy sector of Catalonia shows how the metabolism of a sector can be described by building its structural and functional processors.

Structural processors refer to technologies: in this case, a different processor is built for each type of power plant, such as nuclear, solar PV or hydropower. Within each processor, the pattern of flows (water, electricity, etc.) and funds (land use, human activity, etc.) needed to carry out the process of electricity generation is represented.

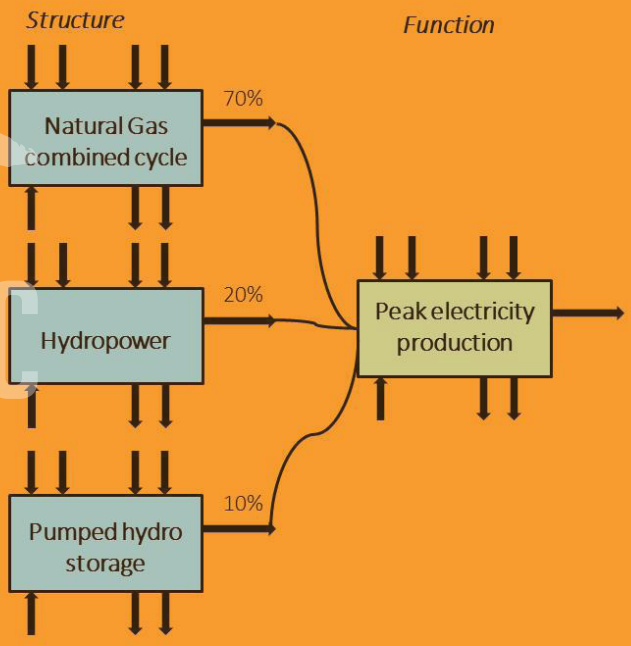
Then, rather than just maintaining a structural (technological) description of the system, the structural processors are grouped depending on the function played by the electricity they produce. Functionality here is an emergent property of the complex system: it can partially be traced back to structural characteristics (e.g. nuclear plants are not flexible therefore they produce baseload power) but also depends on the context: hydropower, for example, can produce both baseload and both peak electricity depending on weather patterns, national policies etc.

In this case, three types of electricity are identified: baseload, peak and intermittent. The structural processors producing the same type of electricity are grouped into three functional processors, which are then aggregated towards a final description of the electricity sectors.

This allows us to: (i) see what flows and funds are consumed and emitted by the electricity sector; (ii) see how its different functional and structural components contribute to the profile of flows and funds.

Policy relevant insights

The distinction of different types of electricity based on their functionality is well known in engineering but less discussed in policy processes. By providing a clear and simple link between structural and functional elements, the tools provided by this pilot study can be implemented to discuss pressing energy issues such as renewable energy transitions, efficiency and technological changes, without requiring sophisticated modelling techniques.



Example of structural processors grouped into their function

Nexus insights

The electricity processors represent a pattern of water, energy, land and more, linking them with a type of electricity produced. This way, we can see how different types of power plants, and the different types of electricity generated, affect and are affected by the other nexus elements in the system.

Future steps

The proposed electricity grammar is being expanded to the whole energy sector of eight countries in the EU, to contrast and compare their energy metabolism in relation to other nexus elements, and to provide valuable insights into possible constraints posed on future policies.

Project website: **www.magic-nexus.eu**

@MAGIC_NEXUS

@MagicNexusEu

The research leading to the present results has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 689669. The sole responsibility for this factsheet lies with the authors. The funding Agency is not responsible for any use that may be made of the information it contains.