EUFORIE
European Futures for Energy Efficiency

Policy Brief 2
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Informing Energy Efficiency Policies: Methodological Stumbling Blocks

Introduction

According to the 2015 *Energy Efficiency Directive implementation progress report*, EU Member States struggled to achieve their energy efficiency objectives. This led the Commission to lay down the 2015 'Energy Union Roadmap', aimed at reviewing the energy efficiency directives and focusing on three main areas: heating and cooling, energy performance of buildings and energy efficiency of products. EU efforts have thus been focused on targets and policies that are relatively easy to frame and handle: efficiency of buildings, labelling of products, and defining efficiency targets for specific processes (e.g., heating and cooling). These targets are being considered one at the time, at a defined scale without considering the broader (societal) context. No explicit relation has been established between the effects that changes in specific parts of the economic process will have on the national or EU economy as a whole.

The Problematic Concept of Energy Efficiency

The quantification of the concept of 'energy efficiency of the economy' brings along epistemological problems. Energy efficiency is only one of many relevant factors. For instance, we do not commonly define the performance of a car by its mileage (the efficiency in fuel use) only. Fuel efficiency must be contextualized in order for it to have meaning as an indicator of performance. What is an acceptable level of fuel consumption depends on many factors, such as the size of the car, the load to be carried, the required speed, the price we want to pay, or the expected durability. We generally do not compare the performance of a sedan, a sport utility vehicle, a van and a truck on the basis of one simple, 'one size fits all' output/input ratio. The same applies to the energy performance of a country (a much more complex system than a car). Using simple ratios such as the economic energy intensity (energy consumed/GDP) or economic emission intensity (emissions/GDP) carries the risk of comparing apples to oranges. A meaningful interpretation of these two ratios at the national level requires us to carefully consider the implications of the following five factors (Figure 1): (1) energy imports; (2) the specific mix of primary energy sources and energy carriers; (3) the specific mix of economic activities; (4) the terms of trade favoring externalization of energy intensive production processes; (5) 'virtualization' of the GDP through credit leverage and quantitative easing.

Key Messages

- The concept of energy efficiency is too simplistic to inform policies
- The evaluation of policies should be based on the concept of multi-level energy performance
- The energy end-use matrix represents an effective tool to inform energy policy

Complex Energy Metrics

The complexity of the metrics of energy accounting represents another problem. There are three non-equivalent ways of accounting energy, all of which are needed to assess the performance of an economy: (1) primary energy sources (e.g., coal, wind, hydro, oil); (2) energy carriers (e.g., electricity, fuels, process heat); and (3) energy end-uses (quantitative characterization of what is achieved by the use of energy). In addition, we need to distinguish between two different energy forms (qualities), thermal energy (e.g., MJ of fuels) and mechanical energy (e.g., kWh of electricity), for both primary energy sources and energy carriers. Often these distinctions are not (properly) used in the development of policy targets and policy evaluations.

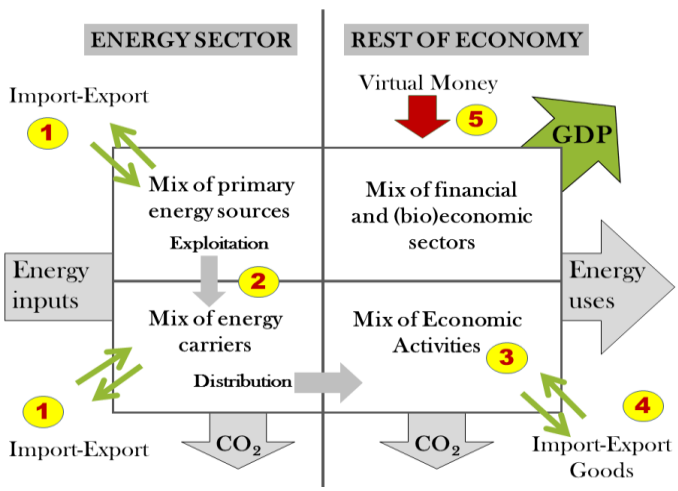

Figure 1: Factors affecting the energy and carbon intensity of an economy

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The Energy End-use Matrix as a Possible Solution

The energy end-use matrix (Fig. 2) represents a useful tool to tackle these obstacles and to evaluate environmental targets, such as GHG emissions, and economic competitiveness in an integrated and transparent way as recommended in the Energy Efficiency Directive 2012/27/EU. In particular: (1) the energy end-use matrix makes it possible to study the energy performance of a country simultaneously at different levels and scales of analysis (national economy, sectors, sub-sectors, sub-sub-sectors); (2) it bridges top-down (national statistics) and bottom-up (technical coefficients) information into a coherent multi-level assessment; and (3) it readily identifies the major determinants of energy performance. The usefulness of the energy end-use matrix has been validated in the EUFORIE project.

Problems with Energy Statistics

Available statistics (EUROSTAT) presently do not make it possible to integrate top-down with bottom-up information. Unfortunately, aggregation of processes that belong to different typologies of biophysical transformations into the same category is presently common practice. However the performance of sectors and sub-sectors can only be integrated across levels if available data describe economic processes that carry out similar biophysical activities (apples with apples and oranges with oranges). For instance, grouping industries that make pulp by cutting trees with industries making notebooks from imported paper into the same category of 'pulp and paper industry' makes the aggregate data useless for drawing inferences about the efficiency of the technologies used in the sector. In addition, the current organization of statistical data muddles the significant role of imports in determining energy performance. It would be helpful if data on the energy consumption of the various sectors and subsectors were complemented with data on imports in these specific (sub)sectors. Although sectors that externalize the production of energy intensive products to other countries may result more 'efficient' in terms of reduced energy consumption, this 'better' performance is not due to more efficient technology but simply to externalization of the consumption elsewhere.

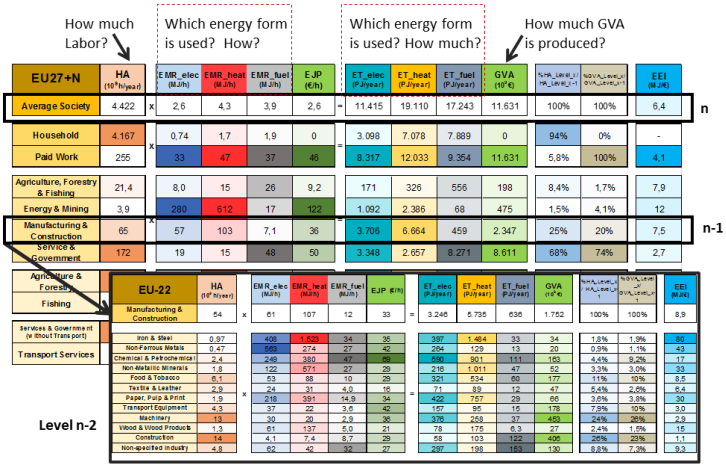

Figure 2: Example of energy end-use matrix describing energy uses across levels (n = national economy, n-1 = economic sector, n-2 = sub-sector)

Policy Recommendations

Defining targets for the energy performance of economies should be based on insights derived from an integrated analysis across different levels of organization of the economic process. This requires:

- An effective characterization of the national energy metabolism, addressing four points: (i) what type of energy is used; (ii) how; (iii) by which sectors; (iv) and why;
- An effective characterization of the openness of the various economic (sub)sectors to assess the effects of externalization on local performance;
- Moving from the (too) simplistic concept of efficiency (unable of handling multi-scale analysis) to the concept of multi-level energy performance.

In order to achieve these results a re-organization of categories of official statistical accounting is of paramount importance.

Further Reading

Deliverable 4.1: Characterizing energy efficiency from the matrix of production of energy carriers at the national level.

Deliverable 4.2: Characterizing the factors determining "energy efficiency" of an economy using the multi-level end use matrix of energy carriers.

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