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Theme : Climate Change, Energy transition and Materials

SURFER – WHAT IS THE BURDEN OF RAW MATERIALS REQUIREMENTS TO ACHIEVE THE FRENCH ENERGY TRANSITION?

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ABSTRACT

In a time of climate emergency, European and worldwide agreements have recently set ambitious targets for reducing our greenhouse gases emissions (GHG), leading the states to engage in an energy transition, that is to say the shift from an energy mix relying on fossil and nuclear fuels to a mix mostly relying on renewables.

Such shift requires to massively and quickly build a large number of renewable energy production facilities (e.g. wind turbines, solar panels...), but also to adapt the existing energy distribution system (e.g. with energy storage options) and to modify the final use equipment (e.g. building heating systems, electric vehicles...). This shift's consequences on raw material demand will not be neutral regarding base materials such as steel, concrete, copper or aluminium, and minor metals (lithium, cobalt, rare earth elements...), raising a polemic question: will the energy transition replace the reliance on fossil fuels by a reliance on metals?

The SURFER project aims to evaluate the burden of raw materials requirements to achieve the French energy transition over the period 2015-2050. First, a database gathering the material requirements of the different energy technologies has been developed and analysed in order to establish a relevant "material intensity" for each technology and each metal. The annual materials requirements are then calculated based on national energy transition scenarios (50, 80 and 90% of renewable energy plus a *status quo* scenario). As well, the annual waste from end-of-life technologies is calculated.

Among the challenges that this evaluation raises, one is: how to take into account the dynamic aspects of raw material consumption and material recycling due to the dismantling of "old" energetic infrastructures? It is here proposed to describe the material-specific recycling model used in SURFER, that both accounts for the "recycled content" of input materials and for the "recycling rate" of output materials. The goal is to compare, over time, the material demand of the energy transition scenarios to the recycled materials available when old energetic facilities reach end-of-life.

In the next task of the project, the material burden borne by the energy transition will be weighed against the French material consumption regarding all manufactured goods; finally, the last task will discuss the criticality of these materials and metals.
