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3s3 Supply chain transition: managing tools and sustainability assessment of innovations

THE FUTURE SPLIT BETWEEN PRIMARY AND SECONDARY STEEL PRODUCTION: INTEGRATING MATERIAL FLOWS IN AN ECONOMIC FRAMEWORK

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We develop a macroeconomic modelling framework in which we explicitly account for the circular flow of materials in the economy. We focus on the future split between primary and secondary steel production. The model combines conventional physical aspects of dynamic material flows analysis with energy-environmental-economy computable general equilibrium models. The endogenous substitution possibilities between primary resources and secondary-recycled materials determines the condition under which the share of recycled material is expected to increase relative to primary resources. For the purpose of this analysis we assume there is no quality prejudice between primary and secondary steel products. Firms decide on the optimal combinations between primary and secondary steel only on price changes and initial conditions reflected in model's calibrated share parameters.

Steel is mostly used in products with a relatively long lifetime, which implies that once steel enters the economy, it will not become available as scrap until the product has reached its end-of-life. Our modelling experiments take this into account and determine to what extent the production of steel obtained using old steel scrap can increase in the long-run, and whether this will bring eventually about a reduced use of primary resources such as iron ores and a fall in energy use.

Our preliminary simulations suggest that steel production obtained from recycled materials is expected to continuously grow and is likely to be a major route for steel production in the long run. Though, albeit lower, a substantial amount of steel will still come from primary resources. This is due to limited availability of steel scrap and increased demand for steel generated by sustained long-term economic growth projections.

High level of steel demand, particularly in steel intensive sectors, might also create the conditions for energy rebound effects. Energy consumption will certainly fall in the steel production but can increase in steel intensive sectors that are also highly energy intensive thereby offsetting the energy savings attained in the production of steel. This means that the shift towards recycled material may save less energy than expected.

Therefore several other mitigation policy options need to be implemented to move the society towards a low-carbon circular framework. For this reason we also analyzed an set of price-based policy options generating the incentive to further reduce the production of steel from virgin materials creating the conditions for a shift towards recycled materials.

Keywords: Computable general equilibrium model, recycling, steel technology