SmILES Use Case by VITO – EnergyVille

National Scale Case

Objectives

1. Developing a sectorial scale energy system model based on the TIMES framework reflecting multi-energy and storage with high temporal granularity
2. Test economic viability of storage solutions and hybrid systems under different exogenous assumptions (scenarios)

Scope

Energy systems are traditionally designed so that power energy supply meets demand on a national scale with transnational power grid interconnections and import of fossil fuels such as oil and gas. The rising share of distributed power and heat generation by renewable energy sources, local storage infrastructure and locally optimized multi-energy systems disrupt this traditional top-down operation and investment thinking.
National scale energy system models, such as the TIMES Belgium linear optimisation model, operate on the assumption that within a defined region (e.g. the respective country) current and future energy demands are met by existing and future service technologies. Optimisation happens over a mid-to long-term time horizon (e.g. till 2050) and on a national geographic scale. With energy services being supplied by technologies which are more and more geographically distributed, local optimisation takes on a more prominent role in the energy systems of the future.
For this use case we study the impact of locally optimized multi-energy infrastructures (generation, storage, distribution and end-users consumption) with long-term scenario tools. The main question we address is to what extent multi-energy infrastructures can be scaled up to enable a transition to a low carbon energy supply at minimum costs.

Description

A TIMES model was developed as a highly detailed representation of the Belgian residential sector. Different scenarios for 2014-2050 were tested for the large scale deployment of several renewable generation and storage technologies: heat pumps, PV panels, solar thermal collectors, electric batteries and thermal storage.
Results allow for a comparison of scenarios with respect to own consumption versus grid consumption and the 'electrification' of thermal appliances (Fig 1). At the same time CO_2 emissions in long-term scenarios can be traced and the impact analyzed (Fig 2).

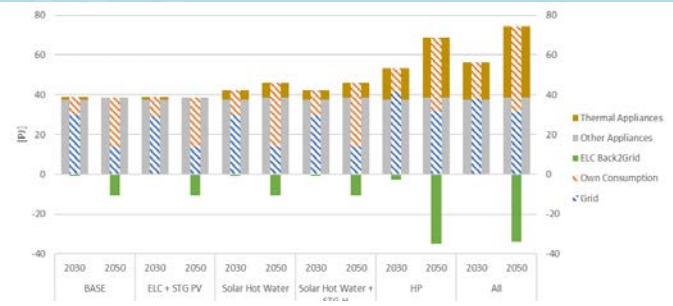

Fig. 1 – Electricity Consumption in 2030 & 2050

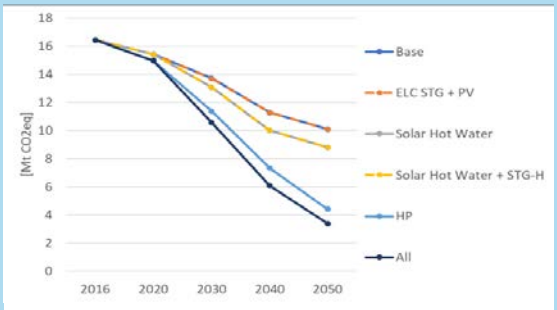

Fig. 2 - Yearly CO_2 Emissions per scenario

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