The Coalition for ENERGY SAVINGS

Fraunhofer ISI

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Energy Savings Scenarios 2050

Summary

As basis for its internal reflection on the development of a 2050 Energy Efficiency Vision, the Coalition for Energy Savings has commissioned Fraunhofer ISI to assess three 2050 energy savings scenarios (see below). The focus of the Fraunhofer ISI study is to establish the development of Final Energy Demand by 2050. This summary provides the main results of the study and the assumptions made to achieve them.

Scenario overview

Baseline
The latest EU Reference Projections, includes energy and climate policies adopted until 2016.

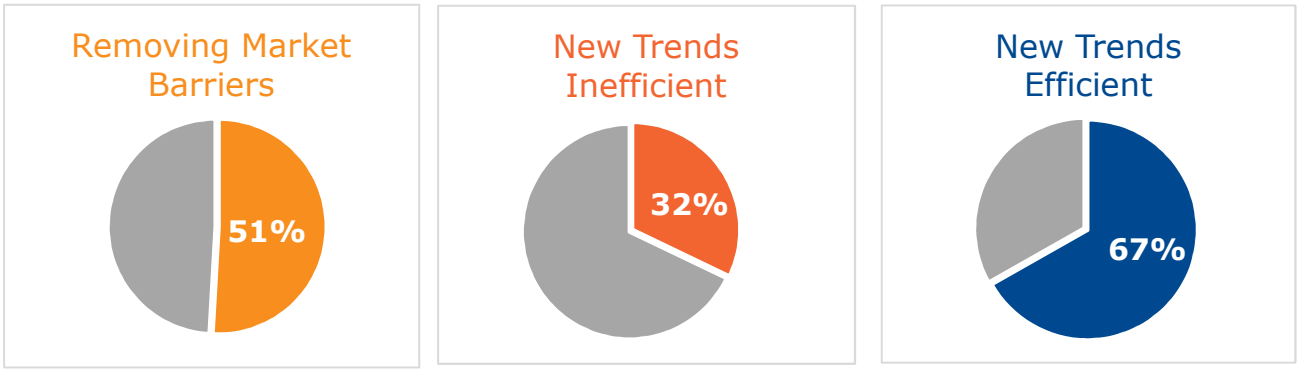
Removing Market Barriers Scenario
The Removing Market Barriers scenario uses a bottom-up method to identify techno-economic savings potentials based on realising all efficiency investments across sectors projected to offer a positive return on investment and leading to growth of the energy services market.

New Trends Inefficient Scenario
The New Trends Inefficient scenario combines the techno-economic savings potentials with an analysis of the estimated impacts of new societal trends. The trends take off in an unmanaged way and create new inefficiencies in energy use, curbing the energy services market and requiring heavy investments in additional energy infrastructure.

New Trends Efficient Scenario
The New Trends Efficient scenario combines techno-economic savings potentials with an analysis of the estimated impacts of new societal trends. Trends are shaped by a policy framework that puts energy efficiency first, further boosting the energy services market and the ancillary benefits of energy efficiency.

Key results

Savings on EU final energy demand in 2050 compared to baseline



The *Baseline* Scenario projects that Final Energy Demand (FED) in 2050 is 1,086 Mtoe (including UK). The additional techno-economic savings that result from running the *Removing Market Barriers* Scenario is **51%**, bringing the FED to **533 Mtoe**. The *New Trends Inefficient* Scenario estimates the savings potential is lowered to **32%,** resulting in **737 Mtoe** FED in 2050. In the *New Trends Efficient* Scenario, the savings increases reaching **67%,** corresponding to a FED of **361 Mtoe** in 2050.

Bottom-up calculation of the techno-economic savings potential

The energy saving potentials identified in the *Removing Market Barriers* scenario have to be understood **as cost-effective or nearly cost-effective technological potentials** for the individual investors or end users. The scenario is based on the key assumption that non-economic barriers for implementing energy efficiency measures are removed in order to realize the existing potential. In this study potentials were determined using a bottom-up approach to identify saving potentials directly linked to the application of a specific technology. Determining the energy saving potentials is mainly based on Fraunhofer ISI work completed in 2012.

Impact of new societal trends on Final Energy Demand

The work on the *New Trend* scenarios is pioneering work. The societal trends considered in the Fraunhofer Energy Efficiency scenario 2050 study are described in several scientific studies (e.g. foresight studies). However, their impact on energy demand, leading to an increase or decrease of final energy consumption, is not systematically investigated.

Results: impact on the techno-economic energy savings potential by trend cluster

In addition to the overall impact of new societal trends on final energy demand by 2050 (see key results above) the impact of four trend clusters was calculated separately, namely: *Digitalisation of Life*, *New Social and Economic Models*, *Industrial Transformation* and *Quality of Life*. The results are estimated lost or additional savings to the techno-economic potentials of the *Removing Market Barriers* scenario as percentages of the baseline energy demand.

Cluster	Trends	Estimated lost/additional energy savings 2050 compared to the Removing Market Barriers scenario	
		New Trends Inefficient	New Trends Efficient
Digitalisation of Life	Shift towards smart products and services/ automatisation	**- 11%**	**+ 5%**
New Social and Economic Models	Sharing economy	**- 4%**	**+ 6%**
	Prosumer		
	Awareness of personal footprint		
	Social Disparities / Energy Poverty		
	New forms of funding - Public spending towards greener and more efficient options		
Industrial Transformation	Reindustrialisation	**- 1%**	**+ 1%**
	Circular economy and resource efficiency		
	Low-carbon industry / Decarbonisation		
Quality of Life	Increasing importance of health (e.g. air quality, noise, heat)	**- 4%**	**+ 5%**
	Regionalisation - governance solving global challenges locally		
	Urbanisation - Global trend towards living in cities		

The estimated impact is significant for three clusters depending on whether the specific trends lead to investments in and consumer choices for increasing energy efficiency - like higher building performance and renovation, more comfort and convenience with lower heating, cooling, electricity and mobility demand - or not.

In case of the trend cluster *Digitalisation of Life*, inefficient choices are estimated to have a more than twice as high negative impact than efficiency choices. The cluster *Industrial Transformation* shows limited impacts because most trend impacts are already included in the techno-economic savings potentials of the Removing Market Barriers scenario. (NB: there are important savings in the industry sector, notably due to Digitalisation and New Social and Economic Model)

Method: estimating impacts on modelling parameters

In order to assess the impact of new societal trends, Fraunhofer ISI has carried out an extensive review of available research and literature. Few studies were found to provide relevant data with sufficient clarity about their assumptions and regarding scope[1]. Other studies provided qualitative findings but no data. In order to fill this gap, Fraunhofer ISI made expert estimates to quantify the impact of societal trends on modelling parameters used for the calculation of the savings potentials in the *Removing Market Barriers* scenario. Estimates were carried out in a conservative way, in order not to overestimate the impacts of the New Societal Trends.

	Parameters	New Trends Inefficient Scenario	New Trends Efficient Scenario
Buildings	» Heating and cooling demand » Appliances and lighting	» Building automation and interconnection of appliances increases energy demand (Digitalisation: factor 1.1 on heating and cooling and 1.5 on appliances) » Changes in comfort levels increase energy demand (Quality of Life: factor 1.1 for both parameters)	» Building automation and interconnection of appliances reduces energy demand (Digitalisation: factor 0.95 on heating and cooling and 0.79 on appliances). » Decentralised generation of electricity raises the awareness of the value of energy (New Social and Economic Models: factor 0.9 for both parameters) » Urbanisation increases space use efficiency, demand for more comfort drive renovation (Quality of Life: factor 0.9)
Industry	» Iron and steel » Non-ferrous metals » Chemicals » Non-metallic minerals » Paper and pulp » Food, drinks and tobacco » Engineering » Textiles » Other industries	» Decarbonisation efforts increase energy demand (notably electricity). (Industrial Transformation: factor 1.32 on steel and 1.35 on non-ferrous metals) » Recycling processes (composite materials, complex types of batteries) increase energy demand. (includes in Industrial Transformation)	» Digitalisation enhances the modularity of industrial processes. (Digitalisation: factor 0.91 to 0.98 and Industrial Transformation: factor 0.82 to 0.92) » Circular economy and shared economy reduce demand for new energy intensive materials and products (New Social and Economic Models: factor 0.8 on steel and 0.76 on non-ferrous metals)
Transport	» Vehicle efficiency – freight » Vehicle efficiency – passenger » Transport activity – freight » Transport activity – passenger	» Increase in person & freight km (Digitalisation: factor 1.18/1.04 for passenger/freight activity and 1.3 for passenger vehicle efficiency) » Technical advancements in traffic automation hinders modal shift away from private transport (included in Digitalisation) » Lack of development of consumer awareness drives travel and freight transport demand (New Social and Economic Models: 1.1 for both passengers and freight activity) » Urbanisation leads to increase in travel and transport demand (out of the city; between large cities; longer distances for food supply) (Quality of Life: 1.1 for both passengers and freight activity)	» Increase in efficiency through automatisation, while person & freight km increase (Digitalisation: 0.78/0.96 for passenger/freight vehicle efficiency and factor 1.1/1.04 for passenger/freight activity) » Large modal shift towards public transport (New Social and Economic Models: factor 0.95) » Sustainable investments lead to efficiency increases in public transport (New Social and Economic Models: factor 0.95) » Urbanisation leads to shorter commutes and thus a shift towards biking and walking. Less consumption of goods reduces freight km. (Quality of Life: factor 0.95)

[1] IEA: Digitalisation. 2017
Zia Wadud: Help or hindrance? The travel, energy and carbon impacts of highly automated vehicles. 2016
Material Economics: The circular economy. A powerful force for climate mitigation. 2018
Accenture: Taking the European Chemical Industry into the Circular Economy. 2017
Boston Consulting Group: Steel's Contribution to a low-carbon Europe 2050. 2013
UK Energy Research Center: Energy 2050. 2011