

Chapter 1

Introduction

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The correlation between CO₂-emissions and climate change, with all the risks that the latter entails, has been acknowledged by most countries and by the vast majority of the scientific community. In this respect, a preliminary international treaty was reached at the United Nations Conference on Environment and Development in Rio de Janeiro in 1992. This treaty, the United Nations Framework Convention on Climate Change (UNFCCC), set the goal of stabilizing greenhouse gas concentrations *at a level that would prevent dangerous anthropogenic interference with the climate system*. The agreement led to the signature of the Kyoto Protocol in 1998, where precise goals for the reduction of greenhouse gases were set for the subscribing countries. More recently, the Paris Agreement, currently ratified by 118 of the 197 Parties to UNFCCC, brought back the attention on the urgent necessity of reducing significantly carbon emissions, to avoid irreversible climate change and extreme weather events.

Besides the will and need of reducing the effects of climate change, other reasons, such as depletion of limited natural resources, environmental protection, energy independence from politically unstable countries, long-term economics, push toward a phase-out of fossil fuels.

Nowadays, 86 % of the primary energy consumption worldwide is based on fossil fuels. Hence, it is reasonable to assume that a radical change of the energy sector cannot rely on a single technology, but will require the smart interaction of a variety of different measures, technologies and energy sources.

1.2 District heating in Europe

The final energy consumption in the EU-28 in 2014 was about 1100 million tonnes of oil equivalent (corresponding to 46 EJ). This amount have been roughly stable since the '90s and is expected to remain such also in the next years. Figure 1.1 shows how the final energy consumption is distributed among the different sectors.

Buildings account approximately for 40 % of total final energy consumption and around 55 % of electricity consumption in the EU-28. So, buildings are the largest end-use sector, followed by transport, industry and agriculture. Residential buildings represent around two thirds of the consumption of buildings.

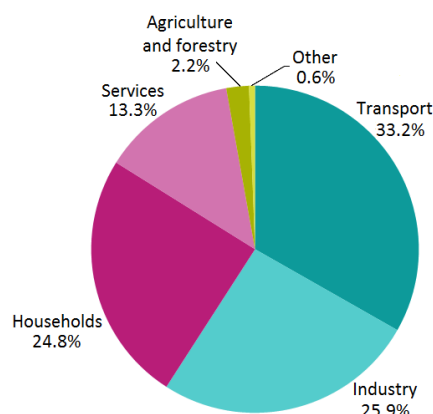


Figure 1.1: Final energy consumption breakdown into sectors in EU-28, 2014.

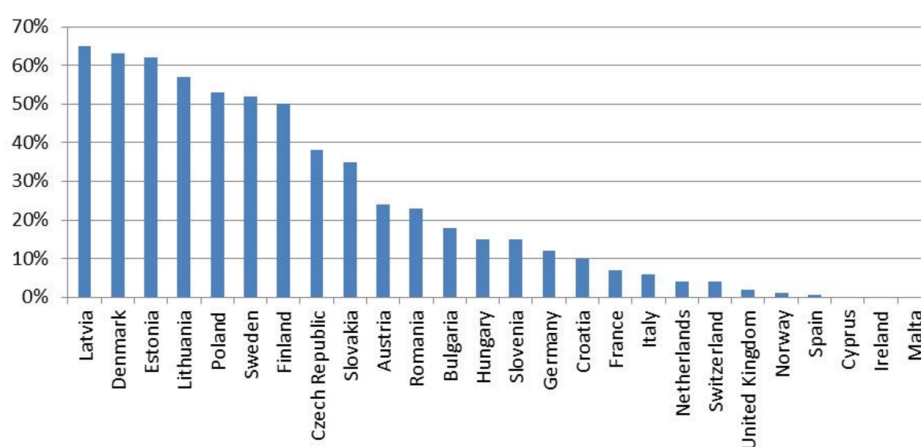


Figure 1.2: Share of the population served by district heating in 2013.

Approximately 80 % of the energy demand of European residential buildings is used for space heating and domestic hot water preparation. An efficient way to provide heat to buildings in densely populated areas is through district heating (DH). A DH network is an expensive infrastructure to build, but the resulting energy savings justify the investment cost. The network is usually supplied by one or more centralized plants, which have a higher efficiency than individual boilers. Secondly, a wider variety of fuels, including municipal solid waste, can be used to generate the heat supplying the network. Additionally, the economies of scale of these large plants allow more sophisticated and efficient emission reduction systems to be installed. The spread of DH in Europe varies significantly from country to country, with shares as high as 60 % in Scandinavian and Baltic countries. Figure shows the percentage of the population served by DH in different European countries. On average, only 13 % of the residential and service sector heat market is covered by DH.

As space heating and domestic hot water preparation require relatively low temperatures, solar thermal collectors seem to be a perfect candidate to cover this demand in a sustainable and efficient way. It is not uncommon to see solar collectors installed on the roof of single-family houses.