Energy Policy 59 (2013) 17–31

Contents lists available at SciVerse ScienceDirect

Energy Policy

journal homepage: www.elsevier.com/locate/enpol

Renewable energy in the heating sector in Austria with particular reference to the region of Upper Austria

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HIGHLIGHTS

- Overview on Austrian heat sector and RES-H development.
- Growing RES-H market mainly due to regional promotion schemes.
- Austrian NREAP foresees only moderate growth of RES-H up to 2020.
- Targets and policies on the regional level might lead to stronger RES-H deployment.

ARTICLE INFO

Article history:
Received 11 December 2010
Accepted 29 August 2012
Available online 25 September 2012

Keywords:
Renewable energy
Heating
Policy targets

ABSTRACT

The heating sector has been neglected in energy policies for quite some time, especially on the European level. Only recently, with the implementation of the European directive 2009/28/EC the sector has gained higher attention. The objective of this paper is to provide an overview of the heat market in Austria and of the current status and future prospects of renewable energy in the heat sector (RES-H) up to 2030. Despite the growing energy demand, the share of renewable energy in the total energy demand for space heating and hot water increased from about 20% in 1970 to about 34% in 2008. This is mainly due to ambitious RES-H support instruments and regional policy targets. For example, the government of the region of Upper Austria has implemented a target of 100% RES-H share in the space heating and hot water sector until the year 2030. However, the National Renewable Energy Action Plan for 2020 foresees only moderate growth rates for RES-H compared to recent market growth and scenarios in literature. Due to the ambitious targets and support schemes of regional governments it seems likely that RES-H deployment could growstronger than stated in the action plan.

1. Introduction

The heating sector and its potential to reduce greenhouse gas emissions, increase energy efficiency and employ a higher share of renewable energy has been neglected in energy policies for quite some time, especially on the European level. Only recently, with the implementation of the European directive 2009/28/EC on the promotion of the use of energy from renewable sources has a higher relevance attached to the heat sector. In Austria, the share of renewable energy sources for heating (RES-H) is relatively high compared to other European countries. Although the promotion schemes are somewhat fragmented between the nine Austrian regions, there are comprehensive programs in place, leading to significant progress of RES-H in some regions. Upper Austria is one of these outstanding regions, with ambitious RES-H support programs and a rapid growth of renewable heating deployment. Above all, the Upper Austrian government has set a target of 100% renewables in the space heating and hot water supply by the year 2030 (Dell, 2009).

Table 1 gives an overview of the structure of the final energy consumption in Austria in 2008. Transport (including off-road traction) accounts for the biggest share in the final energy

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http://dx.doi.org/10.1016/j.enpol.2012.08.067

Table 1
Structure of final energy consumption in Austria in the year 2008.
Source: Statistik Austria (2010a).

Sectors	Consumption (PJ)	Structure (%)
Transport	392.32	36.0
Space heating and cooling, water heating	315.05	28.9
Steam production	85.49	7.9
Industry ovens	159.99	14.7
Lighting and computing	28.33	2.6
Stationary engines	107.06	9.8
Electrochemical purposes	0.32	0.0
Total	1088.54	100.0

consumption, followed by the category "space heating, cooling and water heating". The share of cooling in this category is estimated at less than 1% (e.g. Kranzl et al., 2010a). High-temperature heat generation is subdivided into "steam production" (including process heat) and "industrial ovens". In total, low- and high-temperature heat generation and cooling account for more than 50% of the total energy consumption in Austria.

The greenhouse gas emissions related to heat generation and cooling amounted to about 36.2 million tons (Mt) CO_{2e} in 2005, according to Haas et al. (2007). This is approximately 40% of the total national greenhouse gas emissions. Thereof, 22.4 Mt were related to space and water heating, 0.1 Mt to cooling, 4.6 Mt to steam production and 9.1 Mt to industry ovens.

The objective of this paper is to provide an overview of the heat market in Austria, of the current status and future prospects of RES-H. This includes the following aspects: (1) a description of the characteristics of the Austrian heat market, (2) an analysis of the development of RES-H technologies within the last years and decades, (3) a comprehensive documentation of the policy framework and support schemes for RES-H and (4) an outlook on possible further development paths of the heating sector as a whole and for different RES-H technologies.

This paper focuses on the space heating and hot water energy demand in residential buildings and buildings of the service sector. However, to some extent industrial and high-temperature heat supply is also taken into account. The RES-H technologies considered are (1) biomass heating systems (including small-scale wood log, wood chip and pellet boilers as well as medium to large scale heating plants and district heating systems), (2) heat pumps (air source and ground source heat pumps) and (3) solar thermal systems (hot water and combined space heating and hot water systems).

Several of these aspects are considered not only for the case of Austria, but also specifically for the region of Upper Austria. There are two reasons for this: first, many energy and environment related tasks fall into the responsibility of the regions ("Bundesländer"), especially where the building and the heating sectors are concerned. And second, the region of Upper Austria has an impressive record with regard to RES in the heating sector as well as very ambitious targets.

Upper Austria is one of the nine Austrian regions, located in the northern part of the country with a population of 1.4 million inhabitants. The region is highly industrialized, with heavy industry (steel and machinery) playing an important role. Furthermore, Upper Austria is home to a number of leading companies for renewable heating technologies (especially small-scale biomass boilers, solar collectors and heat pumps). From the year 2000 to 2009 RES-H energy consumption increased by about 38% from 40 PJ to almost 56 PJ. For the future deployment of "eco-heat", ambitious targets have been set. The definition of "eco-heat" in Upper Austria (Dell, 2010) includes RES-H and district heating. According to this definition, the share of "eco-heat" on total space heating and hot water energy consumption increased from less than 40% in 2003 to more than 45% in 2008. In new buildings, more than 85% of all heating systems are "eco-heating" systems (Dell, 2010). For future development, the ambitious energy strategy "Energy Future 2030" foresees 100% RES space heating (including hot water provision except process heat) (Dell, 2009).

With respect to the current state of the heat market as well as historical development of RES-H, this paper draws mainly on statistical data from Statistik Austria (2010a,b,c,d), Haneder and Furtner (2010), Biermayr et al. (2010) and Dell (2010). The future projections for RES-H in Austria have been collected from literature: Austrian Federal Ministry of Agriculture, Forestry, Environment and Water Management (2006), Großmann et al. (2008), Haas et al. (2007), Müller et al. (2009), Haas et al. (2008), Kalt et al. (2010), Kratena and Wüger (2005), Ragwitz et al. (2004), Resch et al. (2009), Weiss and Biermayr (2008), Fink et al. (2009), Lutz (2007), a stakeholder process (described in more detail in Kranzl et al., 2009) as well as Austrian's national renewable energy action plan (NREAP) according to Directive 2009/28/EC submitted in mid-2010 (Bundesministerium für Wirtschaft, Familie und Jugend, 2010).

The literature provides a long list of papers dealing with the renewable heating sector in different regions. Among those are a number of studies dealing with certain sub-sectors or technologies, e.g. Singh et al. (2010), Leidl and Lubitz (2009), Biaou and Bernier (2008), Jablonski et al. (2008). The volume of academic literature dealing with national and regional renewable heating policies is much lower than those covering efficiency and retrofitting policy issues. Relevant examples are José et al. (2011), Bürger et al. (2008), Nast et al. (2006,2009). This paper adds to the part of those papers providing a descriptive discussion based on the documentation of empirical data of the sector and the policies. We combine this descriptive presentation of empirical data, policies and targets with a comparative analysis of scenarios for the future deployment of RES-H technologies in Austria. Based on the comparison of these elements we are able to draw conclusions regarding the level of ambition of existing policy targets for RES-H and its appropriateness in relation to potential and related cost. This should inform the discussion of overall policy of the support of RES-H in Austria.

The historic development and current situation of renewable energy in the Austrian heating sector are described in Section 2. Section 3 provides an overview of the policy background and support schemes for RES-H. The projections for the heat sector according to the studies mentioned above as well as prospects for different RES-H technologies are described in Section 4. This section also includes an overview of the RES-H targets set in the NREAP. Finally, this paper closes with conclusions regarding the importance of RES-H in the NREAP and an outlook and open questions regarding the role of policy targets and support instruments for further RES-H penetration (Section 5).

2. Historic development and current situation of RES-H

2.1. Structure of heat consumption

The structure of the final energy consumption broken down by energy source and sectors is shown in Fig. 1. "Space heating, cooling and water heating" comprises low-temperature heat generation and air conditioning in buildings. "Steam production" includes industrial and commercial heat generation and process heat and "industrial ovens" include industrial and commercial facilities, reaching from small bakery ovens to large blast furnaces. The fraction "stationary engines" includes the final energy