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summary

BE sustainable

BE sustainable
ETA-Florence Renewable Energies
via Giacomini, 28
50132 Florence - Italy
www.besustainablemagazine.com
Issue 5 - May 2014
ISSN - 2283-9486

IMPRINT:

BE Sustainable is published by ETA-Florence Renewable Energies, Via Giacomini 28, 50132 Florence, Italy
Editor-in-Chief: Maurizio Cocchi | editorial@besustainablemagazine.com | twitter: @maurizio_cocchi
"Direttore responsabile: Maurizio Cocchi" "Autorizzazione del Tribunale di Firenze n. 548/2013"
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Marketing & Sales: marketing@besustainablemagazine.com
Graphic design: Tommaso Guicciardini Corsi Salviati
Layout: Laura Pignen, ETA-Florence Renewable Energies
Print: Mani srl | Via di Castelpulci 14/c | 50018 Scandicci, Florence, Italy
Website: www.besustainablemagazine.com
The views expressed in the magazine are not necessarily those of the editor or publisher.
Image on page 34 by © Sbokonole/freezingtime
ISSN - 2283-9486

THE ROLE OF BIOMASS HEATING FOR EU ENERGY POLICY TARGETS

L. Kranzl, A. Müller - **Vienna University of Technology**

Almost 50% of the EU final energy consumption is used for heating purposes. Space heating and hot water preparation in the household and the tertiary sector accounts for more than half of it (Eurostat, Sanner et al., 2011). Historically and until the late 1990s, the largest share of biomass has been used for heating, where the household sector contributed the main part, followed by the industry. From 2000 to 2010, the share of biomass in the EU on total primary energy consumption almost doubled. This was mainly driven by the strong growth of electricity generation from biomass and transport biofuels. However, also biomass consumption for heating steadily increased. This growth of biomass was also driven by EU legislation and corresponding energy related directives. In the past few years, additional directives came into place which will have an impact of mid- and potentially also long-term relevance of bioenergy.

In this context, the following questions arise: (1) What is the role of biomass in residential and service buildings for achieving RES-H/C targets in 2020? (2) What are relevant interactions of biomass heating with other RES-H/C technologies and efficiency improvement? (3) What should be the further role of biomass heating in the mid- and long-term?

These questions will be discussed in this article. Moreover, related modelling work and research is presented.

European Policy Framework with Impact on RES-H

There are mainly three EU directives with direct impact on renewable heating: the renewable energy directive (Directive 2009/28/EC), the energy performance of buildings directive (recast) (Directive 2010/31/EU) and the energy efficiency directive (Directive 2012/27/EU).

Since the renewable energy directive (RED) requires Member States to set up plans for achieving certain overall RES targets, this includes also the heating sector. An analysis of the first round of submitted national renewable energy action plans (NREAPs) reveals that overall, Member States plan to almost double the share of renewable heating and cooling from 2005 to 2020 (Beurskens and Hekkenberg, 2011). Although the share of solar thermal, geothermal and ambient energy should strongly increase until 2020 according to the NREAPs, in absolute terms, biomass would still remain the major RES-H/C source with about 80% of renewable heat in the EU.

Besides of this quite generic requirement to consider RES-H/C in NREAPs, the renewable energy directive includes another, potentially quite strong instrument: Member States shall, in their building regulations and codes or by other means with equivalent effect, require the use of minimum levels of energy from renewable sources in new buildings and in existing buildings that are subject to major renovation. This regulation has to be implemented until end of 2014. However, a review of policies in this field, carried out in the project ENTRANZE (www.entranze.eu) shows that only a few member states up to now have established such type of regulations. Examples are obligations for RES-H use in Germany, Ireland or Spain in new buildings or buildings undergoing major renovation.

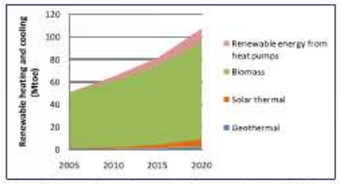

Figure 1. Renewable heating and cooling according to NREAPs Source: Beurskens et al 2011, own calculations

District Heating Plant in Hang Denmark

The energy performance of buildings directive (EPBD recast) sets up the target of 'nearly zero-energy buildings' (nZEB), which have to become standard in new building construction after 2020. The directive defines an nZEB as a building that has a very high energy performance; the nearly zero or very low amount of energy required should be covered to a very significant extent by energy from renewable sources. Thus, there is a direct integration of renewable energy and energy efficiency in the target setting. The definition of nZEB in the different member states is quite different and highly difficult to compare. Thus, currently it is still uncertain which impact the EPBD recast will have on RES-H/C and on biomass heating in particular.

The energy efficiency directive (EED) sets energy saving targets and requires member states to support efficient district heating and CHP. In particular, this includes biomass district heating and CHP. Member states have to submit national heating and cooling plans and a cost-benefit analysis of different district heating and CHP options until end of 2015. Thus, at the current stage a stronger support of biomass district heating and CHP might be expected but is still open.

Long-term energy foresight: the EU energy roadmap

The EU energy roadmap (European Commission, 2011) shows different scenarios of the European energy system up to 2050. In all scenarios, the current share of about almost 7% (2010) increases to about 10% in 2020. After 2020, some scenarios hold this biomass share of 10% or slightly increase until 2050. Other development paths, e.g. the "High-RES", "Diversified supply technologies" or "Low nuclear" scenarios result in an increasing share of biomass on total energy consumption in the range of 22%-27% until 2050. However, besides this absolute increase of the biomass share, a quite substantial shift in the structure of biomass use and the applied biomass technologies might be expected according to these scenarios. If we look at the use of biomass in the triangle of (1) heat, (2) electricity generation and CHP and (3) transport biofuels, we can observe a shift from the strong focus on heating (and to some extent electricity) in European biomass use to an increasing relevance of transport fuels and electricity even already in the short period from 2005 until 2010. In 2050, all EU energy roadmap scenarios indicate that biomass use is much more evenly distribute in this triangle. This means that the main growth is expected in the sector of transport biofuels and electricity generation.

So, why is the role of biomass heating expected to decline? What drives this development? In the next paragraphs, the future trends and possible development paths in the space heating sector and the implications for biomass heating will be discussed in more detail.

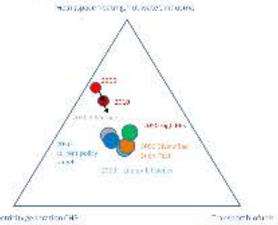

Figure 2.Structure of biomass use in EU-energy roadmap scenarios Source: European Commission, 2011, Kranzl et al., 2013

Scenarios space heating and the future relevance of biomass heating

The strong evidence for huge energy efficiency potentials in the building sector and in particular for space heating have led to concrete implementations of the efficiency measures, e.g. stronger building codes and support measures for thermal building refurbishment in more or less all EU Member states. As documented above, the EED and EPBD (recast) foster these developments on the EU level. In the past few years, at least in some EU countries these measures already led to stabilising or even declining energy consumption for space heating, despite of growing conditioned floor area. The IEE project ENTRANZE (Policies to enforce the transition to nearly-zero-energy buildings, www.entranze.eu) investigates the impact of different support instruments for energy efficiency in the building sector and develops scenarios[1] for EU-Member States and EU-28 as a whole. Preliminary scenario results show that final energy demand for space heating and hot water preparation in the EU is expected to decrease by 35% up to 60% until 2050, depending on the level of ambition in national and EU legislation. Due to the inertia of the building stock and long lead times, in particular the "high efficiency" scenario would need quick and stringent action overall Europe. However, all scenarios in the literature dealing with space heating and hot water preparation indicate a more or less strong decline in space heating energy consumption (e.g. Hansen, 2009, Economidou et al., 2011). In addition, a substantial part of the remaining energy consumption could be covered by solar thermal and ambient energy (made available by heat pumps). Depending on the scenario, this would reduce the remaining energy demand for space heating and hot water preparation to 15% - 55% compared to 2010. It is evident that these potential developments will have a strong impact also on biomass heating.

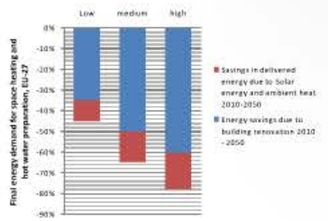

Figure 3. Possible energy savings in the building sector until 2050

For the cases of Austria and Germany, more detailed investigations have been carried out to investigate this transition path and the role of biomass heating (e.g. Müller et al., 2010, Müller, 2013, Wörgetter et al., 2012). Until 2020 in both countries all scenarios show an increasing role of biomass heating both in absolute and relative terms, i.e. total biomass energy demand for space heating increases by about 18% to more than 50% between 2010 and 2020 in Austria and even by 35% to more than 80% in Germany (though starting from a much lower share in the latter case). This growth will strongly be driven by policy instruments and economic side conditions for biomass heating and general RES-H. Until 2050, most scenarios show a decrease in absolute terms compared to 2010 in both countries (and even more pronounced in Germany). However, due to the considerable efficiency improvement in the overall building sector, the market share of biomass still increases. In some cases for Austria even up to a share of more than 40% and in Germany more than 15% in 2050.

Conclusions

Taking the results and the arguments raised into consideration, we may derive the following conclusions:

- Biomass delivers by far the largest share of renewable heating, currently and according to targets for 2020
- Most scenarios show strongest growth of biomass after 2020 for electricity generation and transport biofuels
- Biomass space heating reduces in most scenarios after 2020 in terms of bioenergy demand for space heating
- Thermal building renovation, solar thermal and ambient energy can strongly reduce delivered energy to buildings
- Thus, with lower bioenergy consumption a higher share of buildings could be provided with space heating service
- Tapping the building's efficiency potential is a precondition for a sustainable, resource efficient low carbon energy system
- As long as there is a substantial energy consumption for space heating, biomass space heating is one of the cheapest and most attractive options for GHG-reduction. Policies are required to support these options, in particular obligations combined with economic incentives
- In the long term, high exergy applications for biomass should be advanced, e.g. high-temperature process heat applications, electricity generation, CHP and district heating, transport fuels, materials and cascadic use

In the short-and mid term the relevance of biomass heating will remain high. In the long-term, the role of biomass heating might change, depending on the focus of biomass policies and the ambitions to increase energy efficiency and other RES-H/C options in the building sector.

Summing up, high energy efficiency standards and biomass have to be integrated in order to achieve a high contribution of biomass heating with limited resource consumption.

Acknowledgment

This work has been developed in the project ENTRANZE (Policies to enforce the transition to nearly-zero-energy-buildings in the EU-27), supported by the European Commission in the frame of the programme Intelligent Energy Europe.

[1] *Scenario development in the project ENTRANZE is carried out with the highly disaggregated bottom-up modelling tool Invert/EE-Lab (www.invert.at, Müller, 2012, Kranzl et al., 2011).*

BIOGRACE II

Harmonised Greenhouse Gas Calculations for Electricity, Heating and Cooling from Biomass

Nikolaus Ludwiczek - **BIOENERGY 2020+**

Consumers of bio-electricity, bio-heat and bio-cooling want to be sure that the energy they buy helps to mitigate climate change. In particular Member States that subsidize these kinds of renewable energy production need to ensure that the money of tax payers is invested into technologies that definitely save greenhouse gas (GHG) emissions.

Some of them already legislated GHG criteria that economic operators need to prove or are likely to do so; thus affecting the level playing field of biomass trade. In other words bioenergy suppliers have a strong interest in a sound and reliable methodology that enables them to calculate the emissions of their production pathways; and so do verifiers that are being hired by companies.

The BioGrace-II project responds to this need and aims at harmonising GHG calculations for electricity, heating and cooling from biomass in Europe. In doing so it refers to experiences from the implementation of the sustainability criteria for biofuels according to the Renewable Energy Directive that show that a joint approach of Member States would considerably save time and costs for both administration and companies. Member States with high imports of solid biofuels, the industries and sustainability certification schemes therefore support the idea of BioGrace-II.

The starting point of harmonisation is expected to come from the European Commission in a follow up to the 2010 report on sustainability requirements for bioenergy (other than liquid biofuels). This new report will probably contain default GHG emission values for common production pathways of gaseous and solid biomass, and a methodology including fossil fuel comparators. Yet it is not expected that producers can easily make own GHG calculations based on this report. This is what the BioGrace-II calculation tool is meant for.

A screenshot of the Biograce II tool

A draft version of this tool has already been developed using preliminary data and has been tested by a group of stakeholders. In its final version that will be out once the Commission report is published the tool will feature:

- a list of standard values
- an Excel tool that will:
  - show how the default values were calculated
  - allow stakeholders to make calculations themselves
- a user manual
- detailed calculation rules
- a methodological background document.

Throughout the development of the tool, policy makers and stakeholders have been and will be informed and invited to discuss steps of harmonisation and to give feedback in order to achieve the most user-friendly tool possible. Thus BioGrace-II takes an intermediary role between legislation (EU, EC, and Member States), producers and verifiers.

The project is financed by the Intelligent Energy Europe programme (IEE) for a 3-year-period from 2012 to 2015 and builds upon the earlier (2010-2012) IEE-project, equally named BioGrace, which harmonised GHG calculations for biofuels. As an outcome the calculation tool of BioGrace (I) was recognised as a voluntary scheme by the European Commission in June 2013. Another task of the ongoing project therefore is to keep this recognised tool updated and to support verifiers in using it. The next the BioGrace event in June 2014 will be a public workshop in Vienna covering both topics, liquid biofuels as well as solid and gaseous ones.

For more information visit: www.biograce.net

Co-funded by the Intelligent Energy Europe Programme of the European Union