Biomass and Bioenergy 95 (2016) 64–77

Contents lists available at ScienceDirect

Biomass and Bioenergy

journal homepage: http://www.elsevier.com/locate/biombioe

Research paper

Five years left – How are the EU member states contributing to the 20% target for EU's renewable energy consumption; the role of woody biomass

Svetlana Proskurina [a, *], Richard Sikkema [b], Jussi Heinimö [c], Esa Vakkilainen [a]

[a] Lappeenranta University of Technology, Skinnarilankatu 34, 53850, Lappeenranta, Finland
[b] European Commission, Joint Research Centre, The Institute for Environment and Sustainability (IES), Forest Resources and Climate Unit, Italy
[c] Mikkeli Development Miksei Ltd, Sammonkatu 12, 50130, Mikkeli, Finland

ARTICLE INFO

Article history:
Received 12 December 2015
Received in revised form
27 August 2016
Accepted 15 September 2016

Keywords:
Renewable energy
Bioenergy
Biomass
Renewable energy targets
National Renewable Energy Action Plan
European Union

ABSTRACT

The European Union has set ambitious targets of raising the share of EU energy consumption produced from renewable resources from 20% by 2020 to 27% by 2030. The aim of this paper is to assess the role of woody biomass in renewable energy as gross final energy consumption in the European Union (the EU-28). The paper identifies leading and lagging countries in biomass development by focusing on their current biomass use and forecasts future perspectives. The research compares and evaluates the role of biomass in renewable energy in the EU-28 focusing on countries' potential resources and policy support. The study shows that all countries are making efforts to reach the 20% target in 2020 and exhibit a trend of increasing renewable energy as gross final energy consumption towards the new target of 2030. Solid biomass plays an important role in reaching the EU's renewable energy targets. The majority of the EU-28 countries are close to reaching their national renewable energy targets and show a very attractive biomass development. Unless energy consumption decreases however, some member states will face serious problems in reaching their renewable energy target in 2020. Following our analysis, the largest problems occur in those MS having a relative high-energy consumption pattern: France, Germany and the United Kingdom. It is unlikely that they can comply with expected renewable energy demand, unless they mobilize more woody biomass from their available domestic potential (France, Germany) or considerably increase their woody biomass imports (mostly wood pellets) from elsewhere (United Kingdom).

1. Introduction

Development of renewable energy sources (RES) for energy production has become increasingly significant in European energy markets. The importance of RES has grown due to increasing demand for CO_2-free energy, environmental sustainability and a desire to decrease dependence on fossil fuels. In 2007, the European Union (EU) set a target of raising the share of EU energy consumption produced from renewable resources to 20% by 2020, which is a part of 20-20-20 target with a 20% reduction in EU greenhouse gas emissions (GHG) from 1990 levels and 20% improvement in the EU's energy efficiency. In 2014, European Council [4] specified an EU-wide domestic GHG reduction target of at least 40% below 1990 levels, an EU-wide target of at least 27% of renewables in energy consumption, and an EU-wide indicative, non-binding ambition of at least 27% energy efficiency by 2030, based on 2007 projections of future consumption [5].

Describing the renewable energy policy in the EU-28, Klessmann et al. [6] suggest that despite the existence of the main directive [7] the EU will need additional policy efforts to reach the necessary reduction target. For example, in countries with less advanced infrastructure and energy markets, upgrading of the power grid infrastructure, dismantling of financial barriers in the heat sector, development of sustainability standards for biomass, and lowering of energy demand through increased energy efficiency are all necessary steps.

In addition to the EU target, each EU member has set its own national target for renewable energy share in gross final energy

* Corresponding author.
E-mail addresses: svetlana.proskurina@lut.fi, proskurina.s@mail.ru (S. Proskurina).

http://dx.doi.org/10.1016/j.biombioe.2016.09.016
0961-9534/

List of abbreviations, conversion factors and definitions

AEBIOM	European Biomass Association
CFB	Circulating fluidized bed
CHP	Combined heat and power
CO_2	Carbon dioxide
EEA	European Environment Agency
EU	European Union
EU-28	Member States of the European Union since January 2013, when Croatia joined the EU
FSC	Forest Stewardship Council
GDP	Gross Domestic Production
GFEC	Gross Final Energy Consumption
GHG	Greenhouse Gas
GIC	Gross Inland Consumption
H&C	Heating & Cooling sectors
IEA	International Energy Agency
IEC	Inland Energy Consumption
IRENA	International Renewable Energy Agency
JRC	Joint Research Centre
MS	Member State
NREAP	National Renewable Energy Action Plan
R&D	Research and Development
RE	Renewable Energy
REN 21	Renewable Energy Policy Network for the 21st Century
RES	Renewable Energy Sources
RES-E	Renewable Energy Sources in Electricity sector
RES-H	Renewable Energy Sources in Heating sector
ROC	Renewables Obligations Certificate
UK	United Kingdom
WBA	World Bioenergy Association
Units	
GWh	Gigawatt-hour(s) = 1000 MWh
1 MWh ≈ 0.51 tonnes of wood pellets = 8.98 primary GJ	bases on lower heating value of 17.6 GJ per tonne and an efficiency rate for 10% pellet co-firing of 40.1% [1]
Mm^3 = 1000 000 m^3	= 7.1 PJ (global average) [2]
Definitions	
Bioenergy	Bioenergy refers to energy derived from biofuels
Biomass	Refers to the biodegradable fraction of products, waste and residues from agricultural (including vegetal and animal substances), forestry and related industries, as well as the biodegradable fraction of industrial and municipal waste
Woody biomass	Refers to the trees and woody plants, including limbs, tops, needles, leaves, and other woody parts, grown in a forest, woodland, or rangeland environment, that are the by-products of forest management
Biofuels (=biomass fuel)	Fuel produced directly or indirectly from biomass. The fuel may have undergone mechanical, chemical or biological processing or conversion or it may have had a previous use. Biofuel refers to solid, gaseous and liquid biomass-derived fuels
Bioliquids	Refers to the liquid fuels made from biomass for energy purposes other than transport (i.e. heating and electricity)
Gross inland consumption of energy (GIC)	Gross inland consumption of energy (GIC) is the first aggregate in the national energy balances. It refers to "apparent" consumption and is derived from the formula that takes into account primary production, exports, imports and stock changes. It includes the primary energy from fossil fuels, from renewable energies (biomass, wind, solar, hydro), derived heat and trade of electrical energy
Gross final energy consumption (GFEC)	Gross final energy consumption (GFEC) is calculated from national energy balances. GFEC starts with the GIC data, after which transformation losses, distribution losses and own consumption of electricity and heat within the energy sector are subtracted. The GFEC data can be divided over the sectors involved in the energy consumption, after the subtraction of non-energy consumption (e.g. use of cokes for chemical products). At the end, we remain with final energy consumption by industry, transport and households [3]

consumption as part of EU targets to 2020. In the EU, renewable energy consumption varies with member states (MS) displaying different renewable consumption profiles, depending on level of economic development, historical factors and policy support. The issue of reaching the 2020 target for renewable energy has been the subject of a lot of research [6,8–15] However, limited work has been done on country comparison in terms of the likelihood of achieving their EU targets in 2020 and the contribution of woody biomass beyond 2020. In 2013, the gross inland consumption (GIC) of energy in the EU-28 was 70 EJ [16]. The total renewable energy (RE) consumption (biomass, solar energy, wind energy, hydro and others) is about 8.2 EJ. Biomass remains the major source of RE in the EU-28, accounting for more than 62% of all renewables [17]. Wood accounts for approximately 80% of the biomass used for renewable energy. However, the specific role of woody biomass, including waste wood resources, remains relatively unknown. Recent projections for 2030 quantify the sustainably realisable additional potential of wood for energy from EU forests as high as 5 EJ per year, provided intensive wood mobilization efforts are applied [18].

This study summarizes current available research and focuses on countries' biomass usage status based on current share of all