

Accepted Manuscript

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PII: S0360-5442(17)30013-0

DOI: [10.1016/j.energy.2017.01.013](https://doi.org/10.1016/j.energy.2017.01.013)

Reference: EGY 10148

To appear in: *Energy*

Received Date: 19 April 2016

Revised Date: 3 January 2017

Accepted Date: 3 January 2017

Please cite this article as: Hagos DA, Gebremedhin A, Bolkesjø TF, The prospects of bioenergy in the future energy system of Inland Norway, *Energy* (2017), doi: 10.1016/j.energy.2017.01.013.

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The prospects of bioenergy in the future energy system of Inland Norway

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Abstract

The aim of this paper is to study a biorefinery integrated district heating (DH) and individual and central bioheating systems in an electricity intensive energy system to identify the prospects of bioenergy technologies over other conventional technologies in a long time horizon (2009 to 2030). The model maximises the societal welfare. Two gasification based biorefinery plants were selected: a Fischer-Tropsch (FT) biodiesel and a dimethyl ether (DME) biorefinery. A base case and three alternative scenarios with an annual 2.5% electricity and biomass price escalation rate were formulated. The results showed that a minimum of 6 €/GJ biofuel subsidy is required to initiate investments in a DME biorefinery, while a minimum of 12 €/GJ is required for FT-biodiesel biorefinery at higher energy prices. For biomass combined heat and power (CHP) competitiveness in DH, electricity price is found to be the most determining factor over biomass price. In individual and central heating, despite the high electricity tax, pellet boilers were found to be less competitive than heat pumps and electric heaters, primarily due to high pellet price. In conclusion, earmarking biomass in DH for CHP and biorefineries and heat pumps in individual, central heating and DH are found to be an optimal solution.

Key words: TIMES, FT-biodiesel, Dimethyl ether (DME), Biorefinery, District heat, Heat pump

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