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A closer look at how much bioenergy could be available in 2050

The technical primary biomass potential for bioenergy (technical bioenergy potential) is the potential of available biomass production with current technology. There is no standard methodology to calculate this, which leads to diverging estimates.

Recently published estimates for 2050 span a vast range of possibilities from less than 50 EJ/yr to more than 1,000 EJ/yr [1] compared to annual global energy consumption of 474 EJ in 2008.[2]

Many studies agree that the technical bioenergy potential in 2050 is at least approximately 100 EJ/yr with some modelling assumptions leading to estimates exceeding 5,000 EJ/yr[3][4].

However, how much biomass for energy is technically available in the future depends on the evolution of a multitude of social, political and economic factors, e.g., land tenure and regulation, diets, trade and technology.

The publication of these global reports has not resulted in a consensus, but has helped to better understand some of its many structural determinants.[5]

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[1] Turkenburg W, Arent D, Bertani R, Faaij A, Hand M, Kraft D, Krewitt W, Larson E, Lempp P, Lund J, Mehos M, Merrigan T, Mitchell C, Moreira J, Sinke W, Sonntag-O'Brein V, Taylor R, Tresher B, van Sark W, Usher E (2011) Global Energy Assessment – Knowledge Module 11: Renewable Energy, Pp. 230.

[2] For example, the Special Report on Renewable Energy Sources and Climate Change Mitigation (SRREN) reported global technical bioenergy potentials of 50-500 EJ/yr for the year 2050[2] and the Global Energy Assessment gave a range of 160-270 EJ/yr. Intergovernmental Panel on Climate Change (2014). Special Report on Renewable Energy Sources and Climate Change Mitigation Visit resource centre

[3] Turkenburg W, Arent D, Bertani R, Faaij A, Hand M, Kraft D, Krewitt W, Larson E, Lempp P, Lund J, Mehos M, Merrigan T, Mitchell C, Moreira J, Sinke W, Sonntag-O'Brein V, Taylor R, Tresher B, van Sark W, Usher E (2011) Global Energy Assessment – Knowledge Module 11: Renewable Energy, Pp. 230.

[4] Smeets E, Faaij A, Lewandowski I, Turkenburg W (2007) A quick scan of global bio-energy potentials to 2050. Progress in Energy and Combustion Science, Volume 33, Issue 1, February 2007, Pages 56-106

[5] Dornburg V, van Vuuren D, van de Ven G, Langeveld H, Meeusen M, Banse M, van Oorschot M, Ros J, van den Born G J, Aiking H, Londo M, Mozaffarian H, Verweij P, Lysen E, Faaij A (2010) Bioenergy Revisited: Key Factors in Global Potentials of Bioenergy, Energy & Environmental Science, February 2010, 3, Pages 258–267

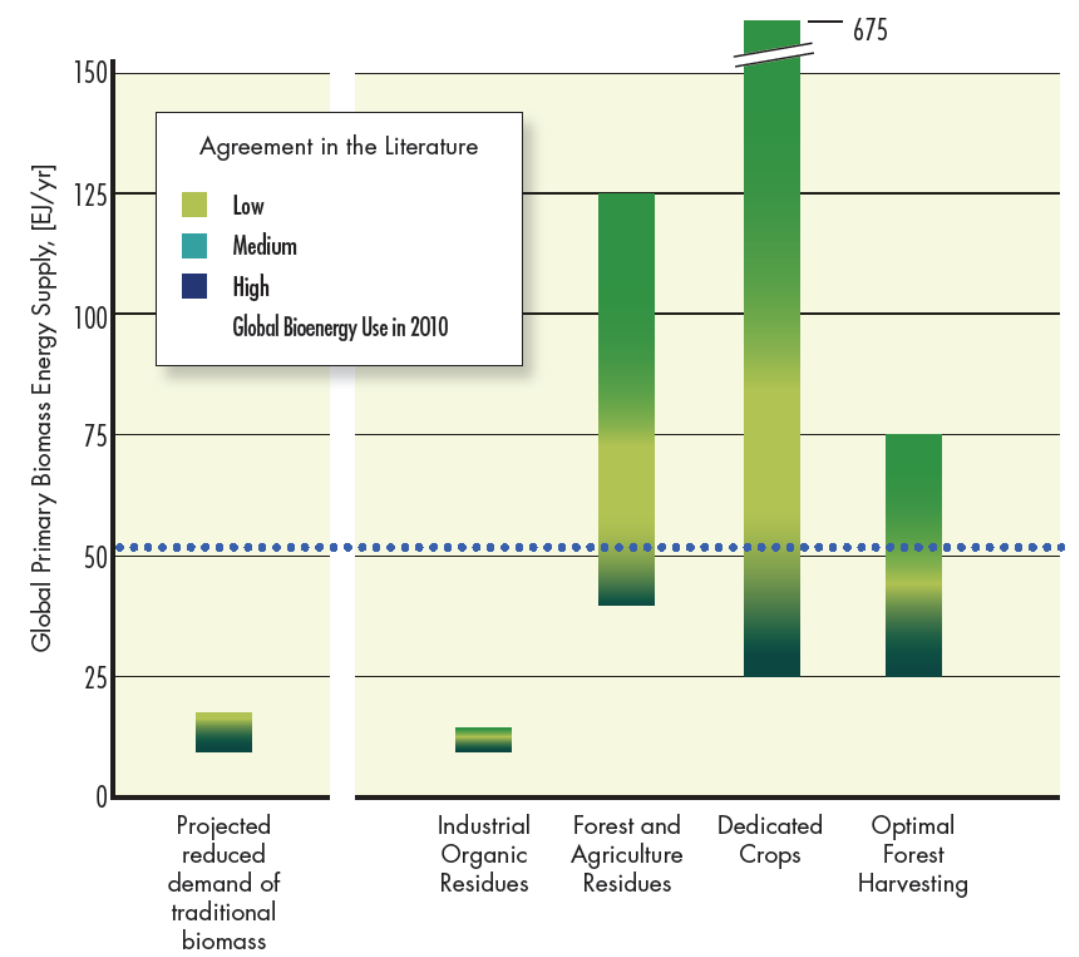

Figure 1. Global Technical Primary Biomass Potential for Bioenergy by Main Resource Category for the year 2050. Source: Creutzig et al., GCB- Bioenergy (2014) Visit resource centre

Figure 1 shows estimates of the global technical bioenergy potential in 2050 by resource categories. Ranges were obtained from assessing a large number of studies based various restrictions regarding resource limitations and environmental concerns but no explicit cost considerations[6].

[6] Creutzig F, Ravindranath N. H., Berndes G, Bolwig S, Bright R, Cherubini F, Chum H, Corbera E, Delucchi M, Faaij A, Fargione J, Haberl H, Heath G, Lucon O, Plevin R, Pop Ap, Robledo-Abad C, Rose S, Smith P, Stromman A, Suh S, Masera O (2014) Bioenergy and climate change mitigation: an assessment Article first published online: 4 JUL 2014, DOI: 10.1111/gcbb.12205 (Global Change Biology – Bioenergy)

The graph shows the ranges in the estimates by categories of the global technical bioenergy potential. The colour grading is intended to show qualitatively the degree of agreement in the estimates, from blue (all researchers agree that this level can be attained) to purple (medium agreement) to red (few researchers agree that this level can be attained). In addition, reducing traditional biomass demand by increasing its use efficiency could release the saved biomass for other energy purposes with large benefits from a sustainable development perspective.

Additional resources

DDGS references:

Hoffman L.A and Baker A. (2011), Estimating the Substitution of Distillers' Grains for Corn and Soybean Meal in the U.S. Feed Complex. A report from Economic Research Service.

Wisner R. (2011), Estimated U.S. Dried Distillers Grains with Solubles, Production and Use, Iowa State University

Mitigating ILUC:

Ernst & Young LLC (2011) Biofuels and Indirect Land Use Change—the case for mitigation. View source