

## MORE INFORMATION...

### *Advanced biofuels – find out more...*

A closer look at what affects the cost of advanced biofuels

Below is a breakdown of the at current cost factors for advanced biofuels:

Cost	Description	Share of total cost	Sensitivity; change vs. impact on cost
Capital costs	Equipment, land, capital, royalties	35-55%	High
Operating costs	Electricity, heat, labour, wastewater treatment	5-10%	Low
Feedstock costs	Biomass, hydrogen, and transportation	30-45%	High
Catalysts	Enzymes, heterogeneous catalysts	5-15%	Medium
Infrastructure	Transport, fueling stations	2-5%	Low

Table 1. Overview of current cost factors and their share and impact on the total cost for lignocellulosic ethanol and biomass-to-liquid processes. The numbers are a compilation of International Energy Agency (IEA) 2013<sup>1</sup>, Stephen et al. 2012<sup>2</sup>, Bentsen et al. 2009<sup>3</sup>, Morrow et al. 2006<sup>4</sup>, Smeets et al. 2006<sup>5</sup>, Larsen et al. 2008<sup>6</sup>.

<sup>1</sup> International Energy Agency (2013) Production costs of alternative transportation fuels [Visit resource](#)

<sup>2</sup> Stephen JD, Mabee WE, Saddler JN. (2012) Will second-generation bioethanol be able to compete with first generation ethanol? Opportunities for cost reduction. *Biofuels, Bioprod. Bioref* 6:159-176

<sup>3</sup> Bentsen NS, Thorsen BJ, Felby C. (2009) Energy, land and feed balances of converting winter wheat to ethanol. *Biofuels, Bioproducts and Biorefining* 3:521-533

<sup>4</sup> Morrow WR, Griffin WM, Matthews HS. (2006) Modeling Switchgrass Derived Cellulosic Ethanol Distribution in the United States, *Envi. Sci. Techn.* 40 2877–2886

<sup>5</sup> Smeets EM, Junginger E, Faaij A (2005), "Supportive Study for the OECD on Alternative Developments in Biofuel", report for the OECD Directorate for Food, Agriculture and Fisheries, Paris [View resource](#)

<sup>6</sup> Larsen J, Petersen MØ, Thirup L, Li HW, Iversen FK. 2008. The IBUS Process – Lignocellulosic Bioethanol Close to a Commercial Reality. *Chem. Eng. Techn.* 31 765-77

An example of the estimated costs of producing a gallon of cellulosic ethanol is shown in the following figure<sup>7</sup>, demonstrating how raw materials and the cost of capital are the major factors determining the cost. The experience gained from the current generation of commercial-scale bio-refineries is expected to further reduce these costs.

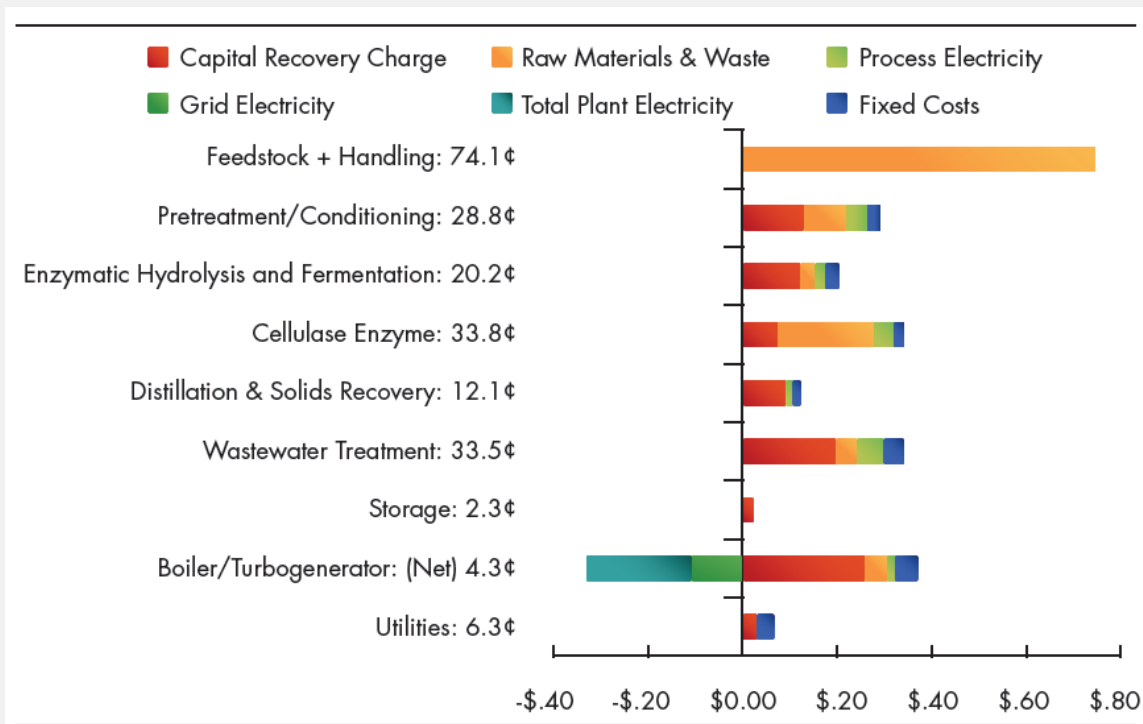


Figure 1. Process Design and Economics for Biochemical Conversion of Lignocellulosic Biomass to Ethanol Dilute-Acid Pretreatment and Enzymatic Hydrolysis of Corn Stover. Source: D. Humbird et al. (2011).

<sup>7</sup> D. Humbird et al., (2011) Process Design and Economics for Biochemical Conversion of Lignocellulosic Biomass to Ethanol Dilute-Acid Pretreatment and Enzymatic Hydrolysis of Corn Stover, National Renewable Energy Laboratory. Technical Report NREL/TP-5100-47764.