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Ethanol

Commercial and developing ethanol fermentation production technologies and cost of production estimates. Global & regional supply/demand and trade forecasts

PERP 2010

Report Abstract
March 2010

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INTRODUCTION

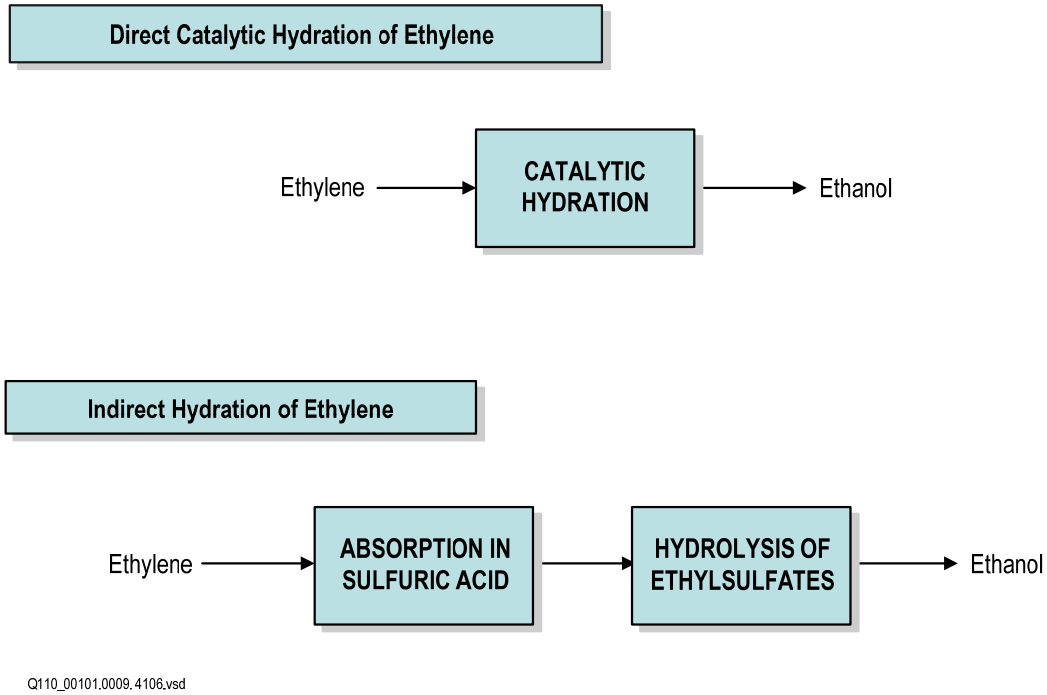
The majority of today's ethanol is produced via fermentation of agricultural resources. Ethanol produced by chemical synthesis is only done by a handful of companies in the world and it is ethanol sourced from renewable sources that has really driven growth. Total global demand for ethanol is well over one million barrels per day.

The objectives of this report are to update the current commercial technologies for ethanol production via corn and biomass fermentation processes and introduce new technologies for ethanol production.

COMMERCIAL TECHNOLOGY

In the past decade, ethanol has become a prominent topic of discussion as the world struggles to find a solution for alternative liquid fuel sources. Marketed as being the next big biofuel, ethanol from renewable feedstocks, otherwise known as bioethanol, is considered by some to have the potential to alleviate the world's dependency on fossil fuels. Bioethanol production via fermentation from renewable feedstocks, such as corn, sugarcane, and beets, are already proven technologies in some regions of the world.

Previously, ethanol was mainly produced via industrial synthesis processes to produce what is now known as synthetic ethanol. Bioethanol is identical to synthetic ethanol except that it may require some purification depending on the renewable feedstock in which it was sourced. Synthetic ethanol utilizes ethylene as a feedstock and mainly consists of the two processes illustrated in the basic process flow diagrams illustrated below.



These synthetic processes are no longer favorable given the rise in popularity of bioethanol. Ethanol produced via synthetic processes currently accounts for only five percent of total world ethanol production. Hence, the focus of this report is on fermentation processes and other developing ethanol technologies. In depth, discussion of the ethylene-based processes can be found in previous Ethanol PERP reports.

This section gives chemistry and process descriptions for the following current commercial ethanol production technologies:

- Fermentation of corn via dry milling and wet milling processes
- Corn wet milling fermentation
- Sugarcane fermentation
- Lignocellulose fermentation

RECENT TRENDS & DEVELOPMENTS

Fermentation of sugar rich feedstocks, such as corn and sugarcane, to ethanol is a proven technology that currently dominates global ethanol production. As with any commercial technology, producers continue to look for ways to improve and to make the process more efficient and cost effective. Hence, most developments in starch/sugar fermentation are not of the same magnitude as developing and emerging technologies such as, lignocellulosic ethanol, biomass gasification, and algae to ethanol. This section of the report focuses on discussing recent trends and developments in current and emerging technologies, for example:

- Improvements in Biochemical Conversion Technologies including technology advances for corn fermentation and advances in pretreatment technologies for lignocellulosic biomass
- Gasification of biomass to syngas to ethanol including range fuels and work by such companies as Coskata, Pearson Technologies, BP.
- Algae to ethanol

ECONOMICS

The following cost estimates have been developed in the report (in each case, effect of capacity, capital employed and feedstock on the estimated cost of production are discussed):

- Production of bioethanol via corn dry milling
- Production of fuel grade ethanol via sugarcane fermentation
- Production of fuel grade ethanol via wheat fermentation
- Production of bioethanol via switchgrass (lignocellulose) fermentation
- Production of bioethanol via biomass gasification

COMMERCIAL MARKET

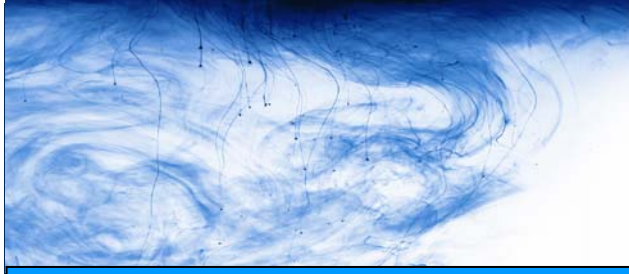
Historical ethanol demand growth over the last eight years has been strong given the interest in renewable fuels. North America and South America have the largest demand for ethanol historically with the United States and Brazil driving demand in each region, respectively.

A global overview of ethanol supply and demand is given. In addition, this section gives:

- Regional market (supply, demand, trade) overview for the following major ethanol producing and/or consuming countries: United States, European Union, Brazil, India, China, Japan
- Capacity tables of the production plants located in the United States is given detailing owning company, specific plant location, feedstock utilized, nameplate capacity, operating production and status with respect to whether under construction/expansion where relevant

Ethanol market outlook is discussed. Including,

- A table giving demand outlook (thousand barrels per day) for each of the following regions - North America, South America, Africa, Western Europe, Eastern Europe, Middle East, Asia and the World – is given for years 2002, 2005, 2008, estimated for 2009 and forecast to 2010, 2015, 2020, 2025 and 2030; average annual growth rates are estimated for the periods 2000-2008, 2008-2015, 2015-2030.
- A figure illustrating consumption (in thousand barrels per day) for these regions over the period 2000 to 2030.
- Remarks on the fuel ethanol value chain are given with respect to industry structure, logistics, fuel blending credit tax, plant ownership, flex fuel vehicles, food versus fuel and ethanol derivatives



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