

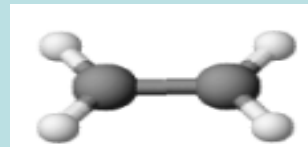
# An alternative route for ethanol use

## Ethylene from ethanol

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# Ethylene

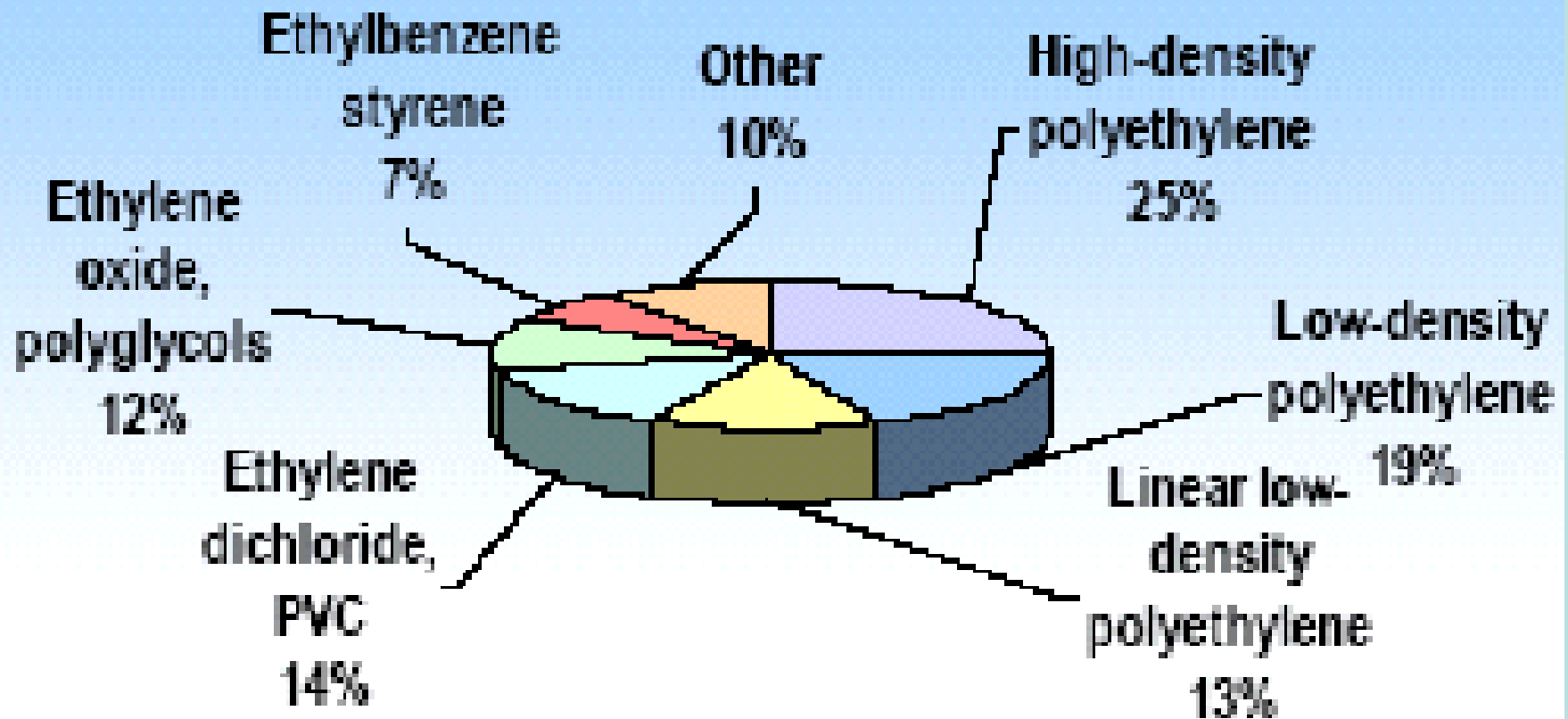


Ethylene is a basic building block for the chemical industry, and it is one of the largest volume organic chemicals produced globally (120 mio tons/yr).

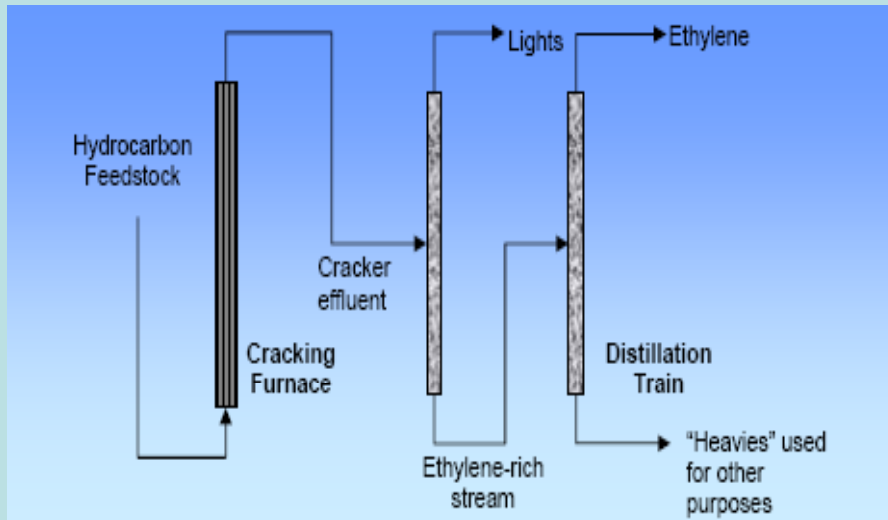
Ethylene is produced by:

- Steam cracking of Ethane,
- Steam cracking of naphtha or heavy oils.
- Dehydration of Ethanol

# Uses for Ethylene

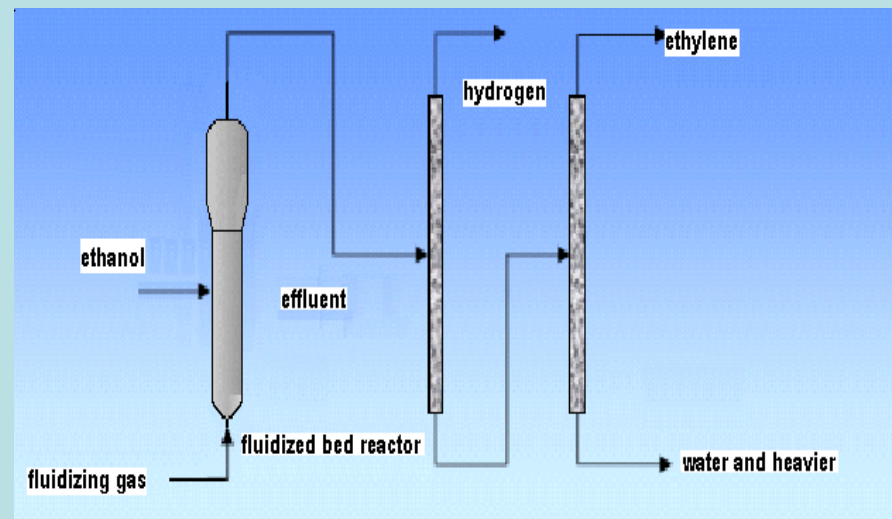


# Ethylene production

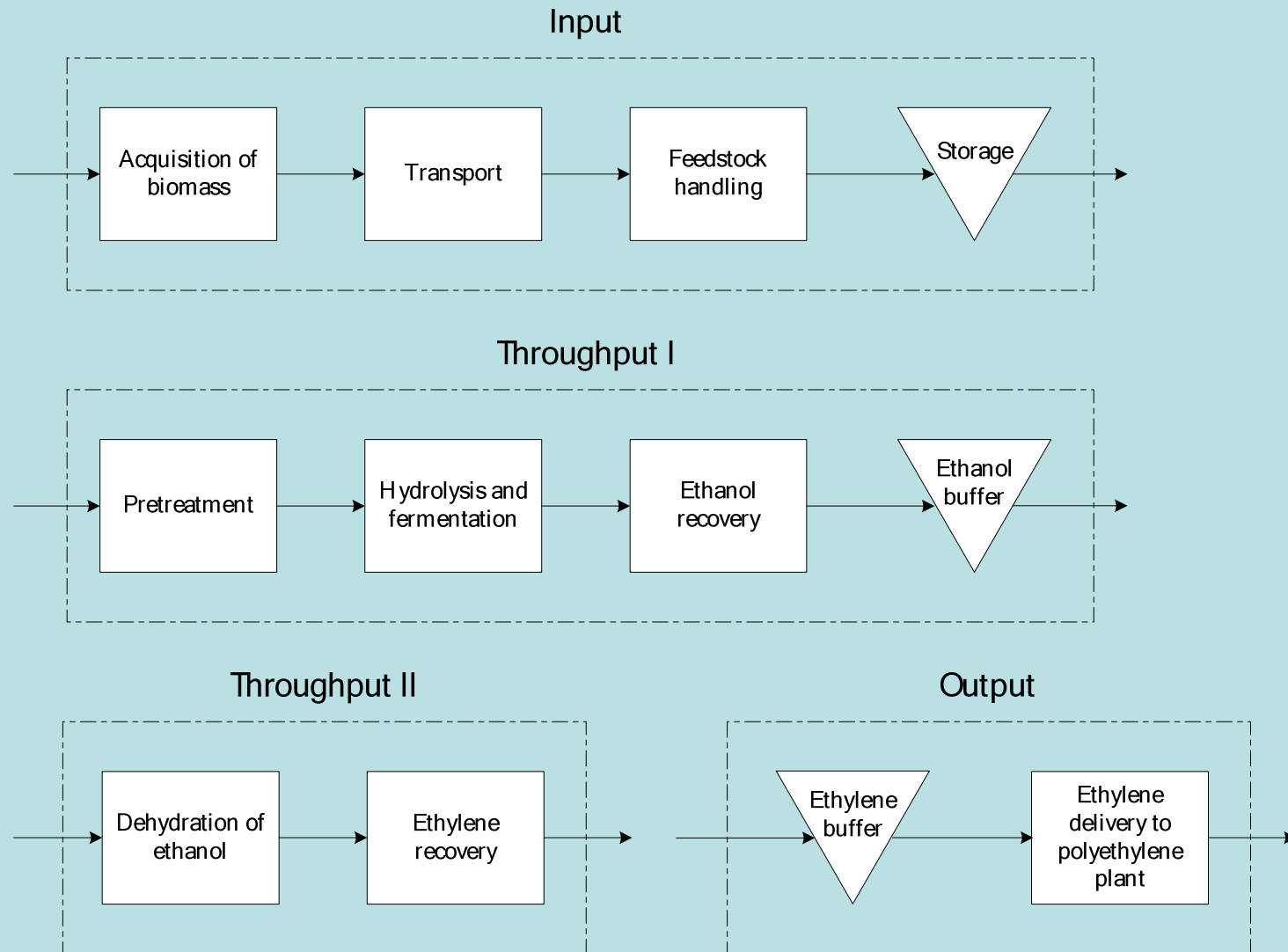


← Fossil fuels

Ethanol →



# Overall production process from Ethanol



# Why ethylene from ethanol?

- Greenhouse effect mitigation
- Exhaustion of fossil fuels
- Oil (in-)dependency
- Polyethylene on biomass base

# Is the sustainable production of ethylene from ethanol biomass feasible?

Criteria to test the feasibility are:

- Technical criteria
- Economical criteria



# Technical criteria

- Process must be well known:
  - Fluidized bed reactor, H-ZSM-5 catalyst
  - Yield 99.5%
- Availability of suitable biomass
  - In the year 2006 India produced 1,500,000 t of Ethanol
- Plant has to meet customary zoning plan
- Sustainable application for waste streams

# Economical criteria

Production cost of ethanol is quite variable depending mostly from the feedstocks.

It is low for the sugar cane (Brasil) and higher for corn (US).  
A reasonable range is 250 – 350 US\$/t

The price of Ethylene ranges between 1,300 – 1,350 US\$/t  
([www. YNFX.com](http://www.YNFX.com))

Conclusion:

Ethylene from bio-ethanol is convenient in countries where the production cost of alcohol is low

# State of the art 1 - Russia

**ETHYLENE PRODUCTION FROM BIO-ETHANOL**

$Bio-C_2H_5OH \longrightarrow C_2H_4 + H_2O$

Application of renewable resources to ethylene production  
Ethanol is originated from cereals, crop etc.

Ethanol consumption	1.7-1.9 t / t C <sub>2</sub> H <sub>4</sub>
Conversion of ethanol	97-98.6%
Ethylene selectivity	94-98%

The process is under testing on the pilot scale set-up.  
Commercial plant of 120,000 tons ethylene in a year is planning to construct.

**IK CO PAH**

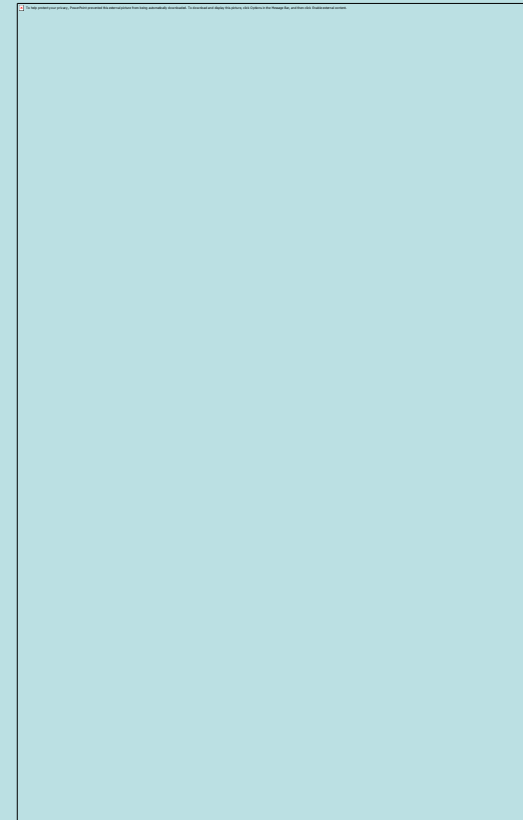
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# State of the art 2

*Braskem*, a Brazilian petrochemical company, received top honors at the annual Bioplastics Conference for developing a “green polyethylene”.

The company uses ethanol dehydration to convert ethanol (made from sugarcane) into ethylene (200.000 tons /yr at the end of 2008).



# State of the art 3

PVC plant in Santo Andre, Brazil; ethylene from ethanol

- Company :  
Solvay Indupa (Buenos Aires, Argentina),
- Investment :  
135 million US\$
- Products:  
360,000-tons/yr of PVC;  
235,000 tons/yr of caustic soda  
60,000-tons/yr of bioethylene

*Source: InvestimentsSP. Br*

# State of the art 4

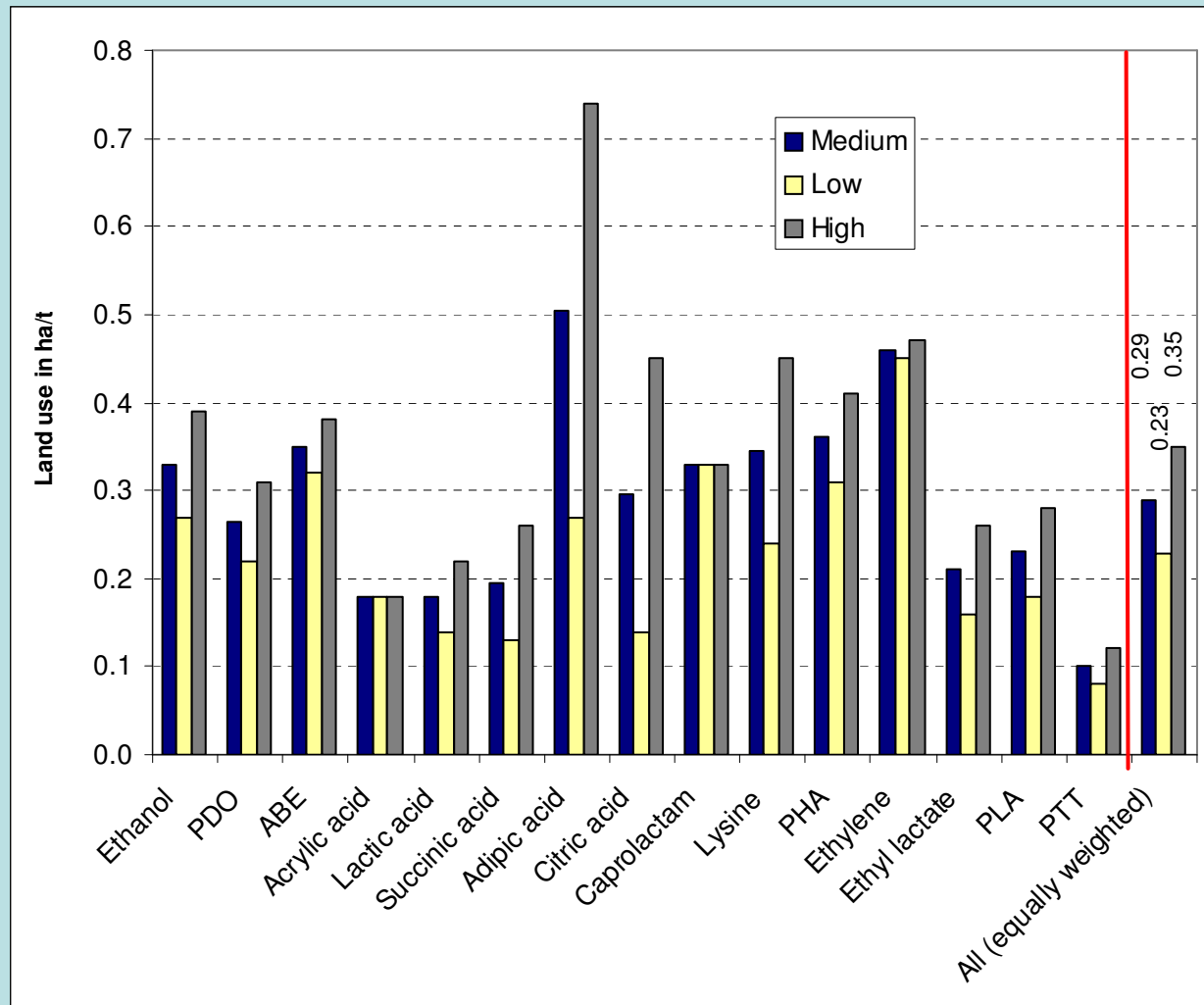
Polyethylene plant in Brazil; ethylene from ethanol

- Company :  
J.V. Dow Chemical Co and Crystalsev Br
- Start up of the plant  
2011
- Products:  
350,000 tons/yr of bioethylene

*Source: CNN Money*

Thank you for your attention

# How much land per tons of chemical?



Source: BREW report