



# INEOS BioEnergy Process:

A clean, sustainable technology  
for energy independence

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# INEOS



- World's 3<sup>rd</sup> largest chemical company with \$48 billion sales
- Vertically integrated from refining to commodities and specialities
- Private company
- 17 Businesses
- Largest producer of ethanol in Europe and sizeable biodiesel producer
- 2008 - INEOS buys BRI and establishes INEOS Bio

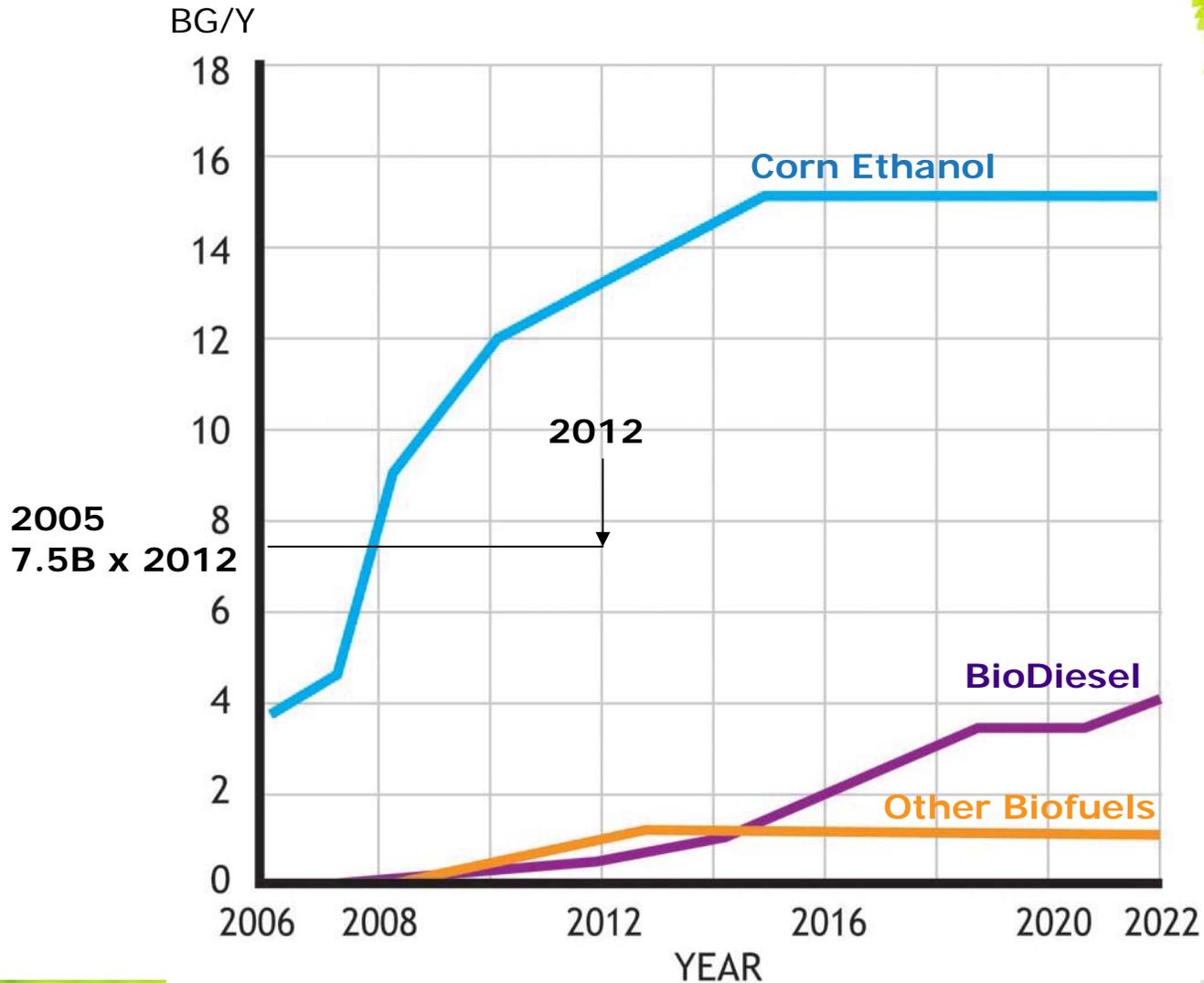
INEOS Locations

# The Vision

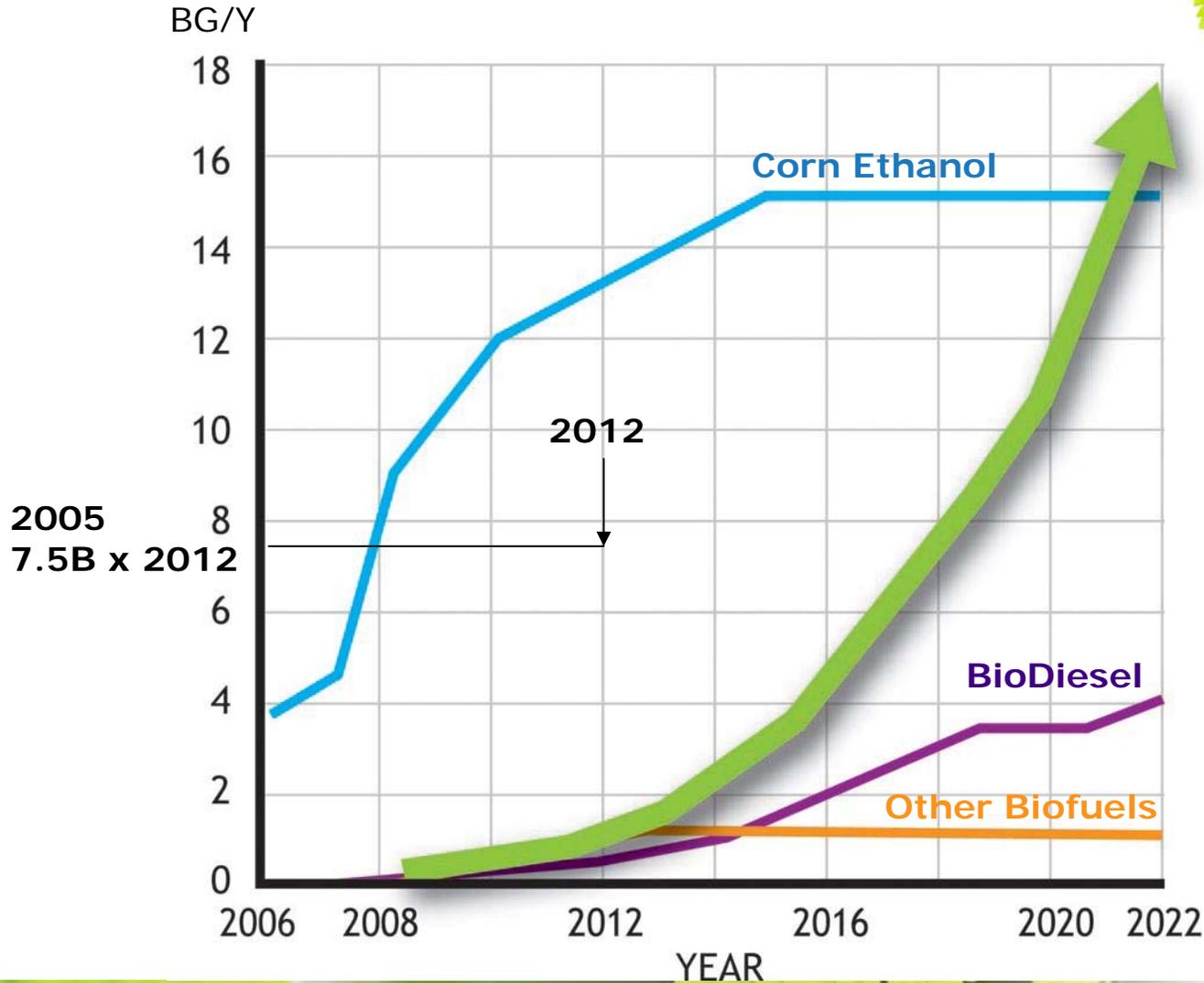


- Utilize low cost carbon and waste to produce fuel and energy
- A step change in green house gas emissions
- Deliver cost effectively and sustainably

# EISA's mandated biofuel growth



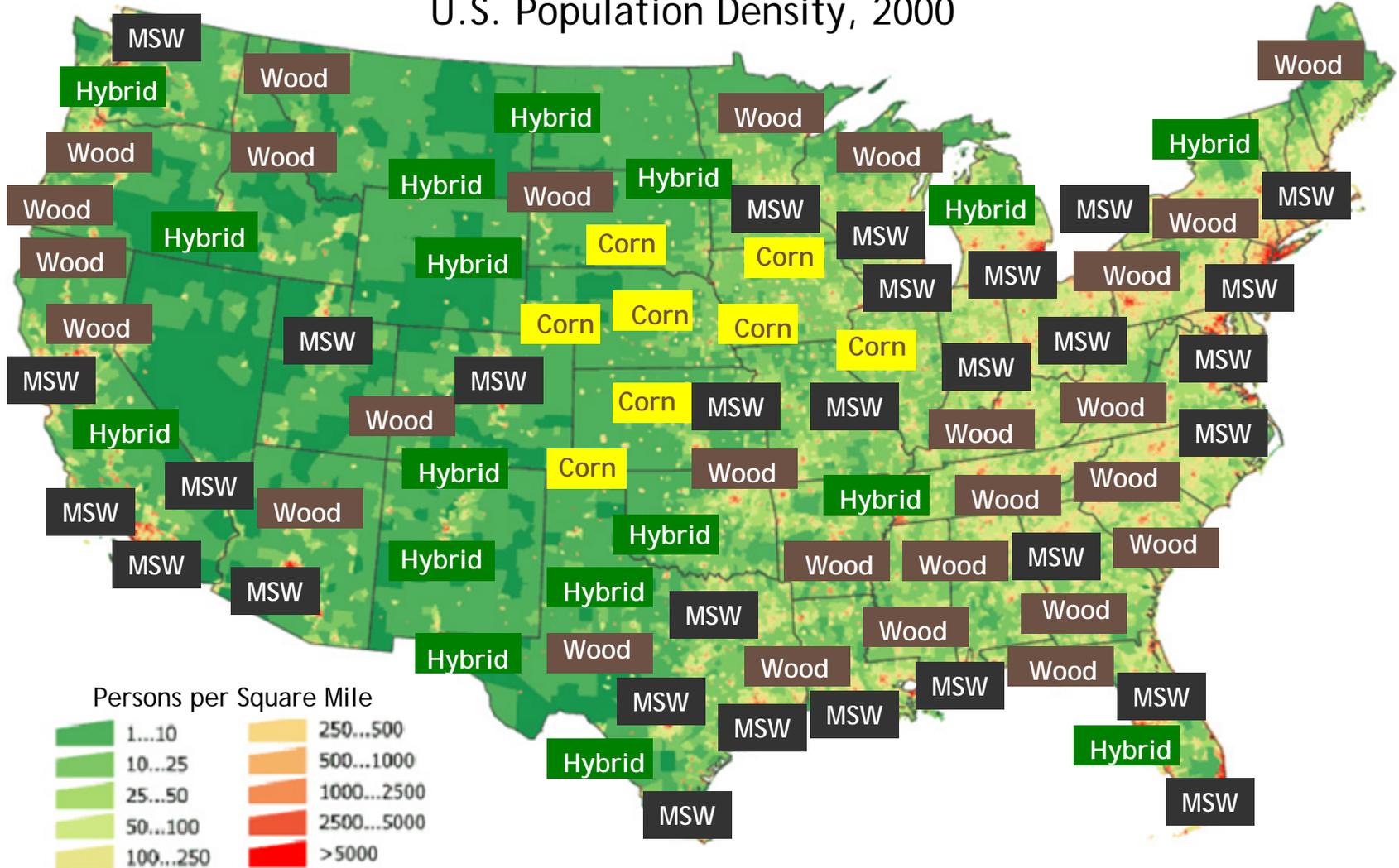
# EISA's mandated biofuel growth



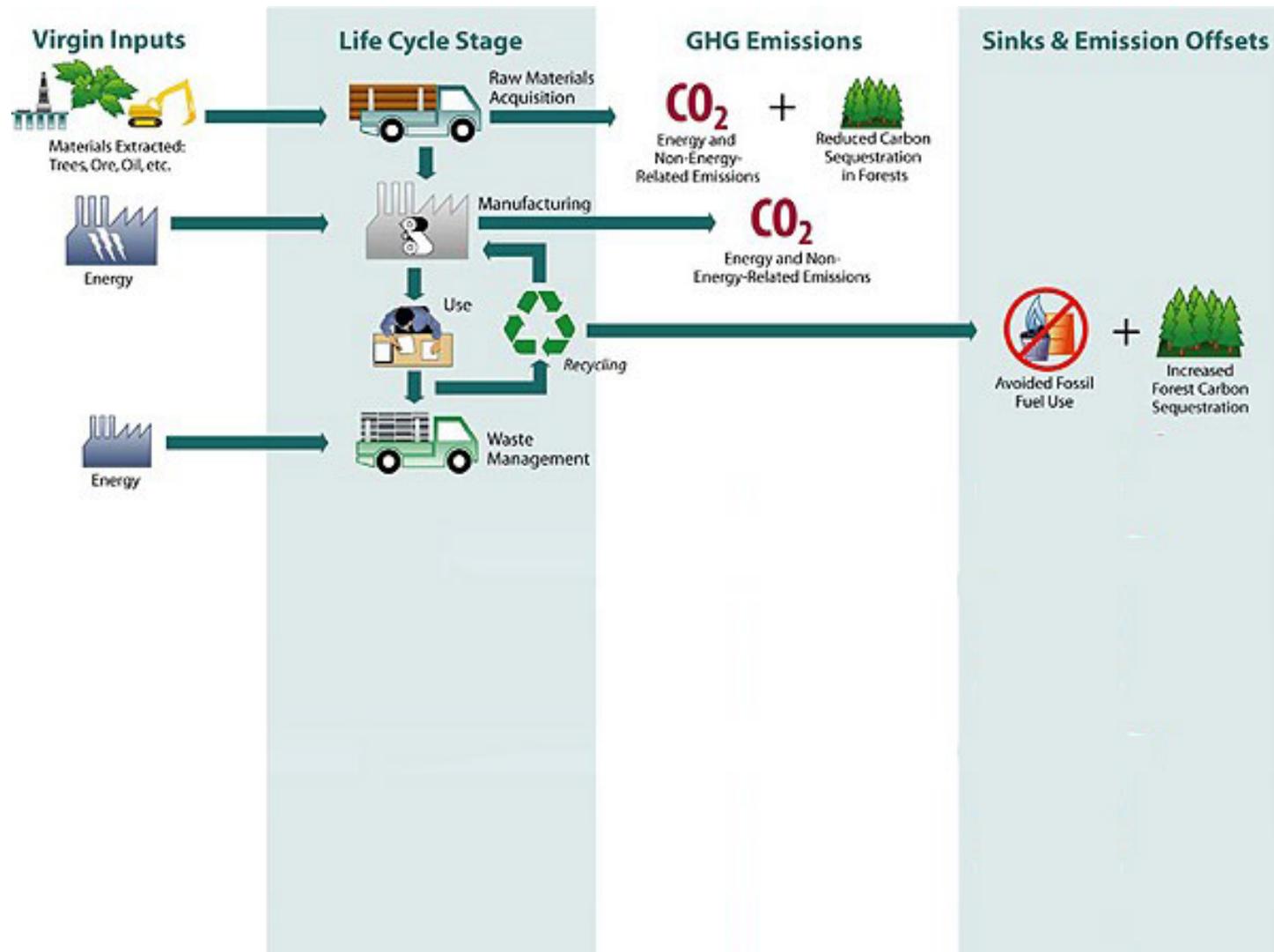
**Cellulosic  
Biofuels**

# Feedstock flexibility offers sustainable solutions

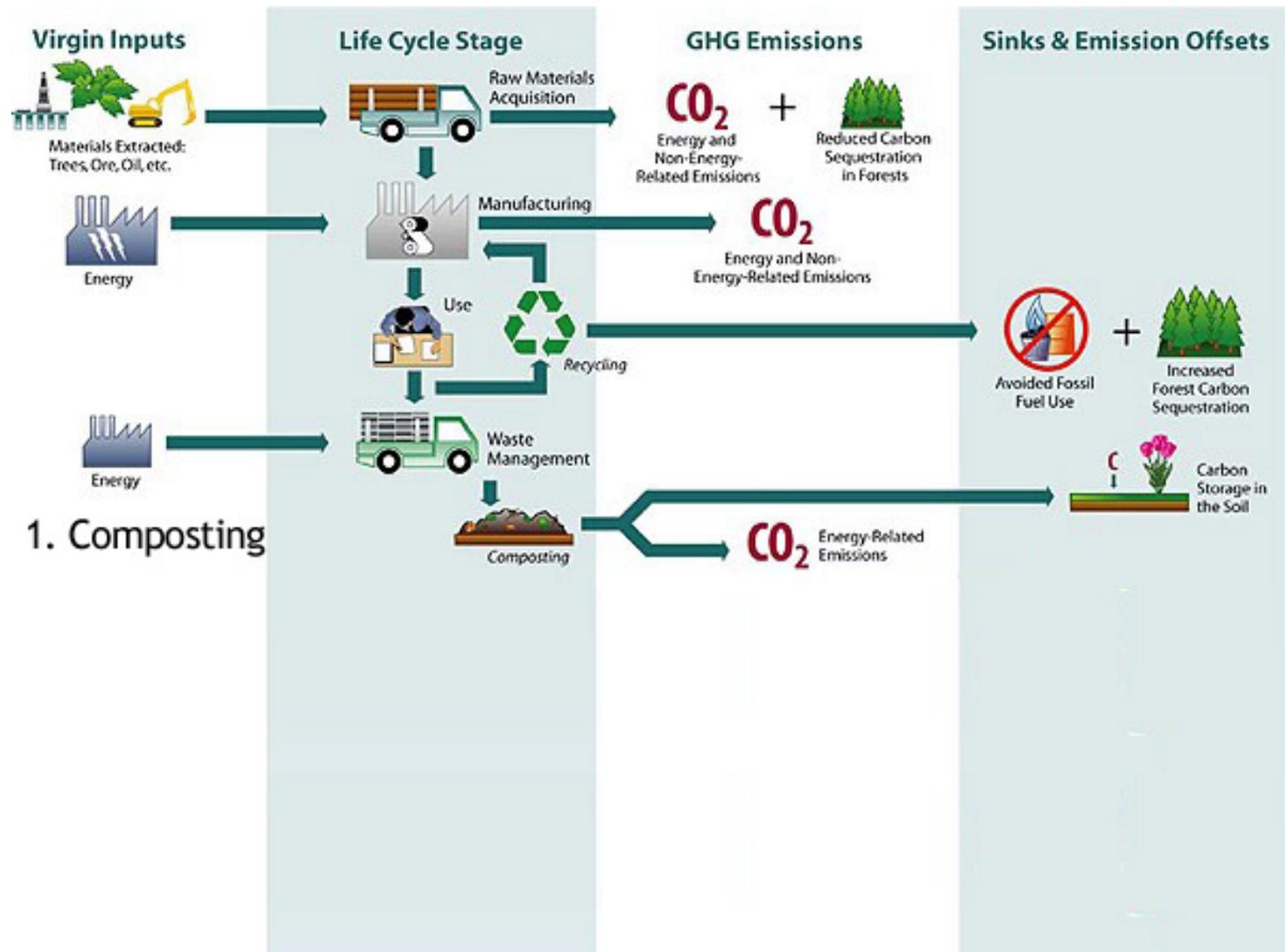
U.S. Population Density, 2000



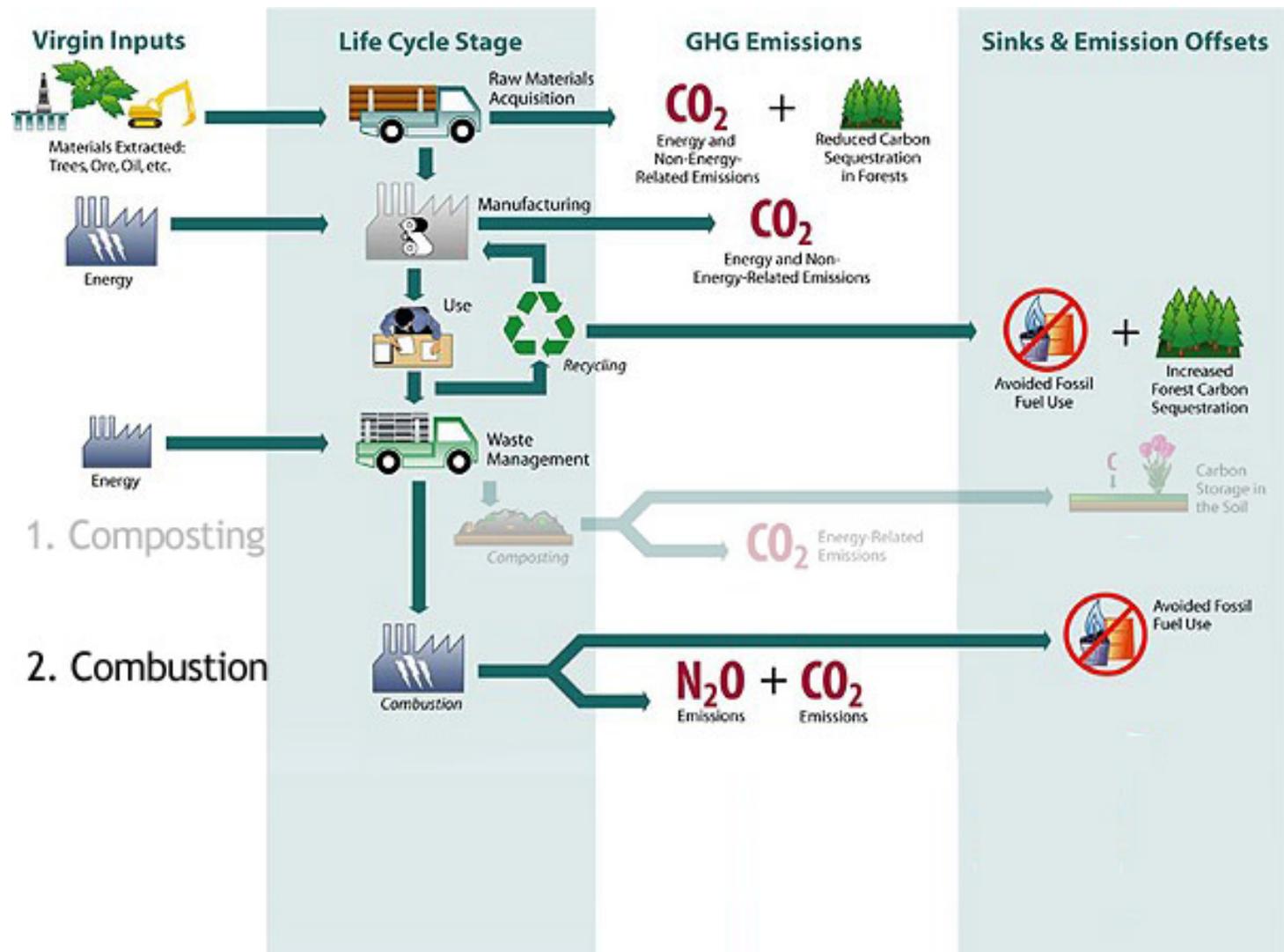
# Lifecycle Analysis - Recycling



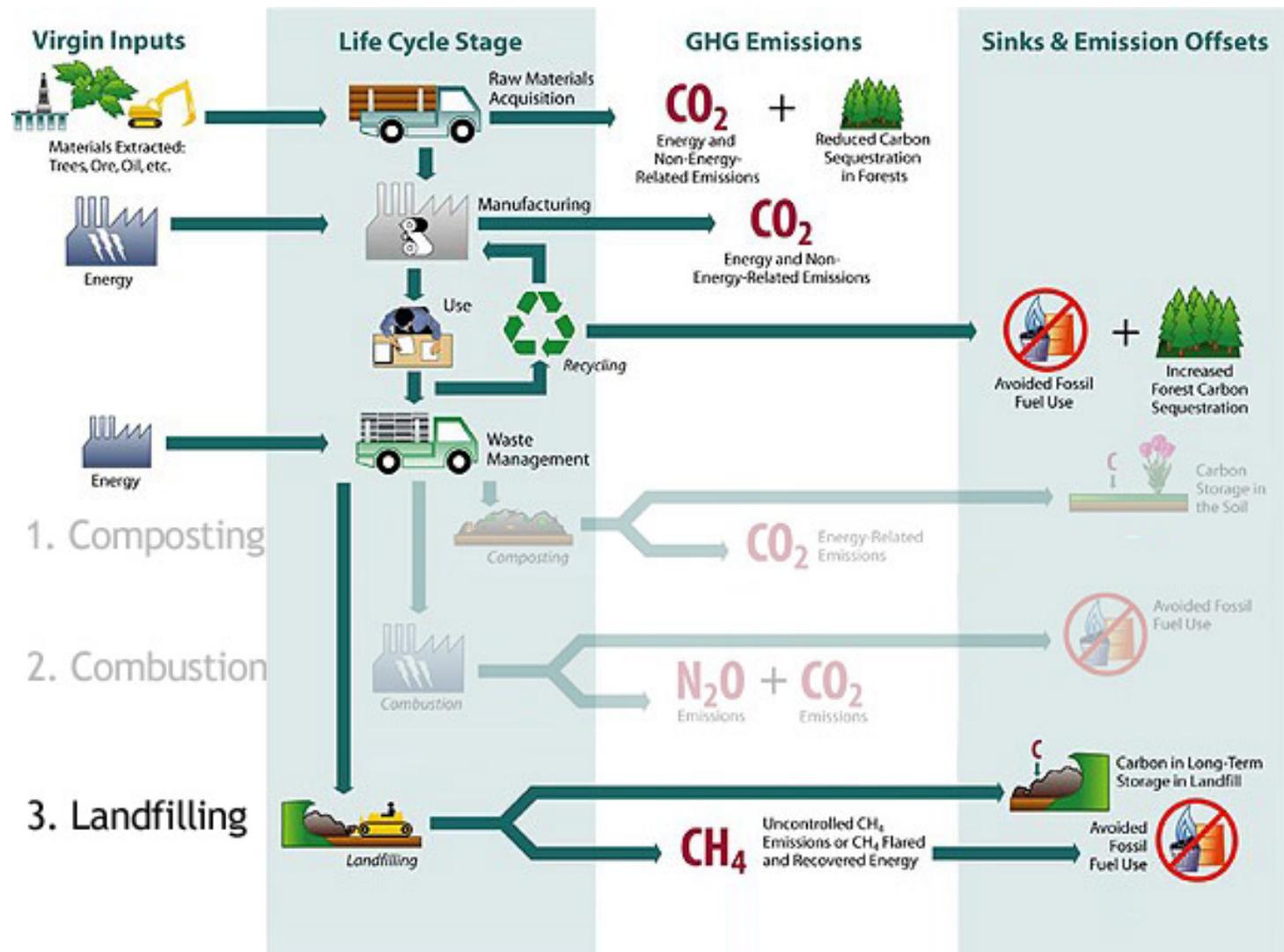
# Lifecycle Analysis - Composting



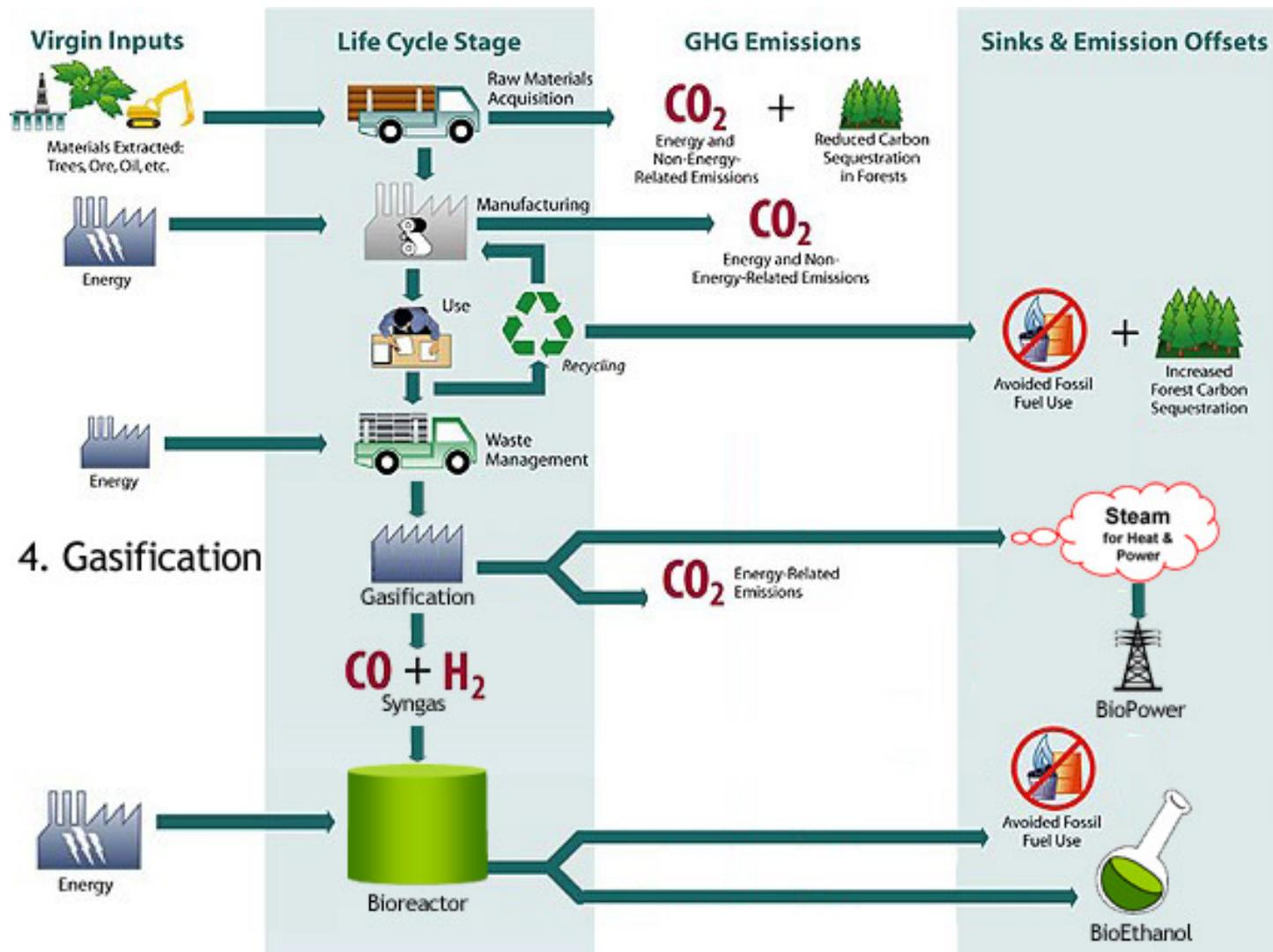
# Lifecycle Analysis - Combustion



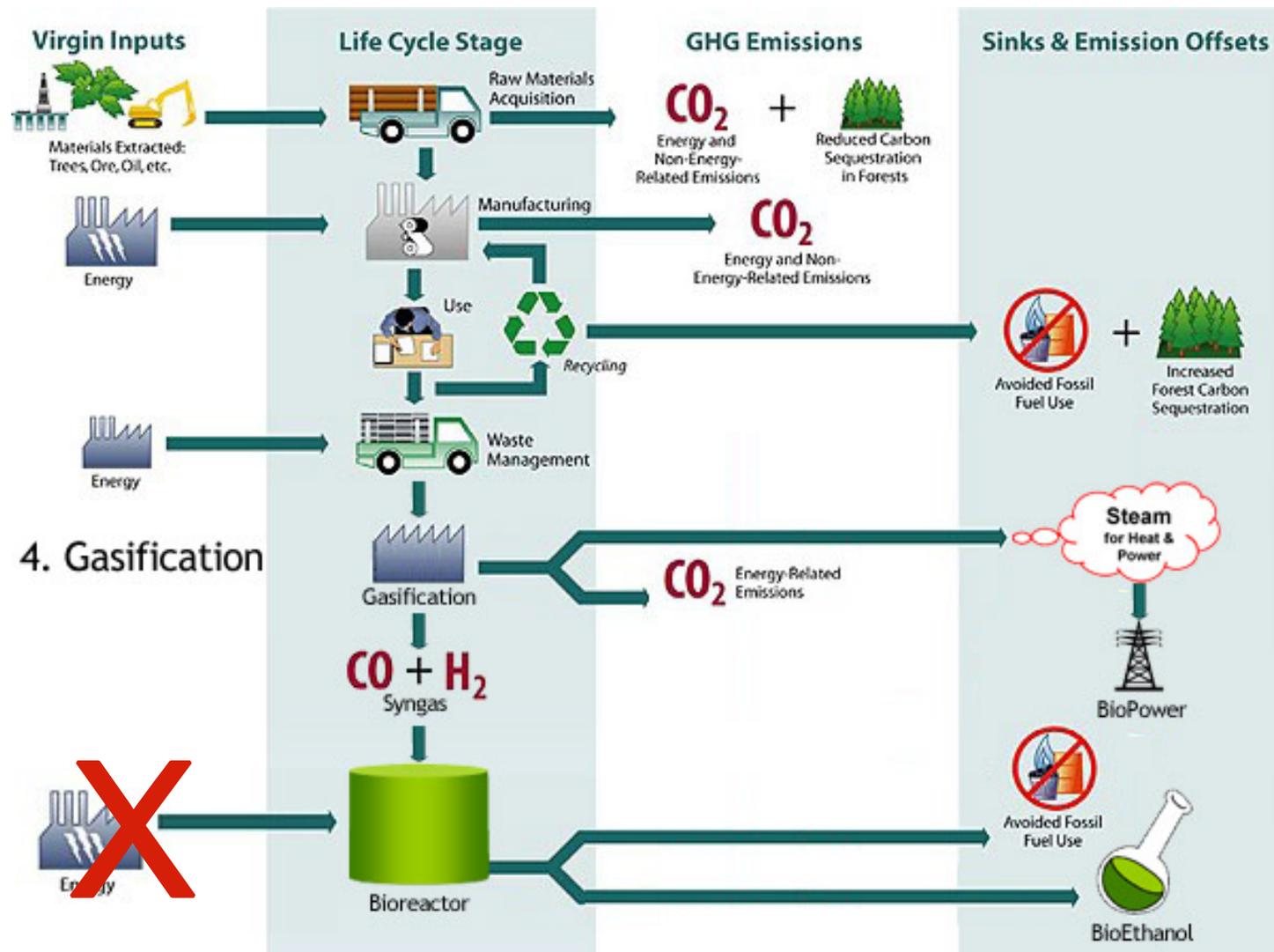
# Lifecycle Analysis - Landfilling



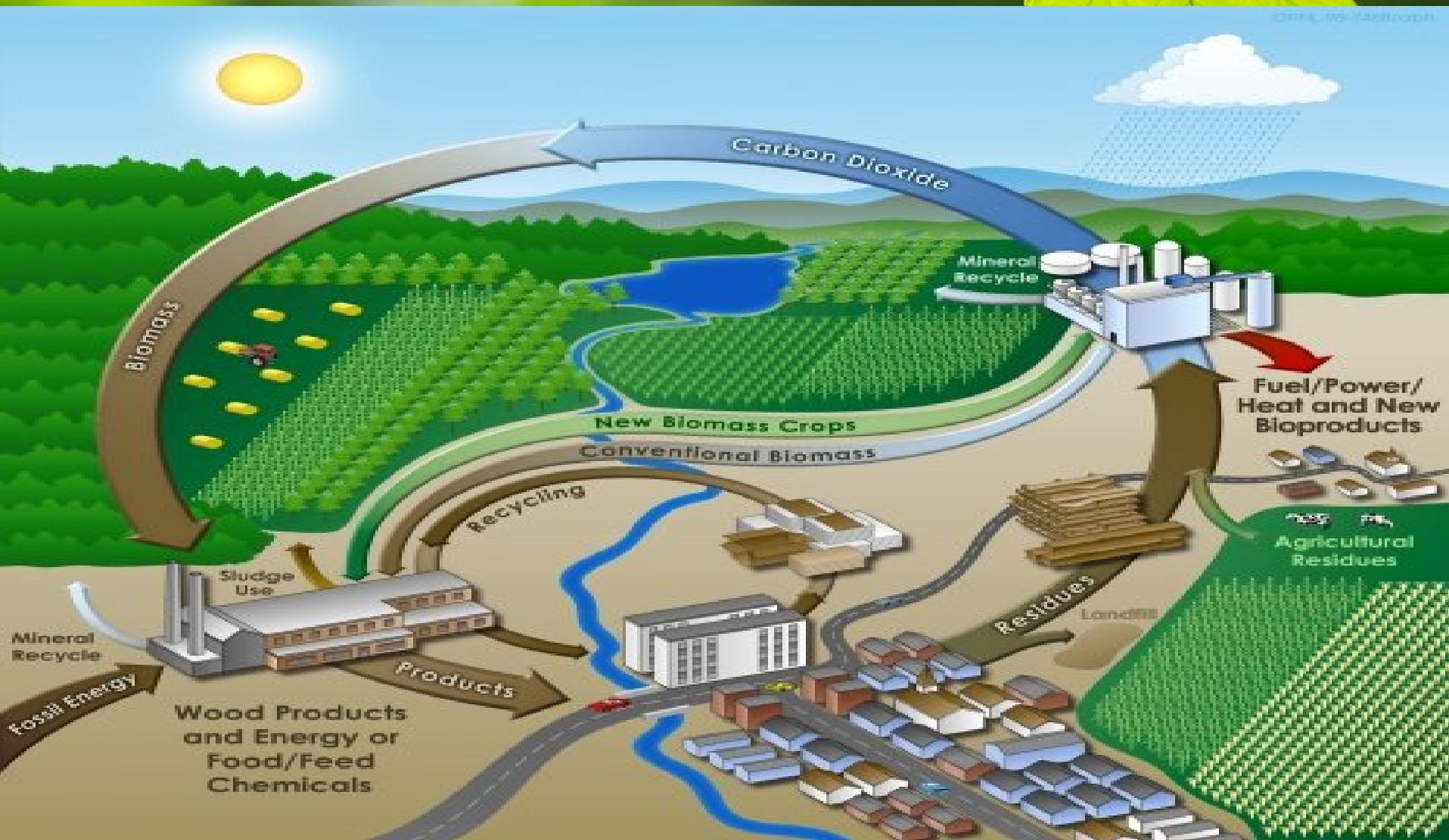
# Lifecycle Analysis - Gasification



# Lifecycle Analysis - Gasification



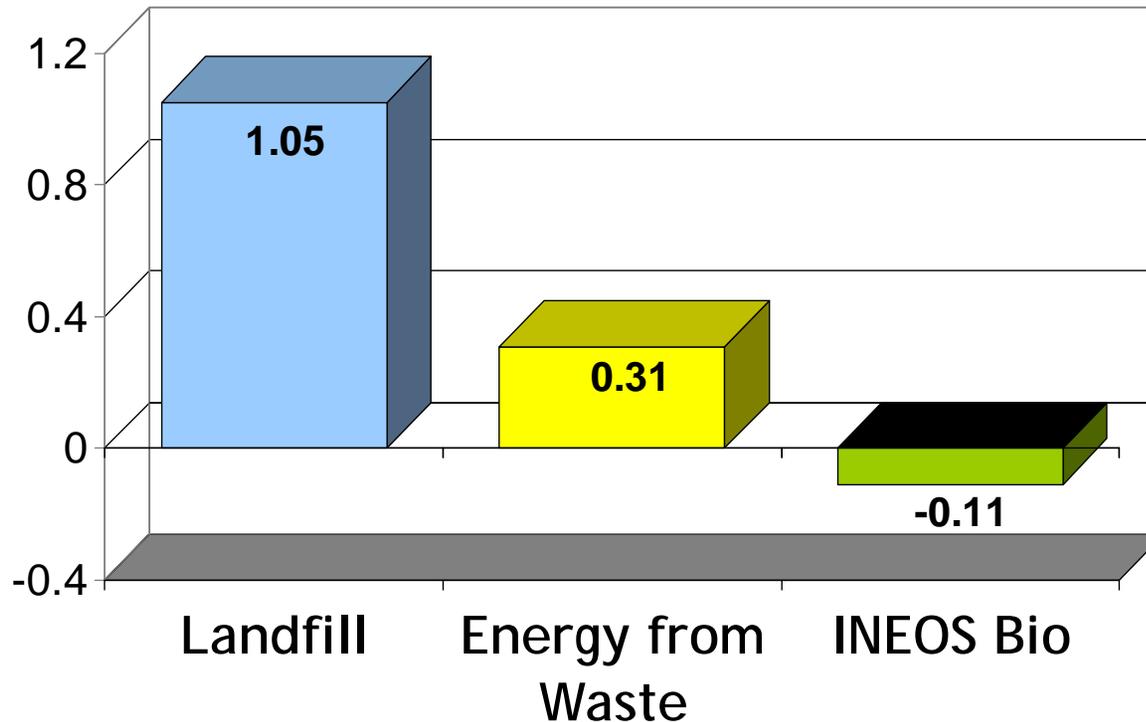
# Closed Cycle



# Life cycle assessment (LCA) - MSW

## Climate change impact

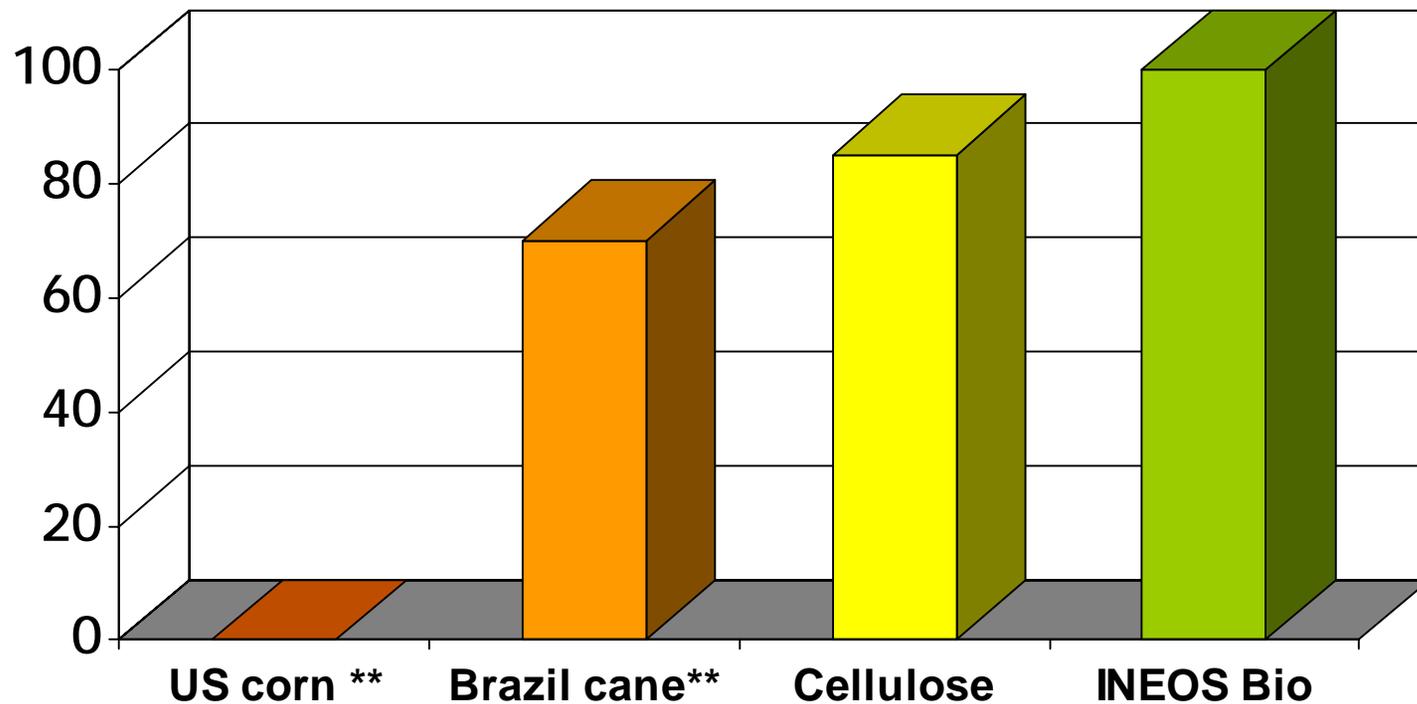
(Ton CO<sub>2</sub> eqv / Ton input waste)



>66% GHG savings using RDF (65% biomass) vs. gasoline

# Comparing different GHG savings

## GHG saving vs. gasoline (%)

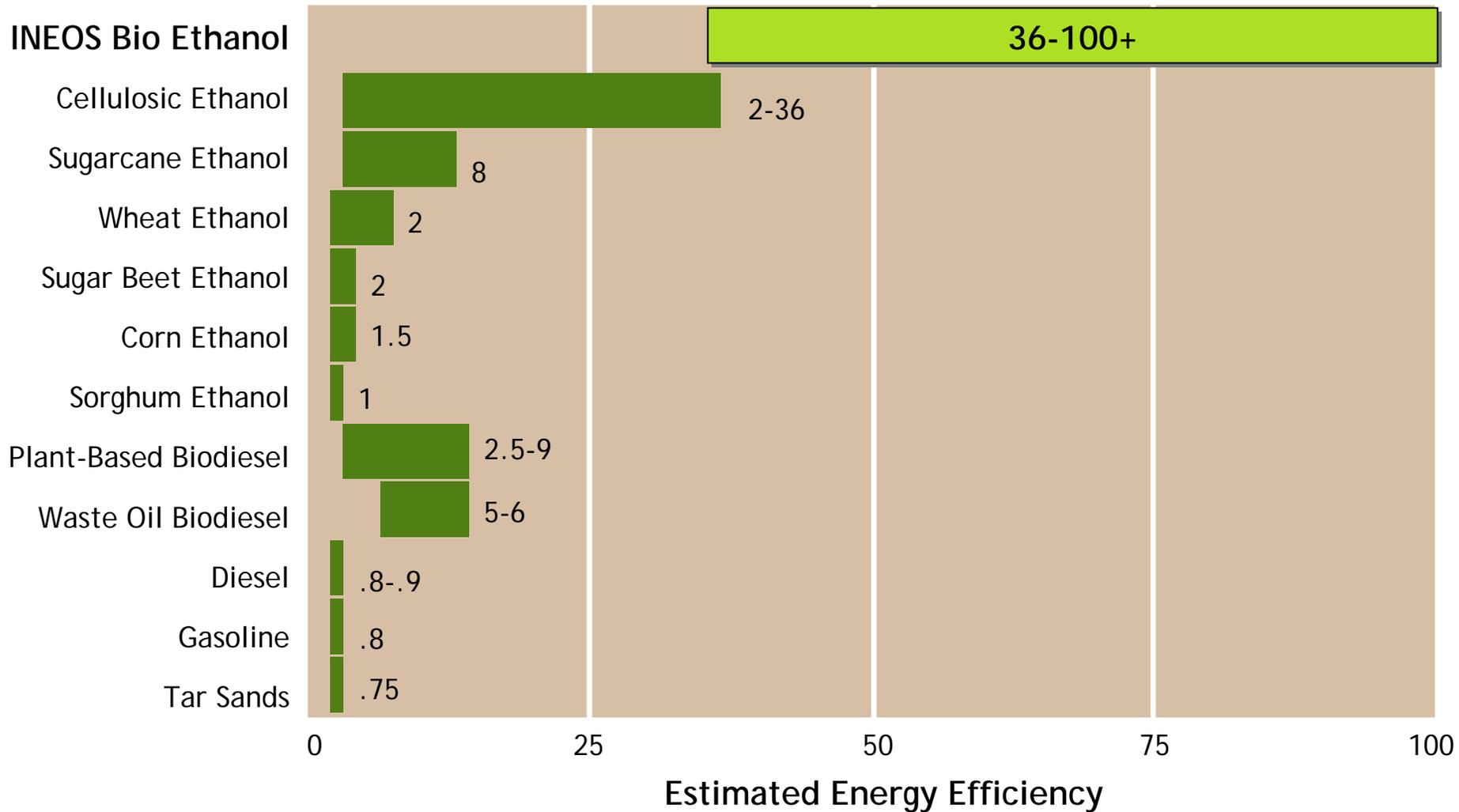


Life cycle calculations performed by Eunomia

*\*\*Renewable Fuels Agency default values*

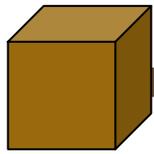
**INEOS Bio**

# Biofuel energy balances



# The INEOS Bio 3rd Generation Process

**Flexible  
Feedstock**



**High Heat  
Gasifier**

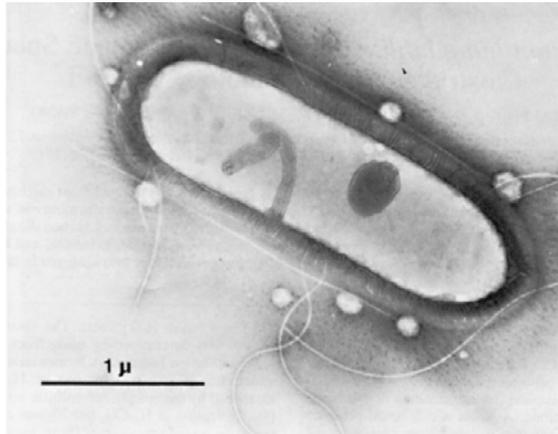
Ash

Syngas clean-up  
& heat recovery  
—  
Syngas (CO+H<sub>2</sub>)

Steam  
for Heat &  
Power



**BioPower**



**Bioreactor**

Dilute

Ethanol

**Distiller**

Water  
Recycled

**BioEthanol**

# 6 years of pilot plant work



## Advanced Gasifier

Commercial design @ 1.5 tons/day capacity - directly scalable to commercial operation



## Fermenter

Sized @ 1/10<sup>th</sup> commercial diameter to enable direct scale-up to full commercial design



## Distillation

Design supported by INEOS' position as Europe's largest synthetic ethanol manufacturer

# Secondary Alcohol Production



- INEOS Bio Process currently produces only ethanol
- Secondary products can include methanol, propanol, and butanol
- Development plans include optimized co-product yields
  - Biocatalysis enhancement
  - Separation / Purification optimization

# Commercialization plans are advanced



- Florida site selected for first project
  - Vegetative waste
  - Construction & Demolition
- Engineering underway
- Target on stream 2011

# INEOS is uniquely positioned to deliver

- Largest licensor of chemical process technology
- Extensive experience with technology scale-up and commercialization
- Well-developed Intellectual Property generation and protection processes
- Global presence with attractive INEOS sites for JV/own builds
- Biofuels experience

# A paradigm shift: Waste-to-sustainable bioenergy

- A sustainable solution
- A step change in green house gas emissions
- A real option to advance energy independence





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