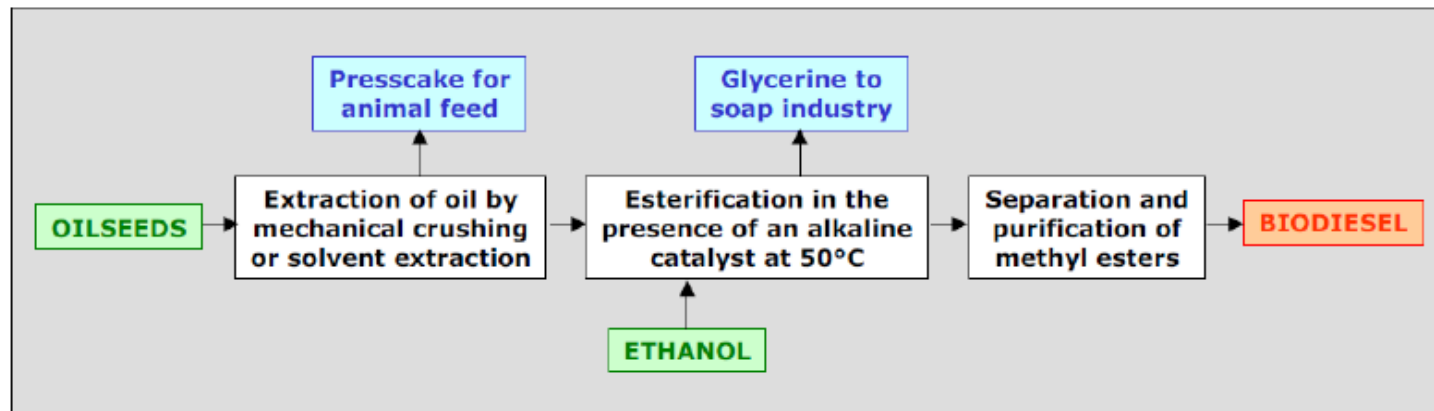


# Biodiesel

Rail Industry Perspective

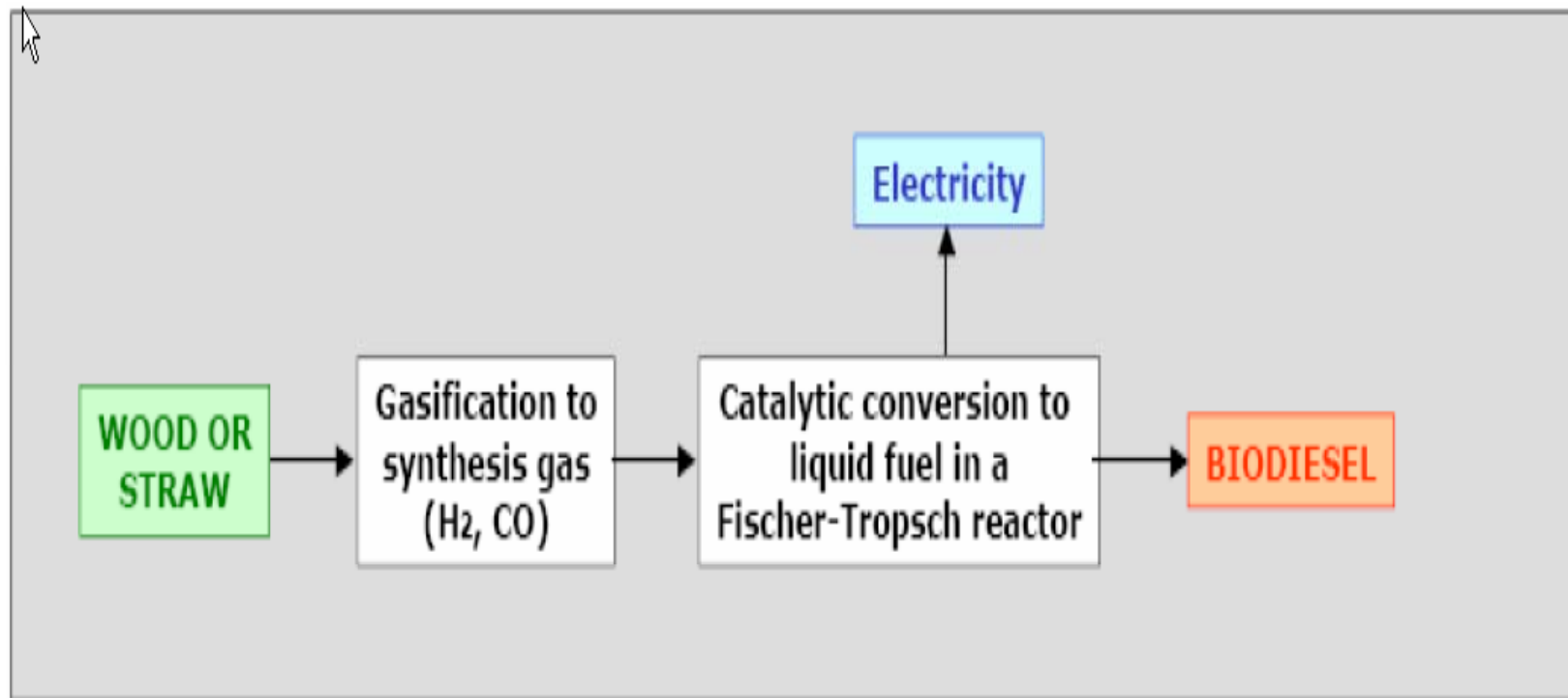
# Production of Biodiesel



Source: AEA, 2003<sup>3</sup>

# Production of Biodiesel

## Other Process



Source: AEA, 2003<sup>3</sup>

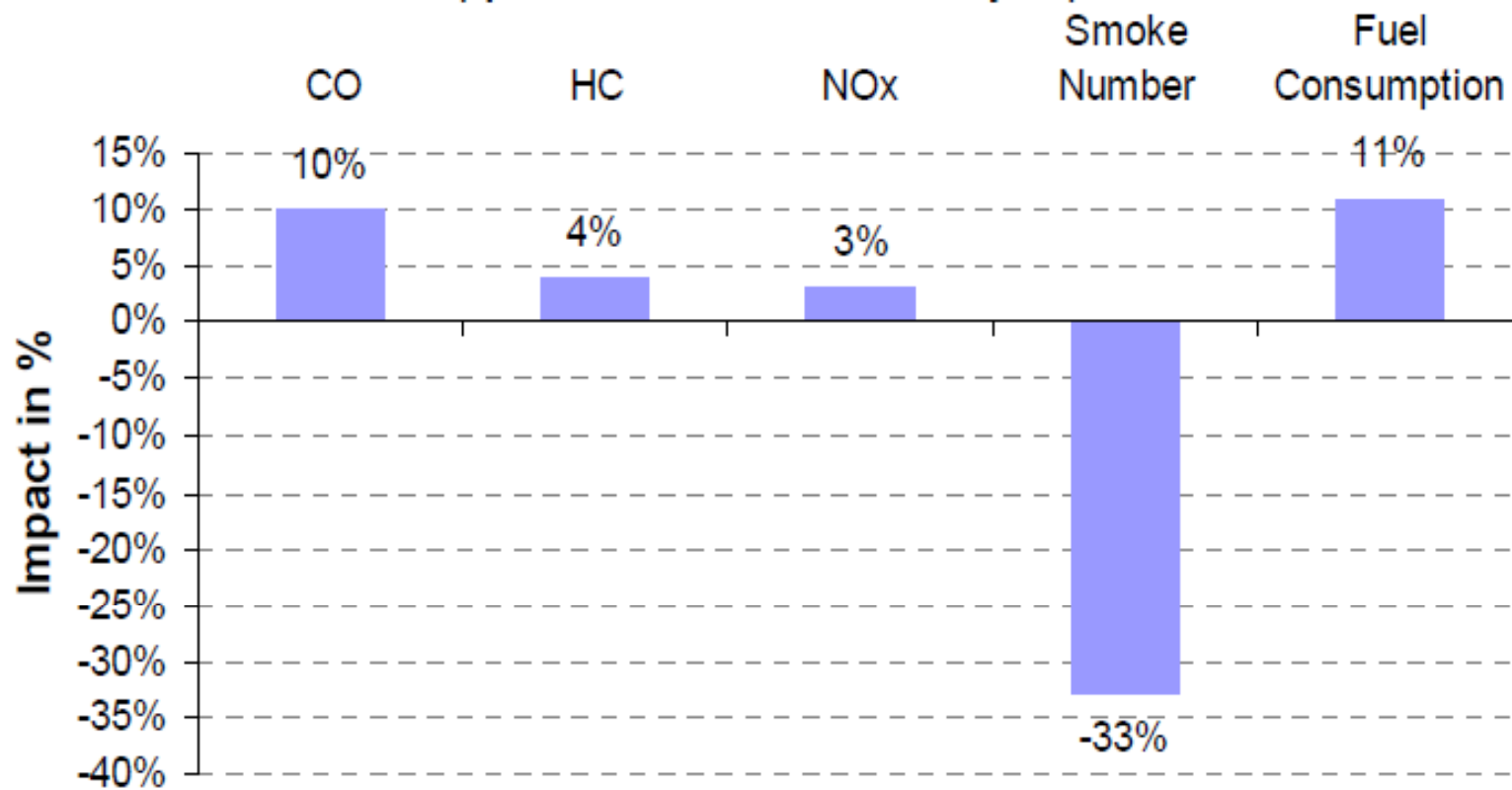
# Energy Balance

## Energy balances of Biodiesel crops

<b>Fuel</b>	<b>Ratio of energy content to energy used to produce the fuel</b>
Palm oil	Around 9
Waste vegetable oil	5 to 6
Soybeans	Around 3
Rapeseed	Around 2.5
Diesel (crude oil)	0.8 to 0.9

Source: Worldwatch Institute (2006) summarising the results of various studies

# Biodiesel vs Diesel



# Biodiesel advantages

- **Conservation of carbon stocks**
  - Protection of above-ground carbon
  - Protection of soil carbon
- **Conservation of biodiversity**
  - Conservation of important ecosystems & species
  - Basic good biodiversity practices
- **Sustainable use of water resources**
  - Efficient water use in water critical areas
  - Avoidance of diffuse water pollution
- **Maintenance of soil fertility**
  - Protection of soil structure and avoidance of erosion
  - Maintain nutrient status
  - Good fertiliser practice
- **Waste management**
  - Waste management complies with relevant legislation
  - Safe storage and segregation of waste”

WWF reference

# Good & Bad

- ***Benefits:***

- Reduced gaseous (except nitrogen oxides) and particulate emissions
- Minimal sulphur content (<10ppm)
- Higher cetane number and flash point
- Higher density/viscosity
- Improved lubricity
- Biodegradable and low toxicity
- Reduced energy content (by approximately 8-10%)

- ***Challenges:***

- More rapid lubricating oil degradation
- Increased fuel consumption
- Increased nitrogen oxide
- Poor low temperature starting and operation
- Poor oxidation stability and water absorption characteristics
- Incompatibility with certain elastomers and natural rubbers
- Degradation during long-term storage

# Challenges

- Clear regulation with sufficient lead time,
- Robust commercial infrastructure consistent with petroleum distribution
- Limited production capacity and infrastructure
- High quality feed stock with rigorous quality process.
- Shortage will create price increase ( 1 – 2 c/gal )



# Rail needs or Response

- 2.1 billion liters of diesel used by all RR
- 2011 : 420 M needed to meet requirements
- Existing production capacities:
  - Production target 500 M liters
  - Actual production: 11 plants for 471 M liters
- Legislation @ door step: still testing impact on engine
- Regional requirement variance is a concern
- NAFTA potential import restriction: requiring different standards

# Our concerns

- Cannot blend on our fueling facility,
- Limited ability to add or modify the blend in changing seasons,
- Want to be able to import diesel without limitation
- Transportation to various location with different mix