

BIOFUELS

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Overview:

- Depletion of fossil fuel has led to increase in its prices, which has affected all sectors of the economy.
- Biofuels can be used to replace fossil fuels without significant change in infrastructure.
- Three main problems associated with biofuels **efficiency, carbon emissions and food vs. fuel dilemma.**

EFFICIENCY

Petrol contains 11.8 kWh/kg of energy and has a thermal efficiency of 25% – 30%.

Ethanol contains 6.3kWh/kg of energy and has a thermal efficiency 16.5% - 19.8%.

Corn ethanol gives a net energy output of 124%

Solution:

- Direct Ethanol Fuel Cell (DEFC) to run cars instead of combustion engines (Figure1).
- Use switchgrass to produce ethanol.

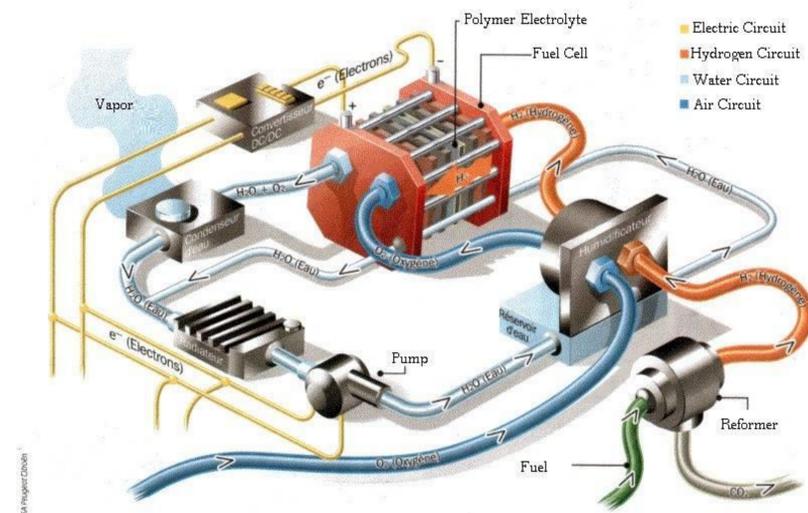


Figure.1: Fuel cell diagram [1]

Evaluation:

- Switchgrass net energy output of 540%.
- DEFC has a thermal efficiency of 97%.

CARBON EMISSIONS

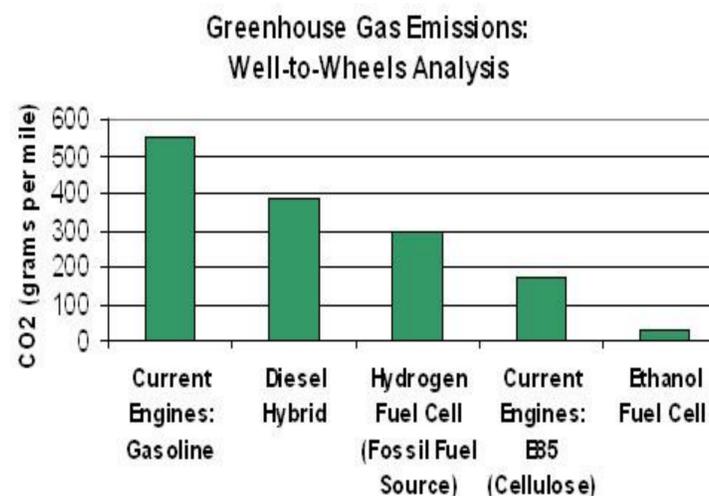
Combustion engines running on petrol produce 550 grams per mile of CO₂.

Combustion engines running on Ethanol 85 produce 180 grams per mile of CO₂ (Table.1).

Solution:

- DEFC uses electrolysis, hence no combustion.
- Switchgrass acts as a carbon sink, it takes in CO₂ during the production phase.

Table.1: Carbon emissions of engines [2]



Evaluation:

- DEFC reduces CO₂ emissions to 40grams per mile.
- 64% reduction in emissions using switchgrass in combustion engines.

FOOD vs. FUEL

Larger lands are needed as food crop are diverted for fuel needs. Biofuel driven expansion of ethanol has increased the prices of maize crop by 21% in 2009 in the USA [3].

Solution:

- Crop waste.
- Switchgrass.
- Algae grown on waste water.

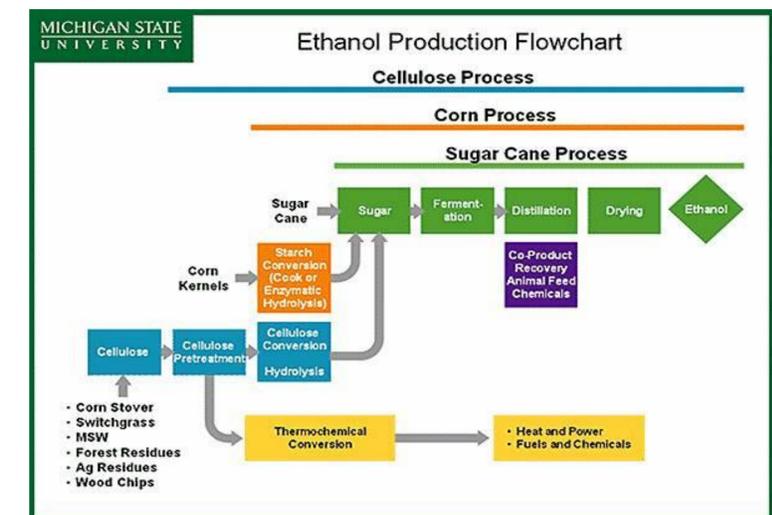


Figure.2: Ethanol Production Flowchart [4]

Evaluation:

- Crop waste is otherwise disposed of.
- Switchgrass is not food and grows on marginal lands.
- Algae is not part of human food chain.

References

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- Bruce E. Dale, " Why Cellulosic Ethanol is Nearer Than You May Think," NACAA Conference, July 16, 2007.