



Renewable fuels & the environment: Why canola biodiesel?

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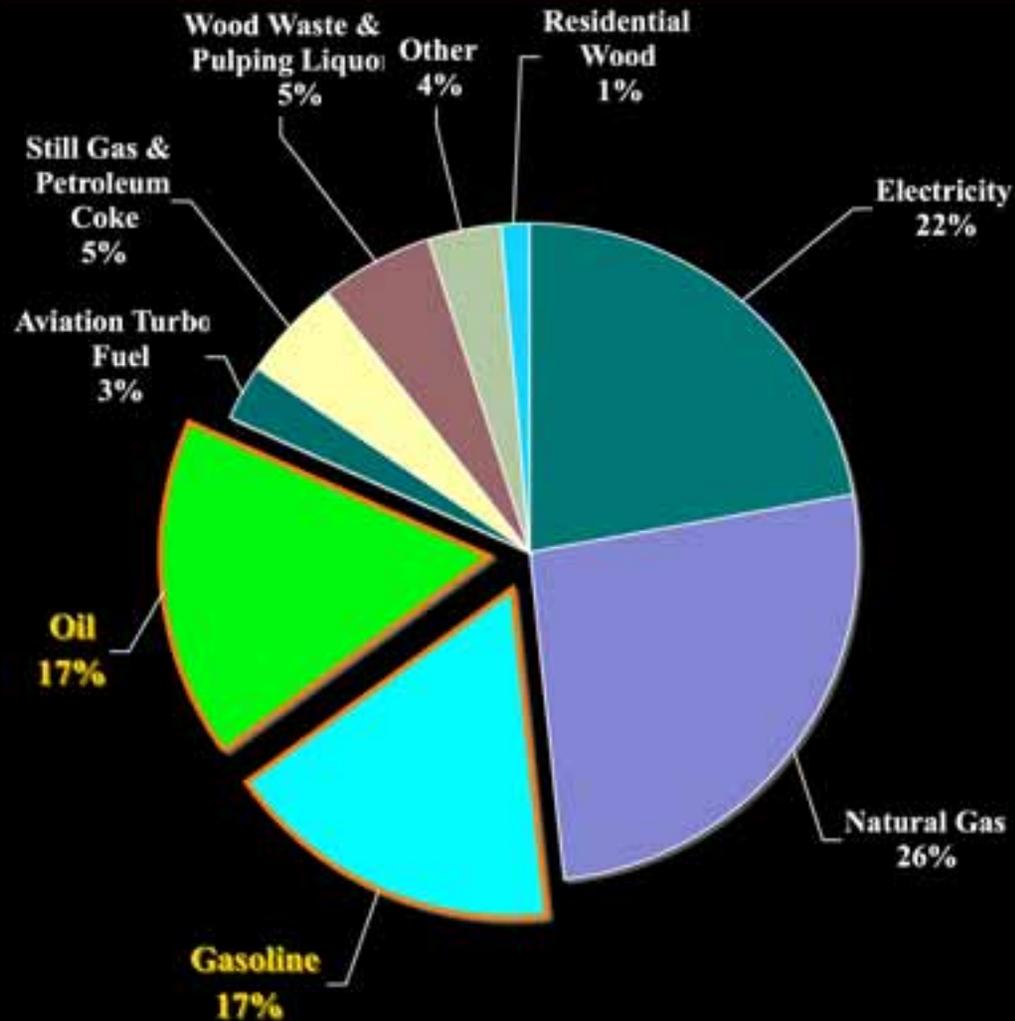
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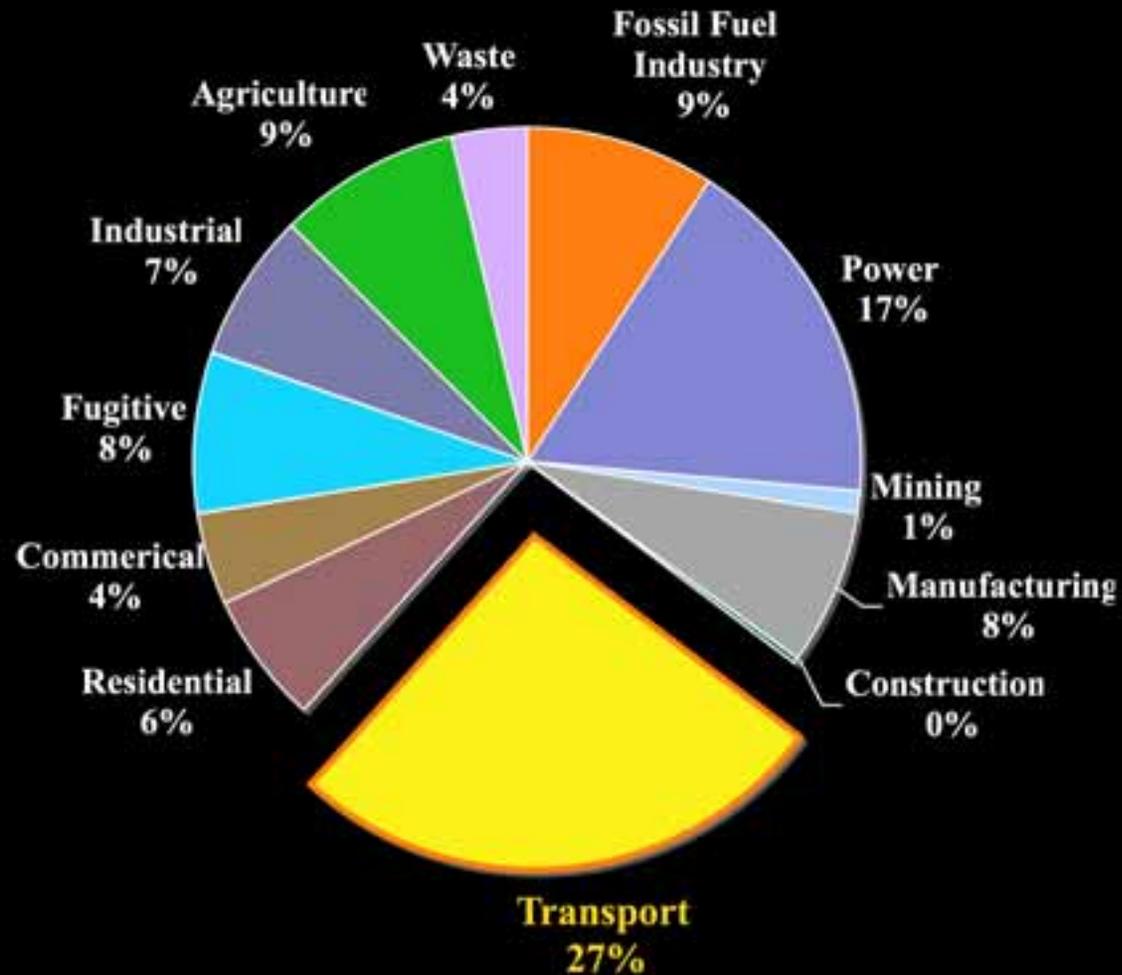
The challenge!

- Meeting energy needs via options that are:
 - Economically viable, AND
 - Energetically sound, AND
 - Environmentally beneficial

Primary energy in Canada



Canada's GHG Emissions Pie 2000



The challenge

- Reduce reliance on exhaustible liquid fuels
 - Drive less
 - More efficient vehicles
 - Renewable fuels

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 - Renewable fuels
 - Renewable fuels could be environmentally restorative ...

The diesel opportunity

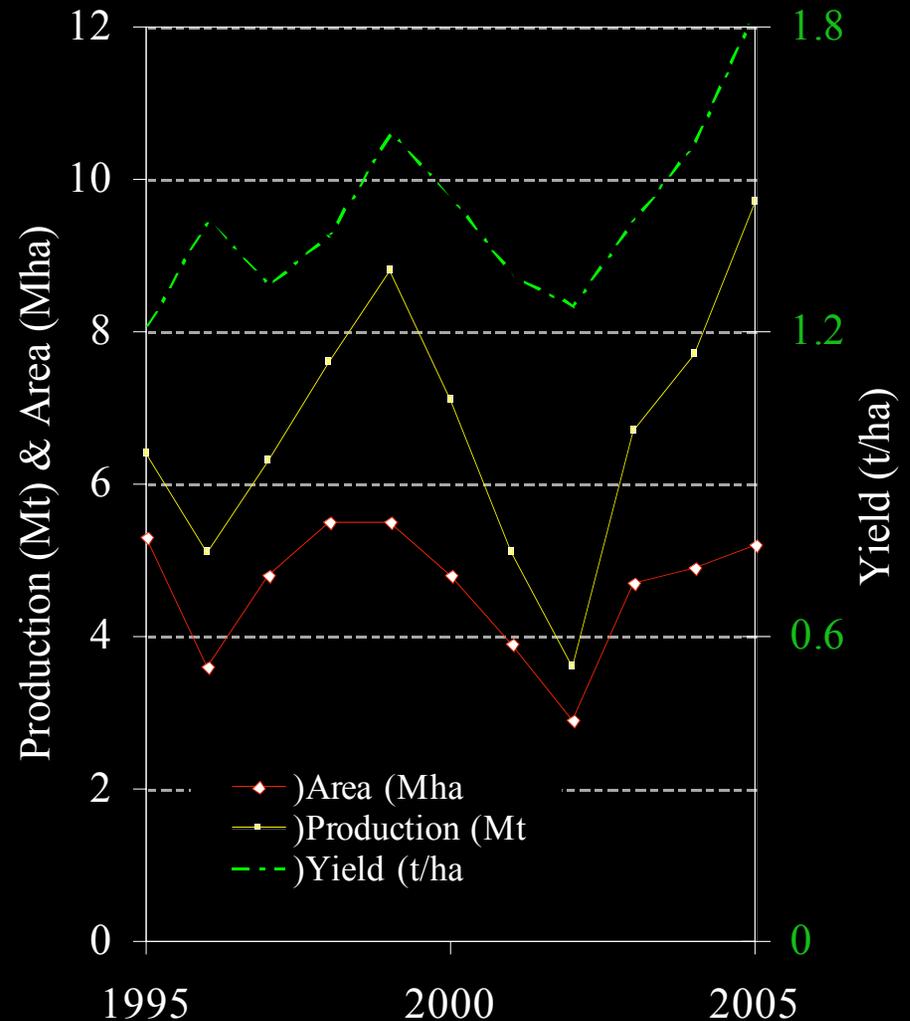
- Direct injection technology has made diesels more desirable to a broader range of consumers.
- Biodiesel can be used without modification in existing diesel engines.
- Biodiesel blended with ultra low sulphur diesel permits the adoption of pollution control technologies that eliminate diesel-gasoline differences in NO_x and particulate emissions.

Evaluation

- Will the production of biodiesel:
 - Put food production at risk (land & water)?
 - Take more energy to produce than yield?
 - Emit more GHG emissions than dino-diesel?
 - Worsen air quality?
 - Exacerbate exposure to toxic chemicals?
 - Harm the environment in accidental spills?

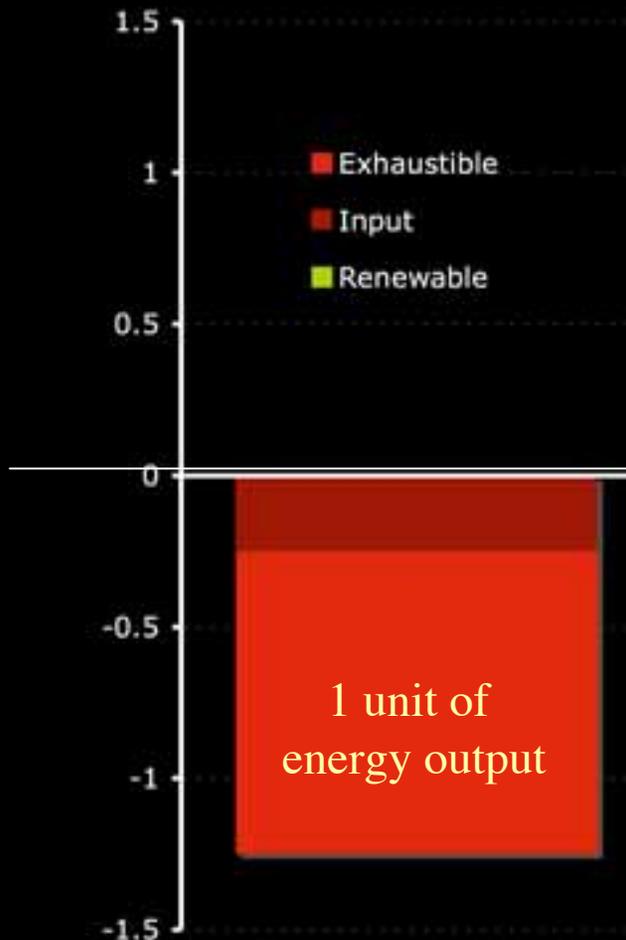
Canola production

- Over the past 10 years, between 3.6 and 5.5 Mha of canola has been harvested.
- The total production has fluctuated from 3.6 to 9.7 Mt.
- The yield has risen from 1.2 to 1.8 t/ha.
- The fluctuations have been due to market & weather conditions.
- Canola is almost always grown with available moisture.

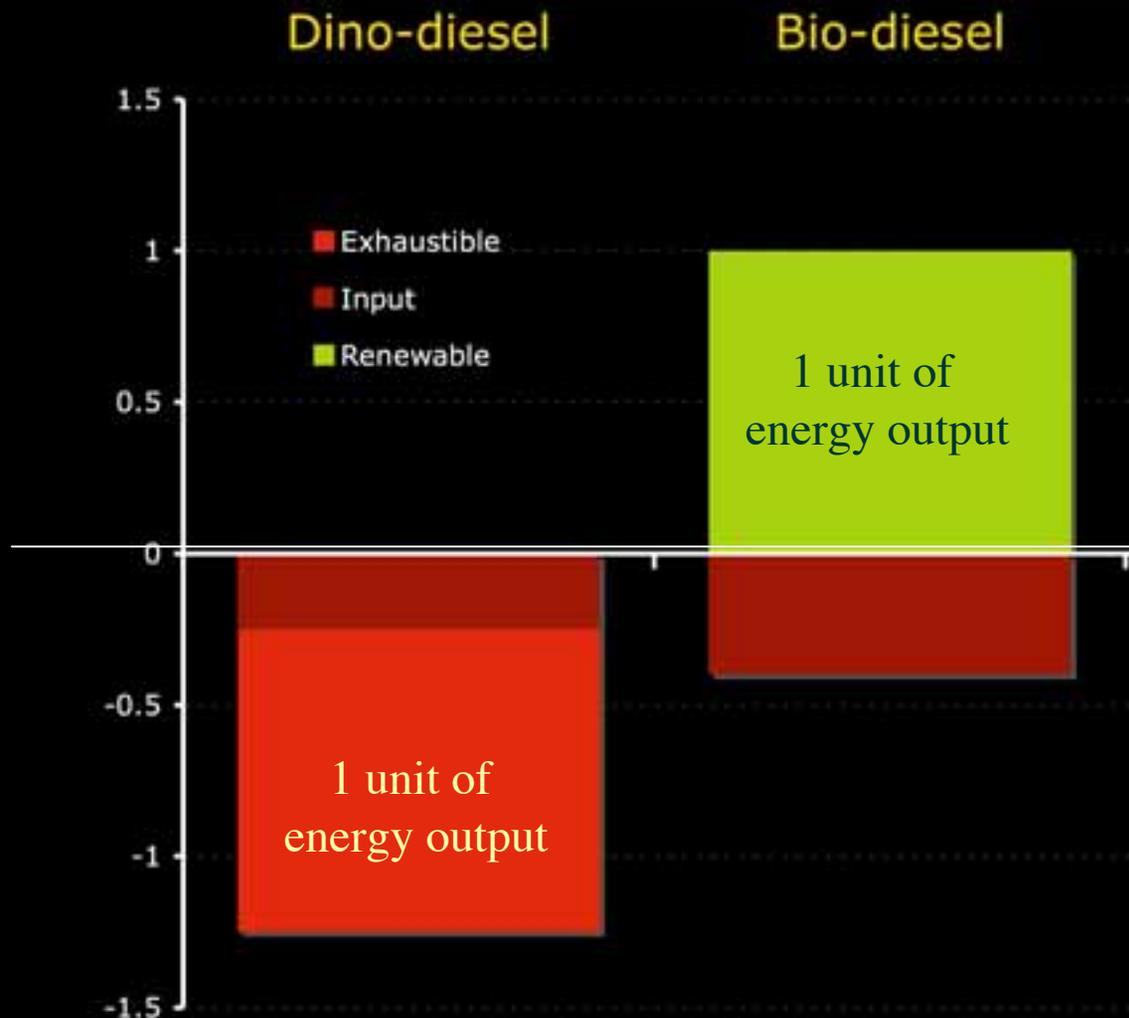


Energy inputs/outputs 2005

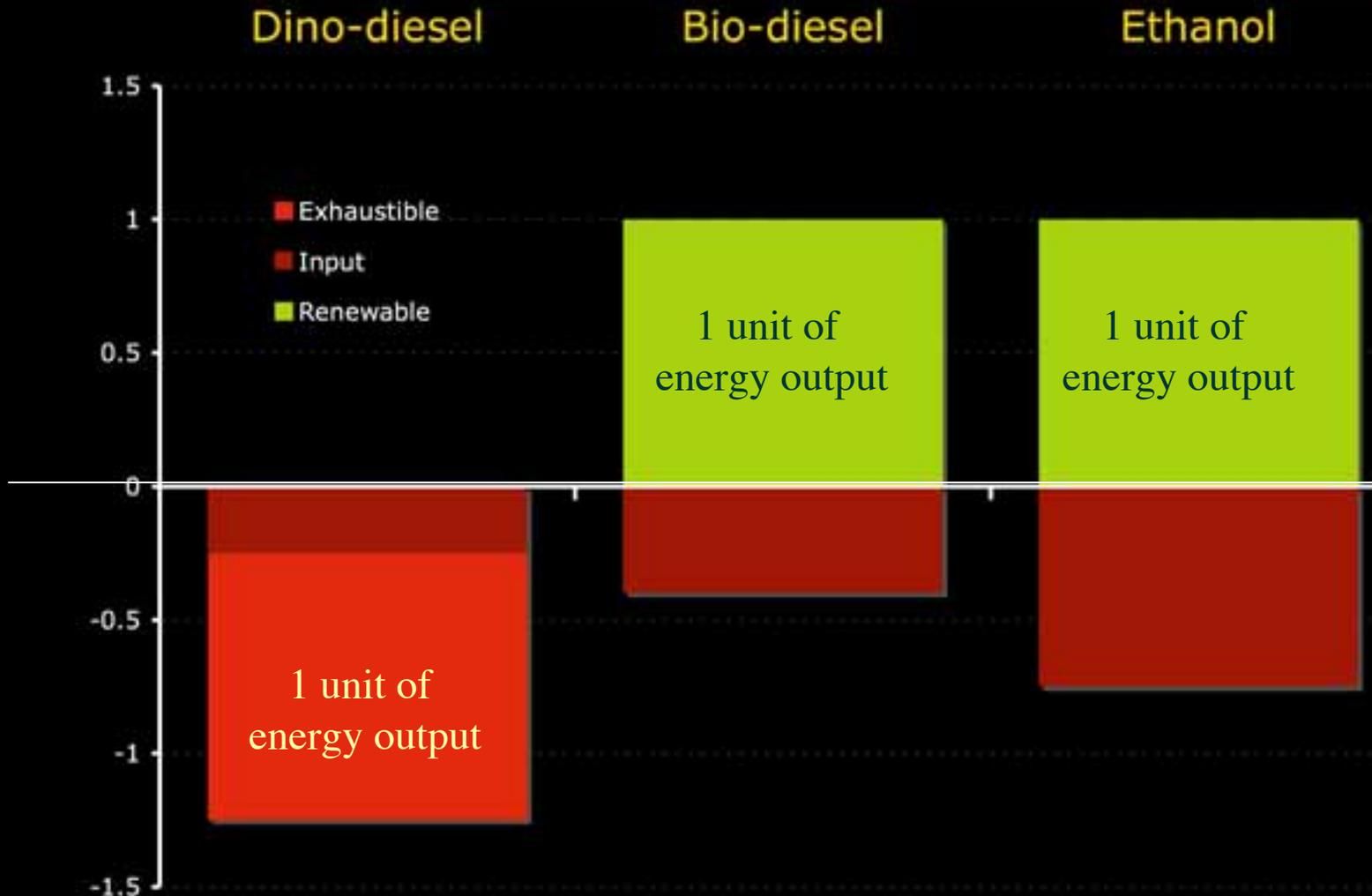
Dino-diesel



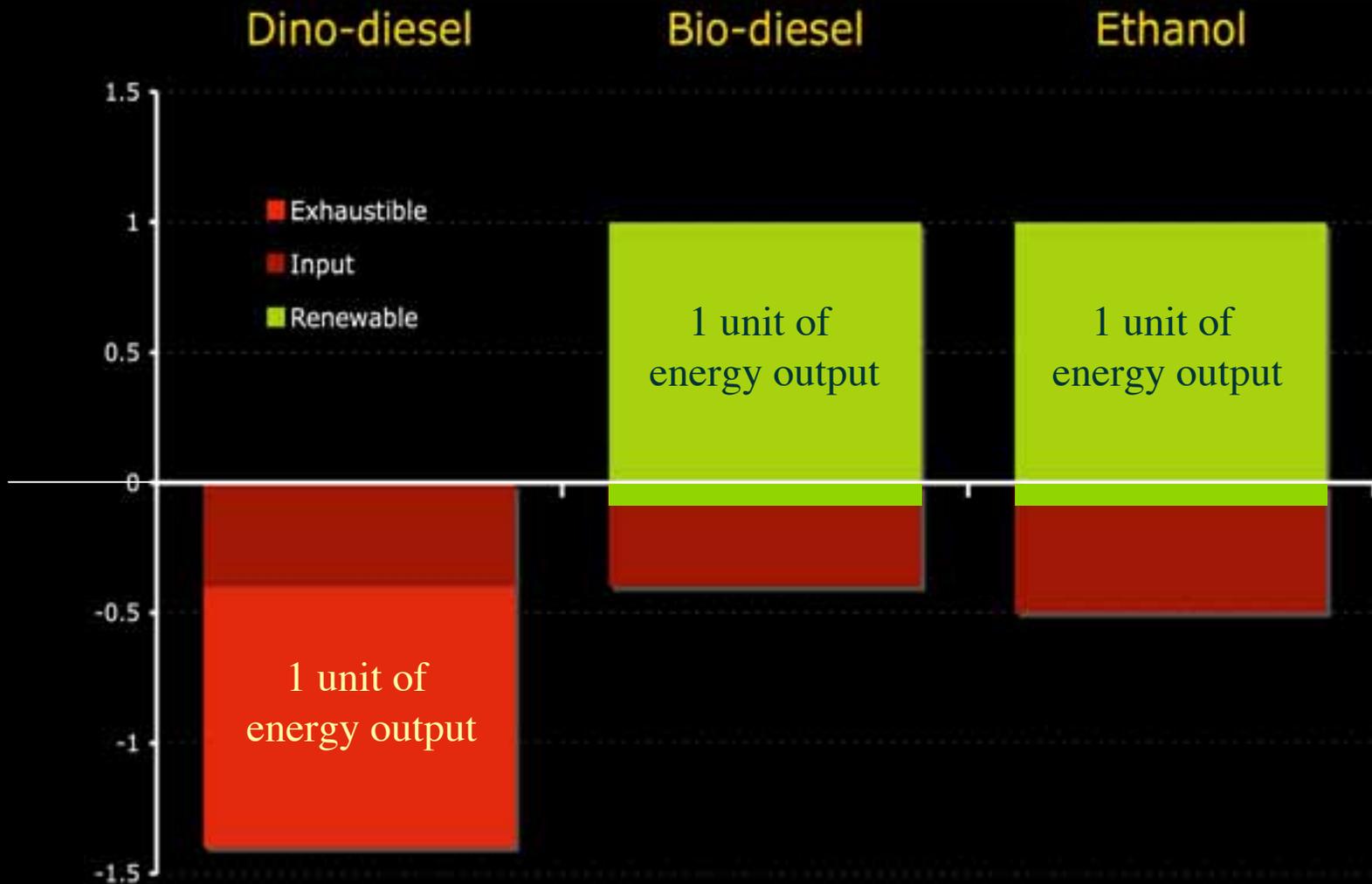
Energy inputs/outputs 2005



Energy inputs/outputs 2005



Energy inputs/outputs 2025

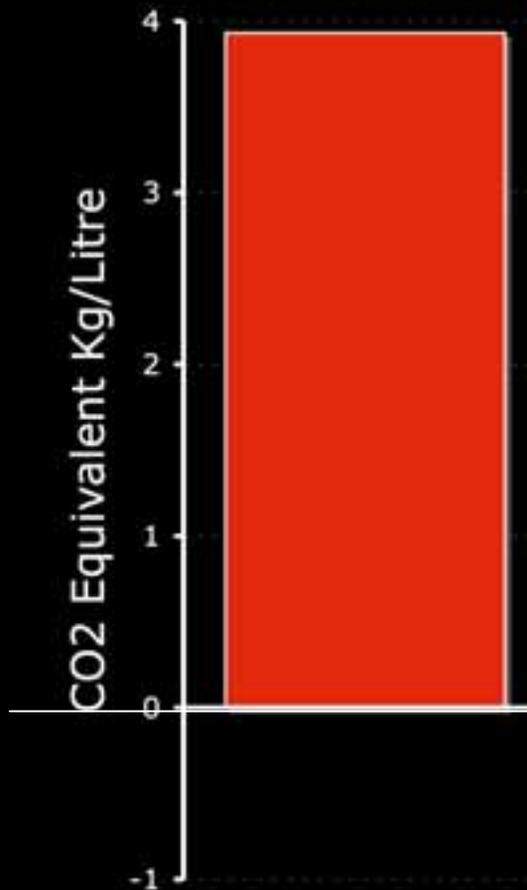


Climate impacts

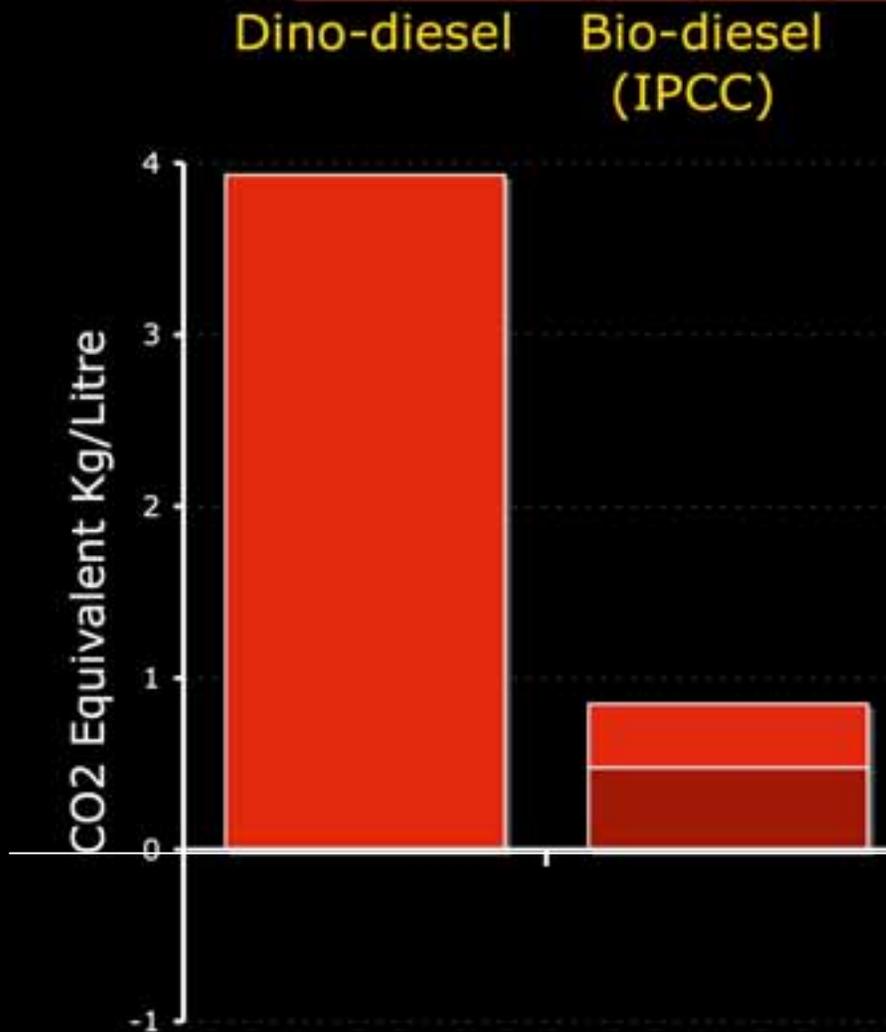
- We all know that climate change is, to a large measure, due to combustion of fossil fuels.
- We also know that there are greenhouse gas emissions in farming and industrial chemicals.
- The question is whether in producing biodiesel we emit more of these gases than we would by displacing dino-diesel.

Greenhouse gas emissions

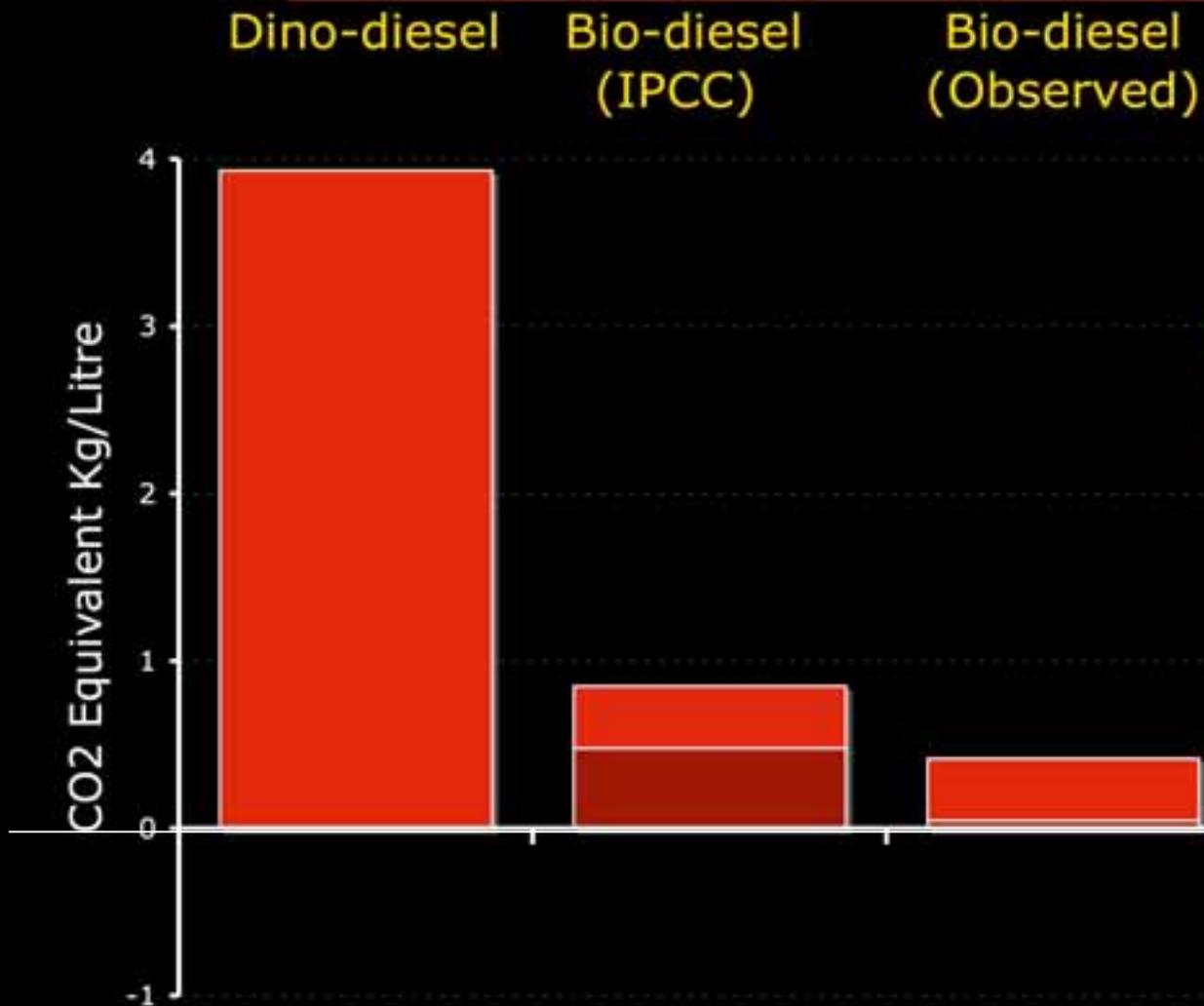
Dino-diesel



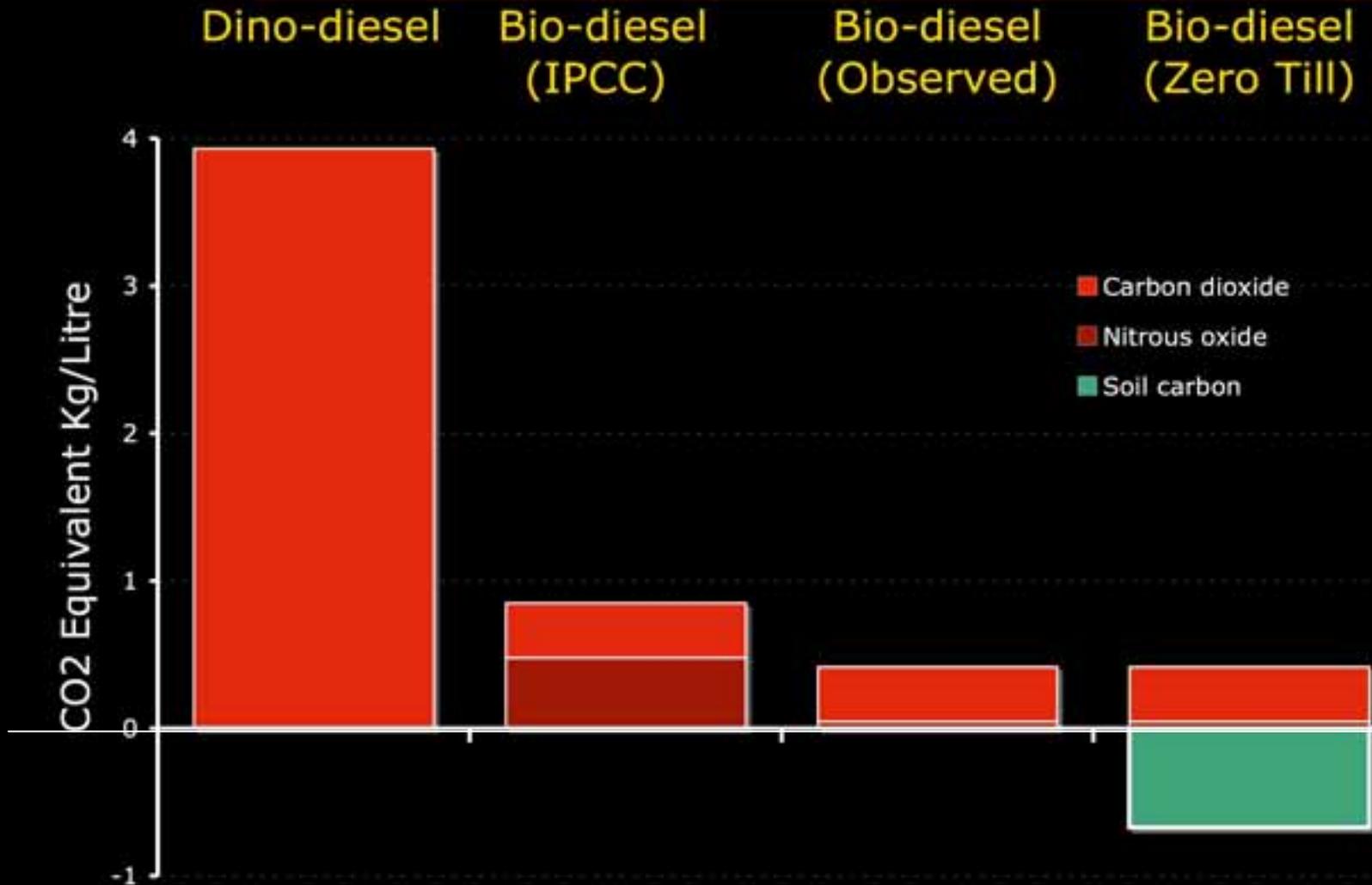
Greenhouse gas emissions



Greenhouse gas emissions



Greenhouse gas emissions

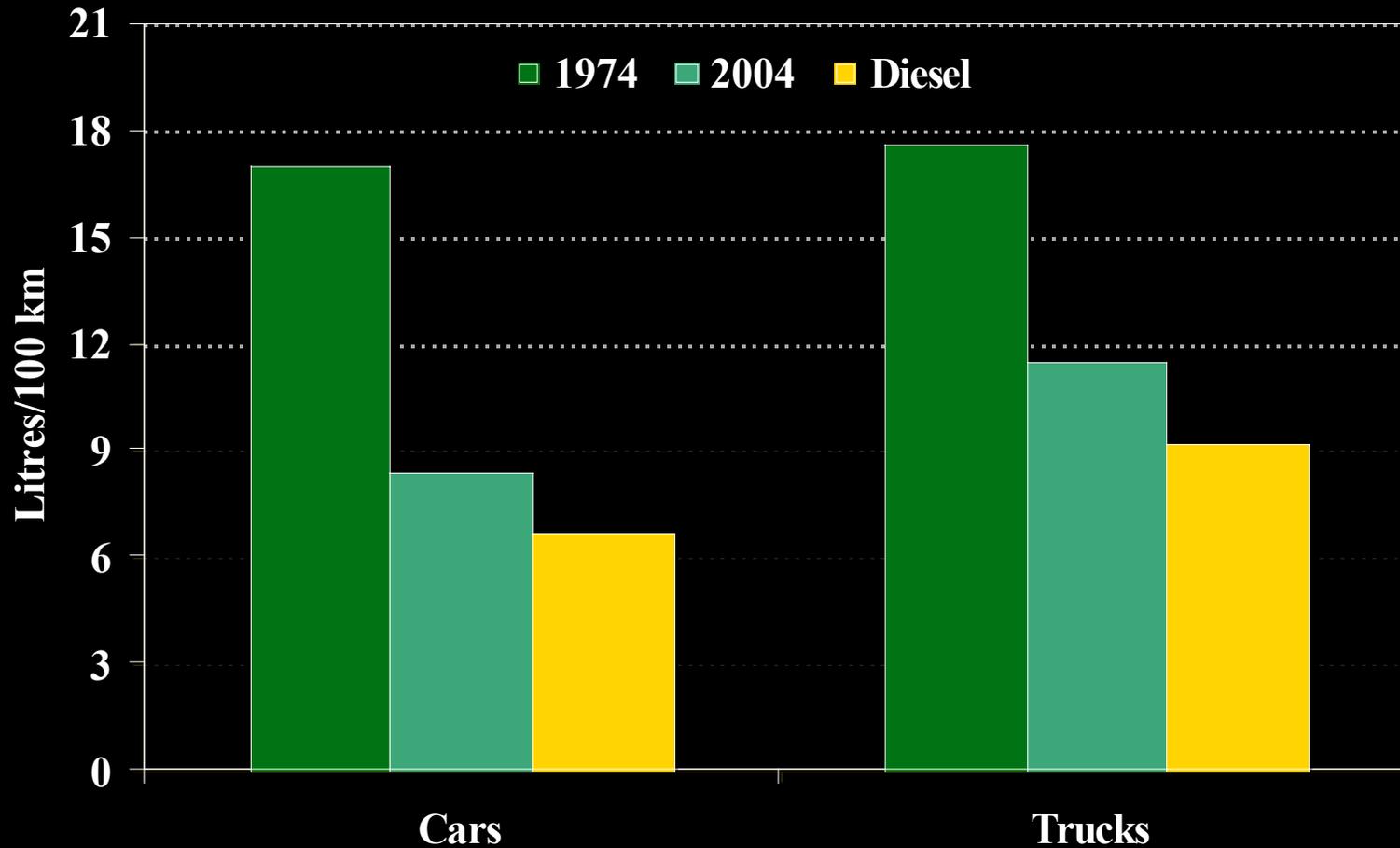


Use efficiency

- Over the past thirty years, auto and truck propulsion systems have become 30% more efficient.
- However, most of that efficiency gain is lost in marketing.
- Consumers have opted to buy
 - larger vehicles,
 - that have more power and torque!

Use efficiency

The Alliance of Auto Manufacturers (2006)



Air quality impacts

- Sunlight, nitrogen oxides (O_x) and reactive organic gases (ROGs) are the ingredients that lead to formation of smog and ground level ozone.
 - Bio-diesel combustion in older engines produces marginally more NO_x .
 - Biodiesel reduces emissions of reactive organic gases.
 - Models using B20 in all heavy duty vehicles in the Los Angeles air shed show no impact on ozone concentration and health effects.
- Carbon monoxide (CO) emissions are lower with biodiesel.
- Particulate emissions are lower with biodiesel.

Air toxics

- Diesel fuel fumes are considered hazardous because they are the source of volatile organic chemicals considered to be noxious and carcinogenic.
- Biodiesel does not contain these chemicals.
- Biodiesel blends change the evaporation characteristics of the fuel and toxic emissions are significantly lower.
- Models using B20 in all heavy duty vehicles in the Los Angeles air shed show significant reductions in adverse health effects from exposure to toxic emissions.

Oil & oil product spills

- In Canada we average 3500 spills per year.
- The average spill discharged 9 tons of oil / products.
- Bio-diesel:
 - Biodegrades in 1-2 weeks five times faster than dino-diesel.
 - Is at least four times less toxic in terrestrial and aquatic ecosystems than dino-diesel.
 - As an additive, it helps in the clean up of dino-diesel spills by promoting its breakdown and bioavailability.

Summary

- The production of biodiesel:
 - Will not impact food production.
 - Will not be an additional demand on water resources.
 - Generates 2.5 times more renewable energy than energy put into its production.
 - Saves at least 3 kgCO_{2eq} per litre of fuel.
 - Improves air quality where it is ROG limited.
 - Reduces exposure to toxic emissions.
 - Helps the environment recover more quickly in the event of spills.

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