Ethanol: When tradition becomes modernity

Prof. Gonçalo Pereira

SUSTAINABLE MOBILITY: ETHANOL TALKS INDIA

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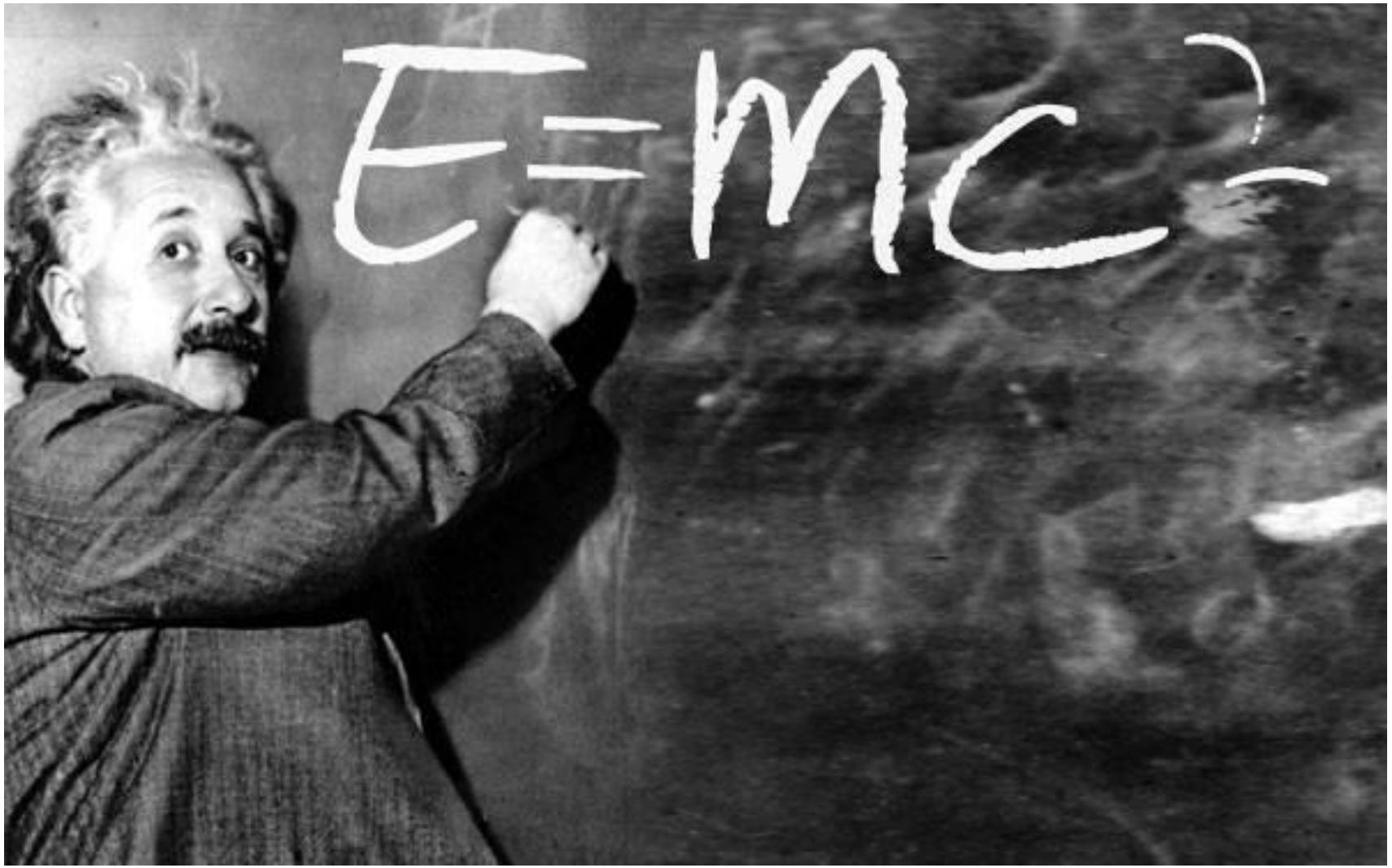
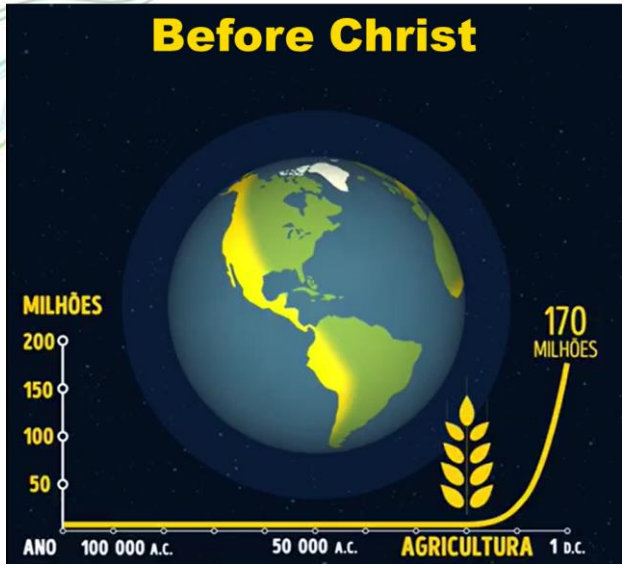
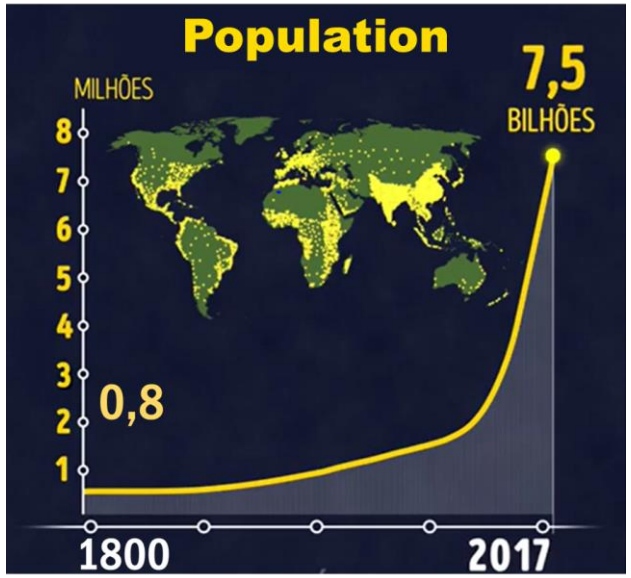
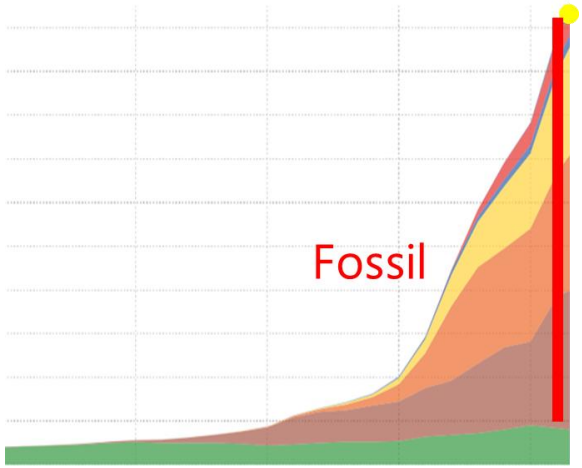
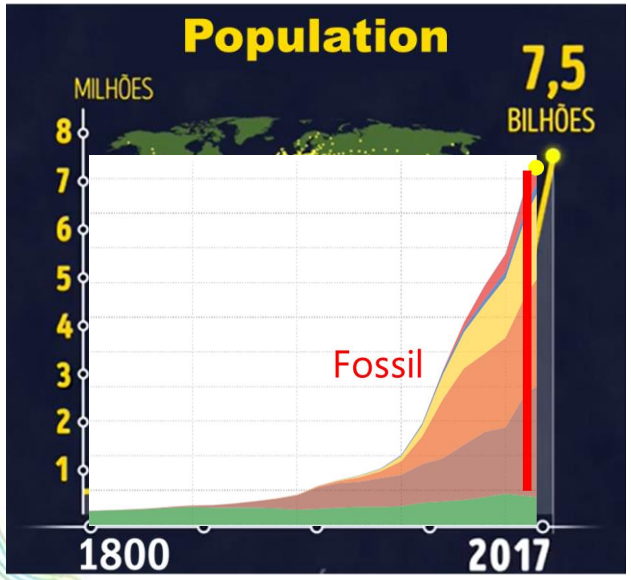


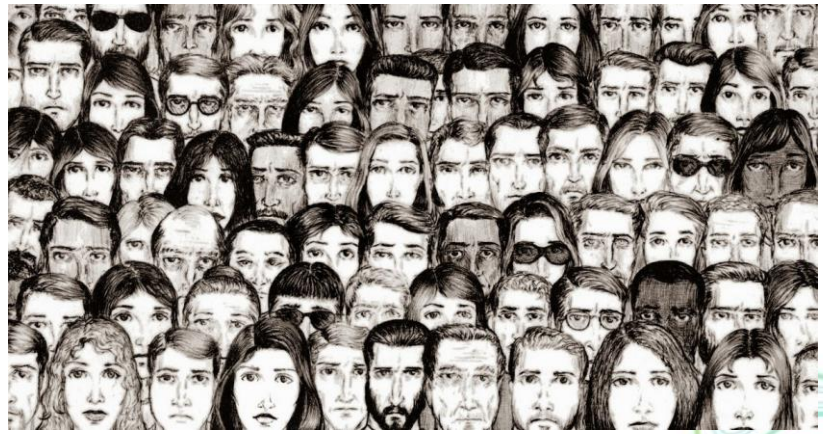

Before Christ
MILHÕES
200
150
100
50
170 MILHÕES
ANO
100 000 A.C.
50 000 A.C.
AGRICULTURA
1 D.C.

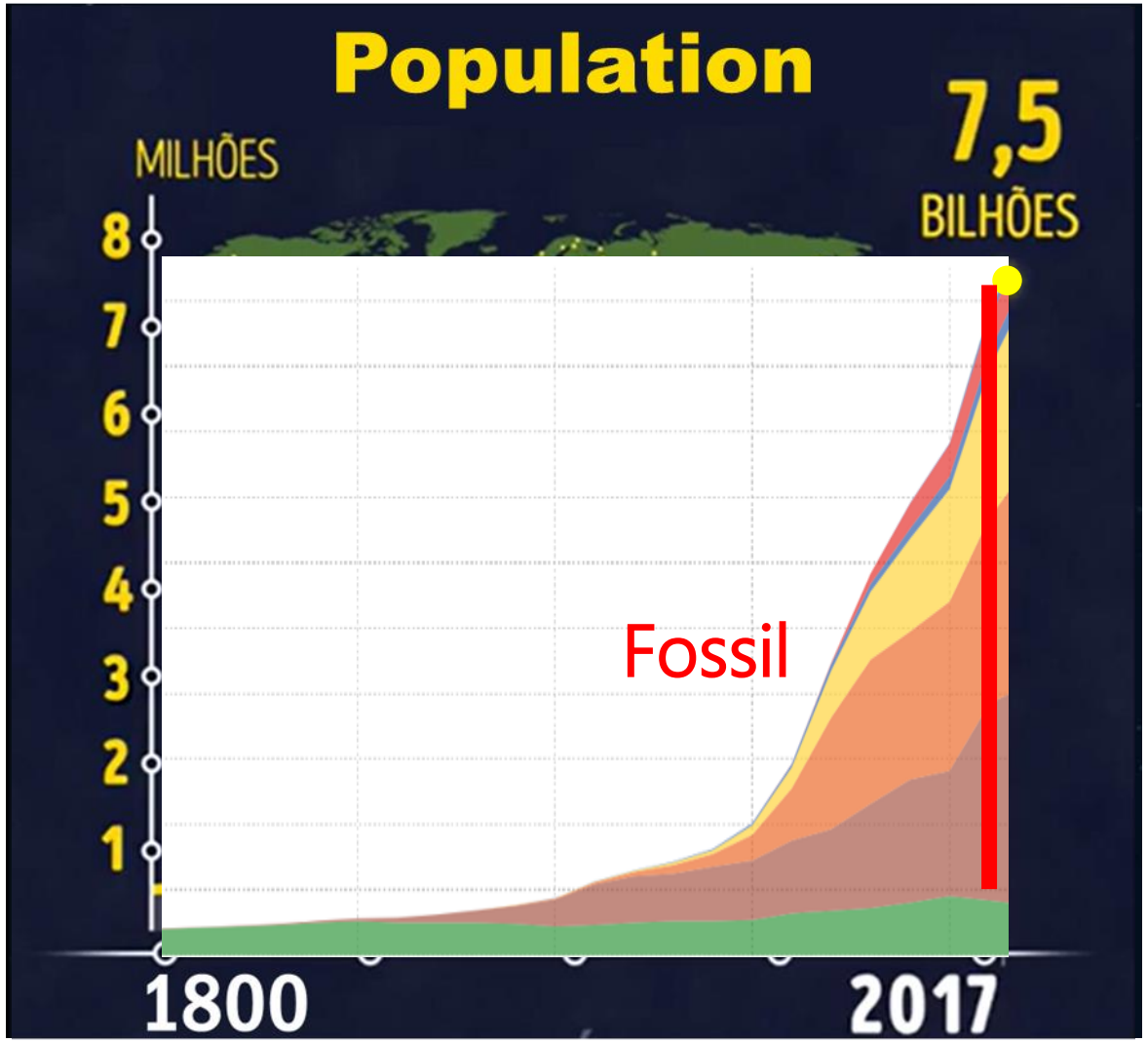

Population
MILHÕES
8
7
6
5
4
3
2
1
7,5 BILHÕES
0,8
1800
2017


Fossil


Population
MILHÕES
8
7
6
5
4
3
2
1
7,5 BILHÕES
Fossil
1800
2017


Mobil
elf
CAT
Castrol
ГАЗПРОМ




Population
MILHÕES
7,5
BILHÕES
8
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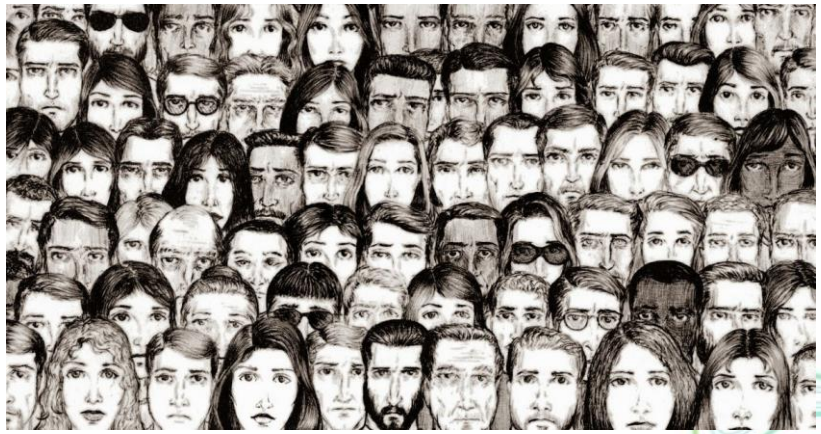
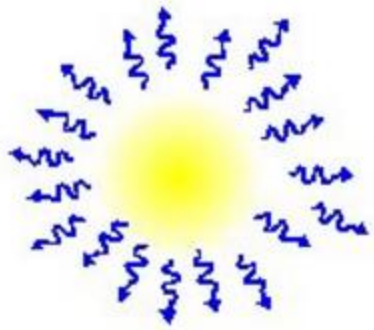
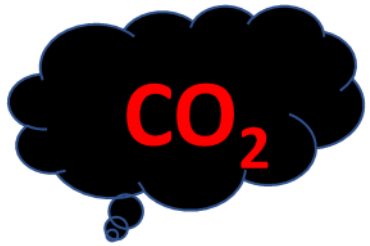
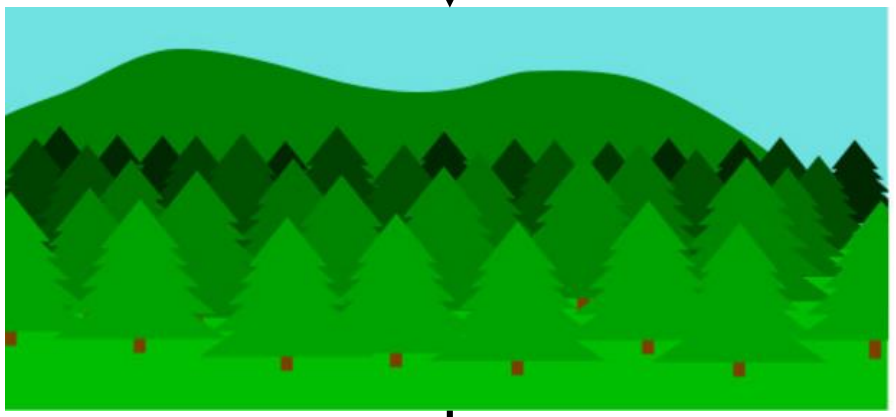


Fossil “Carbon Cycle”

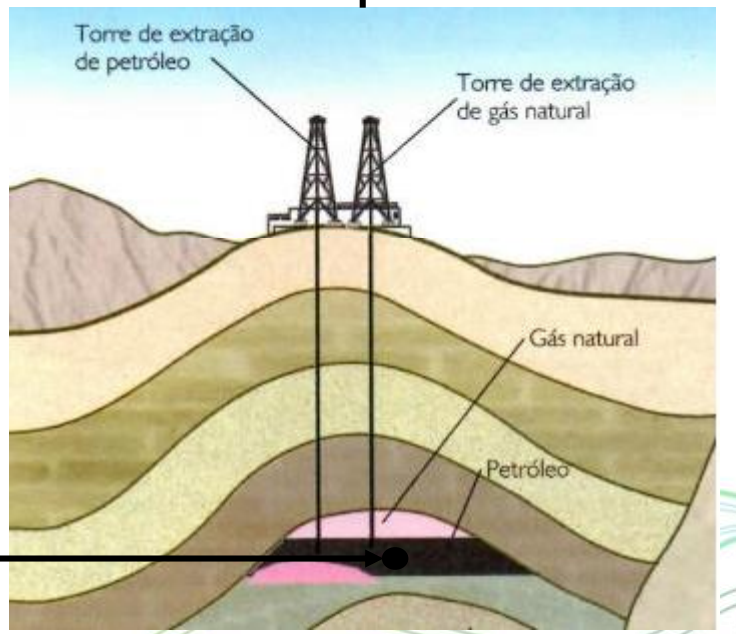




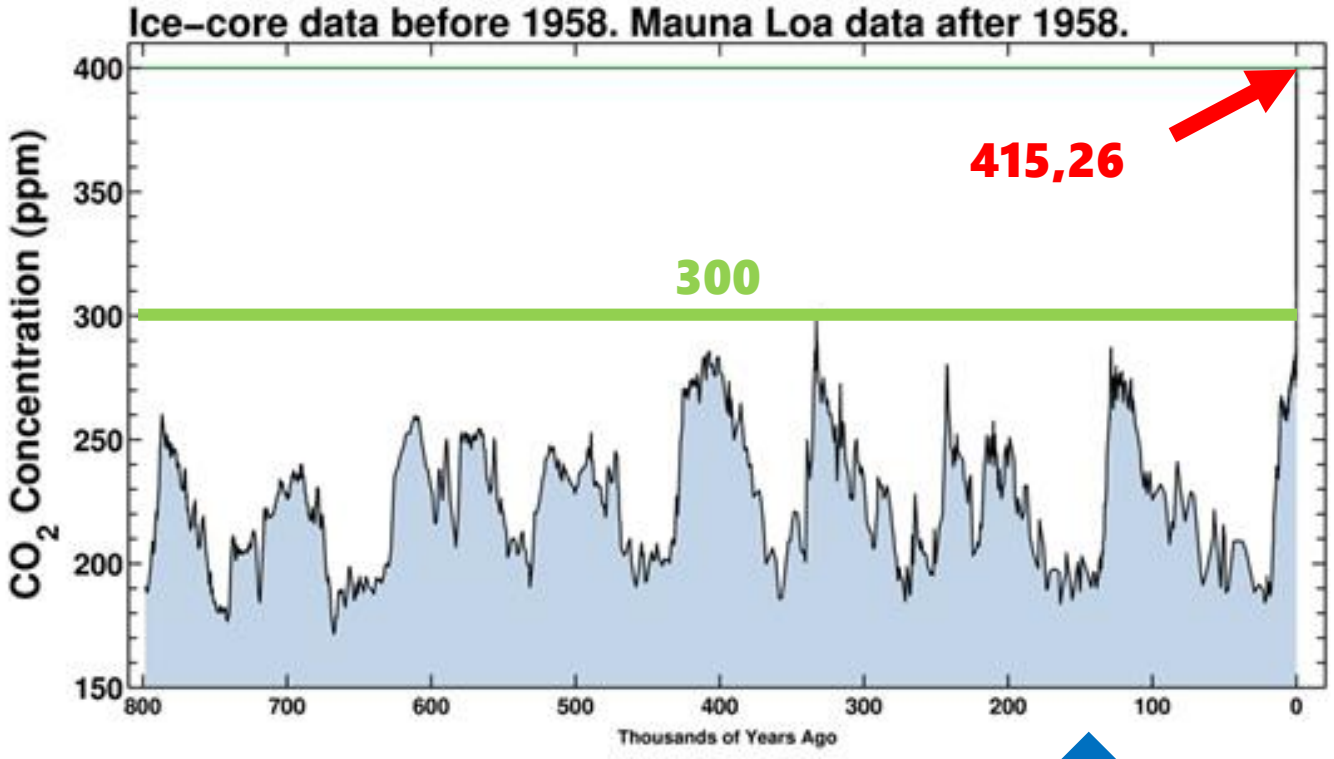
4.500.000.000 t/y

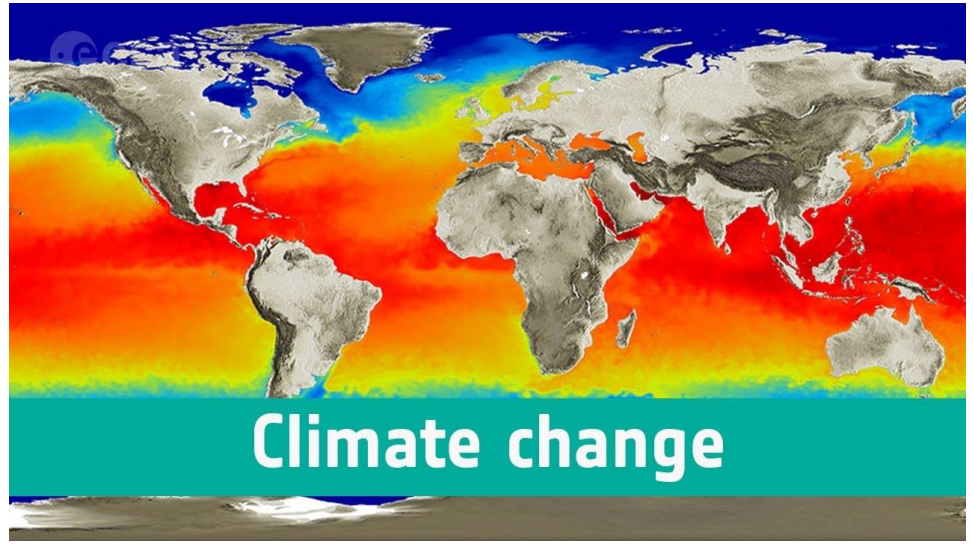


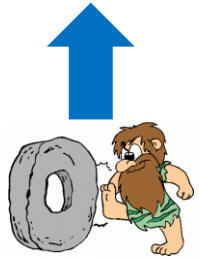
1500 t/y



CO2 is a Global Problem

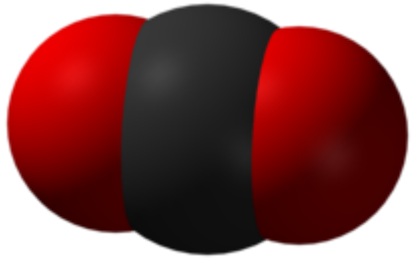






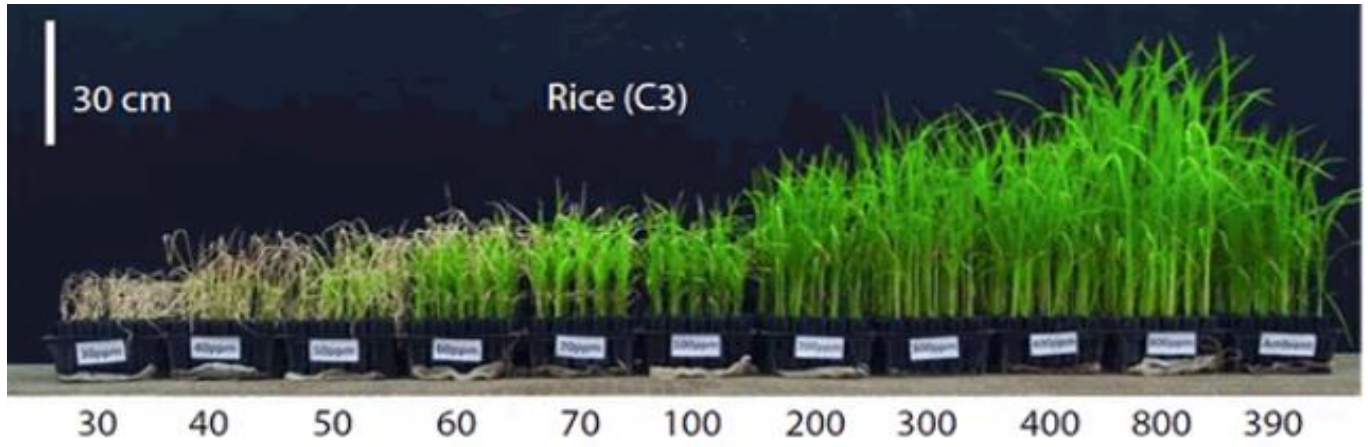
CO2 is NOT a LOCAL Problem

O=C=O



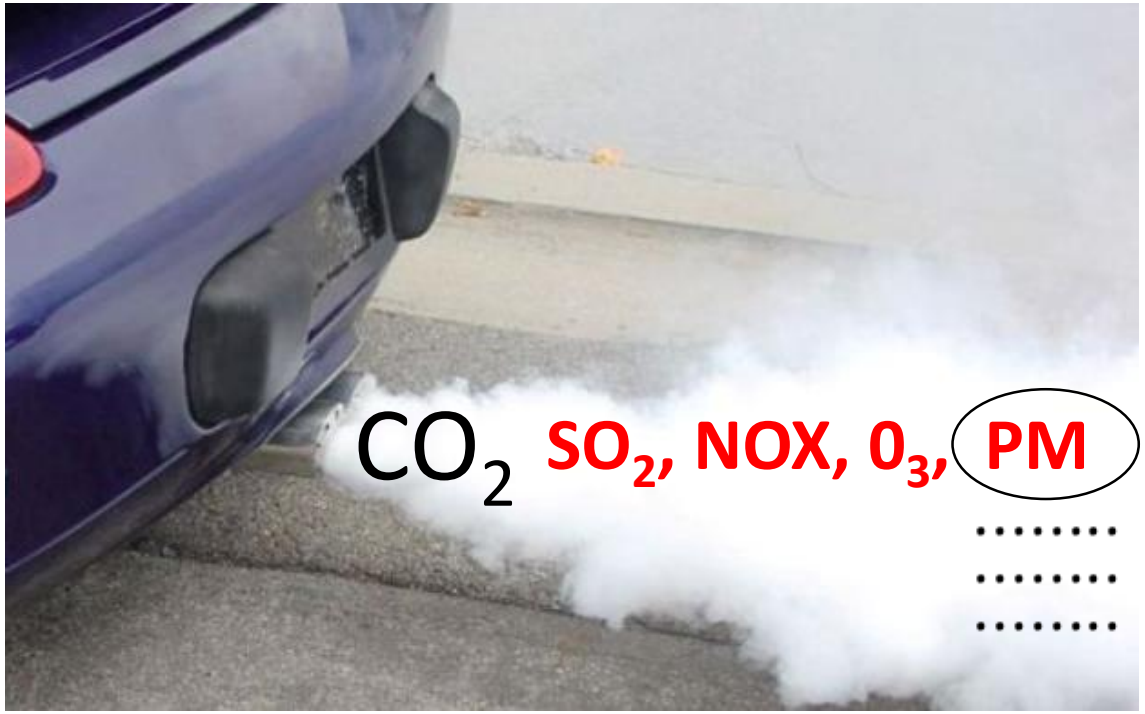
NOT TOXIC ≠ SO_2, NOX, 0_3, PM

Extremely Beneficial for Plants

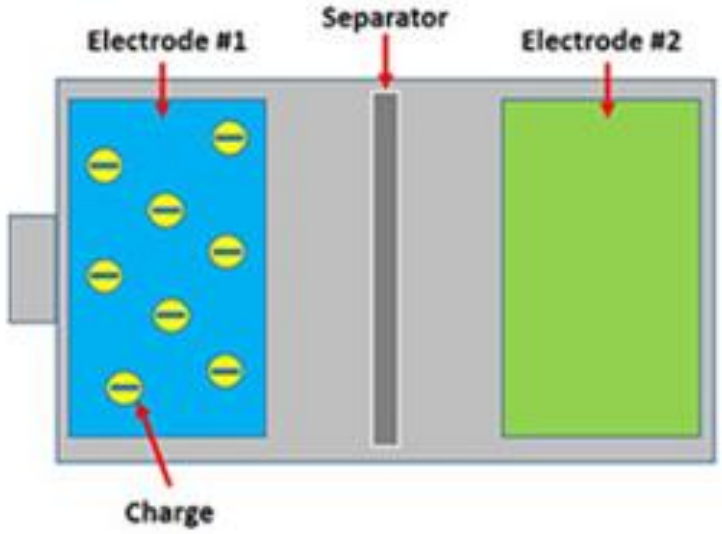


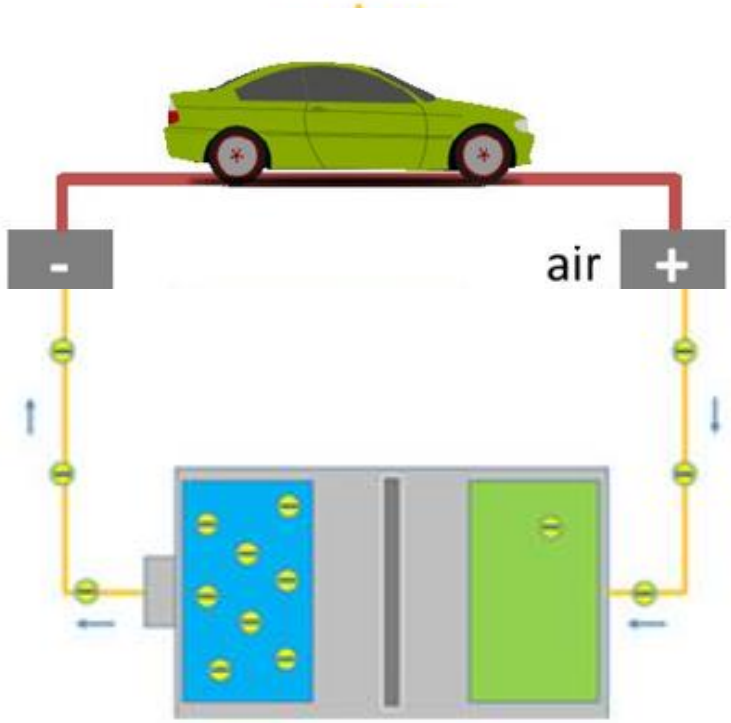
A Gaseous Fertilizer

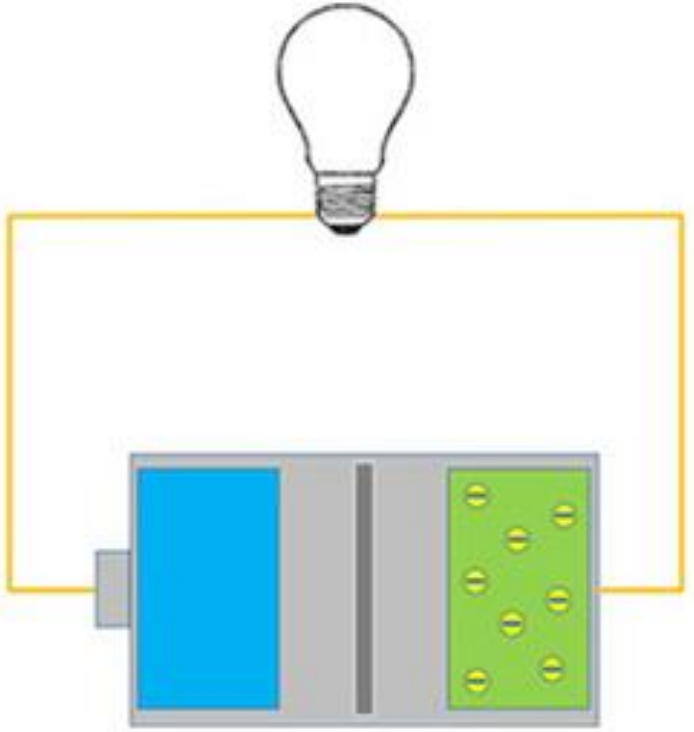
Fallacious Reasoning



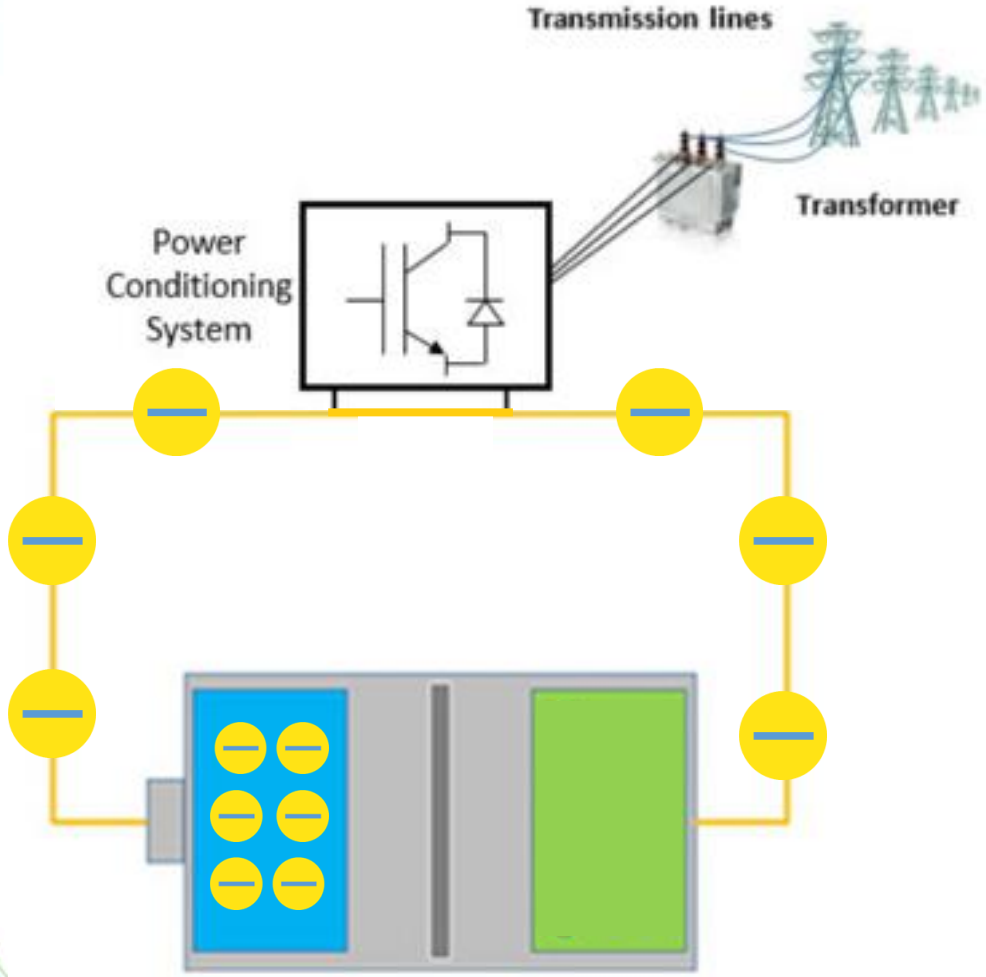
How does a Battery work?





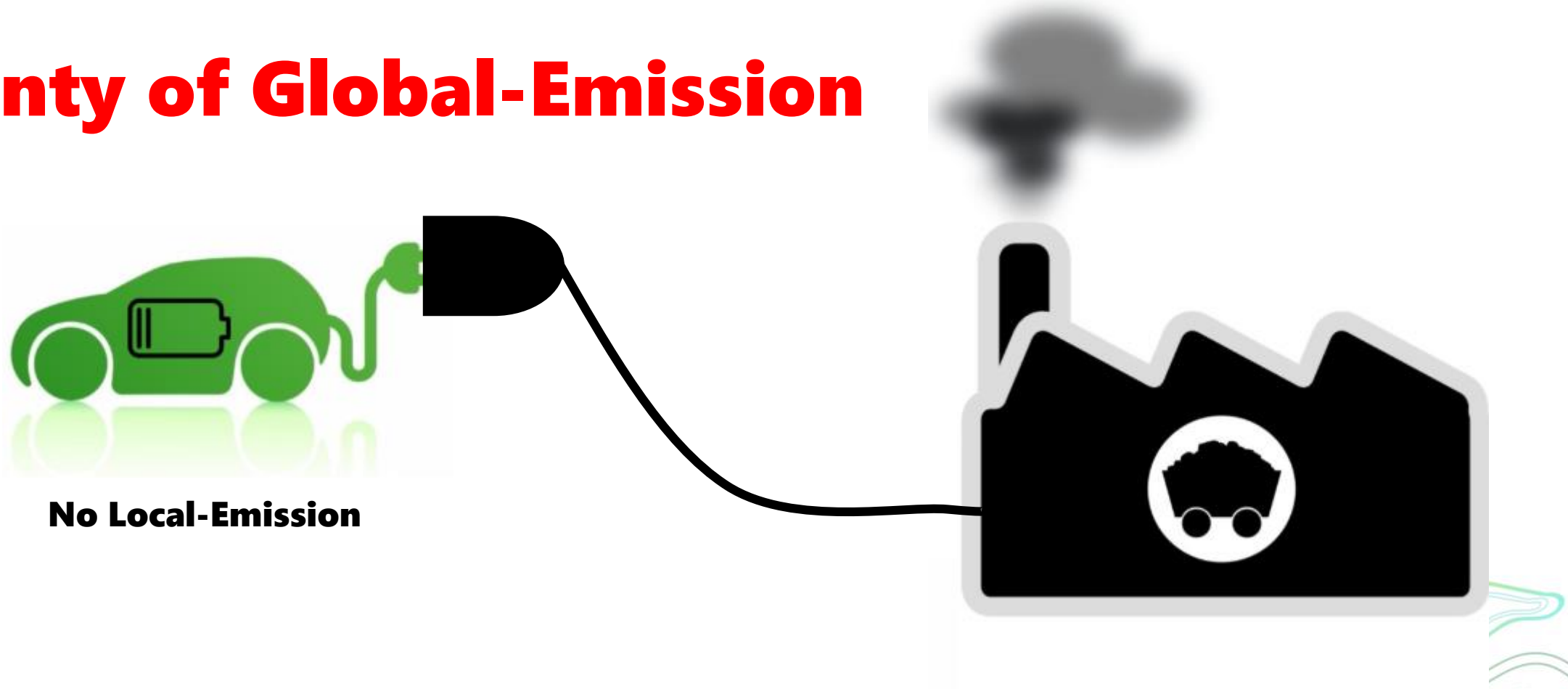


How to recharge a Battery?



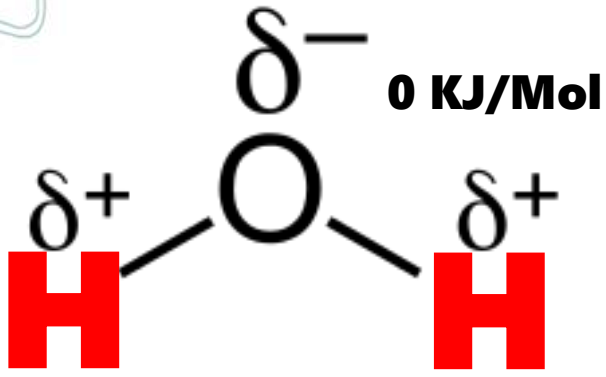
Metal Battery Cars

Plenty of Global-Emission

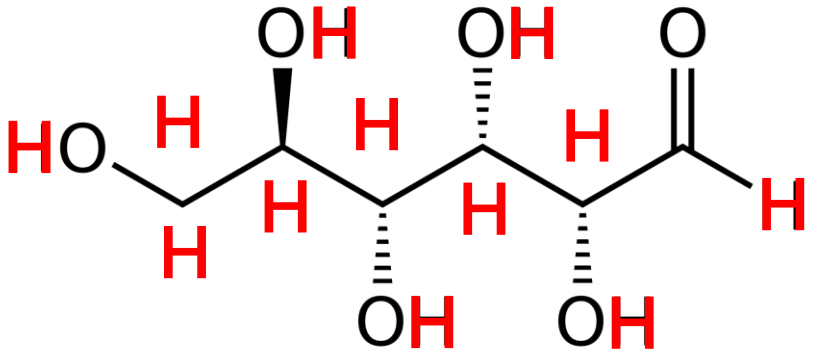


No Local-Emission

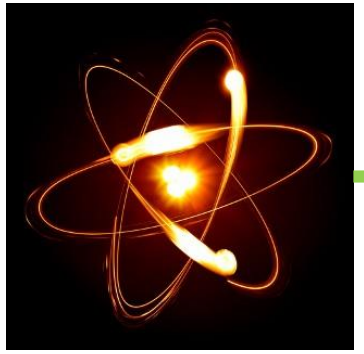
CO_2-Battery

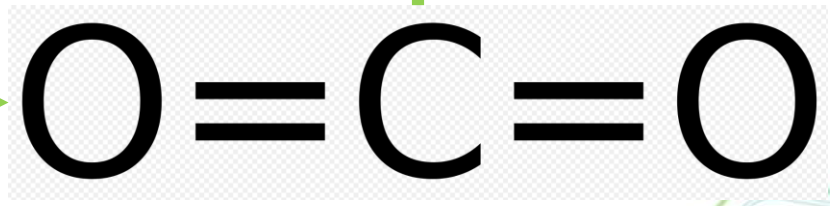


0 KJ/Mol



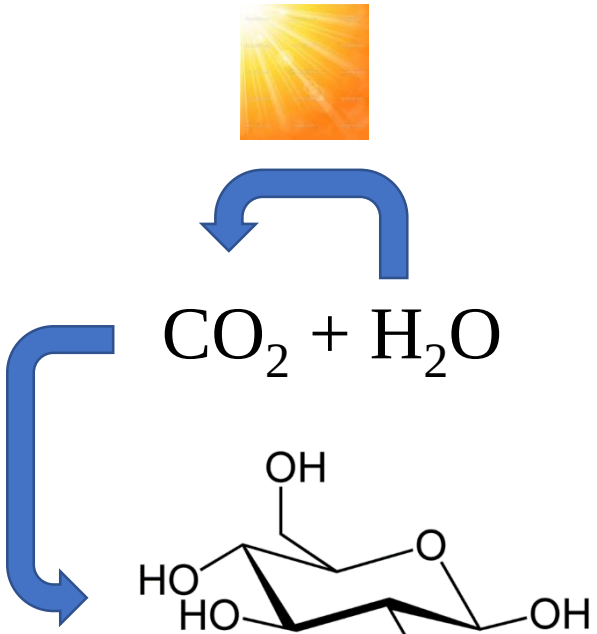
2540 KJ/Mol

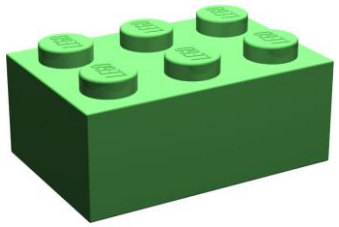


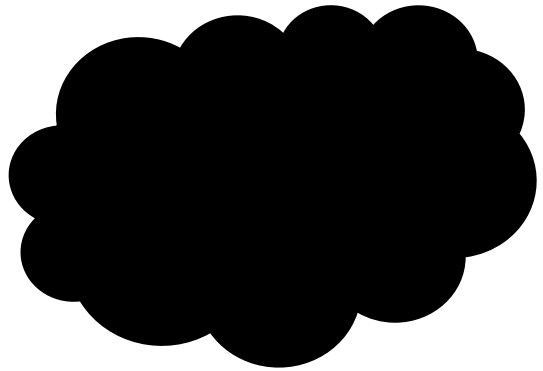


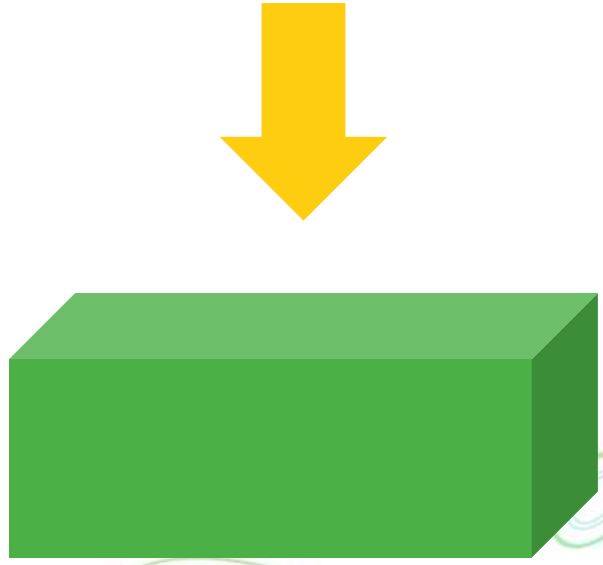
0 KJ/Mol

Carbon Fixation









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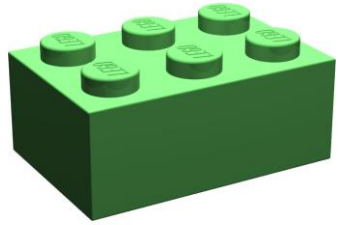
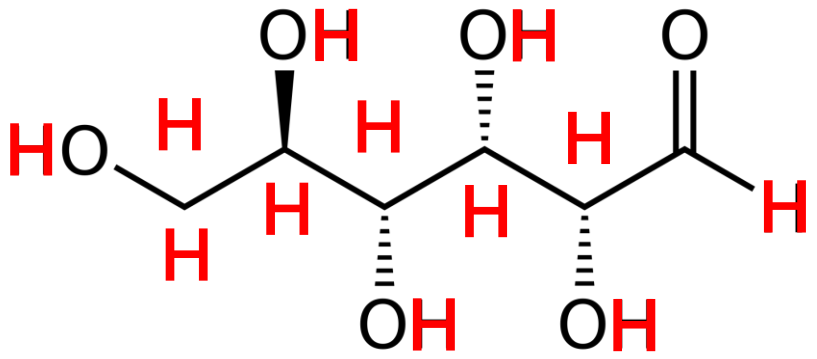
Battery Liquefaction





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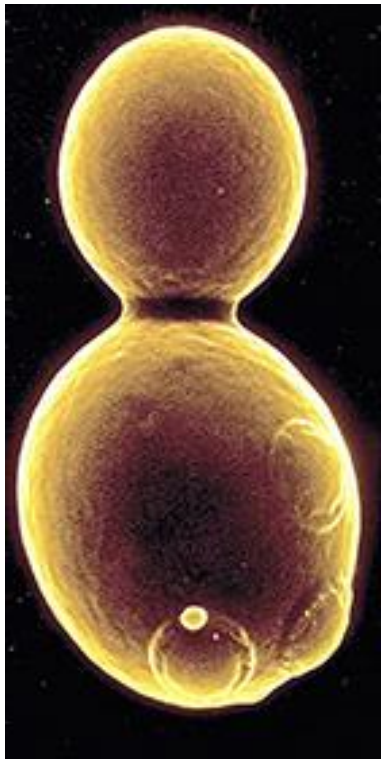
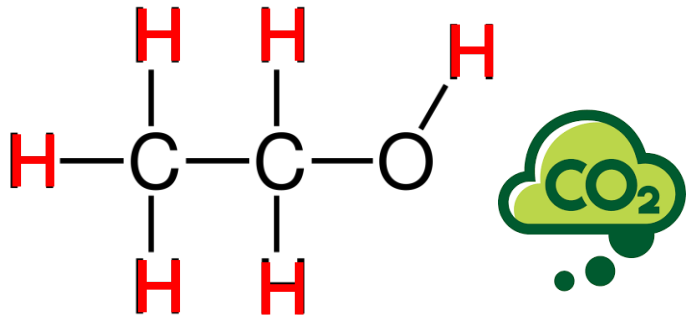
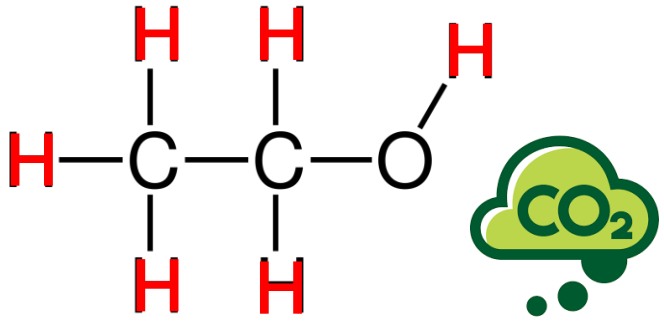


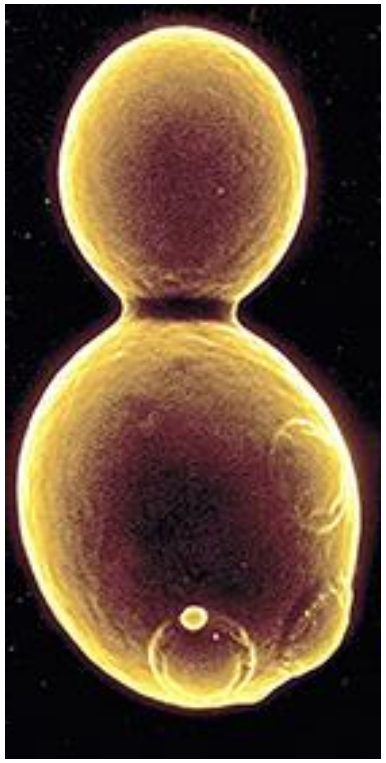




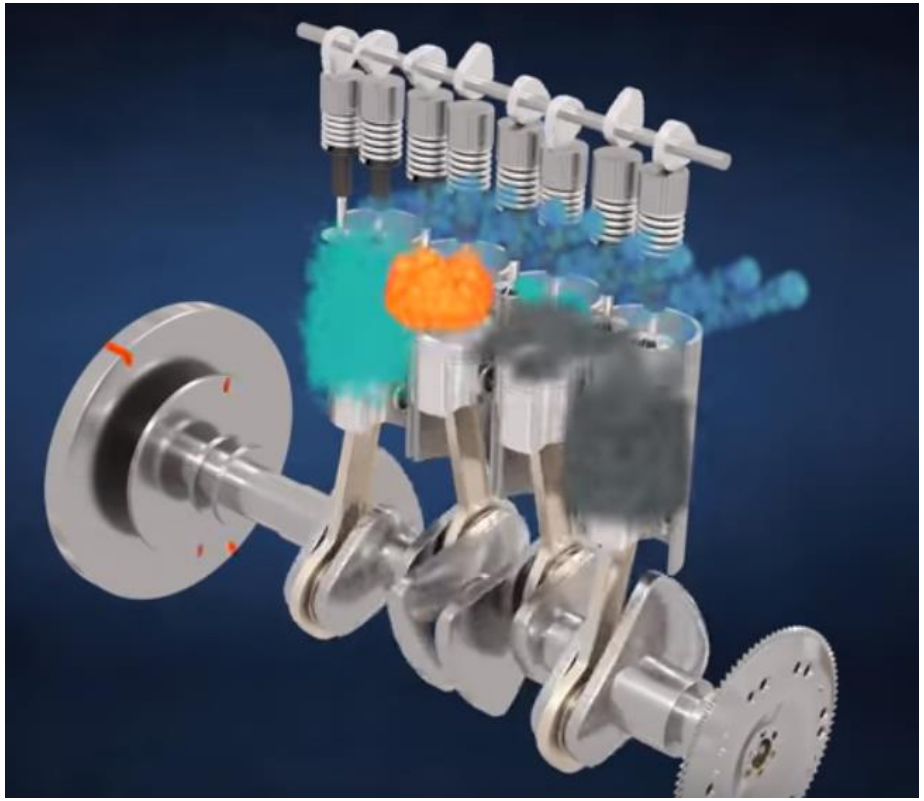
2470 KJ/Mol

SUSTAINABLE MOBILITY: ETHANOL TALKS INDIA

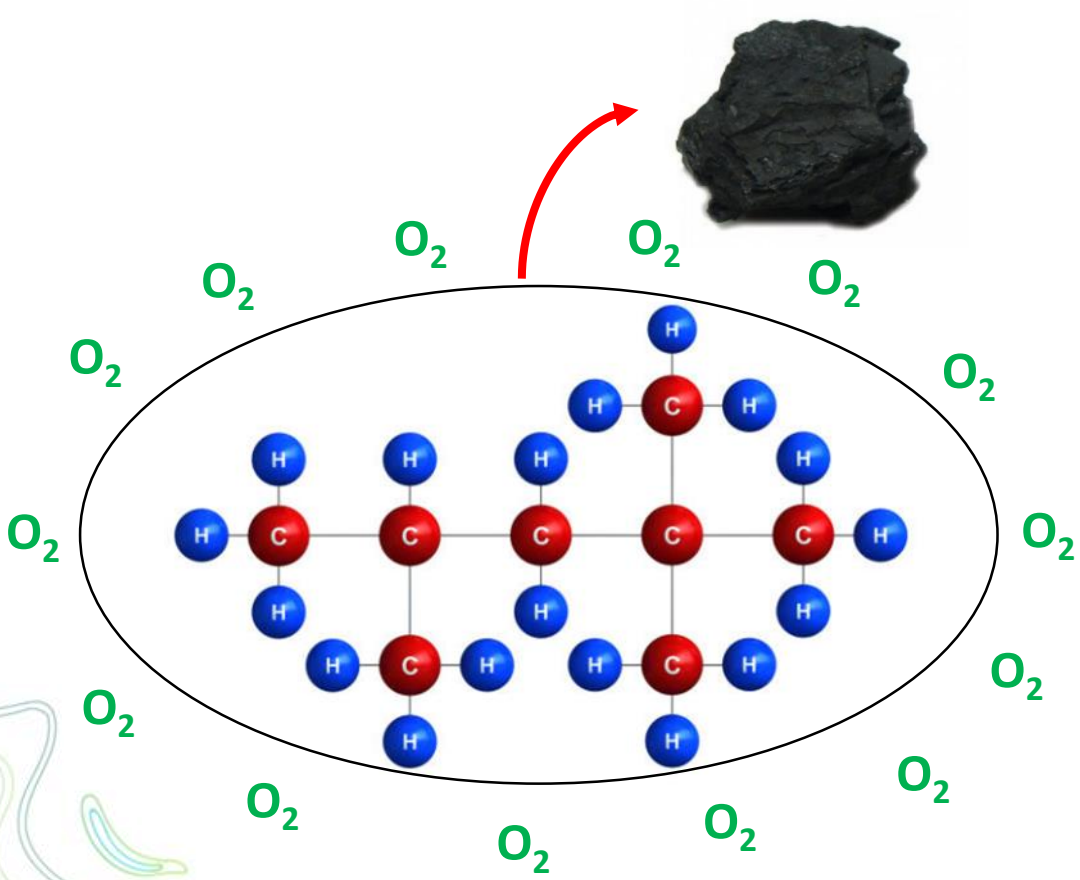
Battery Liquefaction

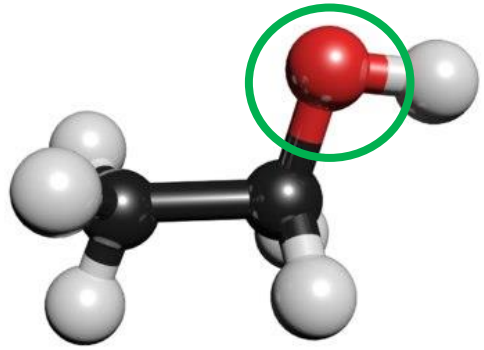


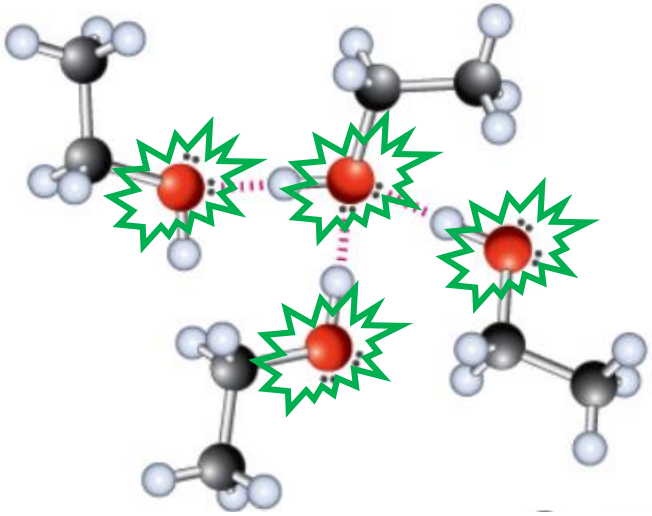
Traditional Discharging Way



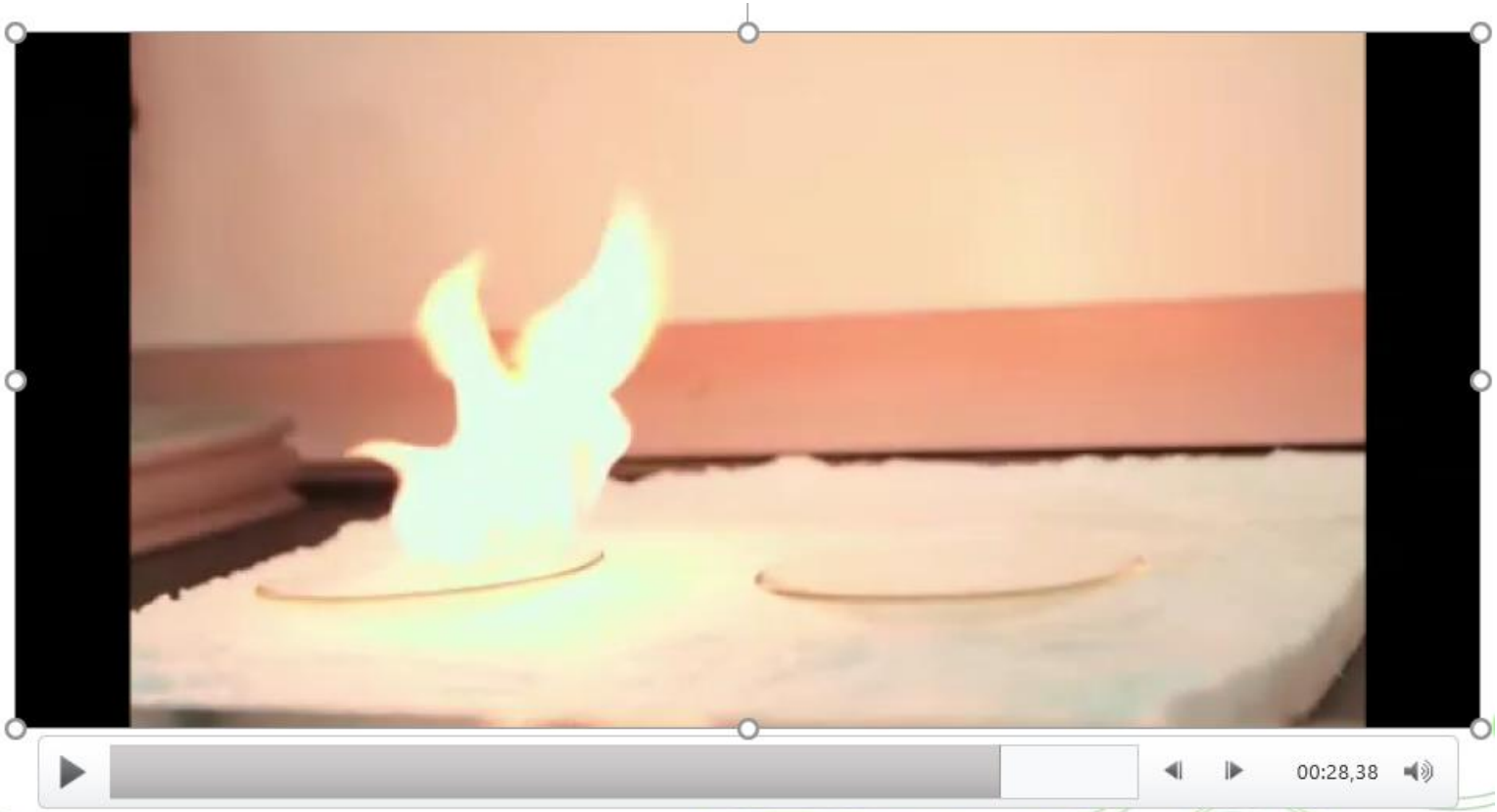
Internal Molecular Combustion







Clean Combustion



Energy Efficiency

25%

90%

The Fuel Cell Revolution

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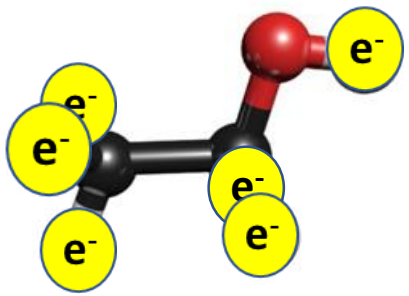
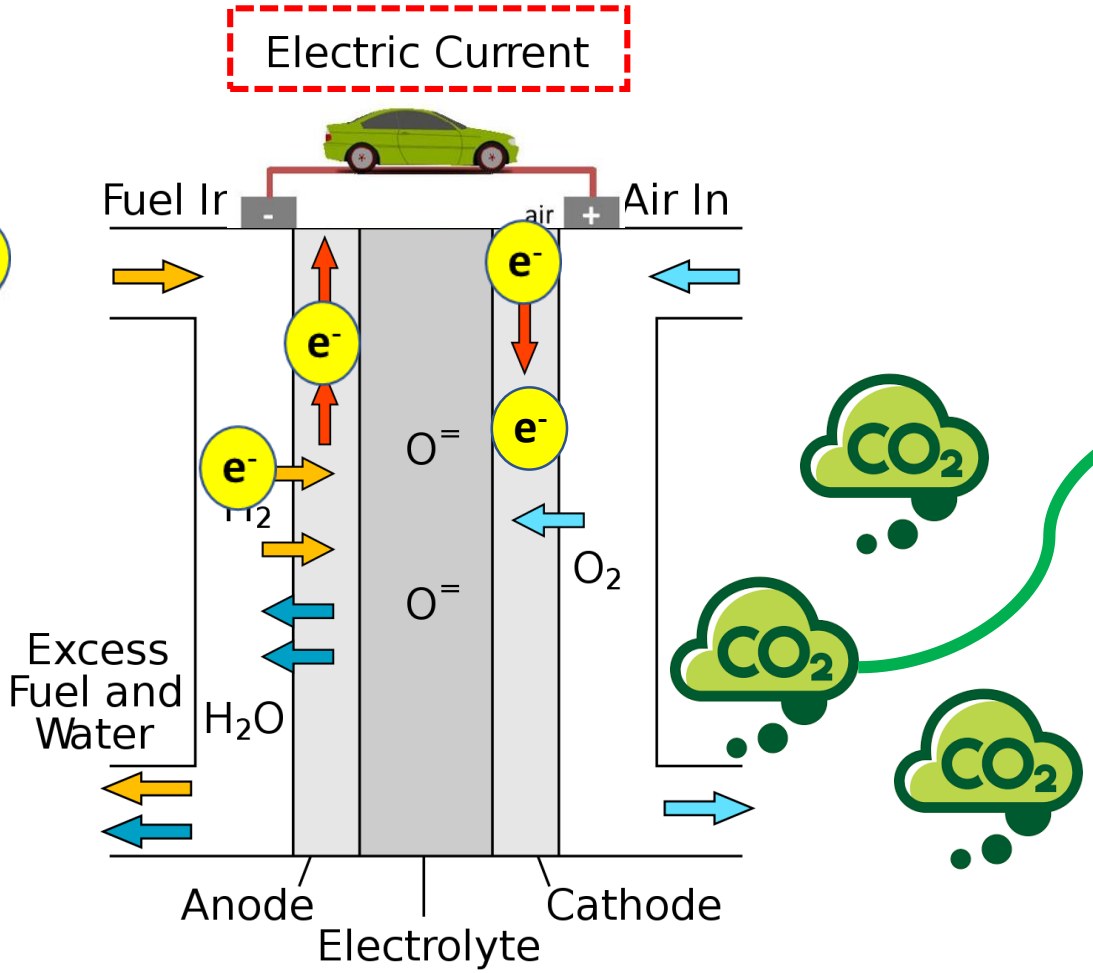
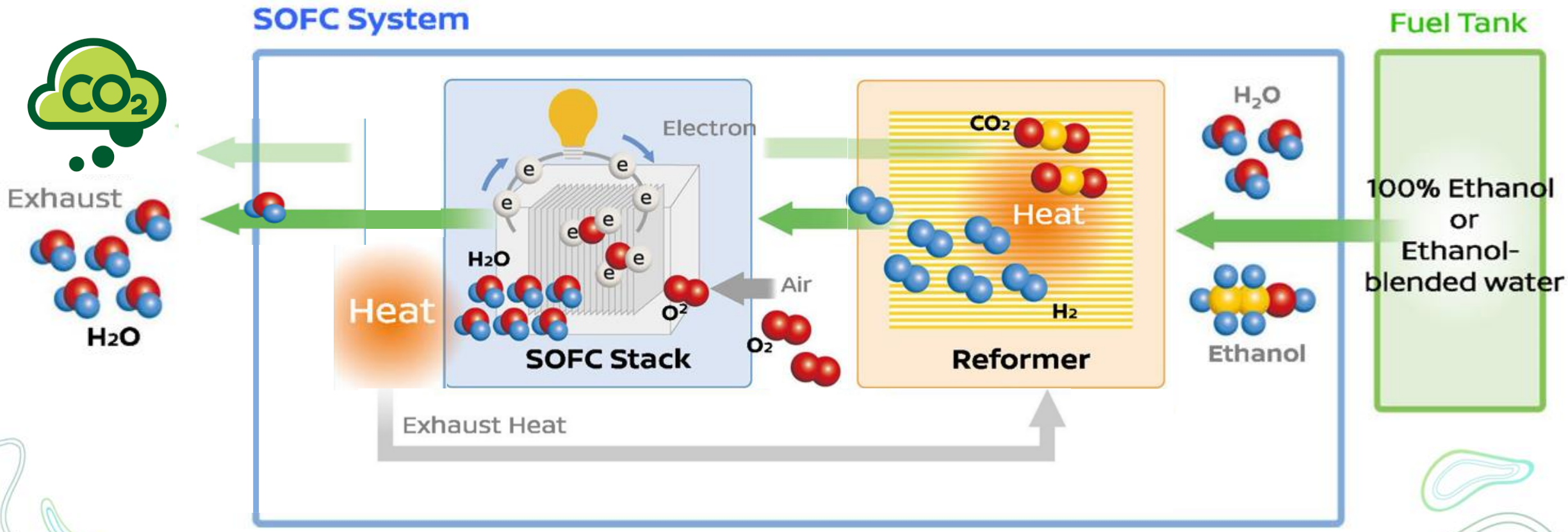




Solid Oxide Fuel Cell System



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Nissan unveils world's first Solid-Oxide Fuel Cell vehicle

YOKOHAMA, Japan (August 4, 2016) – In Brazil today, Nissan Motor Co., Ltd. today revealed the world's first Solid Oxide Fuel-Cell (SOFC)-powered prototype vehicle that runs on bio-ethanol electric power. The breakthrough model is an all-new light–commercial vehicle that can rely on multiple fuels – including ethanol and natural gas – to produce high-efficiency electricity as a power source.

1920 x 1080

1200 x 1200

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Nissan mostra no Japão tecnologia de etanol de 2ª geração criada no Brasil

Carmaker presented at the japan auto show, a project that allows the use of cane fuel to generate hydrogen for fuel cells

Cleide Silva*, O Estado de S.Paulo
23 de outubro de 2019 | 14h34

Agora em sua segunda fase de testes em conjunto com a **Universidade de Campinas (Unicamp)** e o Instituto de Pesquisas Energéticas e Nucleares (Ipen), ligado à USP, o projeto começa a se mostrar viável comercialmente e, segundo Silva, poderá ser adotado de forma global. "Esse já não é um projeto só do Brasil."

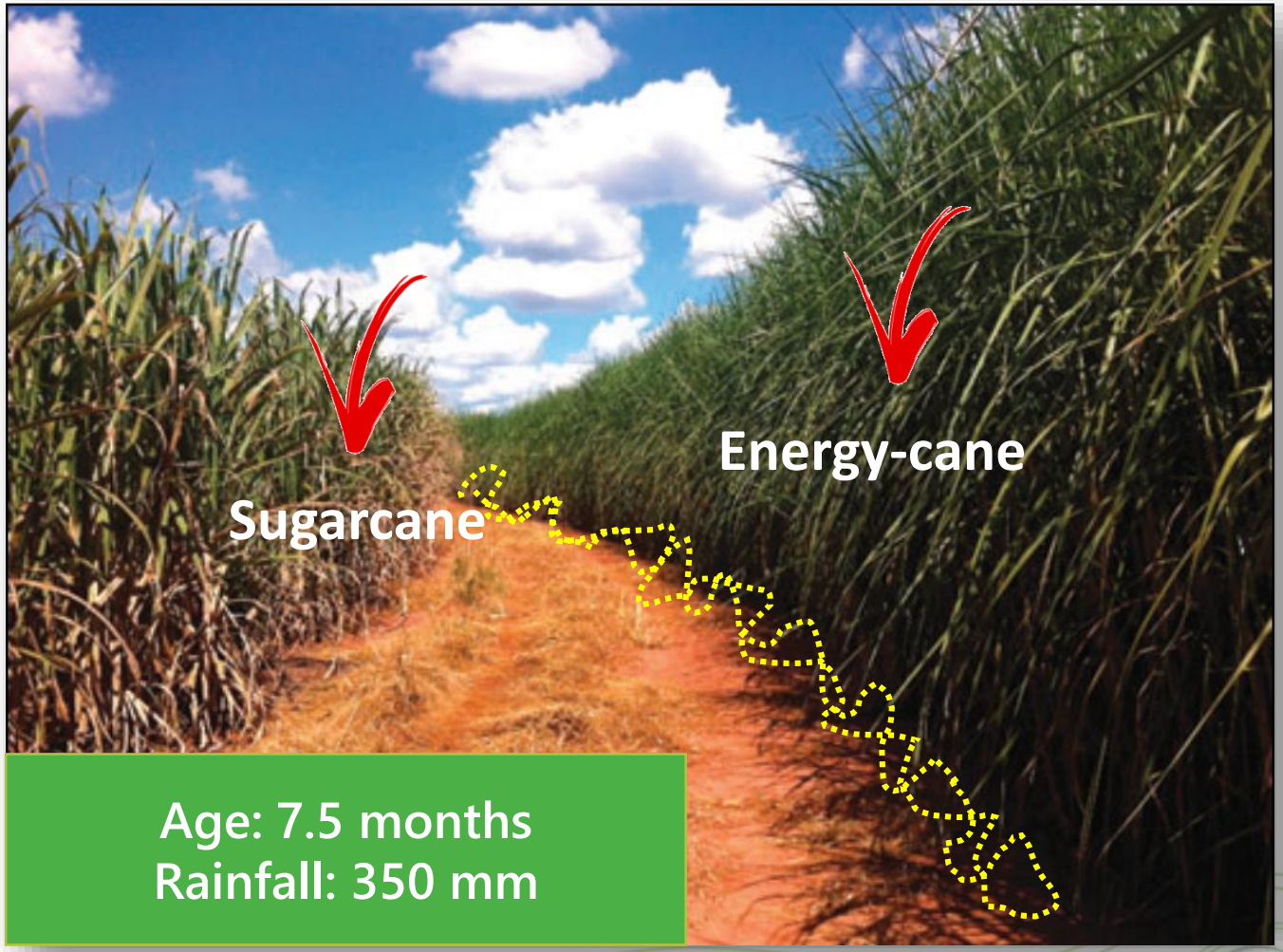
This is not a project just for Brazil

Is this Possible?

New Biomasses

Energy-cane I | Sugarcane | Energy-cane II

Resistance, Productivity and Biofertilizers



Root System

Sugarcane

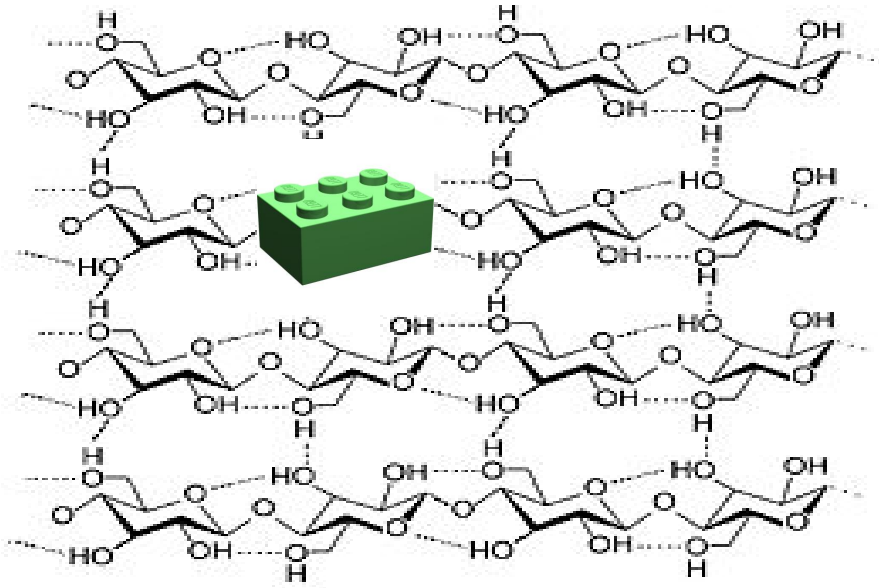
Energy-cane

Agave for Arid Areas

Second Generation

Sugar Cane – Typical Composition

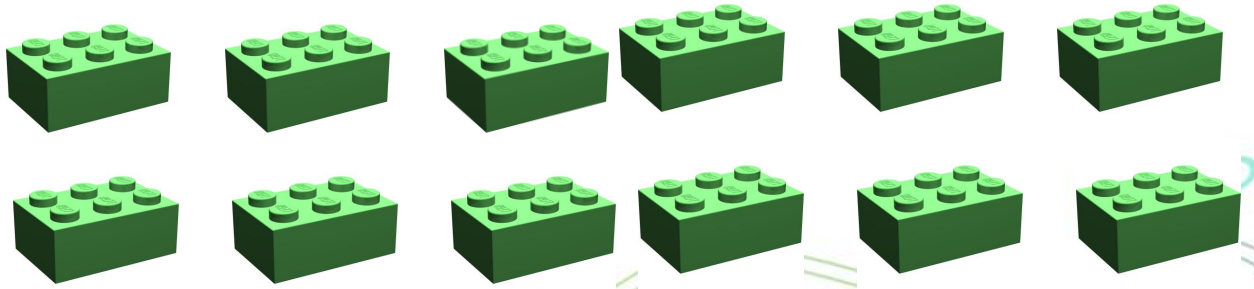
1 Ton Sugar Cane
>> 140 kg Sugar
>> 140 kg Bagasse (FIBER)
>> 140 kg Straw and Tip (FIBER)



1 ha Sugar Cane 80

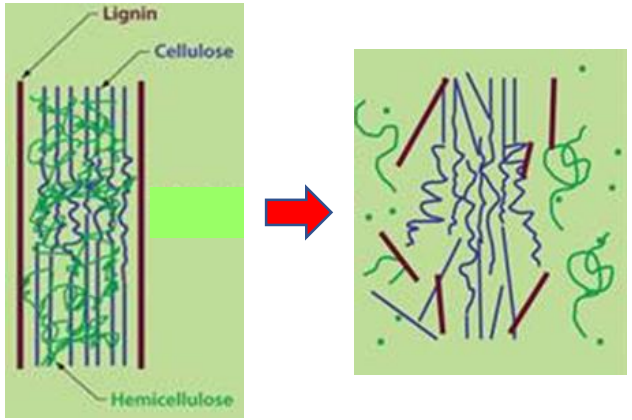
Per Year

1 ha Energy Cane 240

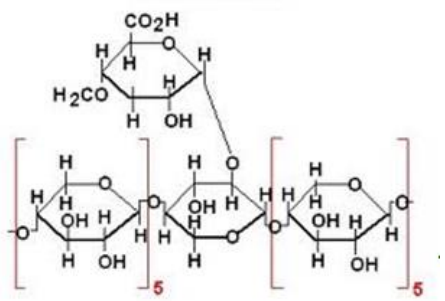


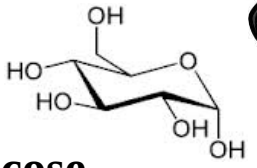
2G Technology

Pre-Treatment

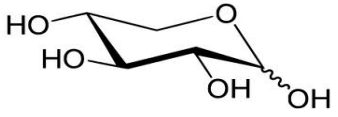


Hydrolysis



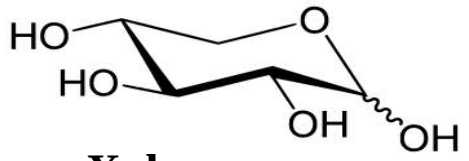


Glucose

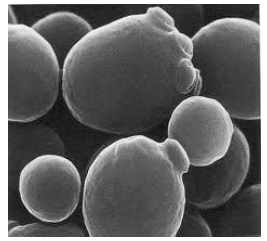


Xylose

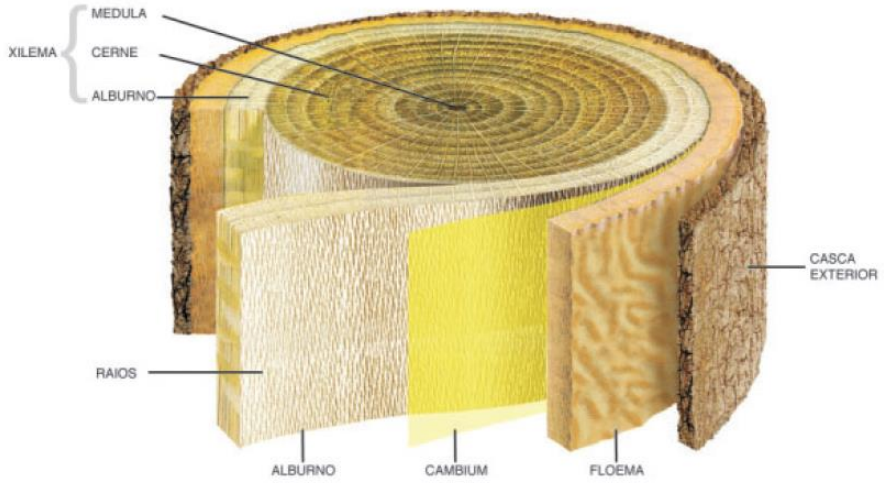
Fermentation

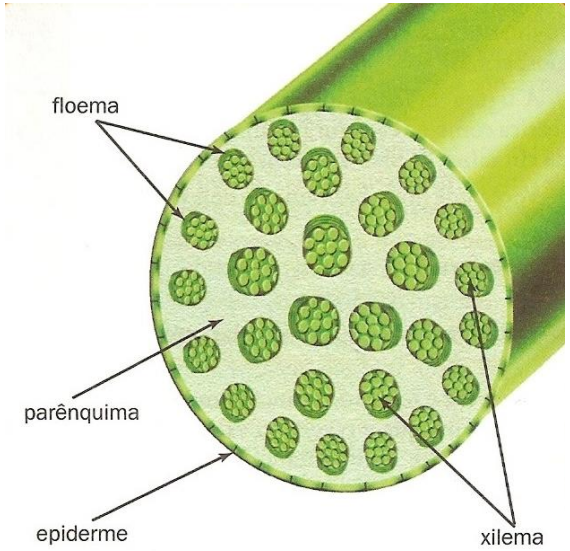


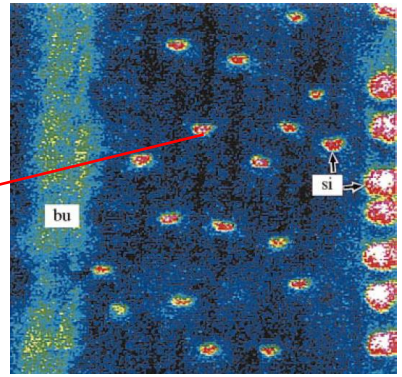
Xylose



Bagasse is not Wood







Abrasion and Erosion

Bagasse becomes a Porridge

Wood

Bagasse

Adhesion

2G is Real

Imprensa Investidores Governança Corporativa Trabalhe com a gente Blog EN

GranBio

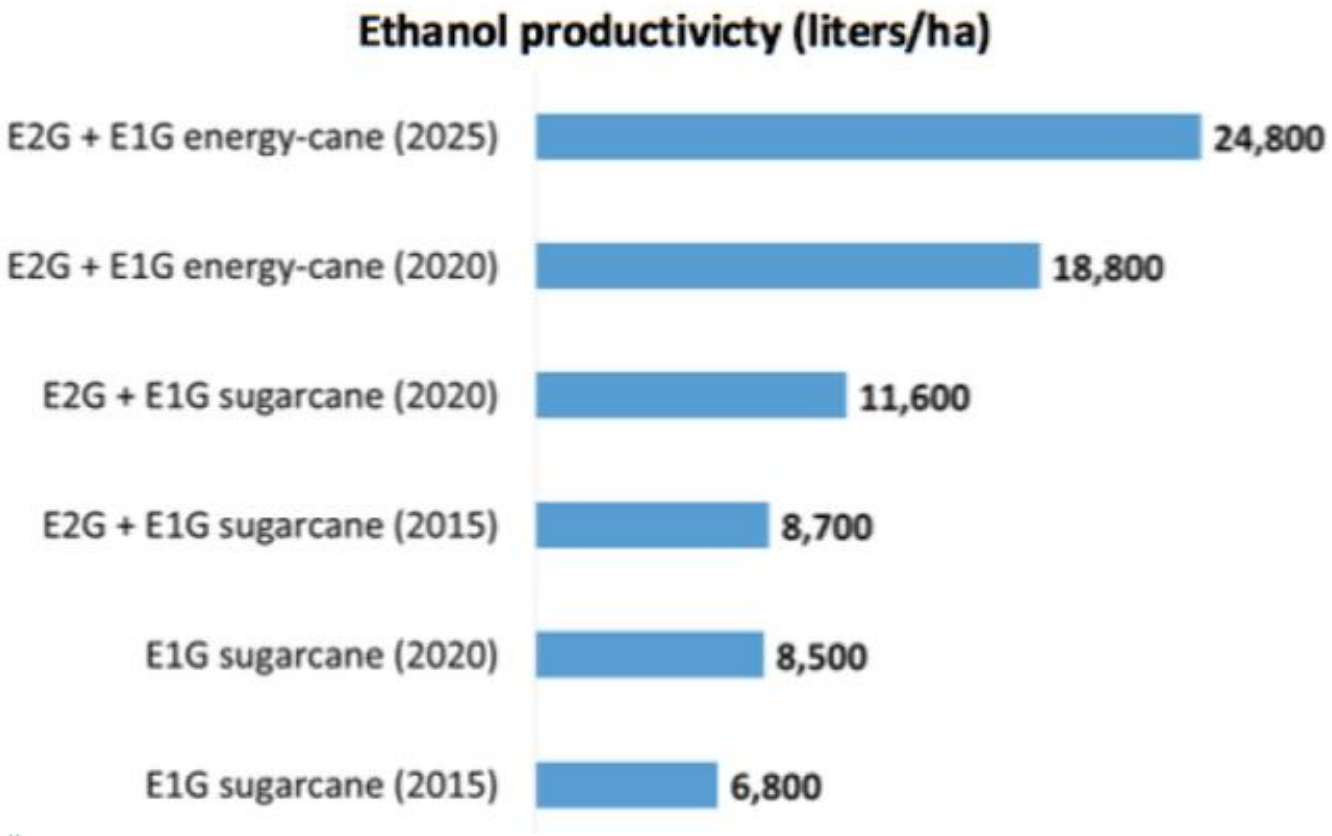
A GRANBIO MATÉRIA PRIMA INOVAÇÃO INDÚSTRIA BLOG

2020: 100.000 l ETOH in 24 h

Raizen

50 MM lit. produced
254 l/ton dry bagasse
10-11 months/year

Soft Energy Transition



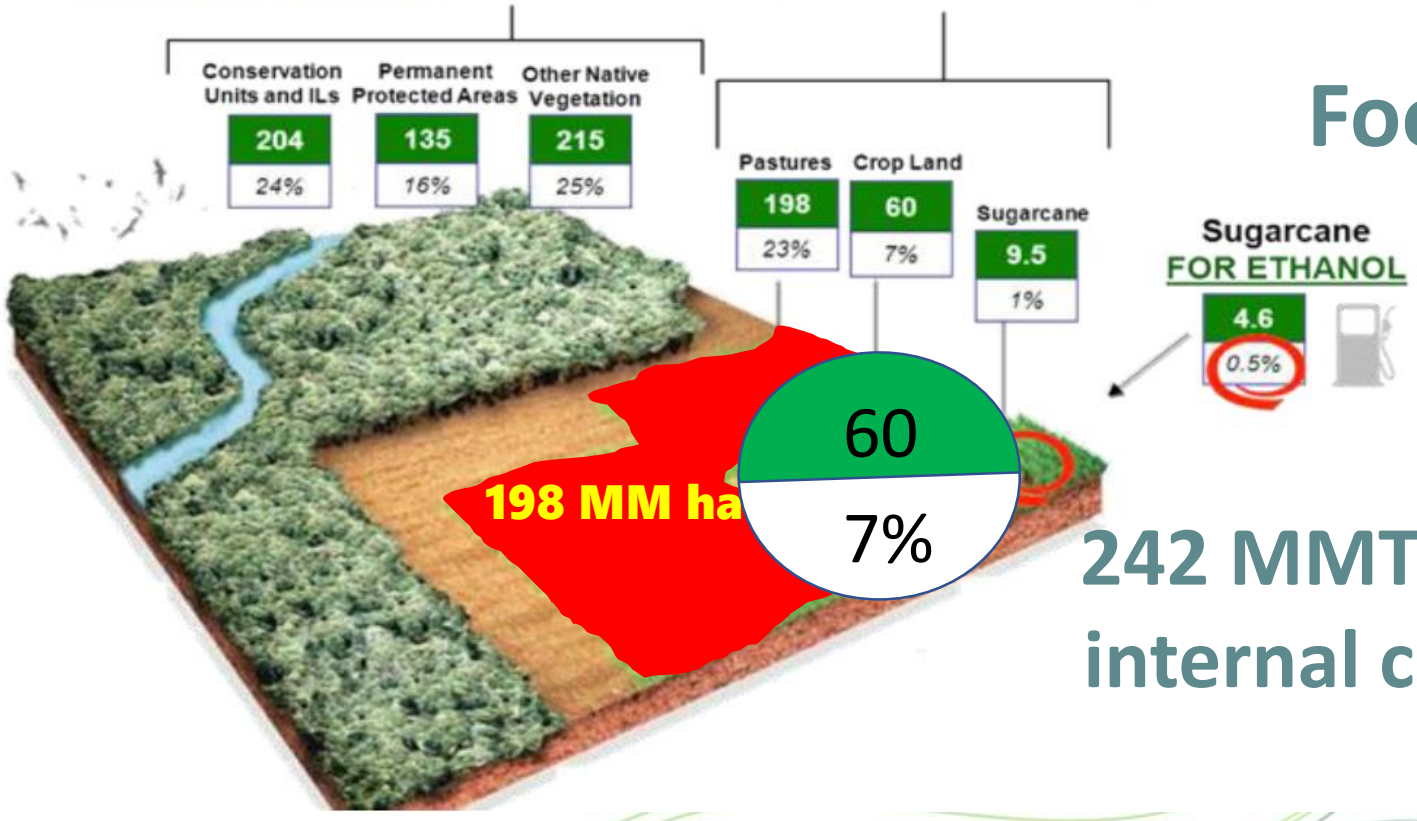
Area Requirement Analysis	
Global Gasoline Consumption	1,3tri liters/year
EtOH Equivalent	1,86 tri liters/year
Required Area E2G + E1G Energy Cane (2020)	*100MM hectares*
Required Area E2G + E1G Energy Cane (2025)	*75MM hectares*

75 MM ha = Global Gasoline Consumption Equivalent

Brazilian Landscape

Million Hectares

Total Area	Native Vegetation	Land in Actual Use	Other Uses
851	554	258	38
100%	*65%*	*30%*	*5%*



Food X Fuel

242 MMT (7,5 years of internal consumption)

Africa

BIODIVERSITY AREAS

5.5 mil km²

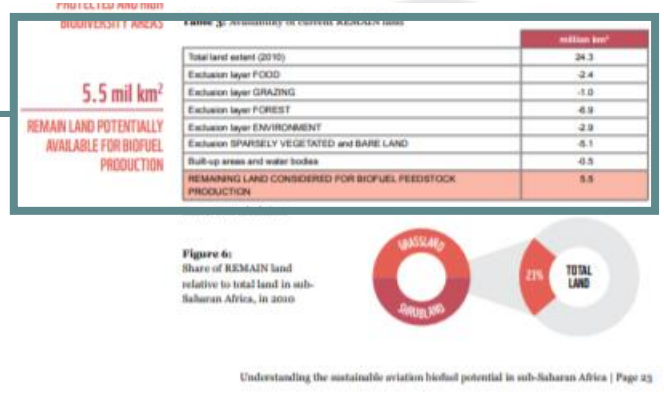
REMAIN LAND POTENTIALLY AVAILABLE FOR BIOFUEL PRODUCTION

Table 3: Availability of current REMAIN land

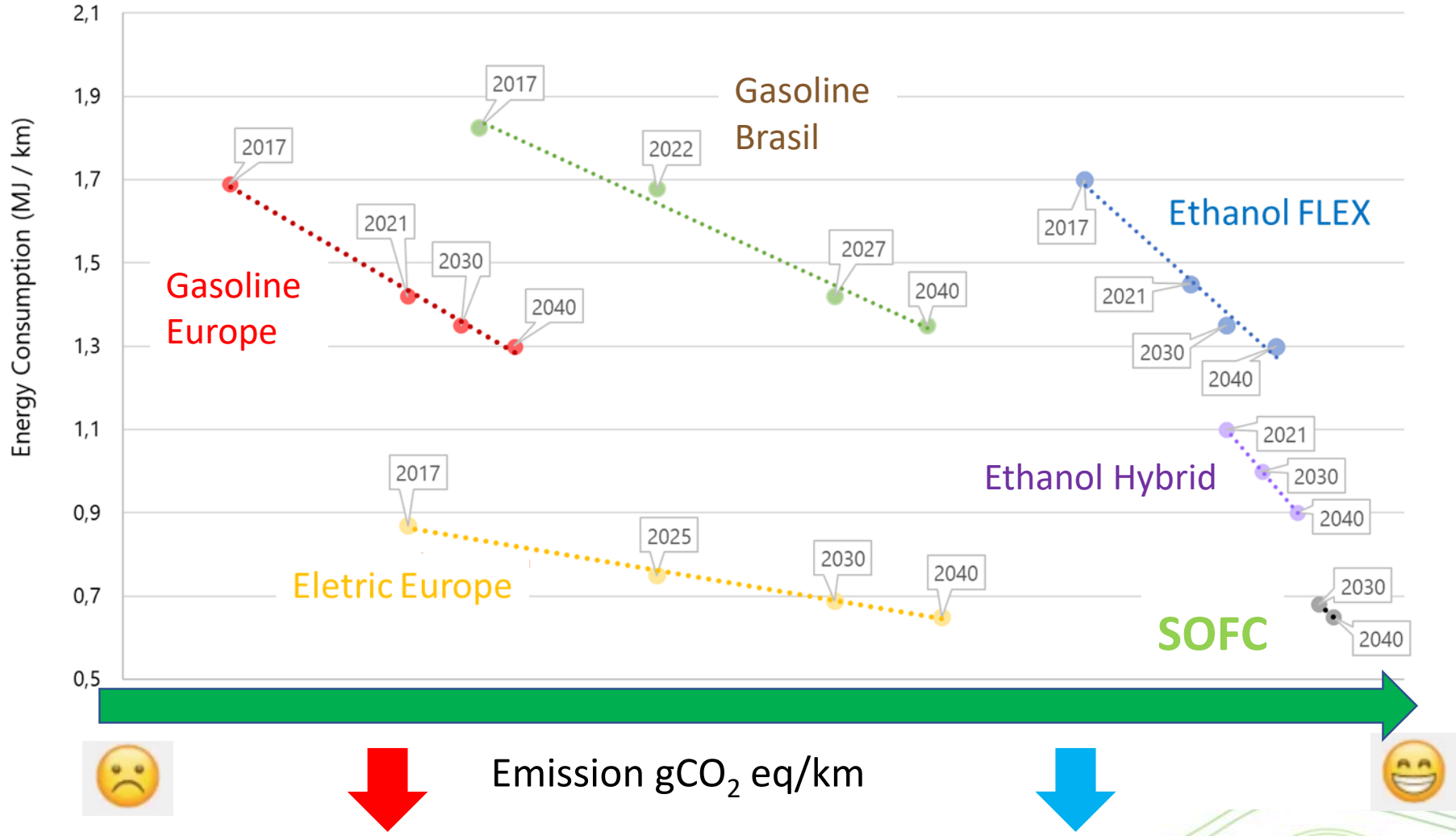
	million km²
Total land extent (2010)	24.3
Exclusion layer FOOD	-2.4
Exclusion layer GRAZING	-1.0
Exclusion layer FOREST	-6.9
Exclusion layer ENVIRONMENT	-2.9
Exclusion SPARSELY VEGETATED and BARE LAND	-5.1
Built-up areas and water bodies	-0.5
REMAINING LAND CONSIDERED FOR BIOFUEL FEEDSTOCK PRODUCTION	5.5

Source: Own calculations

550 MM Ha

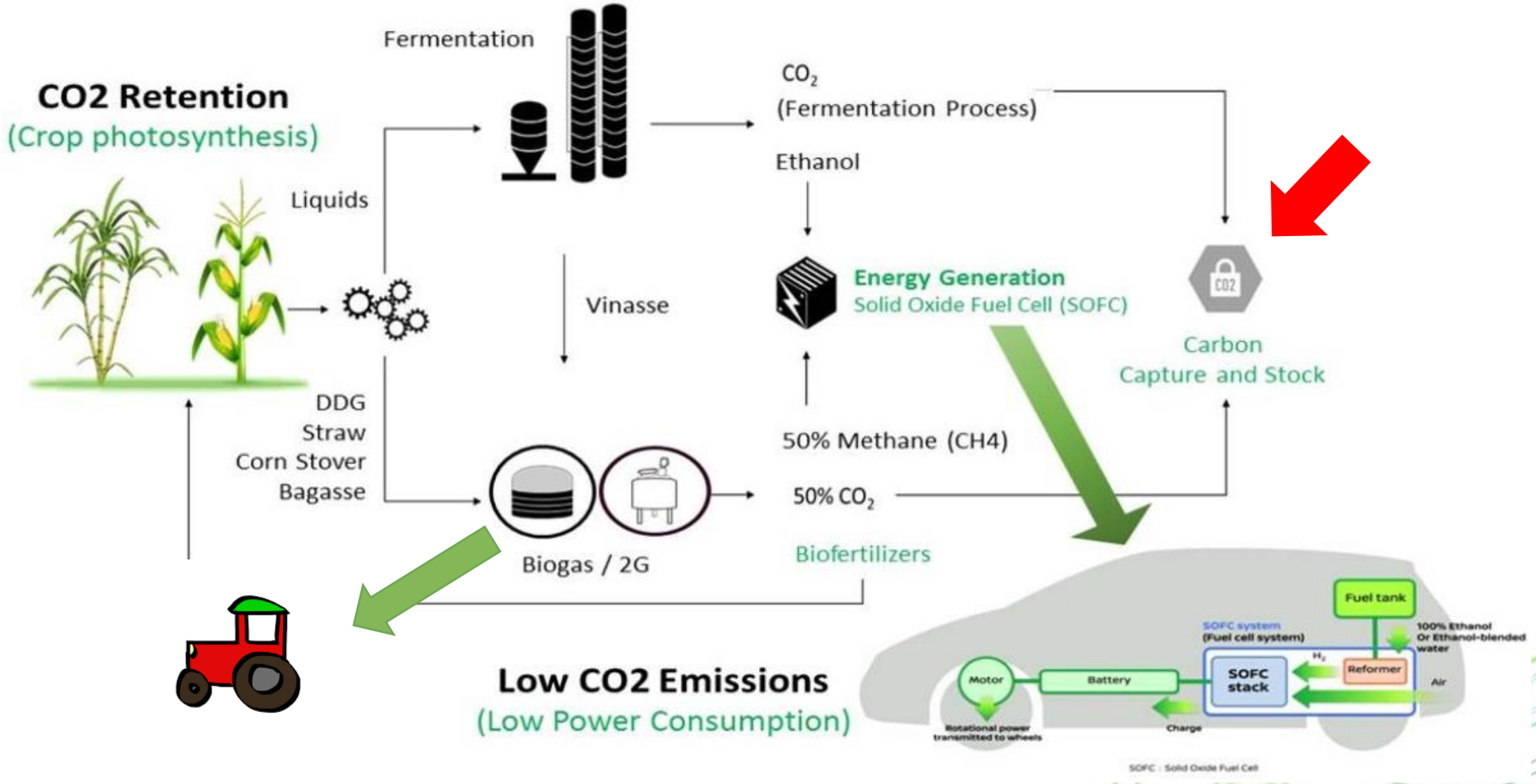


Life Cycle Analysis



Biogas - Methane

Negative Emission



bio future

SUSTAINABLE MOBILITY: ETHANOL TALKS INDIA

REALIZATION:

isma™ indian sugar mills association

BRAZIL Sugarcane Bioenergy Solution

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TECHNICAL SUPPORT

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