Options for Reducing Transport Carbon Emissions

Prepared for Hawaii Bioeconomy Forum

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2. Our clients: government agencies, oil and renewable fuels companies, trade associations, technology developers, private equity firms, and law firms.
3. Leading experts on California's Global Warming Solutions Act (AB32) programs - the LCFS and Cap & Trade.
4. Stillwater's **LCFS Newsletter** offers producers, importers, traders, and investors the right information to make smart credit market decisions.
5. **Questions about the LCFS?** Our team of experts is available to provide specific analysis and tailored strategy for your needs.

Objectives

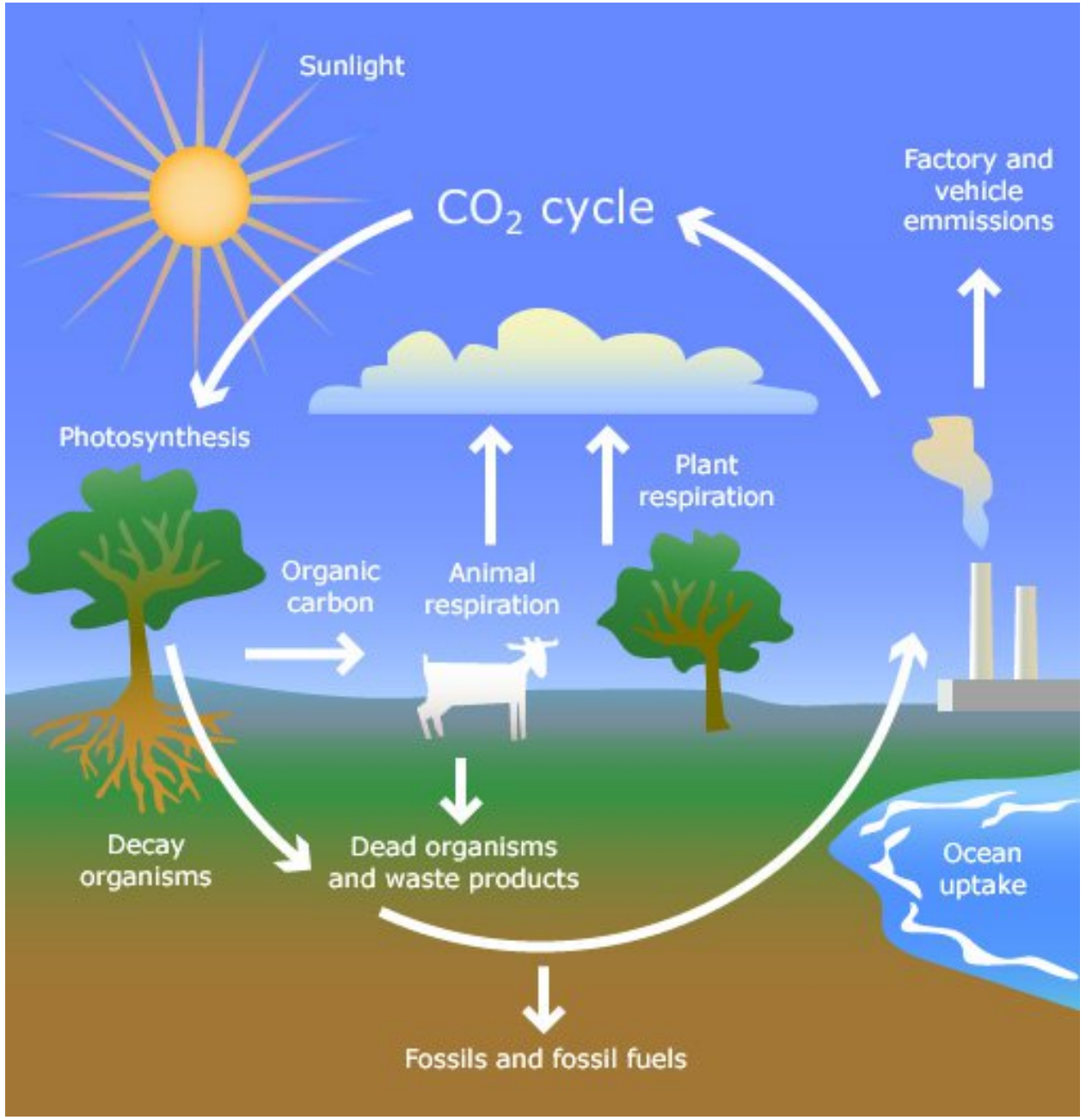
1. What is a greenhouse gas?
2. Difference between life-cycle and tailpipe emissions
3. Different ways to reduce carbon emissions
4. Specific examples for a diesel bus

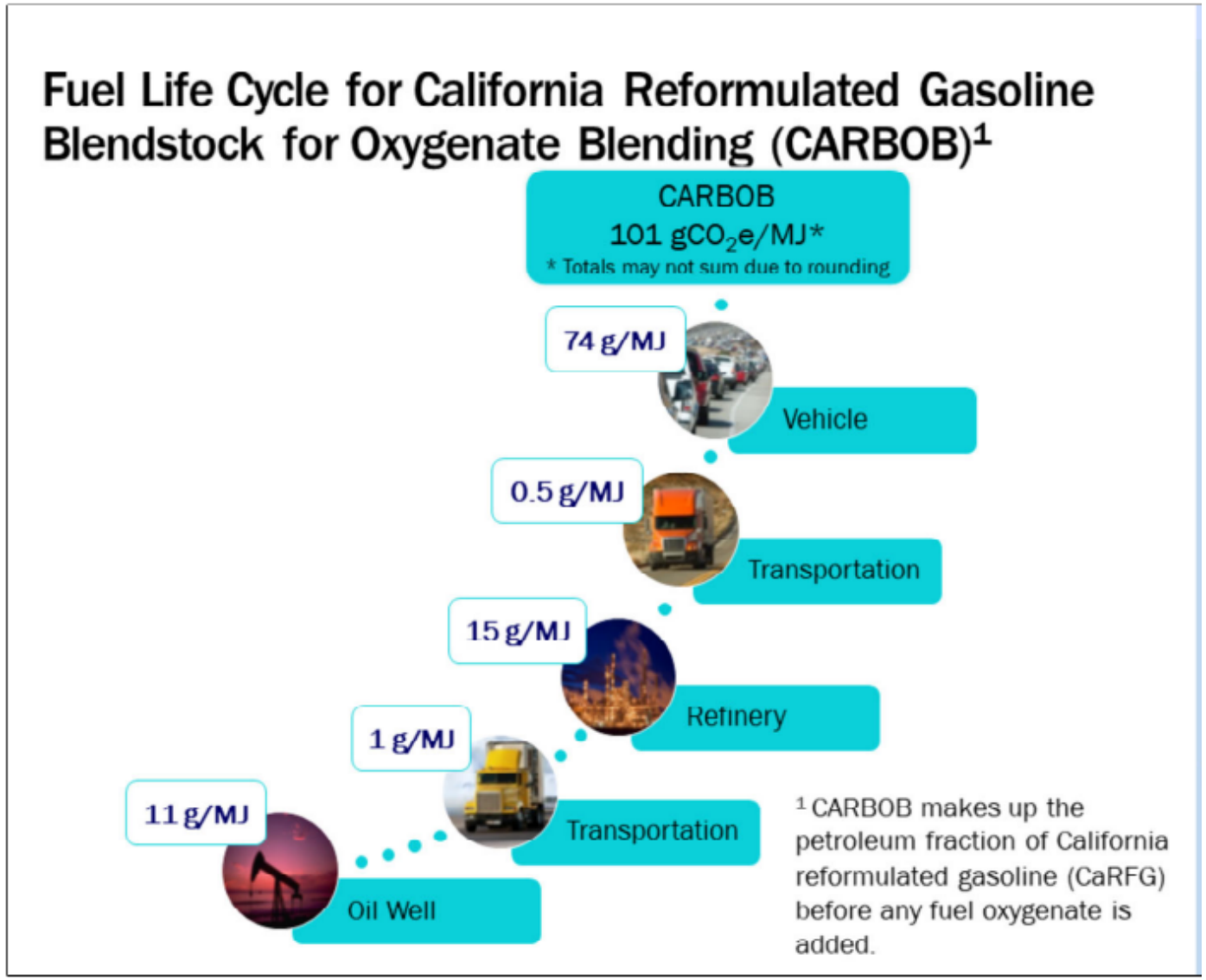
What is a Greenhouse Gas?

1. A greenhouse gas (GHG) absorbs energy radiating from the earth and re-radiates it into the atmosphere, increasing global temperatures.
2. The primary GHGs are water vapor, **CO_2**, methane, nitrous oxide, and ozone.
3. The primary objective of legislation and regulations to address climate change is reduction of GHG emissions.

The CO_2 Cycle

1. Burning fossil fuels increases CO_2 content in the atmosphere.
2. The natural CO_2 cycle shown here does not increase CO_2 in the atmosphere.
3. So, fuels from carbon in the natural cycle do not increase GHGs in the atmosphere
4. CO_2 emissions are not all treated the same in the LCFS.





Life Cycle Analysis vs. Tailpipe Emissions

1. Life cycle emissions include all fossil fuels emissions from producing, transporting, and consuming the transport fuels.
2. Tailpipe emissions from renewable fuels are not included in life cycle emissions calculations.

Methods for Decarbonizing Transport

1. Decarbonize electricity with wind, solar, or nuclear; electrify the transport fleet
2. Use renewable fuels
3. Increase engine efficiency
4. Recover energy lost when braking (i.e. hybrid vehicles)
5. Reduce vehicle miles travelled
6. Increase use of mass-transit

Example CO2 Reductions for a Bus

Bus Type	CO_2 Emissions (kg/mile)	% Reduction
Diesel	2.69	0%
Diesel Hybrid	1.88	30%
Fuel Cell H2 from Nat. Gas	1.57	42%
Electricity from Diesel	**1.24**	**54%**
Renewable Diesel	**1.08**	**60%**
Hybrid RD	0.75	72%
Electricity from Nat. Gas	0.71	74%
Electricity from RD	**0.32**	**88%**
Electricity from Wind/Solar	0.05	98%

1. All examples which reduce CO2 emissions increase costs.
2. Electrification with wind or solar power is closest to zero carbon but takes decades to convert the fleet & electrical generation infrastructure.
3. Biofuels have substantial benefits and can be implemented quickly in existing vehicles & electrical generation infrastructure.
4. LCFS programs incentivize many pathways.

Summary


FREE Shuttle!
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FREE
FREE DAILY CULTURAL ACTIVITES

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...experience runs deep

Thank you.

Questions?