

The “Green” Gold Rush:

Opportunities in Carbon Markets for Washington Dairies, Digesters and Beyond

Time of Change and Timely Opportunities for Dairy Digesters

Hosted by Washington State University and University of Idaho (in collaboration with Washington Dairy Federation)

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About CleanFuture, Inc.



CleanFuture is focused on fleet efficiency and transportation emissions reduction including management of the generation, marketing and sale of the associated environmental credits.

CleanFuture helps fleets save money while reducing emissions.

CleanFuture helps renewable energy projects connect with lucrative transportation carbon markets.

Dairy Digester Update & Opportunities

Panel Overview

1. Dairy digesters – time of change & opportunity
2. Dairy Digester Pathways
 - RNG – Renewable Natural Gas
 - Biogas to Power for Electric Vehicle Charging
3. Overview of revenue sources for dairy digester projects
 - State Clean Fuels credits (CA LCFS, OR CFP, WA CFS) – baseline issues
 - Federal RFS RIN credits
 - Commodity energy sales
 - ITC – extended to biogas projects in 2022
4. Evaluation of dairy digester pathways:
 - RNG – saturated market, RFS RIN + State CFS credits
 - Biogas to power for EV charging – future market; no eRIN, but ITC + State CFS credit = financing
5. Concerns
6. Opportunities
7. Questions

Dairy Digester Project Pathways

1. RNG – Renewable Natural Gas (for transport or other uses)
2. Power for EVs – power for electric vehicle charging

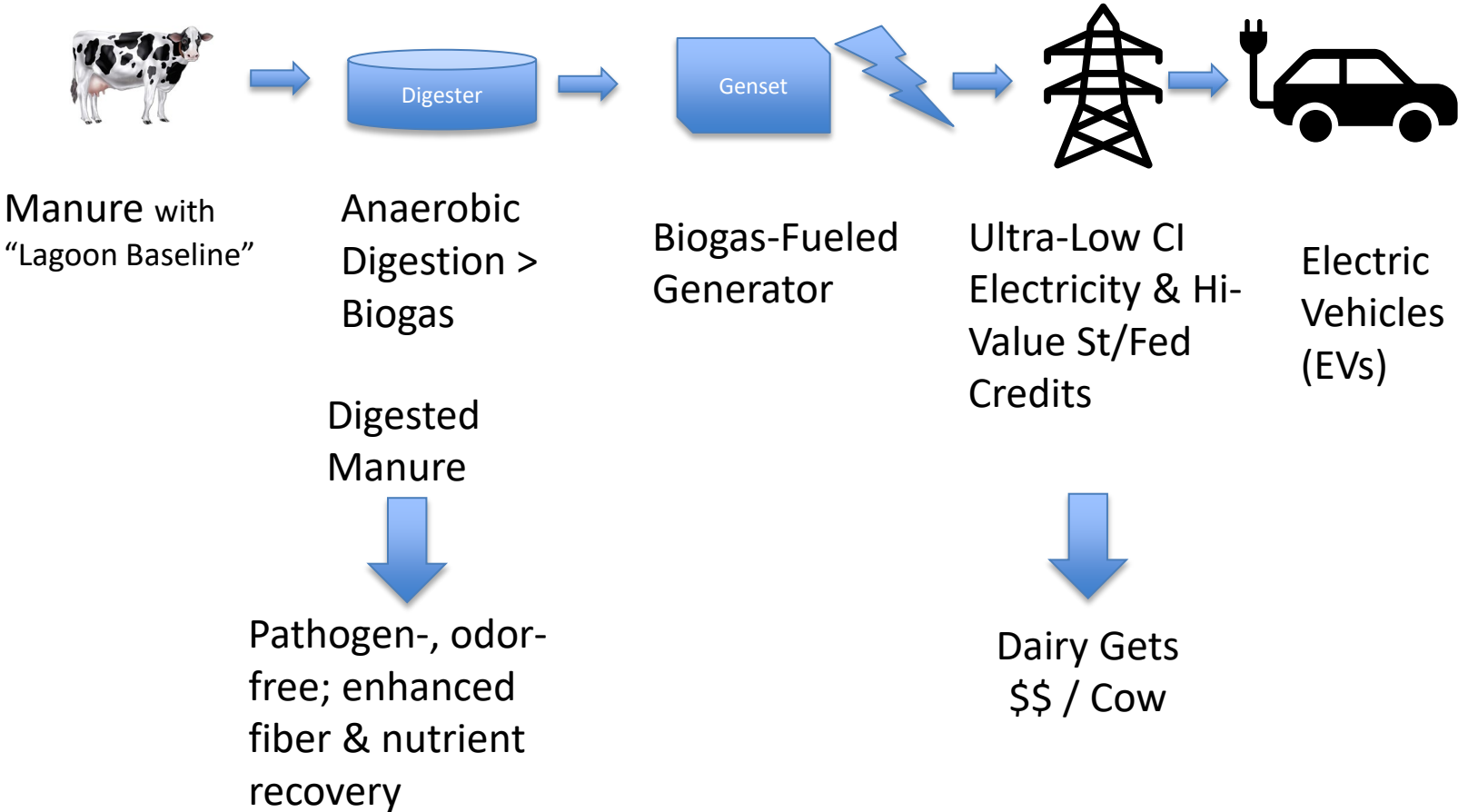
FUTURE

Hydrogen, SAF, industrial feedstocks

NON-DIGESTER CARBON REDUCTIONS

Non-digester alternative manure management that reduces CH₄ emissions

Biogas-to-Power for Electric Vehicles (EVs) Model



Market Opportunities for Biogas and Biomethane

Market	Description	Historical Price Performance
<p>Clean Fuel Standard (CFS) - Credits</p> <ul style="list-style-type: none"> CA – Low Carbon Fuel Standard (LCFS) OR – Clean Fuels Program (CFP) WA – Clean Fuels Program (WA-CFP) BC – Low Carbon Fuel Standard (BC-LCFS) Canada – Clean Fuel Regulation (CFR) 	<ul style="list-style-type: none"> Programs to reduce the carbon intensity of transportation fuels <ul style="list-style-type: none"> RNG must be dispensed to vehicles in the jurisdiction Electricity must be supplied to EVs in the jurisdiction CI score is important factor, determines project viability Book-and-claim accounting 	<p style="text-align: center;">Credit Price CA-LCFS & OR-CFP</p> <p style="text-align: center;">— OR-CFP average — CA-LCFS average</p>
<p>Renewable Fuel Standard (RFS)</p> <ul style="list-style-type: none"> USA – RIN 	<ul style="list-style-type: none"> Federal program to reduce greenhouse gas emissions and reliance on imported oil <ul style="list-style-type: none"> RIN credits are generated with each gallon equivalent of qualifying renewable fuel Book-and-claim accounting 	<p style="text-align: center;">RIN Price D3</p> <p style="text-align: center;"><small>Transfer Date by Week, FUEL (D Code)</small></p>
<p>Commodity</p> <ul style="list-style-type: none"> Natural Gas Electricity 	<ul style="list-style-type: none"> RNG is identical to fossil methane (CH₄) and can be injected into same infrastructure Electricity is supplied to the electric grid 	



State Transportation Market Summaries

Clean Fuel Standard Policies Are a Key Driver of Growth

California LCFS as the catalyst for biomethane (RNG), new Clean Fuels Standards will drive growth

25

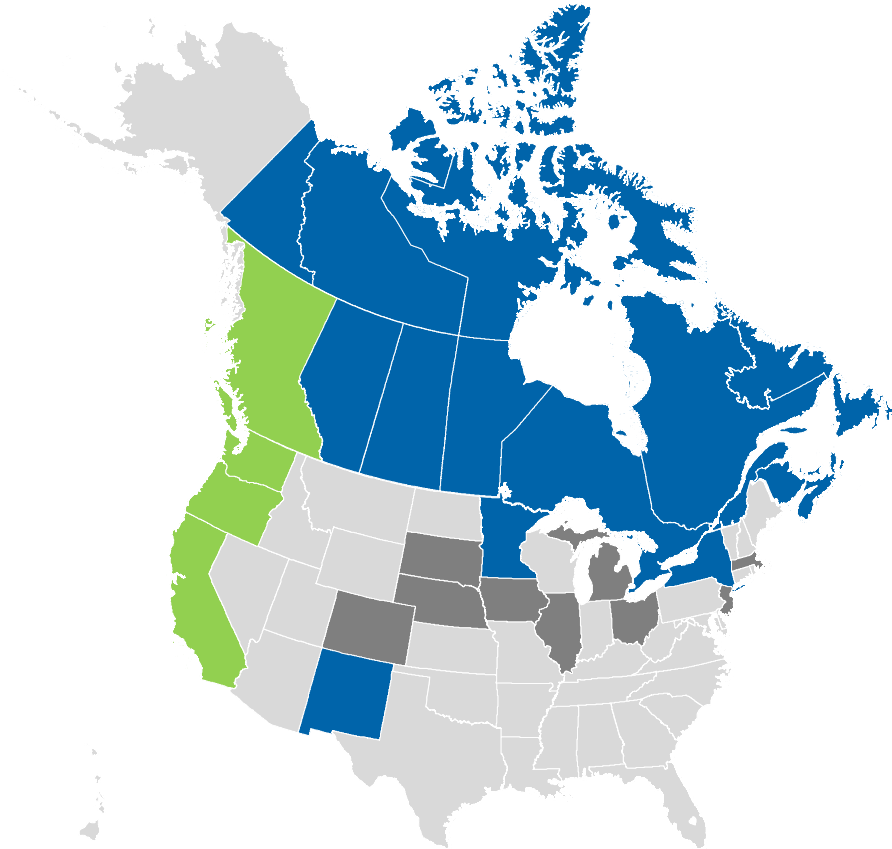
U.S. states and Canadian provinces administering, implementing, or considering a clean fuels standard

California established the precedent of decarbonizing state-level transportation fuel markets with the 2009 enactment of the LCFS.

Other states have followed California's lead in establishing market-based incentives for investments in low-CI vehicles and equipment (Oregon and Washington).

Clean Fuel Standard (CFS) policies establish systems of tradable credits to incentivize the adoption of low-carbon energy technologies.

In addition to the British Columbia LCFS, Canada is launching a national CFS in 2023 covering its 10 provinces.



Clean Fuels Standards In Place

Clean Fuels Standards In Development and/or Proposed

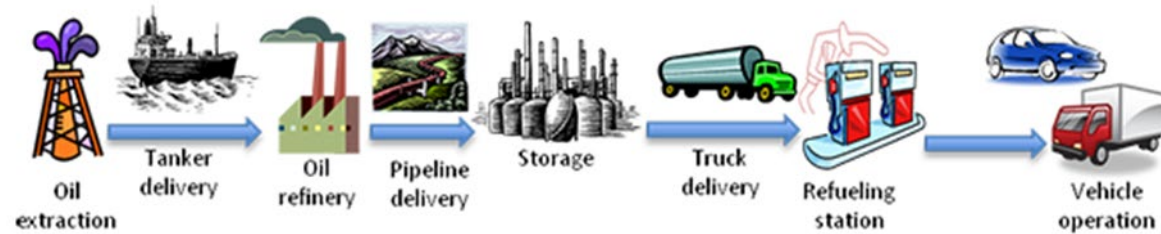
Clean Fuels Standards Under Consideration

Carbon Intensity

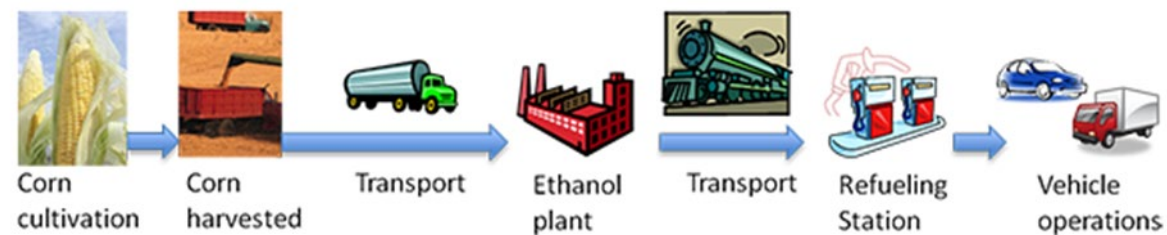
Lifecycle Emissions (“well-to-wheel”) for Fuel Pathway

Total GHG pollution expressed in carbon dioxide equivalence (CO₂e)

Example for petroleum fuel as a baseline:



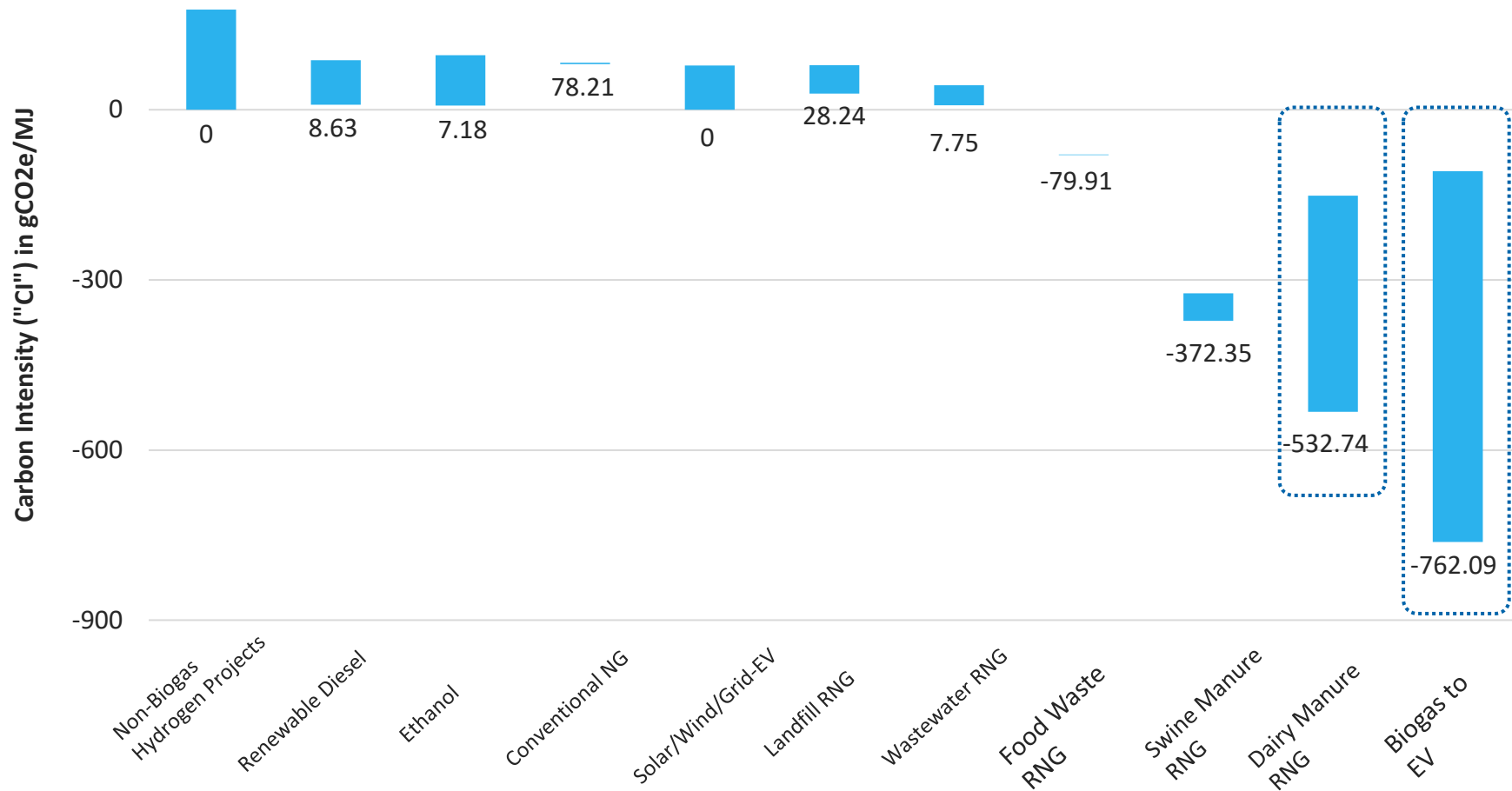
Example for biofuel (ethanol):



Carbon Intensity of Fuel Pathways

RNG (biomethane) and biogas-to-electricity vehicle fuels have the lowest carbon intensity of transportation fuels

California Air Resources Board ("CARB") LCFS Pathway Carbon Intensity Ranges by Technology



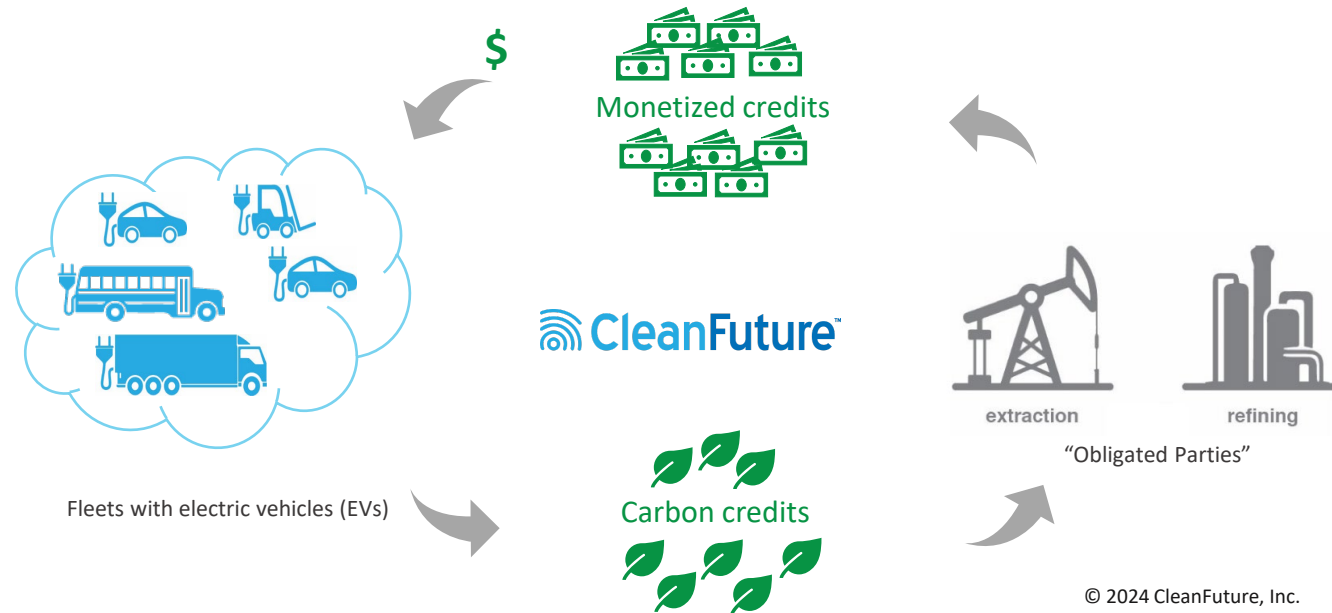
Source: American Biogas Council, California Air Resources Board



**Renewable Electricity &
Electric Vehicle Pathways**

Environmental Credits from Clean Fuel Standards

Low Carbon Fuel Standard (California & British Columbia)
Clean Fuels Program (Oregon & Washington)



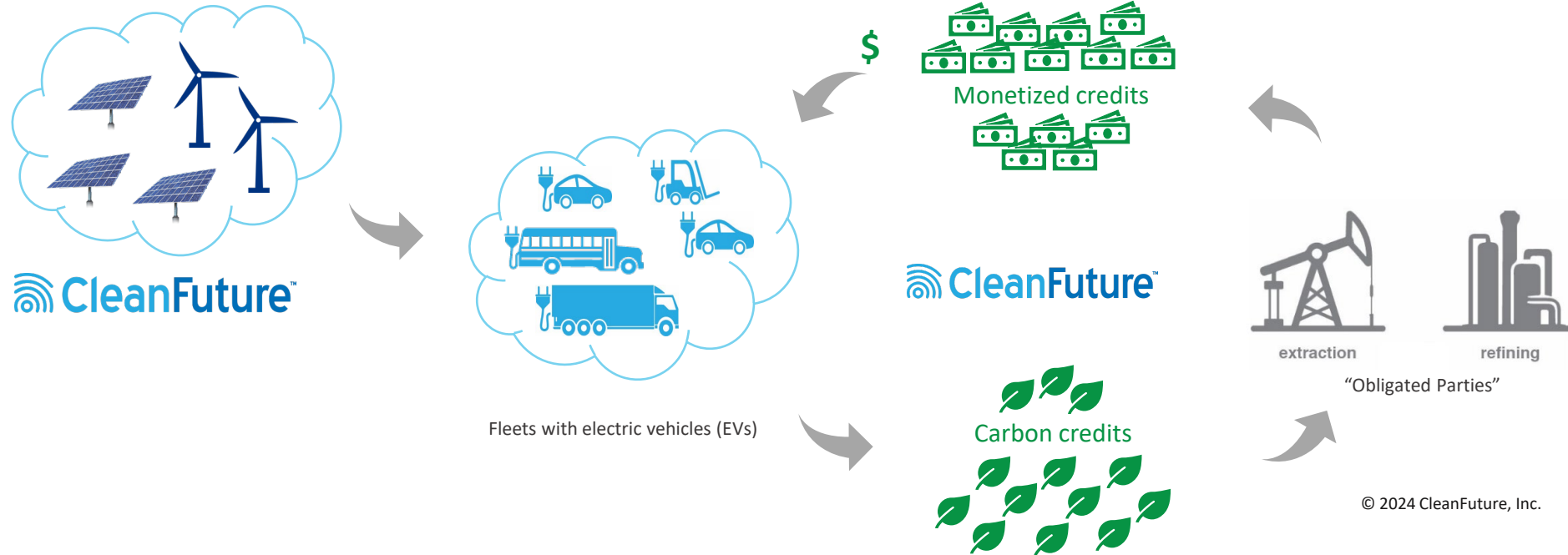
Environmental Credits from Clean Fuel Standards

Low Carbon Fuel Standard (California & British Columbia)

Clean Fuels Program (Oregon & Washington)

Renewable electricity generates:

- Incremental credits



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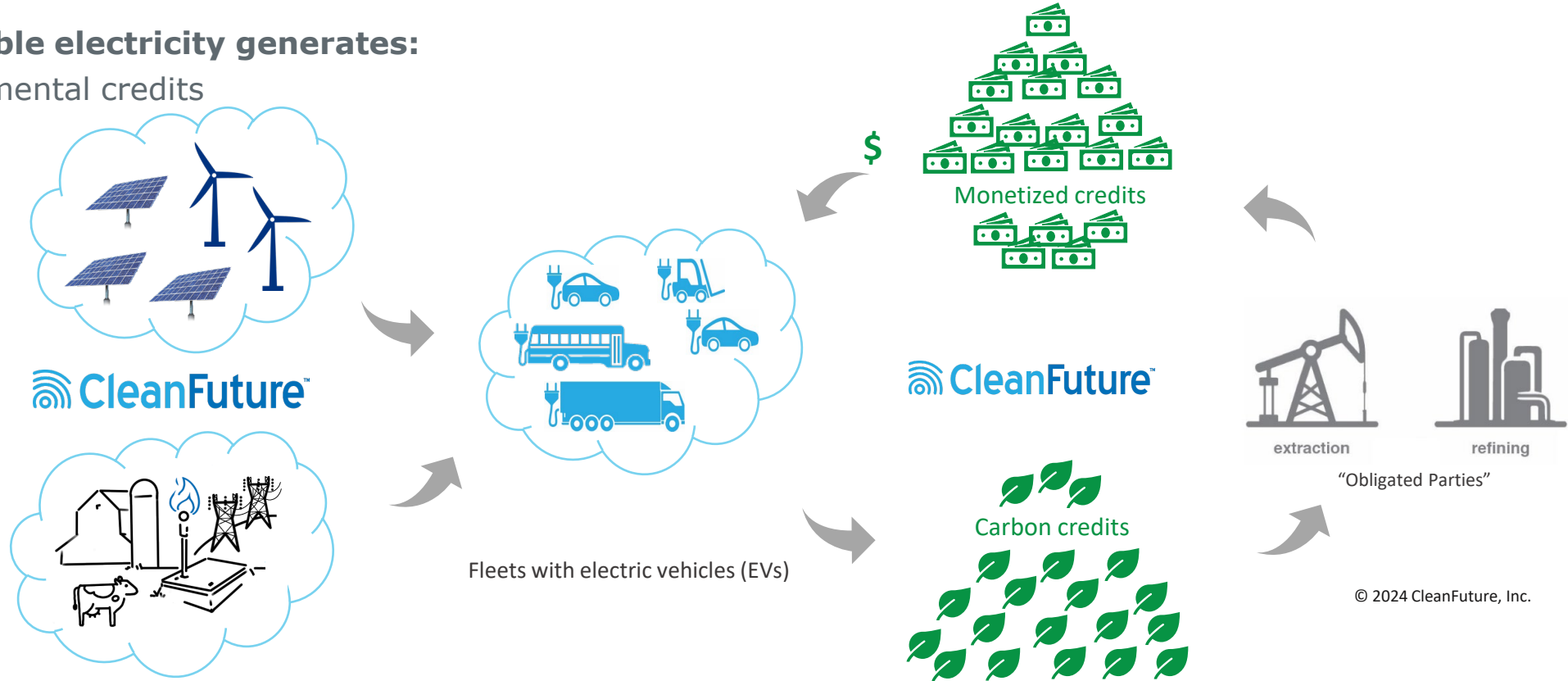
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CleanFuture's Role

- Turnkey service provider to fuel producers
 - Registering with regulatory programs,
 - Lifecycle modeling,
 - Pathway certification,
 - Monitoring
 - Overseeing third-party verification (hire VB), work through questions,
 - Matching with EV fleets,
 - Issue credits on environmental markets,
 - Monetize credits.
 - Work with producer, work with developer, work with both.
- Turnkey service provider to EV fleets
 - Registration / Reporting
 - Credit generation / monetization
- Policy/regulatory expertise

Electric Vehicle Types & Energy Efficiency

EVs in many forms and functions

Cars (light-duty on-road)

- Cars
- Motorcycles



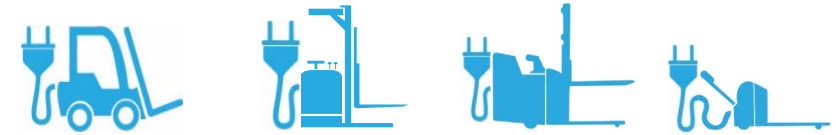
Trucks & Buses (heavy-duty)

- Electric Buses
- Electric Trucks



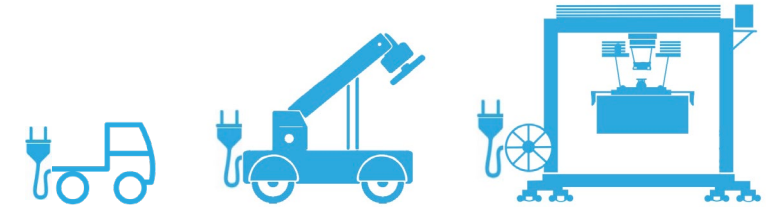
Forklifts & Material Handling Equipment

- Electric Forklifts
- Electric Reach Trucks
- Electric Order Pickers
- Electric Very Narrow Aisle
- Electric Pallet Trucks



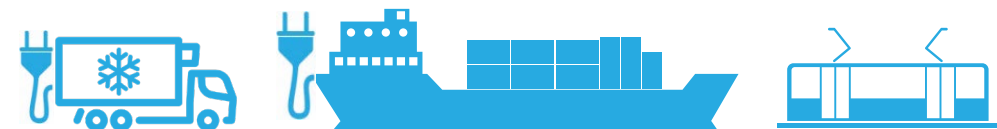
Cargo Handling Equipment

- Electric Yard Cranes
- Electric Rubber-tired Gantry (RTG) Cranes
- Electric Top Handlers
- Electric Yard Tractors (hostlers, yard goats, utility tractor rig, etc.)



Other

- Electric Transport Refrigeration Units (eTRU)
- Shore Power / Cold Ironing
- Rail (heavy & light)
- Other



Electric Fuel Pathways – Example CleanFuture Pathways

Pathway Type	Fuel Pathway Description	Feedstock	Pathway Holder	LCFS	CFP	Carbon Intensity (gCO2e/MJ)
Lookup	Electricity	Grid Mix, average		X	X	75.93
	Low-CI Electricity	Solar, Wind		X	X	0
	Smart Charging	Time of Day		X		Varies
Tier 2	Low-CI Electricity	Cheese Wastewater Biogas	CleanFuture		X	6.03
	Low-CI Electricity	Organic Waste Biogas	CleanFuture		X	-78.22
	Low-CI Electricity	Organic Waste Biogas	CleanFuture		X	-109.96
	Low-CI Electricity	Dairy Manure Biogas	CleanFuture		X	-309.19
	Low-CI Electricity	Dairy Manure Biogas	CleanFuture	X		-352.89
	Low-CI Electricity	Dairy Manure Biogas	CleanFuture	X		-431.65
	Low-CI Electricity	Dairy Manure Biogas	CleanFuture	X		-493.57
	Low-CI Electricity	Dairy Manure Biogas	CleanFuture	X		-525.14
	Low-CI Electricity	Dairy Manure Biogas	CleanFuture		X	-630.91
	Low-CI Electricity	Dairy Manure Biogas	CleanFuture		X	-647.53
	Low-CI Electricity	Dairy Manure Biogas	CleanFuture	X		-758.46
Tier 2	Electricity	Organic Waste Biogas	CleanFuture		X	105.02
	Electricity	Milk Waste Biogas	CleanFuture	X		107.75
	Electricity	Cheese Wastewater Biogas	CleanFuture	X		167.54
	Electricity	Organic Waste Biogas	CleanFuture		X	172.44
	Hydrogen	Fossil Natural Gas	CleanFuture	X		153.17
	Low-CI Electricity	Manure	CleanFuture	X	X	TBD
	Low-CI Electricity	Organic Waste Biogas	CleanFuture	X	X	TBD
	Electricity	EER-Adjusted	CleanFuture	X	X	TBD

+6.03
to
-762.09

Two CleanFuture Pathways into Oregon's Clean Fuels Program with Northwest Electricity Projects

Vander Haak Dairy

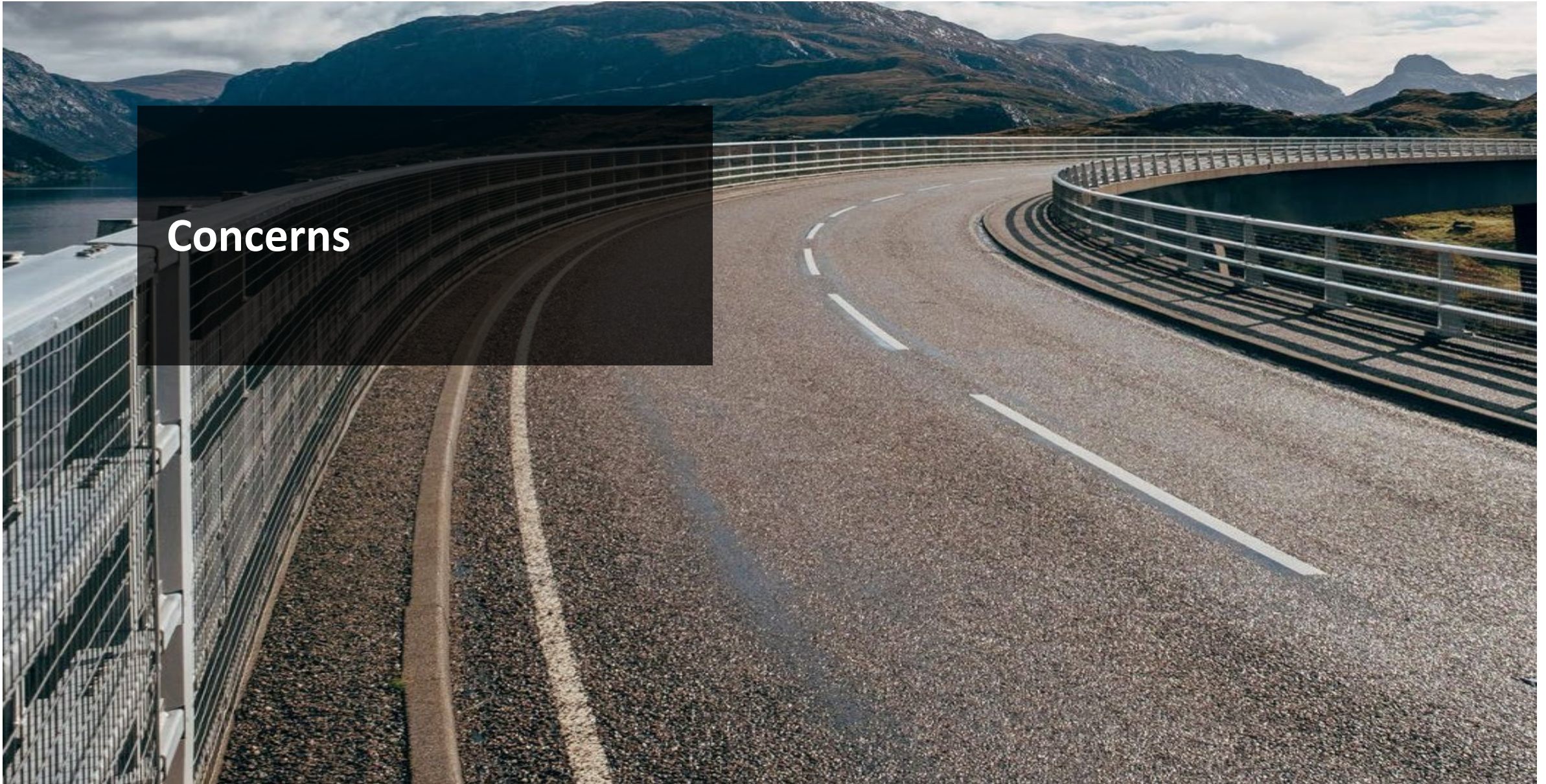
- About 700 cows + Food Waste
- Lyndon, WA



Oak Lea Dairy

- About 400 cows + Organic Waste
- Aumsville, OR

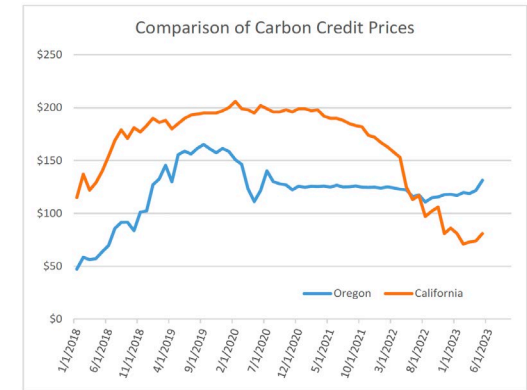




Concerns

Concerns & Threats

- Volatility
 - Credit price fluctuation
- Regulatory Uncertainty (i.e., rule changes)
 - State Markets / Clean Fuel Standards
 - Possible retraction of methane avoidance crediting
 - Deliverability
 - Book-and-claim rules
 - Federal Markets / Renewable Fuel Standard
 - Electricity (i.e., eRIN)
- “Environmental Justice” movement (anti-dairy, anti-nat gas)
- Political attacks on carbon reduction programs & policies -- Cap & trade programs (WA CCA Initiative), federal RFS, ITC

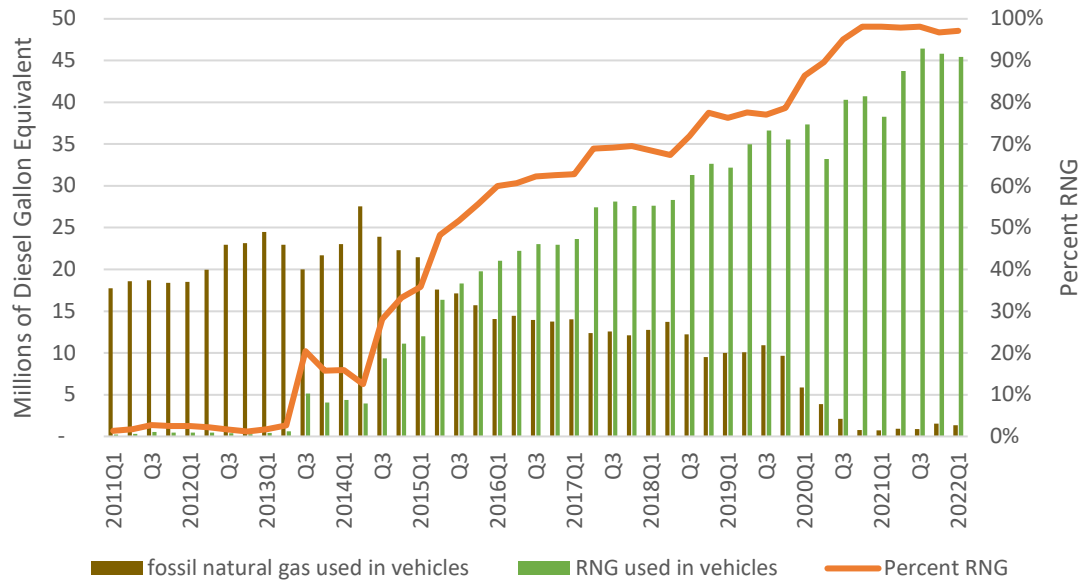




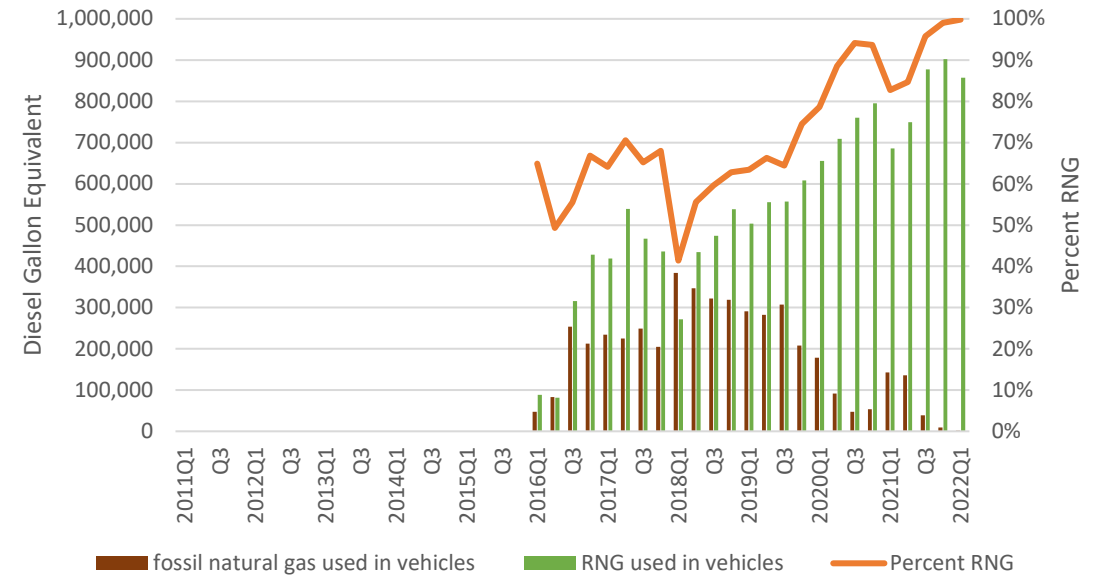
Opportunities

Saturated Markets for Renewable Natural Gas

California Natural Gas Use in Vehicles



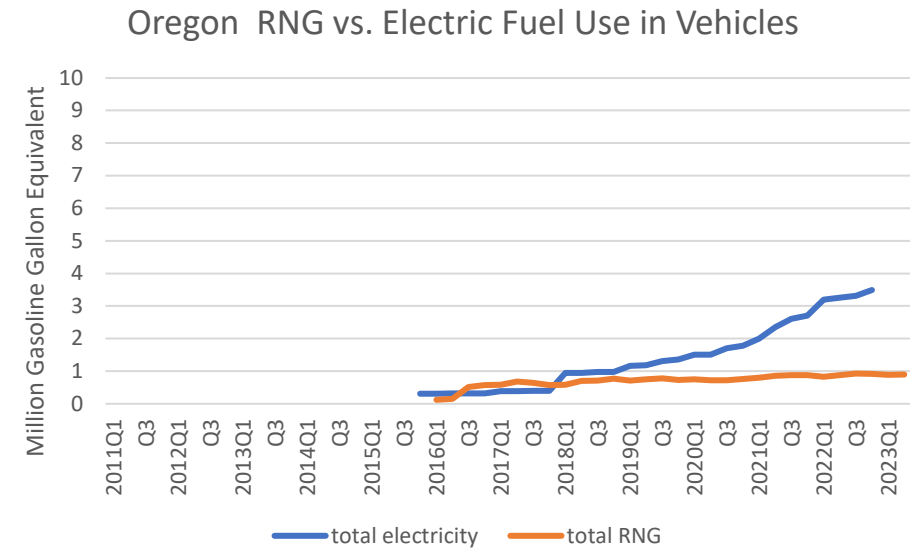
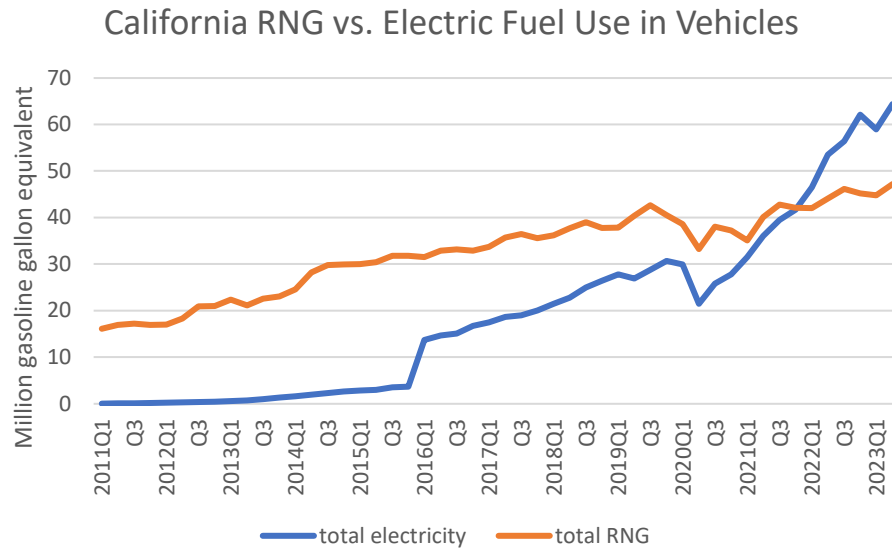
Oregon Natural Gas Use in Vehicles



Supply exceeds demand for RNG!

Data Sources: California Air Resources Board, Oregon Department of Environmental Quality

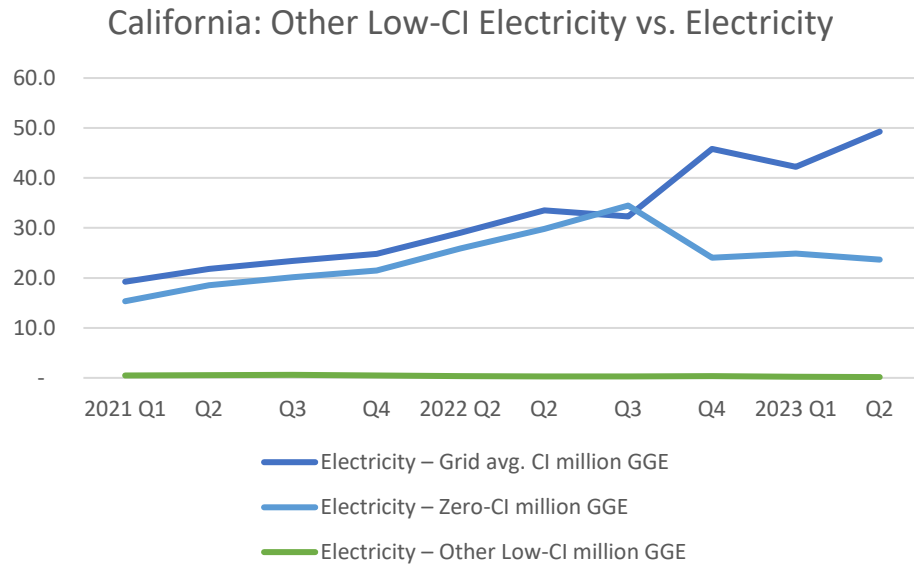
EV Opportunity for Growth



Rapidly growing EV end-use / stagnant RNG end-use!

Data Sources: California Air Resources Board, Oregon Department of Environmental Quality

Opportunity for Dairy Electricity in Clean Fuel Standard Markets



Plentiful appetite for dairy electricity!

Data Sources: California Air Resources Board, Oregon Department of Environmental Quality

Opportunities

New markets for Carbon Credits with Electricity from Biogas

Clean Fuel Standard changing market dynamics

- New markets
 - Oregon
 - Washington
- California LCFS

Carbon credits / environmental attributes are a powerful economic tool

- Electricity projects well-suited for small and medium farms
 - Lower capital cost
 - Less complicated than pipeline RNG
 - Expanding market with policy support

Lock-in baseline for methane avoidance

- Act now!!!

Opportunities: bioenergy provides powerful incentives for electrification

Fuel Producer – convert wastes into electricity while destroying methane

- Revenue from electricity, CFS credits, tipping fees, etc.
 - Agricultural and farm wastes
 - Co-benefits
 - Water treatment
 - Fertilizer & bedding
 - Rainwater exclusion
 - Recaptured heat
 - Organic and food wastes
 - Divert organic and food wastes from landfills into energy projects

Fleet - low carbon intensity electricity provides a powerful economic tool

- To drive electric mobility adoption:
 - especially for “hard to electrify” freight and goods movement segments.
- For capturing methane:
 - Projects not suited for RNG
 - Small & medium sized dairies
 - Use biogas to make Low-CI electricity.

Questions / Discussion

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