

An aerial photograph of an industrial facility, likely a renewable DME production plant. The central feature is a tall, green metal distillation column with multiple levels of platforms and ladders. To the right, there are several large, white cylindrical storage tanks. The facility is situated in a dry, arid environment with a dirt road and several small, rectangular ponds or reservoirs. The overall scene is brightly lit, suggesting a sunny day.

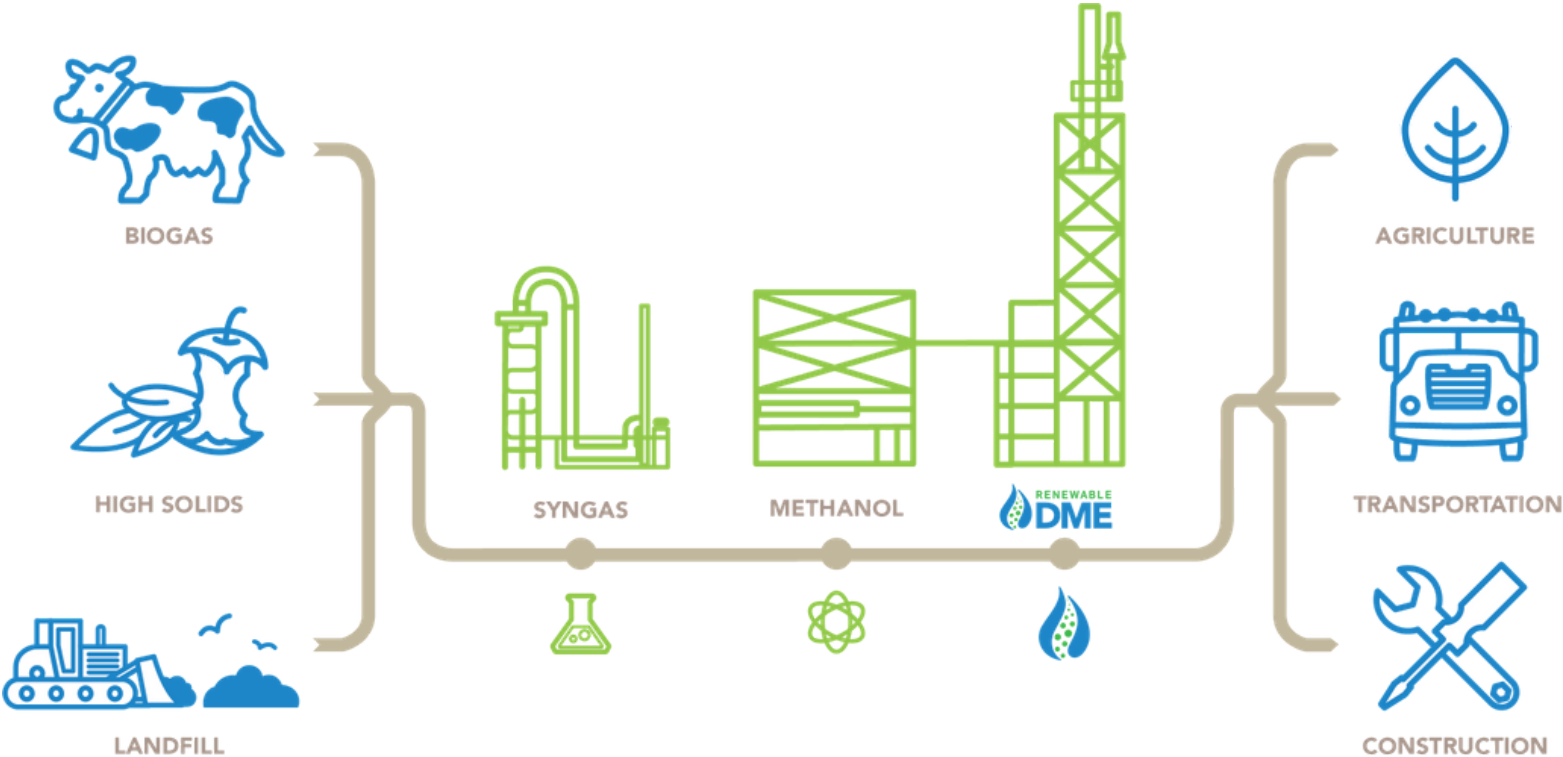
OBERON FUELS

Renewable DME: Commercialization in North America

ELLIOT HICKS, CO-FOUNDER & COO, OBERON FUELS

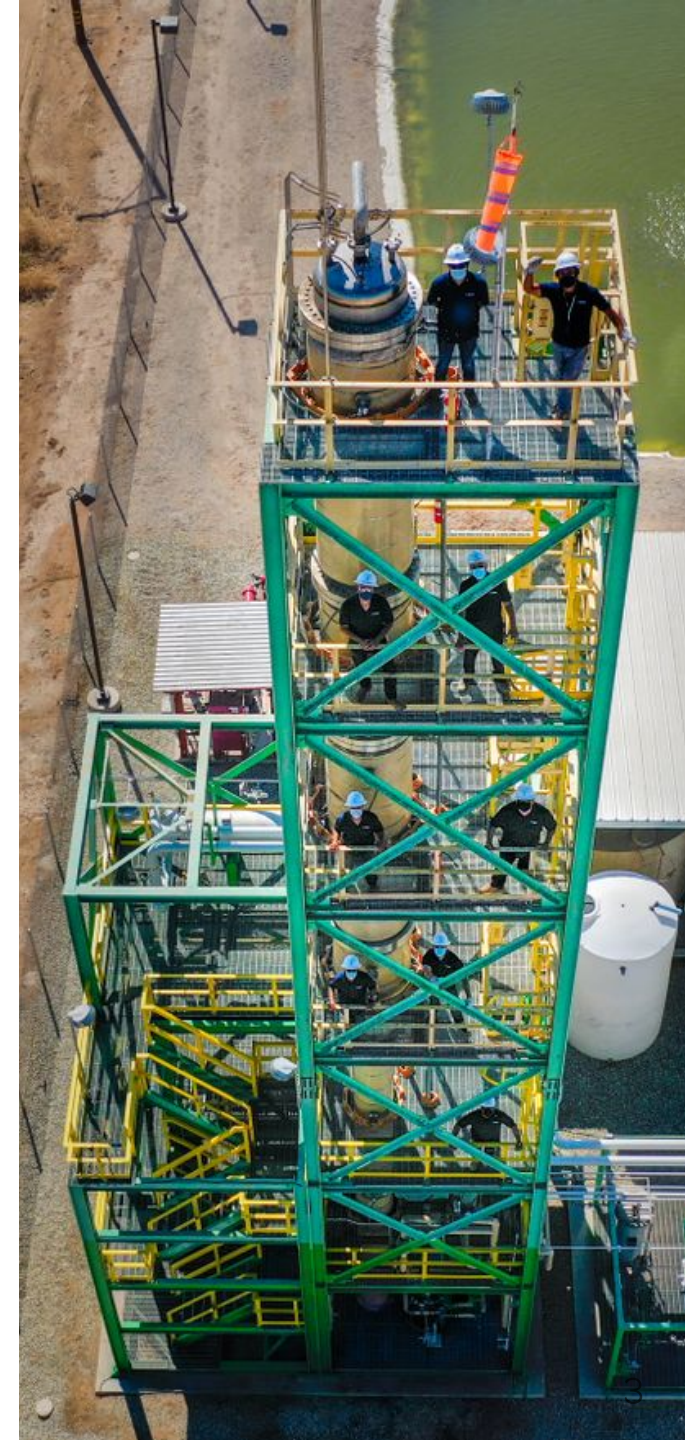
OBERON'S SMALL-SCALE DME PRODUCTION PROCESS

Various biogas-producing feedstocks such as animal manure, food waste, and landfill gas can be used to produce rDME by a 3-step, thermocatalytic process. Oberon's standardized, ready-to-build plant design is engineered to produce 10,000-gallons-per-day (24 MT), a size that balances the amount of biogas feedstock available from typical sources with plant economics.



DME PRODUCTION: OBERON'S PILOT PRODUCTION FACILITY

- **LAST STEP OF OBERON'S 3-STEP PROCESS. PRODUCED 1ST FUEL-GRADE DME IN NORTH AMERICA.**
- **OBERON'S DME PLANT IN SOUTHERN CALIFORNIA**
Located 2 hours east of San Diego in the Imperial Valley region of CA
- **STARTED PRODUCING FUEL-GRADE DME IN 2013**
Fuel-grade DME from Oberon's plant has been used for Volvo, Mack, and Ford DME vehicle demonstrations in Texas, NYC, Germany, and Canada.
- **PERMITTED AND BUILT IN 12 MONTHS**



DME: PATHWAY TO ZERO EMISSION MOBILITY

DME+PROPANE BLENDING

Blending DME into propane for use as a transportation fuel.

DME AS A DIESEL REPLACEMENT

OEM Production of new, 100% DME vehicles & Aftermarket Conversions of existing diesel vehicles to run on 100% DME or DME+Diesel blends.

DME AS A HYDROGEN CARRIER

DME serves as hydrogen carrier and converted at existing H2 fueling stations to H2 to power fuel-cell electric vehicles.



A brick wall with a mural. The mural includes a red star in the upper left, a grizzly bear in the center, a green landscape with mountains and a river in the lower middle, and the text 'CALIFORNIA REPUBLIC' in brown letters at the bottom. The bricks are white with some red paint splatters at the bottom.

WHAT MAKES CALIFORNIA SPECIAL?

DME PRODUCTION: SCALING UP WITH CALIFORNIA SUPPORT

In 2019, CEC awarded Oberon Fuels \$2.9 million to upgrade its existing CA DME production plant (Imperial Valley) from pilot to demonstration scale and produce the 1st renewable DME in the US.



DME: PART OF THE CLIMATE CHANGE SOLUTION, AB 2663



REDUCES TAXATION ON DME TO GIVE PARITY WITH OTHER ALTERNATIVE FUELS

CA Sales and Use Tax on DME, whether used as a diesel replacement or blended with propane, is reduced from 18 cents per gallon to 6 cents per gallon, providing parity with propane, CNG, and LNG.

DME: PART OF THE CLIMATE CHANGE SOLUTION, AB 2663



CALIFORNIA LOW CARBON FUEL STANDARD

- **LONG TERM CERTAINTY**

LCFS Extended to 2030

- **SALES AND USE TAX ADVANTAGES VS. DIESEL, GAS**

\$0.30 - \$0.40/DGE less for alt fuels

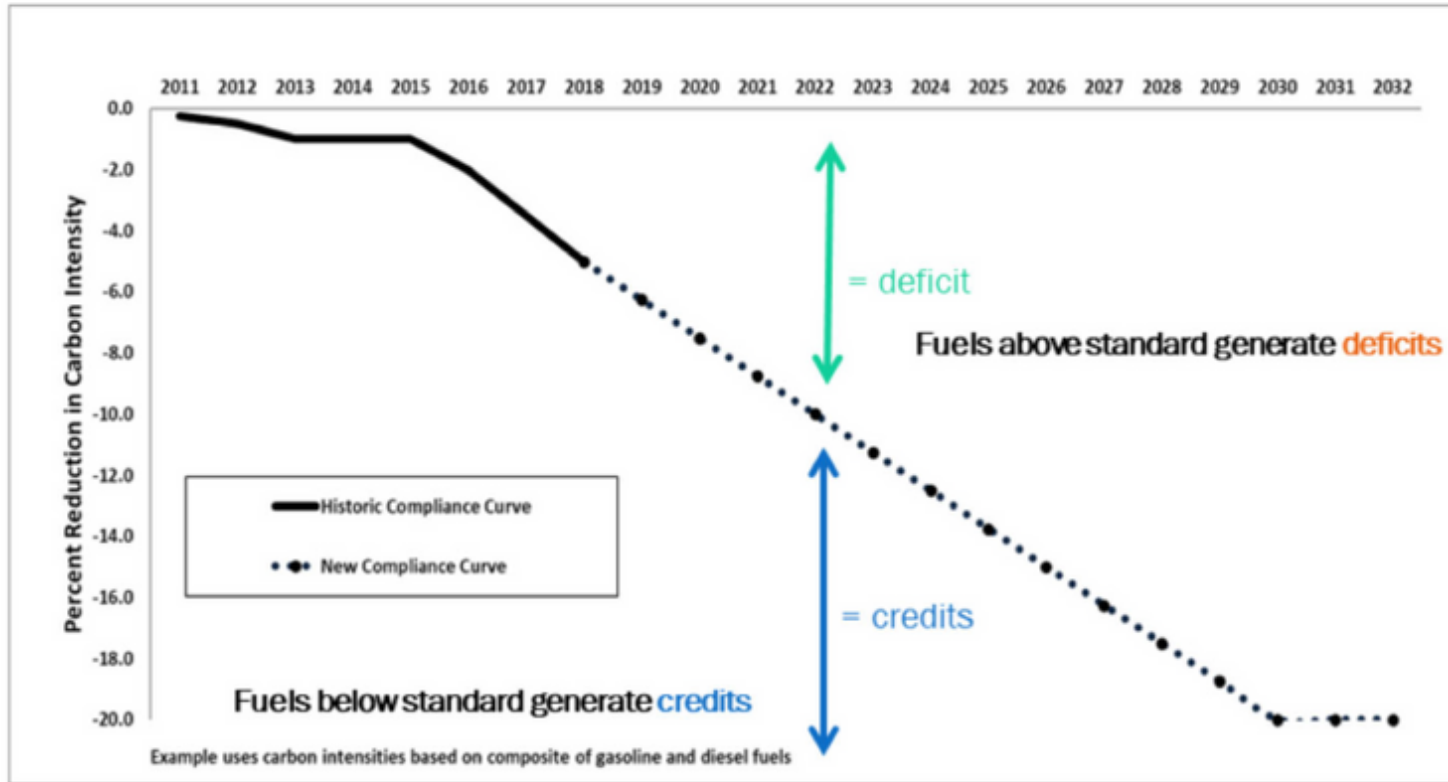
- **CARBON INTENSITY PATHWAYS**

Economic benefit for incremental process improvements

- **FINANCIAL INCENTIVES**

Each diesel gallon equivalent of rDME (worth \$2) generates ~\$10 in credit revenue

Declining Carbon Intensity Curve



Program continues with a 20% CI target post 2030

Others are Joining California: Pacific Coast Collaborative



- Pacific Coast Collaborative (PCC) is a regional agreement between California, Oregon, Washington, and British Columbia
- Strategically align policies to reduce GHGs and promote clean energy
- CA, OR, and BC: LCFS programs in place
- Regional low-carbon fuels market in the future with Washington considering a program
- Other regions including Canada and Brazil are taking notice of PCC's success and developing LCFS-like performance standards for transportation fuels



DME+PROPANE

DME MARKETS: DME+PROPANE BLENDING

- **DME OFFERS A SCALABLE WAY TO REDUCE THE CARBON INTENSITY OF PROPANE AS A TRANSPORTATION FUEL.**
- **IN THE STATE OF CALIFORNIA ALONE, OVER 6,000 - 7,000 VEHICLES (25 MILLION GALLONS PROPANE) AND 49,000 FORKLIFTS (40 MILLION GALLONS PROPANE) RUN ON PROPANE.**
- **PROPANE ENGINES AVAILABLE THAT ARE CERTIFIED TO CARB ULTRA-LOW NOX (0.02 G/BHP-HR)**



DME MARKETS: DME+PROPANE BLENDING



- **WITH CI OF 83, PROPANE USED IN TRANSPORTATION APPLICATIONS WILL EXCEED THE ALLOWABLE CI AND GENERATE DEFICITS BEFORE 2030.**
- **CARB CALCULATED DME MADE FROM DAIRY BIOGAS (CI - 150) BY THE OBERON PROCESS TO HAVE A CI VALUE OF -278.**
- **WITH ONLY 5VOL% BLEND OF DAIRY-BIOGAS DME, PROPANE'S CI VALUE COULD BE REDUCED FROM 83 TO 68.**
- **AT 16VOL% DME, DME+PROPANE BLEND WOULD HAVE A CI OF 35.**

THE POWER OF DME...DME+PROPANE BLENDING



OBERON + SUBURBAN: MOVING DME TOWARDS COMMERCIALIZATION



OBERON & SUBURBAN PARTNERSHIP

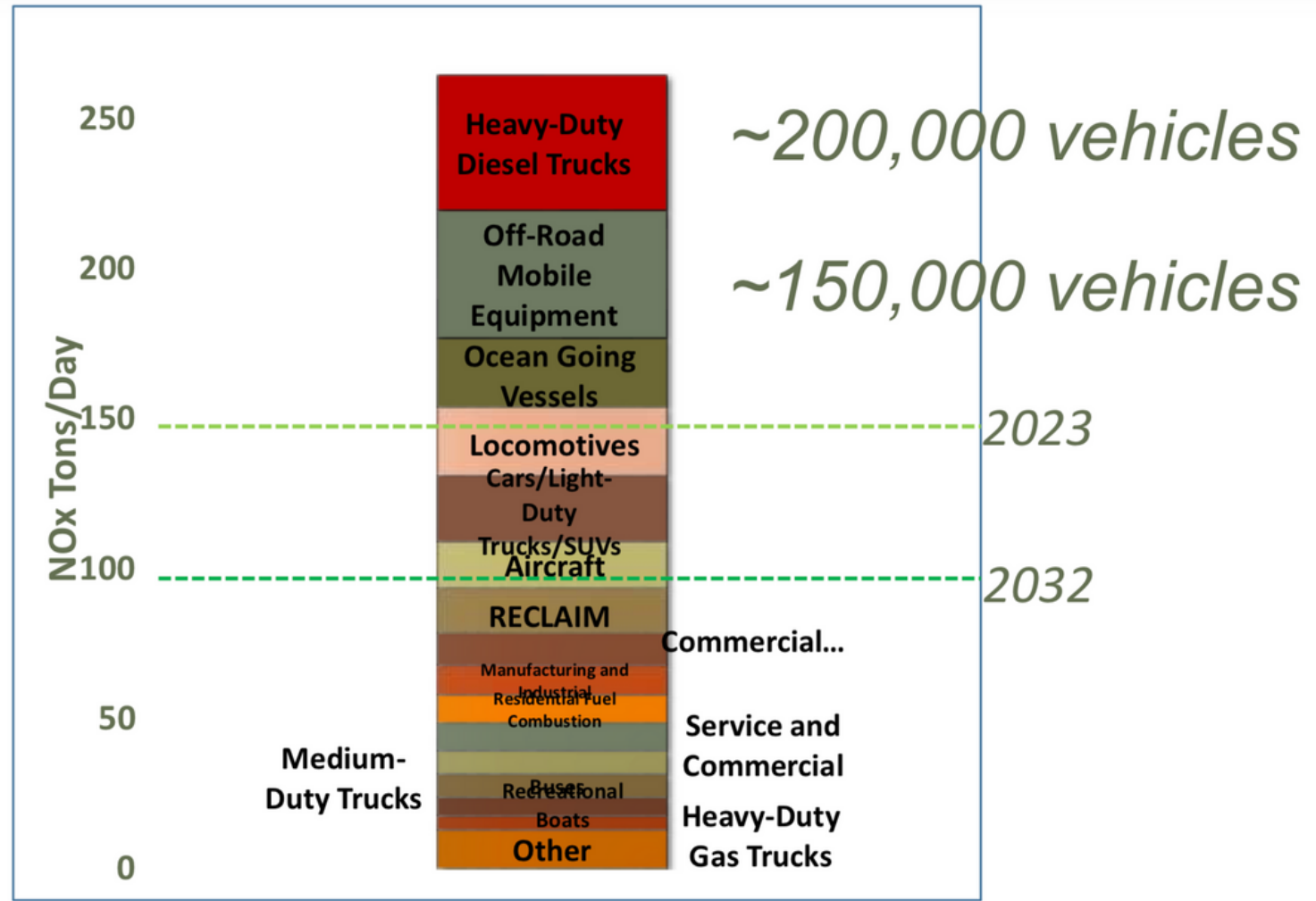
- **VISIONARY PARTNERS** WHO UNDERSTAND THE DYNAMIC ENERGY SECTOR AND THE IMPORTANT ROLE OF RENEWABLE ENERGY SOURCES
- **INFRASTRUCTURE:** 41 STATES ACROSS THE US
- **LOGISTICS:** MOVING, STORING, AND DISPENSING
- **CUSTOMERS:** IN THE TRANSPORTATION SECTOR AND BEYOND





IS IT ALL GOING ELECTRIC?

Top NOx Sources 2023



ELECTRIC OFF-ROAD HEAVY DUTY?



- **265 GALLON DIESEL TANK**

Massive energy storage capacity - consumption >1 gallon per acre

- **HOW TO FUEL WITH H2?**

700 bar H2 compression in the middle of a field?



HYDROGEN?

RENEWABLE HYDROGEN MANDATE

The state requires hydrogen to be made from renewable resources

1

33.3% RENEWABLE HYDROGEN MANDATE

SB 1505 requires 33.3% renewable content in the hydrogen sold as transportation fuel in CA.

2

ARB 2017 SCOPING PLAN

Includes renewable hydrogen deployment and electrification of transportation with batteries AND hydrogen.

3

GOVERNOR'S 2020 EXECUTIVE ORDER

Bans internal combustion engines* by 2035.

* *where feasible*

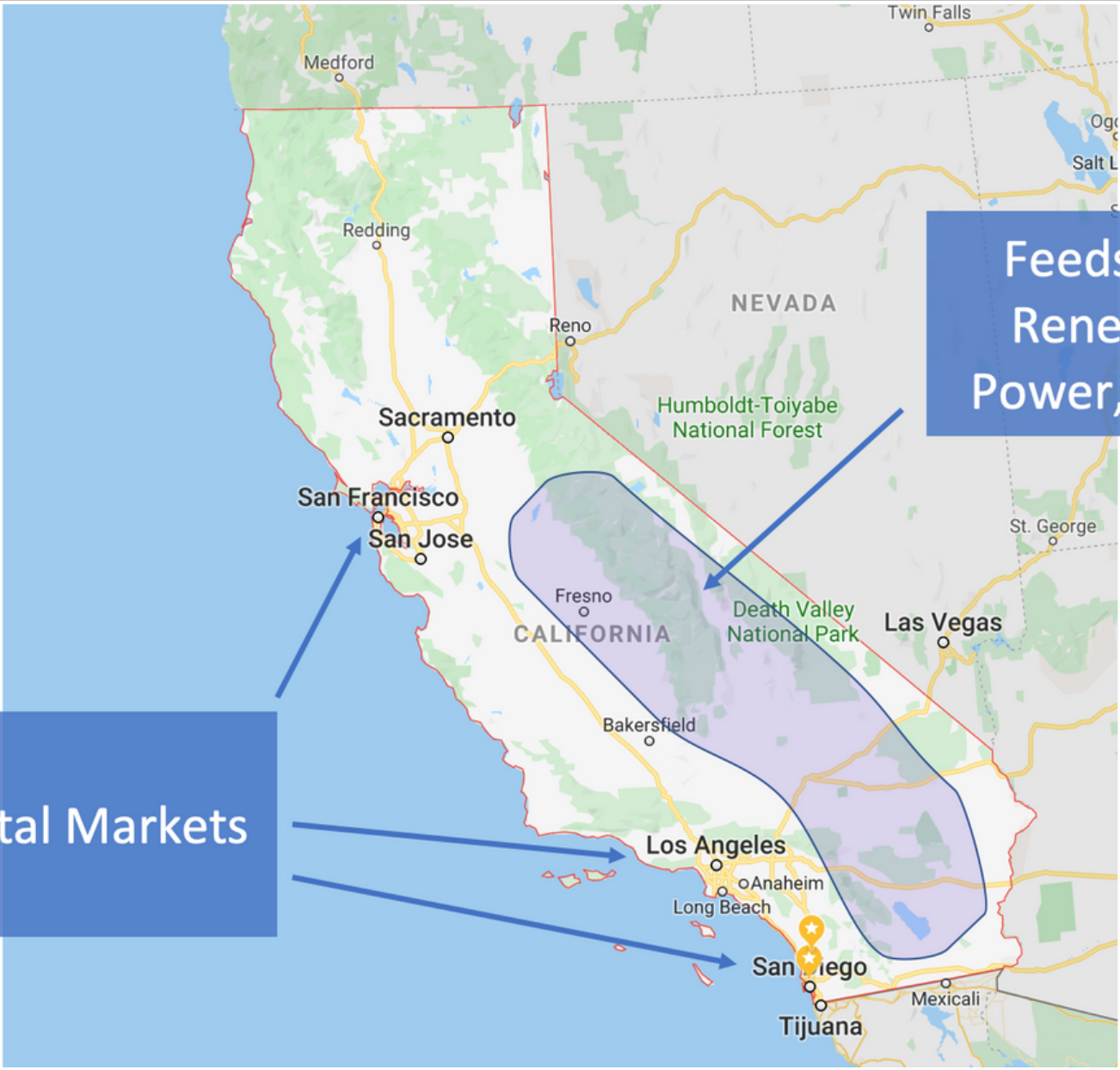
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HEAVY DUTY TRUCK OEMS

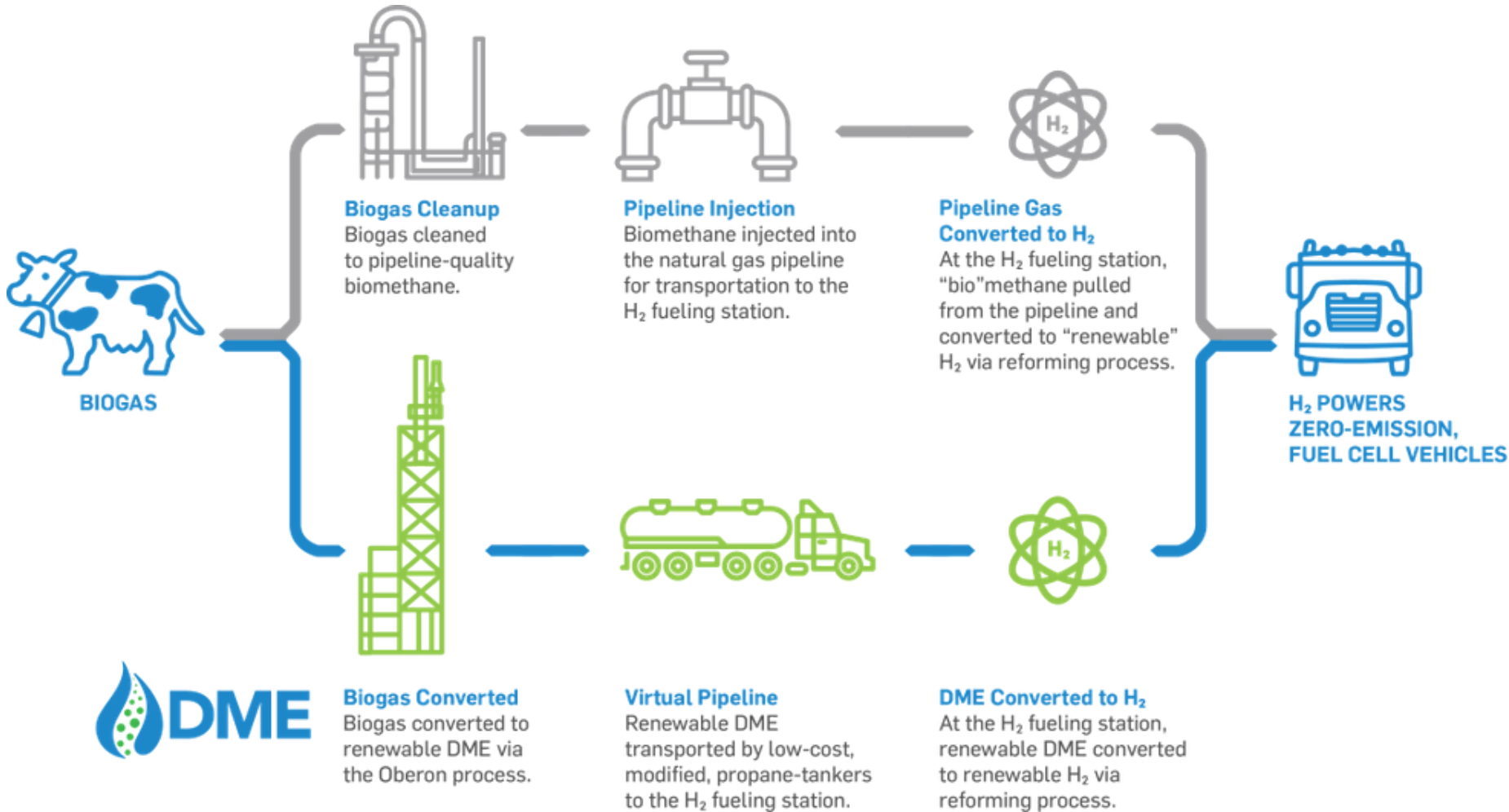
Volvo, Daimler, Hyundai, Paccar, Hino, Cummins, Nikola - all bringing hydrogen fuel cell trucks to market.

Coastal Markets

Feedstocks,
Renewable
Power, & Land

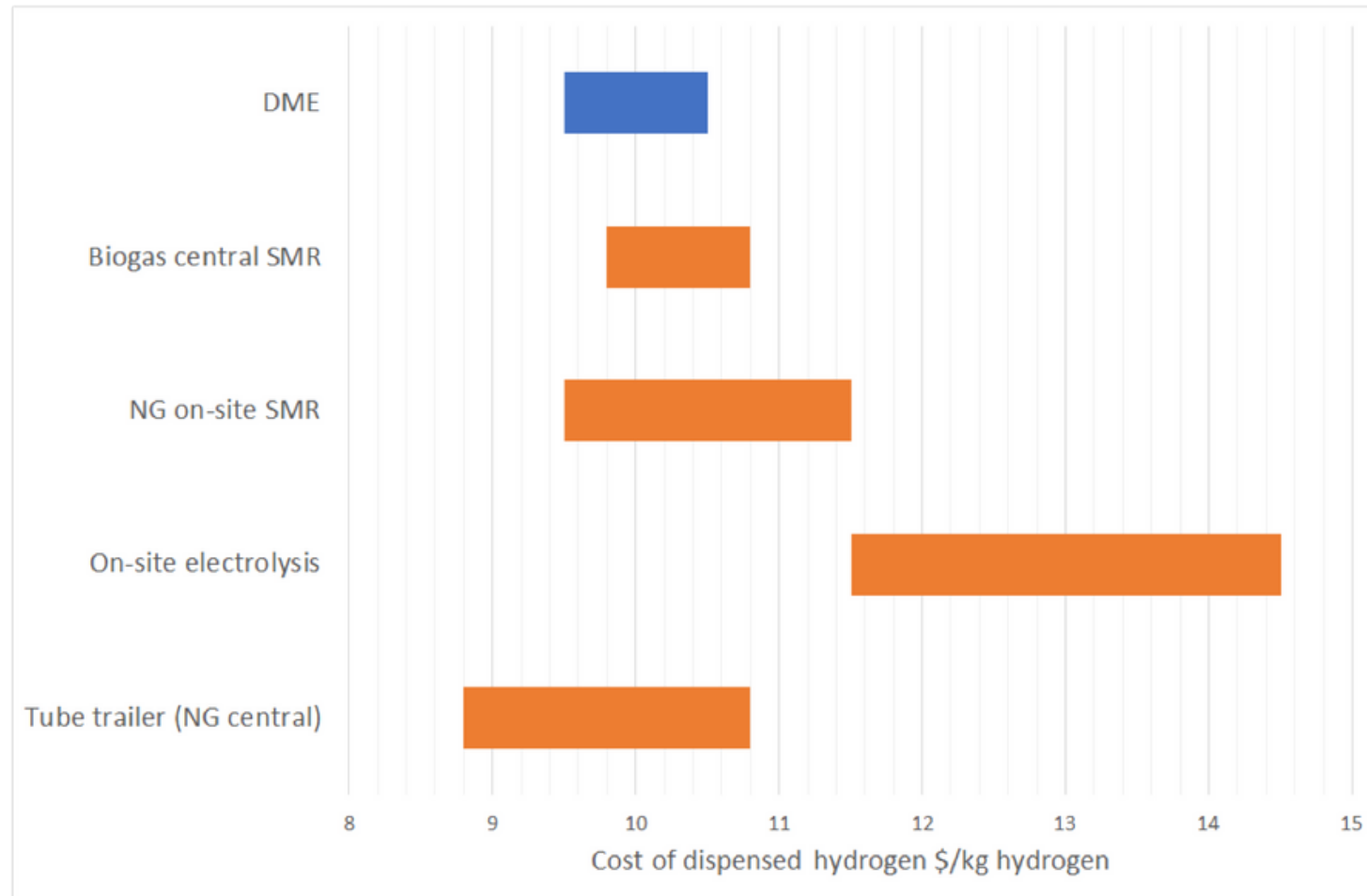


DME AS A HYDROGEN CARRIER:



ON-SITE DME TO HYDROGEN PRODUCTION: COMPARATIVE COSTS

Initial Cost Calculations Assuming **NO** Environmental Credits (E4 Tech & Oberon Fuels)



WHERE ARE WE HEADED?



LIQUID FUELS CAN DELIVER POSITIVE IMPACTS NOW

DME+Propane blend in NZE 0.02g NOx engine



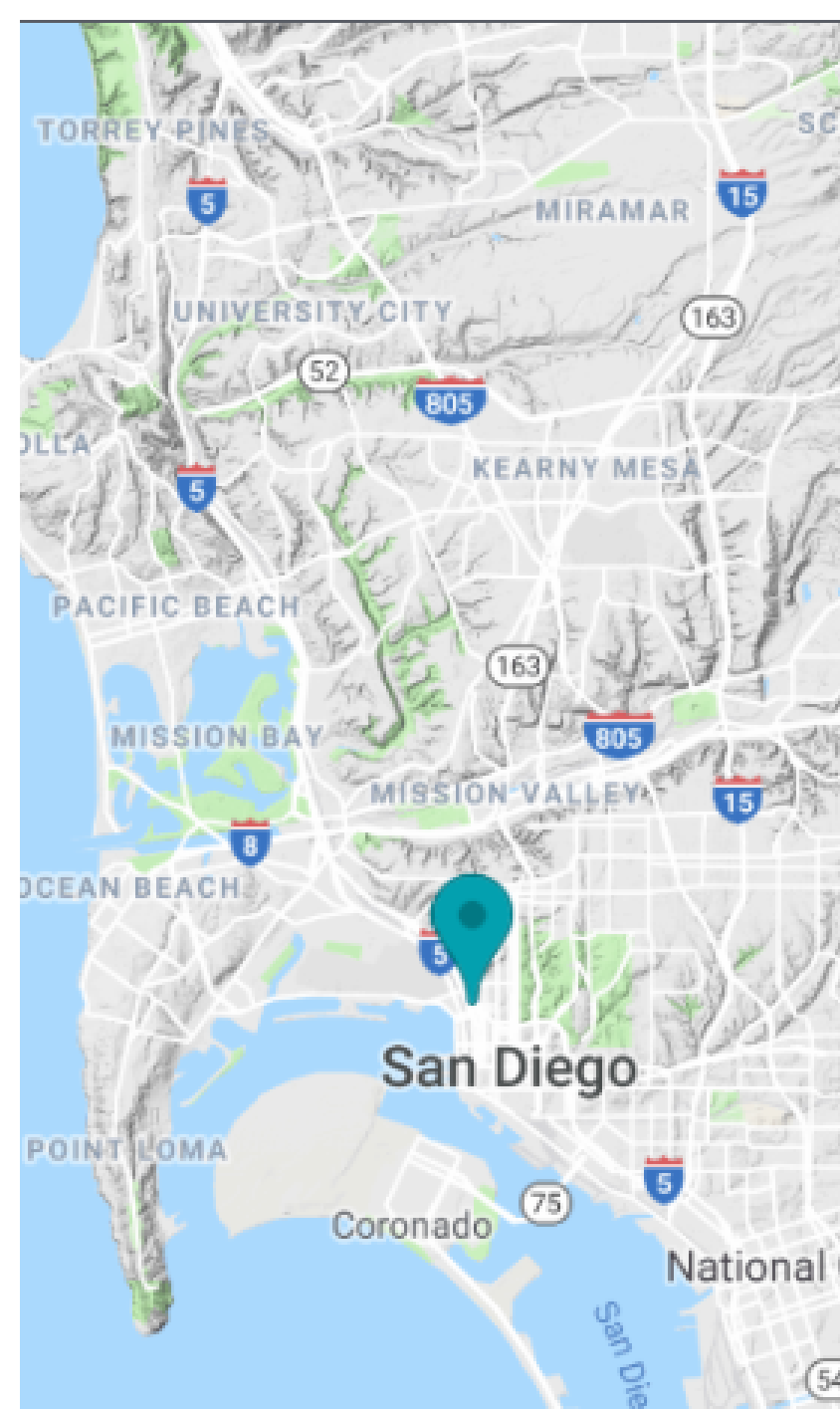
ELECTRIFICATION IS NOT THE SAME FOR ALL APPLICATIONS

Liquid fuel for your e-tractor



RENEWABLE PATHWAYS TO LIQUID FUELS ARE EVOLVING

Renewable feedstocks require small scale solutions and new tech



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