BEYOND THE PIPELINE

Innovative Approaches to California Biogas Utilization

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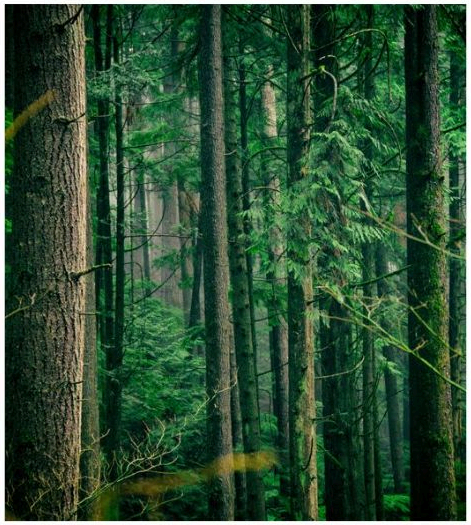
2020 WORLD BIOGAS FESTIVAL


CALIFORNIA OPPORTUNITY


DRIVE TO CLEAR THE AIR


END
CLIMATE
INJUSTICE
CURB CLIMATE CHANGE



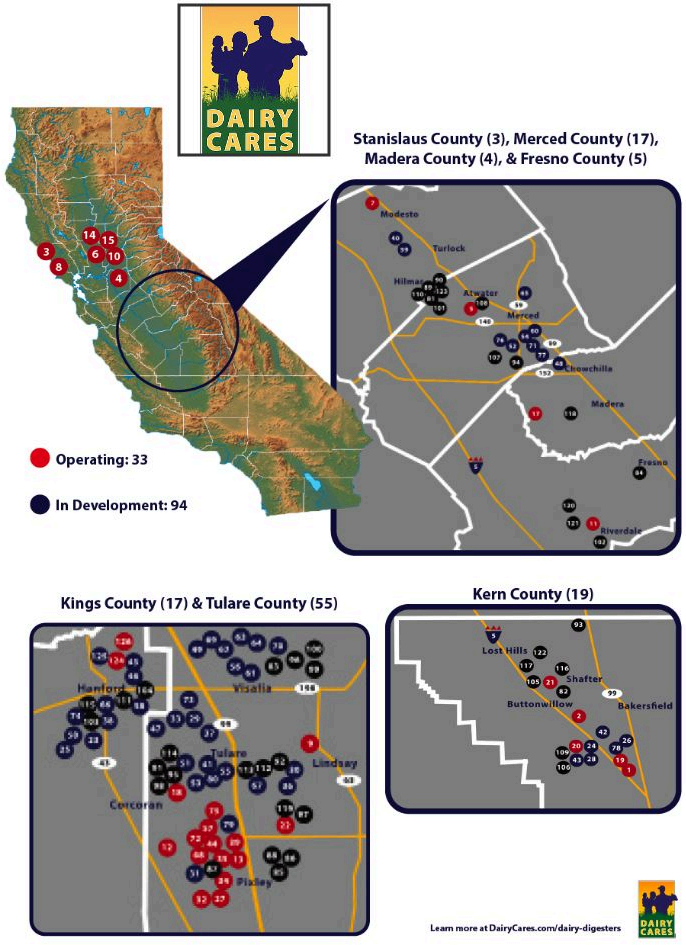



USE BIORESOURCES

CALIFORNIA POLICIES: PAVING THE ROAD FOR BIOGAS UTILIZATION

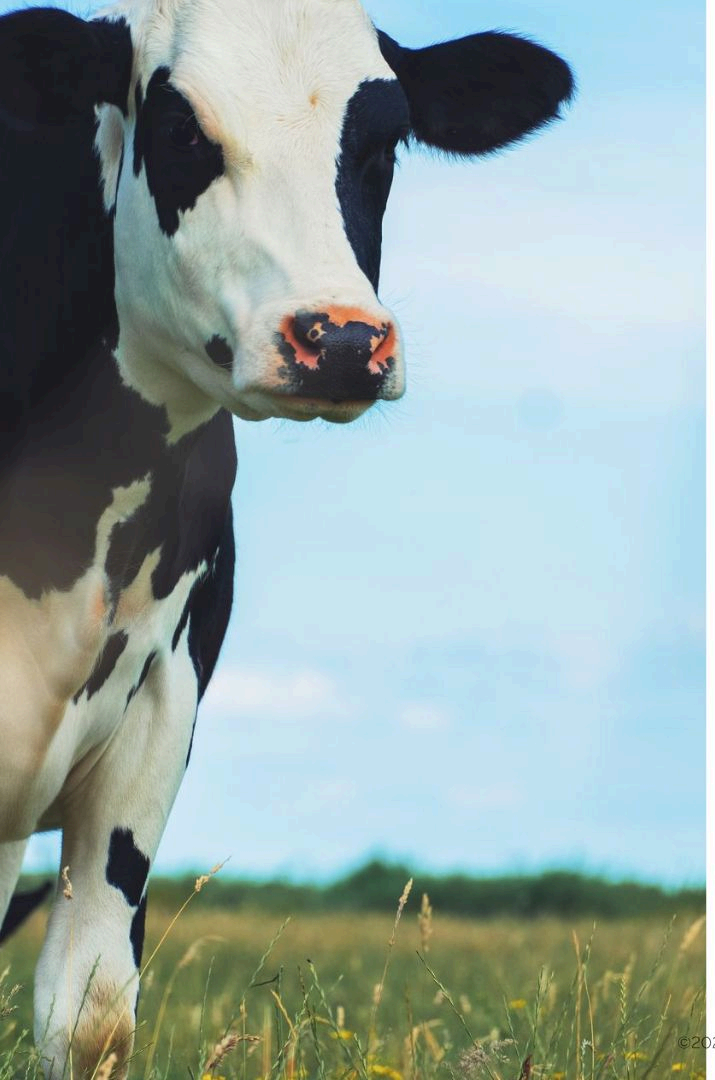
1. **SENATE BILL 32: 40% GHG REDUCTION BY 2030**
2. **CALIFORNIA AIR RESOURCES BOARD (CARB) LOW CARBON FUEL STANDARD**

   Extended to 2030. Reduce the carbon intensity of California's fuel supply by 20% by 2030.
3. **SENATE BILL 1383: METHANE REDUCTIONS**



CALIFORNIA POLICY: LEADING TO SIGNIFICANT INVESTMENT

- CA DEPARTMENT OF FOOD AND AGRICULTURE DAIRY DIGESTER RESEARCH & DEVELOPMENT PROGRAM
- 33 OPERATING ANAEROBIC DIGESTERS
- 94 ADDITIONAL DIGESTERS IN DEVELOPMENT
- GREATEST VALUE FOR DAIRY BIOGAS: TRANSPORTATION FUEL

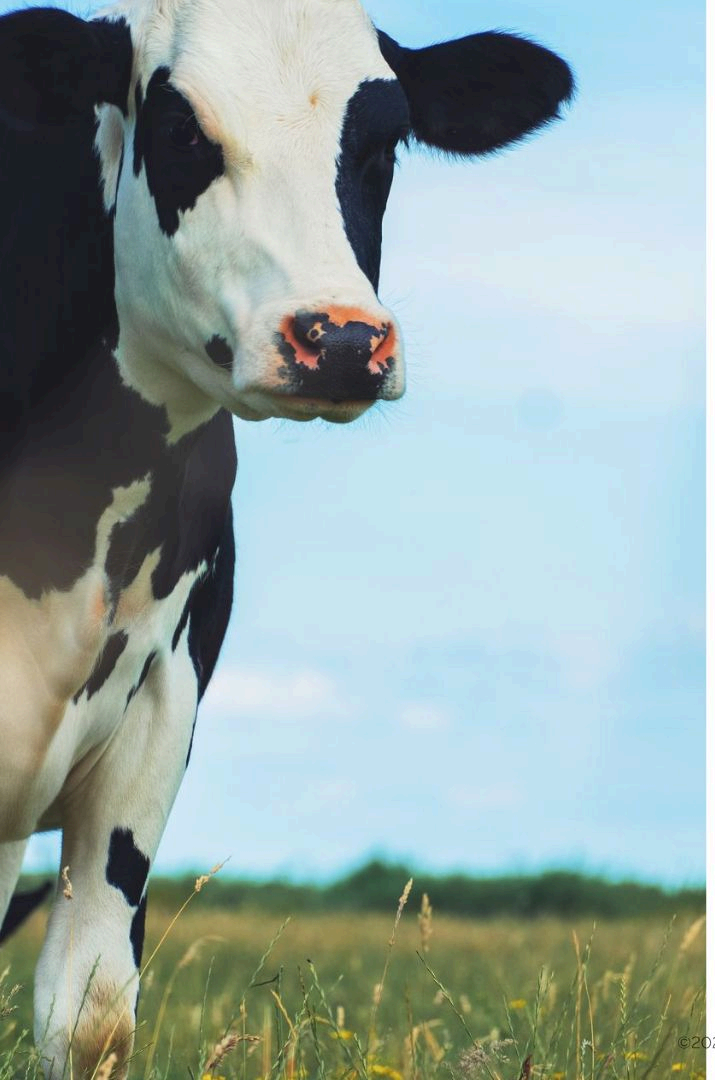


SOLUTION: DO CHEMISTRY TO THE BIOGAS

- "STRATEGIES SHOULD BE DEVELOPED TO INCENTIVIZE INVESTMENTS FOR THE PRODUCTION AND DELIVERY OF DAIRY-MANURE-DERIVED RENEWABLE ELECTRICITY, HYDROGEN, DME, AND OTHER BIOFUELS, AS WELL AS TO ALLOW THOSE TECHNOLOGIES TO GENERATE LCFS CREDITS IF AND WHEN THEY BECOME SUFFICIENTLY COMMERCIALIZED."*

Recommendation from SB 1383 Dairy and Livestock Subgroup #2: Fostering Markets for Digester Projects

*HTTPS://WW3.ARB.CA.GOV/CC/DAIRY/DSG2/DSG2_FINAL_RECOMMENDATIONS_11-26-18.PDF

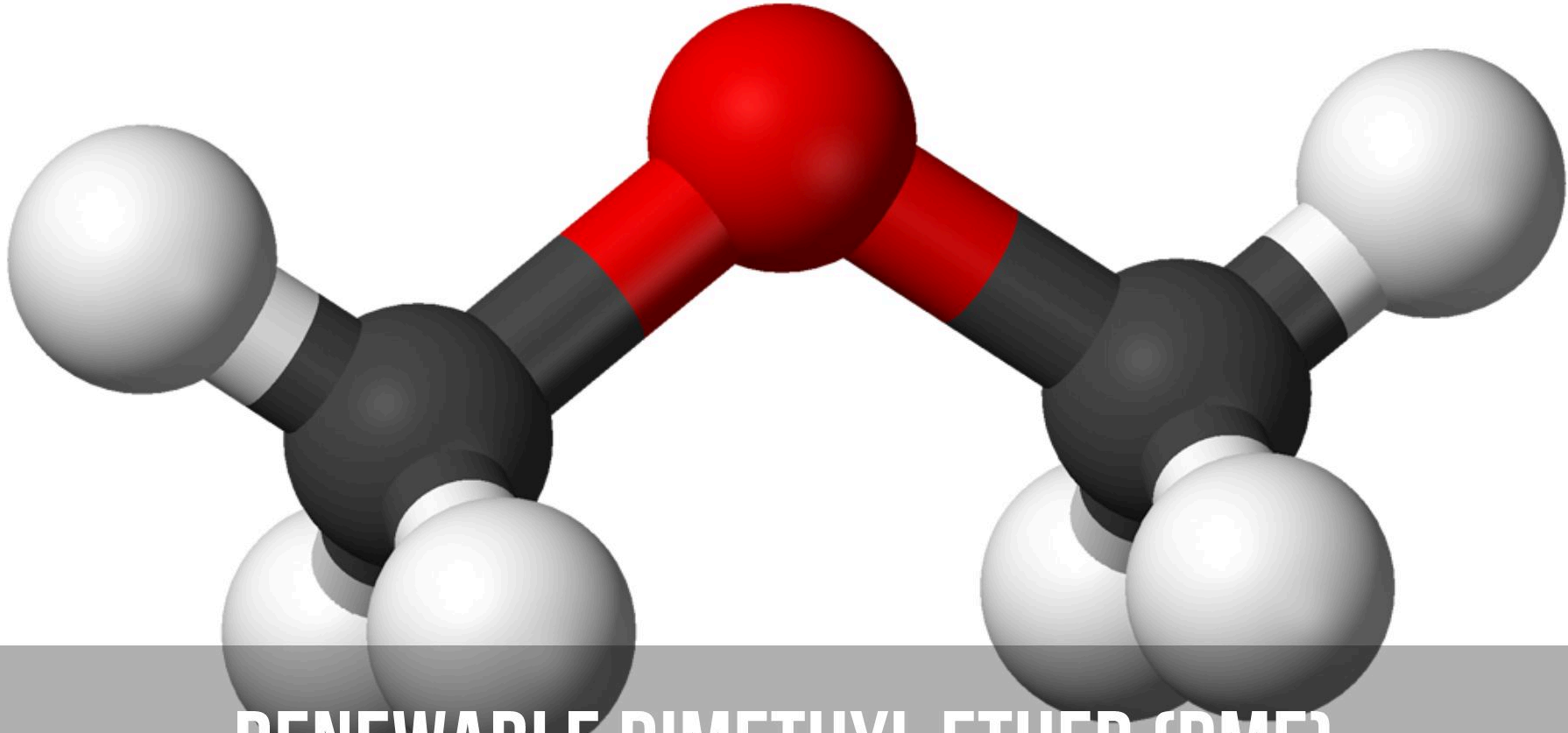


SOLUTION: DO CHEMISTRY TO THE BIOGAS

- **"THE LEGISLATURE SHOULD ALLOCATE FUNDING TO EXPAND RESEARCH AND DEMONSTRATION FOR PROCESS TECHNOLOGIES AND BIOMETHANE DELIVERY ALTERNATIVES CAPABLE OF PRODUCING CLEAN, LOW CARBON RENEWABLE FUELS FROM DAIRY MANURE."***

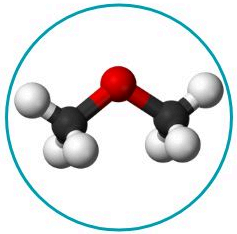
  Recommendation from SB 1383 Dairy and Livestock Subgroup #2: Fostering Markets for Digester Projects

*HTTPS://WW3.ARB.CA.GOV/CC/DAIRY/DSG2/DSG2_FINAL_RECOMMENDATIONS_11-26-18.PDF



RENEWABLE DIMETHYL ETHER (DME)

BEYOND THE PIPELINE: EXPANDING MARKET OPPORTUNITIES WITH DME



1 MOLECULE = 3 MARKETS

Because DME compression ignites in a diesel engine, it offers the power and torque of a diesel engine...but with cleaner-burning properties. Future opportunities to convert farm equipment.

MORE POTENTIAL FOR MARKET GROWTH

Opens up the market for vehicles still running on diesel (e.g. traversing the Grapevine to deliver milk to LA). In addition, DME can be blended with propane and converted to hydrogen for the existing hydrogen fuel market.

PIPELINE INJECTION NOT REQUIRED

Because biogas can be converted to DME, pipeline injection is not required. No interconnection needed, increasing the speed to market.

BEYOND THE PIPELINE: ADVANTAGES OF BIOGAS-BASED DME

LOWEST CARBON INTENSITY FUEL

CARB calculates converting dairy biogas to DME results in a CI of -278 (starting with renewable natural gas CI= -150). Lower CI, greater project revenue.

CLEAN-BURNING. IMPROVES AIR QUALITY.

No particulate matter. No SOx. Low NOx. Reduces aftertreatment equipment.

DIESEL-LIKE PERFORMANCE PROPANE-LIKE HANDLING

Offers the power, torque, and efficiency of a diesel engine with low-cost, propane-like infrastructure for fueling and storage.

LOCAL FEEDSTOCK. LOCAL PRODUCTION. LOCAL CONSUMPTION.

Opportunity to use local waste streams to create regional fuel supply.

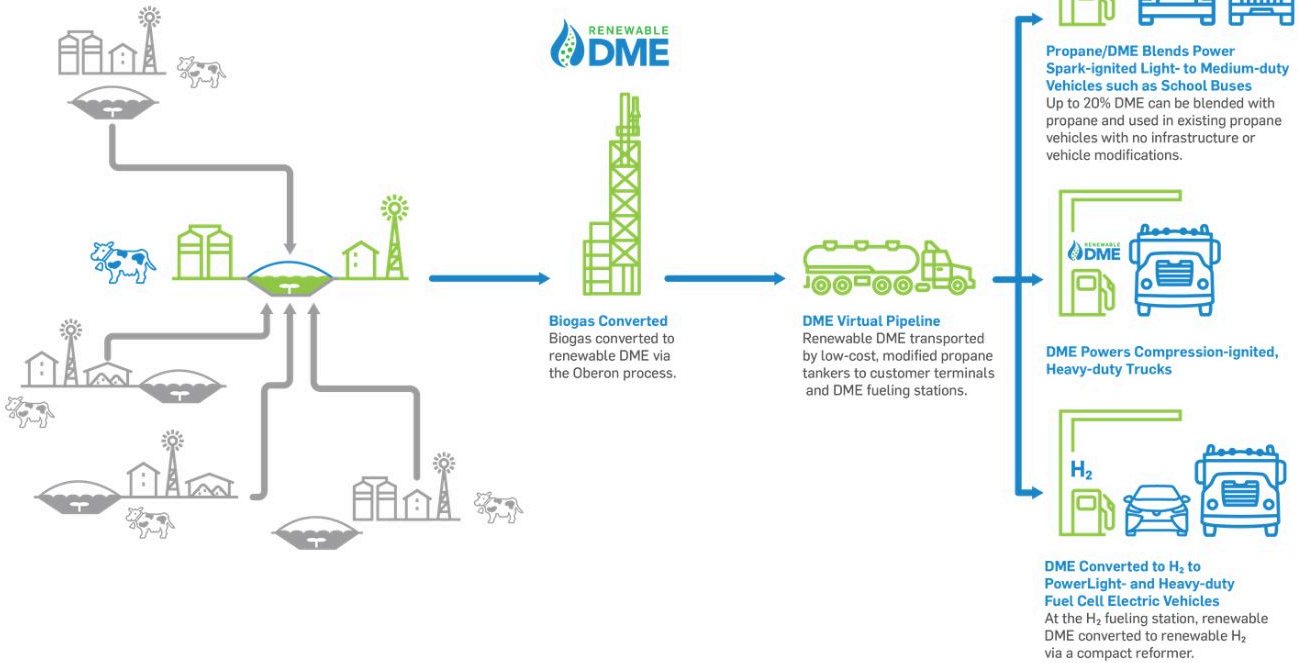
REDUCES METHANE EMISSIONS

Methane is converted to DME rather than being released.

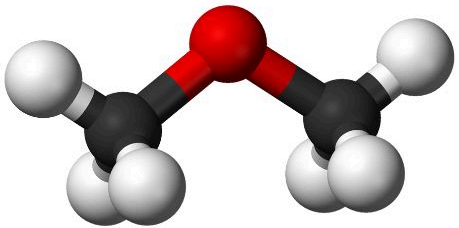
PATHWAY TO ZERO EMISSION VEHICLES

DME offers a pathway to zero emission vehicles. DME can be cost-effectively converted to hydrogen at fueling stations.

BEYOND THE PIPELINE: INNOVATIVE BIOGAS-BASED FUELS



RENEWABLE DME: 1 MOLECULE = 3 TRANSPORTATION MARKETS



DME/PROPANE BLENDING

Blending renewable DME into propane for use as a transportation fuel to drastically reduce its carbon intensity.

DME AS A DIESEL REPLACEMENT

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

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.

RDME: DME/PROPANE BLENDING

- BASED ON THE CURRENT PROPANE CI OF 83 CALCULATED BY CARB, PROPANE USED IN TRANSPORTATION APPLICATIONS WILL EXCEED THE ALLOWABLE CI AND GENERATE DEFICITS BEFORE 2030.
- CARB RECENTLY CALCULATED RDME MADE FROM DAIRY BIOGAS (CI -150) BY THE OBERON PROCESS TO HAVE A CI VALUE OF -278.
- WITH ONLY 5% BLEND OF DAIRY-MANURE-BASED RDME, PROPANE'S CI VALUE COULD BE REDUCED FROM 83 TO 65.
- AT 20% RDME, THE RDME PROPANE BLEND WOULD HAVE A CI OF 11.

RDME: DIESEL REPLACEMENT

VOLVO TRUCKS (TEXAS)

Beginning in 2013, Oberon fueled Volvo's first DME demonstration in North America. This demonstration lasted over two years and enabled Volvo to test DME-powered trucks in the North American duty cycle. Martin Transport, Oberon's financing partner, was the fleet testing the trucks in their daily operations.

FORD (GERMANY & CANADA)

Initiated in 2015, Ford became the world's first OEM to launch a DME passenger car project, building a DME-powered Ford Mondeo/Fusion fueled by Oberon DME. In addition, Ford has launched DME-powered F250 and Transit projects with Prins, a Westport subsidiary, as the fuel system provider.

MACK TRUCKS (NYC)

Fueled by Oberon DME, NYC Department of Sanitation (DSNY) became the world's first customer to test a Mack DME-powered truck in 2017. DSNY has over 2,100 refuse collection trucks and 59 fueling terminals across NYC, necessitating a powerful fuel with low-cost fueling infrastructure.

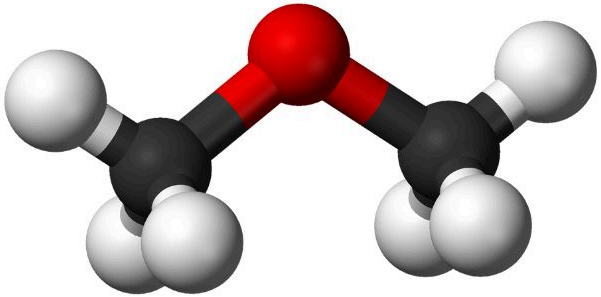
RDME: DME AS A HYDROGEN CARRIER

- ## DME = BETTER HYDROGEN CARRIER

  More fuel, less tank. DME is a high-energy-density, liquid fuel capable of providing more hydrogen with small, inexpensive, lightweight tanks. 1 DME tanker carries as much hydrogen as 3-4 hydrogen tube trailers.

- ## DME = EASIER, LOWER COST TRANSPORTATION

  DME's simple handling properties (low pressure, non-toxic, energy-dense) lead to lower-cost distribution and storage.



CURRENT STATUS OF RDME

OBERON'S PILOT DME PRODUCTION FACILITY

This pilot facility is the last step (methanol to DME) of Oberon's 3-step process and produced the first fuel-grade DME in North America.

- ## OBERON'S DME PLANT IN SOUTHERN CALIFORNIA

  Located 2 hours east of San Diego, Oberon's pilot facility is in the Imperial Valley region of CA and has a nameplate capacity of 4,500 gallons of DME per day.

- ## 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

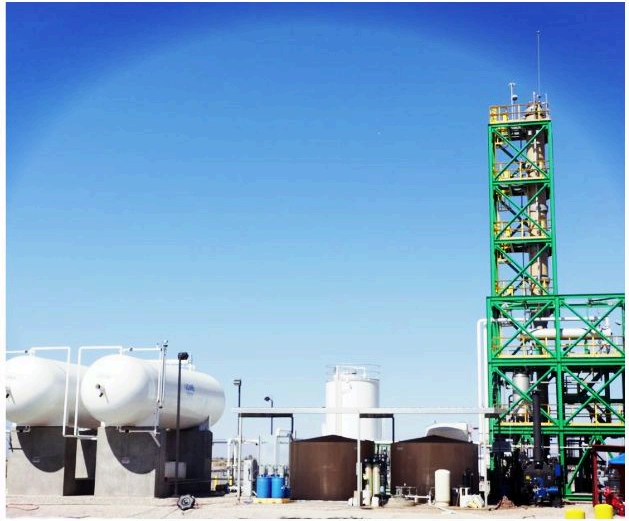
  Skid-mounted construction allowed for construction in parallel with the CA's environmental and air permitting process. This facility has additional space and infrastructure to expand production or test new process technologies.


METHANOL


DME
oberon


549
MACK


oberon
FUELS
oberon



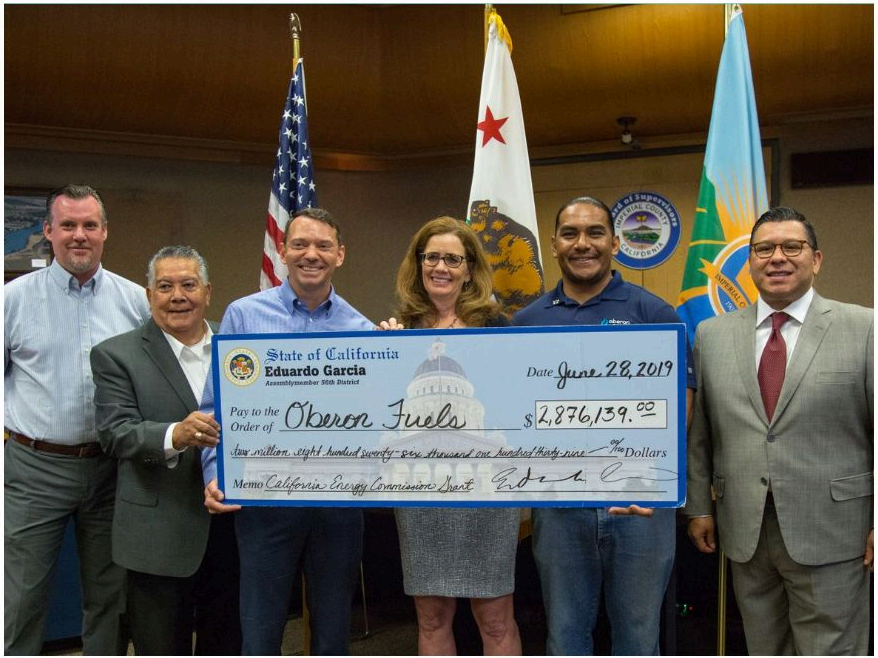
2019: INVESTMENT BY THE STATE OF CALIFORNIA

In 2019, CEC awarded Oberon Fuels $2.9 million to upgrade its existing DME production plant in Imperial Valley region of CA from pilot to demonstration scale and produce the first renewable DME in the US.

MOVE FROM PILOT TO DEMONSTRATION PHASE.

TEST NEW FEEDSTOCK. PRODUCE RENEWABLE DME.

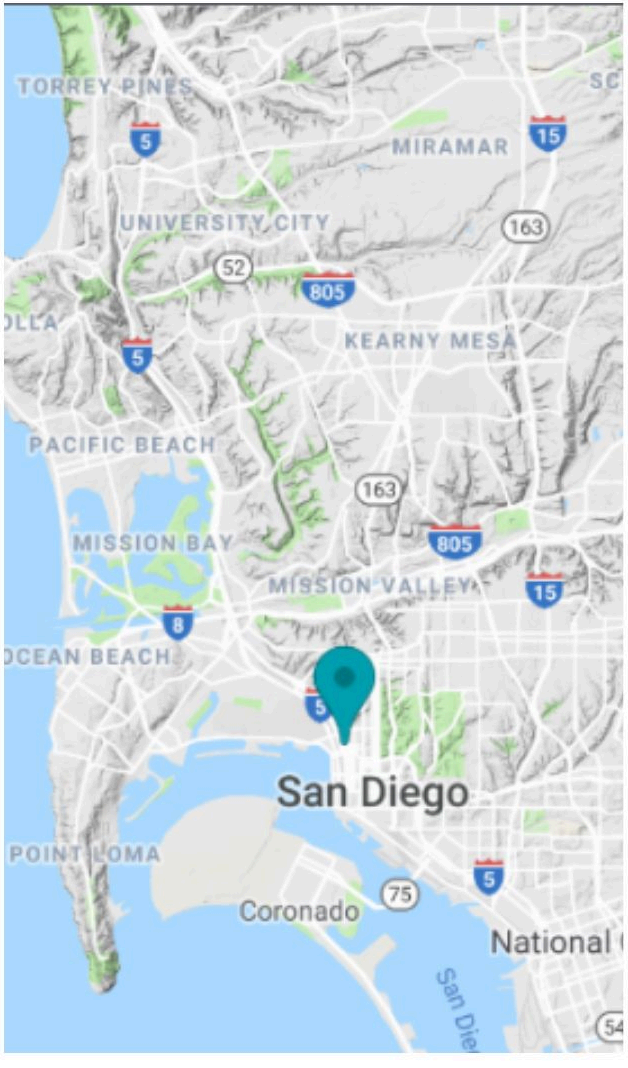
2019: INVESTMENT BY THE STATE OF CALIFORNIA



2020: SHV ENERGY & OBERON FUELS

- STRATEGIC COLLABORATION WITH WORLD'S LARGEST PROPANE/LPG DISTRIBUTOR
- ACCELERATE UPGRADE TO FACILITY TO PRODUCE RDME
- ACCESS TO TECHNICAL RESOURCES TO TEST BLENDING OF RDME AND PROPANE
- ACCESS TO GLOBAL DISTRIBUTION NETWORK


CALIFORNIA OPPORTUNITY



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