

5. rDME Business and LPG-rDME Market in USA
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+
o **DME & RDME IN
THE UNITED
STATES**

Prepared by H&H Worldwide, Inc



INTRODUCTION

- DME is a low-cost, low-carbon, and zero-soot option for petroleum diesel. DME is also a cost-effective hydrogen transporter, making it simple to supply this green fuel to the rapidly expanding hydrogen fuel cell vehicle industry.
- In addition, when combined with propane, the product will significantly minimize the carbon intensity of this widely used, clean-burning fuel.
- There are one major DME player Oberon Fuels in the United States and two major propane suppliers, UGI Corp from the United States and SHV from Europe, which are closely related to US DME player.
- Beyond these traditional DME players, H&H Worldwide and Bio Friends are planning to build a rDME plant in the United States using bio-gas and natural gas.
- This presentation is focusing on the major player in the US DME market along with its European and US partners and a new rDME option.



Oberon Fuels

- President: Rebecca Boudreaux, Ph.D.
- 2010: Founded
- 2013: Pilot plant in Brawley, CA & Partnership with Volvo to launch DME as a transportation fuel
- 2015: California changes the state's Code of Regulations to allow the legal sale of DME as a fuel
- 2019: The state of California awards Oberon Fuels \$2.9 Million to upgrade Oberon's pilot plant to demonstration scale and produce the 1st renewable DME in the US
- 2020: Celebrating passage of AB2663 with Councilmember Eduardo Garcia & Suburban Propane takes 39% equity stakes in Oberon Fuels
- 2021: Oberon produces first-ever rDME in the United States

Methanol to DME Plant

Phase 1: Pilot Plant

- Pilot Plant Online
- Converts methanol to DME (last process step)
- 1st Fuel-grade DME in North America
- **Location:** Brawley, California





1st US rDME Production

- On May 27, 2021, Oberon Fuels has begun production of the first-ever renewable DME (rDME) in the United States, and the only current commercial production of this molecule in the world.
- As part of a \$6 million project funded in part by a grant from the California Energy Commission, Oberon is converting waste methanol into rDME at its upgraded facility in Brawley, CA.
- It is the first time this feedstock has been used to make rDME at commercial scale. In addition to waste methanol, other potential feedstocks include: biogas from dairy waste, food wastes, agricultural waste, as well as excess electricity and CO₂, resulting in ultra-low carbon to carbon-negative DME.

Propane + rDME

- Oberon Fuels announced commercial availability of a new approach to drive down emissions across the propane industry: a blend of propane and Oberon's renewable DME.
- The blended alternative product has a low carbon intensity and can be used as a drop-in replacement for propane engines in both on-road and off-road applications.
- The product is currently being used in material handling and over-the-road engine applications by a pilot group of Suburban's existing forklift and fleet customers.
- Oberon partner Suburban Propane Partners, L.P. (NYSE: SPH), the third largest propane supplier in the U.S., is the first company to make this more sustainable blended product available to its customers across Southern California.



STATE OF CALIFORNIA

Change of CA's Code of Regulations for Legal Sale of DME as a Fuel

- On February 26, 2015, Oberon Fuels announced that DME is now approved for use as vehicle fuel in the state of California.
- This latest approval builds on earlier approvals and ongoing work by other regulatory bodies, including the US Environmental Protection Agency, the California Air Resources Board, and ASTM International, and will help accelerate commercial adoption of this low carbon fuel.
- These approvals are a key step in increasing confidence among distributors, engine manufacturers and fleet owners that DME is ready for commercial markets.

STATE OF CALIFORNIA

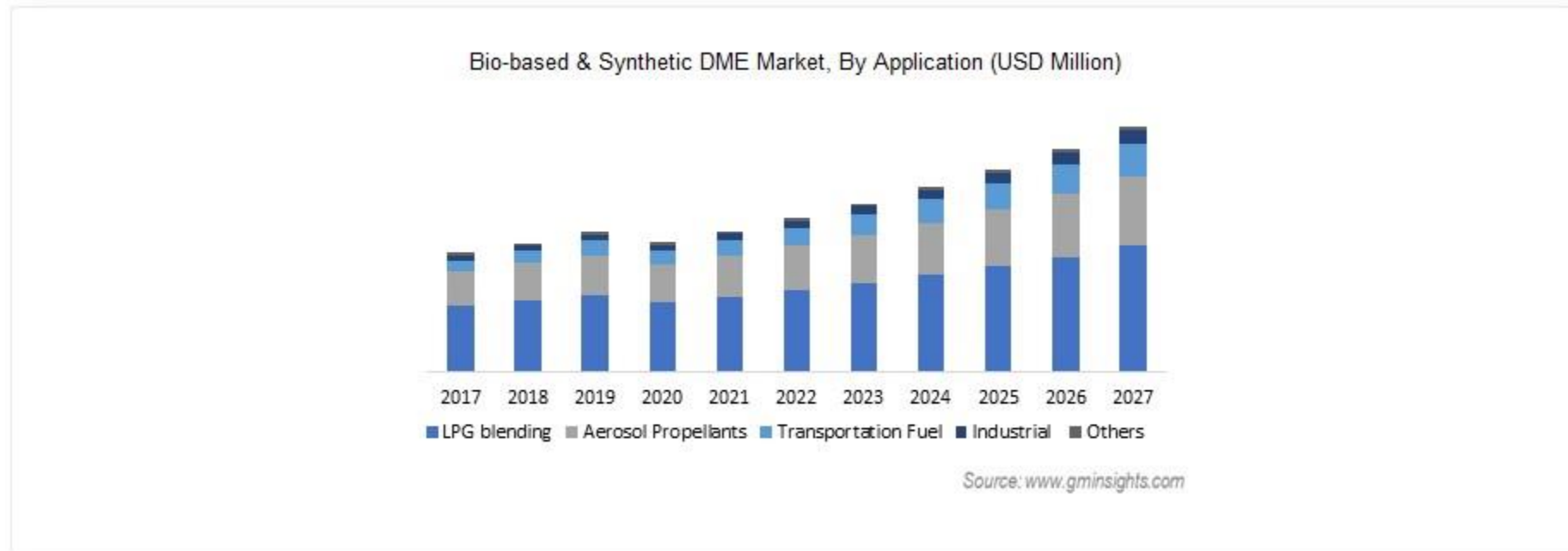
Assembly Bill No. 2663

- On September 28, 2020, Oberon Fuels celebrated the signing of California Assembly Bill 2663 into law.
- The bill, which received bi-partisan support and passed unanimously through the California Legislature, effectively lowers the tax on DME when used as a diesel replacement or to blend with propane to the same rate as other alternative fuels.
- Existing law requires, with certain specified exceptions, every person offering for sale or selling any motor fuel to the public from any place of business to display, as prescribed, on the premises the total prices of the three major grades of motor vehicle fuel offered for sale. **This bill would exempt a dimethyl ether-propane fuel blend, as defined, from these requirements.**



LPG Blending in Action

The LPG blending segment generated the highest revenue in 2020



- LPG blending segment accounted for over 50% of revenue share in 2020.
- It is anticipated to generate a revenue of over \$5,053 million by 2027.
- The rising need to reduce harmful emissions is one of the key factors driving the dimethyl ether market sales in LPG blending.

Propane and rDME Blending

- Three Major Propane Players in Europe:
 - UGI Corporation: A leading LPG supplier in Europe serving 17 countries in western and central Europe
 - SHV Energy: The World's largest distributor of Propane
 - Flogas, a Part of DCC plc: Largest propane supplier in northern Europe



Oberon, SHV Partner for rDME

- [Oberon Fuels](#) and [SHV Energy](#), a multinational company based in the Netherlands and one of the largest distributors of propane, and a pioneer of BioLPG, are partnering to accelerate the use of renewable DME on February 26, 2020.
- The move is to reduce the carbon footprint of transportation fuel. With only a 20% blend of rDME, propane's carbon intensity is said to experience a marked cut.

✦ Dimeta : Bold Step toward rDME

- **On May 17, 2021, SHV Energy and UGI International, a subsidiary of UGI Corporation (NYSE: UGI), leading distributors of off-grid energy, announce the intention to launch a joint venture to advance the production and use of Renewable Dimethyl Ether (“rDME”), a low-carbon sustainable liquid gas, to accelerate renewable solutions for the LPG industry.**
- By leveraging the expertise, innovation capabilities and distribution power of both companies, the joint venture will aim to develop the full potential of rDME as a sustainable solution.
- The parties anticipate the development of up to 6 production plants within the next 5 years, targeting a total production capacity of 300 kilotons of rDME per year by 2027. The aggregate investment is estimated to be up to **\$1 billion** which is expected to involve third party investment

US Propane Market

- **Market Overview**

- **Americans use about 10 billion gallons (19 million tons) of propane every year, making the liquified petroleum gas 2% of our country's energy consumption.**
- The propane market in the United States is expected to register a CAGR of more than 5% during the forecast period (2022-2027).
- The COVID-19 pandemic had a negligible effect on the market. Additionally, the market is projected to grow steadily during the forecast period.
- The increasing demand from the residential and transportation sectors has been driving the market growth.
- However, the harmful effects of propane at higher concentrations are likely to hinder the growth of the studied market.
- The usage of propane in power generation is likely to provide opportunities for the US propane market over the next five years.
- Residential is the most dominating end-user segment of the market studied.

Market Snapshot



US Propane Market

- The US propane market is partially fragmented in nature. Some of the major companies (in no particular order) are AmeriGas Propane, Ferrellgas Partners LP, Suburban Propane Partners LP, Growmark Inc., and CHS Inc., among others.

Major Players

- 1 AmeriGas Propane
- 2 Ferrellgas Partners LP
- 3 Suburban Propane Partners LP
- 4 Growmark Inc.
- 5 CHS Inc.

United States Propane Market Concentration



Source: Mordor Intelligence




Suburban Propane



- Suburban Propane Partners, L.P., is a nationwide distributor of propane, fuel oil and related products and services, as well as a marketer of natural gas and electricity, servicing over 1 million customers through 700 plus locations across 41 states.
- The company proudly celebrated 90 years of innovation, growth and quality service in 2018.
- Suburban Propane is a New York Stock Exchange listed limited partnership headquartered in Whippany, NJ.
- Through Go Green with Suburban Propane pillar, the company is committed to the development of innovative solutions to further reduce the emissions profile of propane, to creating a pathway to zero carbon emissions and promoting the affordable, clean burning and versatile nature of propane as a bridge to a green energy future.



UGI Corp & AmeriGas

- UGI Corporation is a distributor and marketer of energy products and services. Through subsidiaries, UGI operates natural gas and electric utilities in Pennsylvania, distributes LPG both domestically (through AmeriGas) and internationally, manages midstream energy assets in Pennsylvania, Ohio, and West Virginia and electric generation assets in Pennsylvania, and engages in energy marketing in eleven states, the District of Columbia and internationally in France, Belgium, the Netherlands and the UK.
 - UGI Corporation and AmeriGas Partners, L.P. successfully completed the merger transaction that was announced on April 2, 2019. UGI acquired the approximately 69.2 million public common units of AmeriGas it did not already own in completing the buy-in of AmeriGas, the nation's largest retail propane marketer.
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rDME Production from Bio Methane and NG

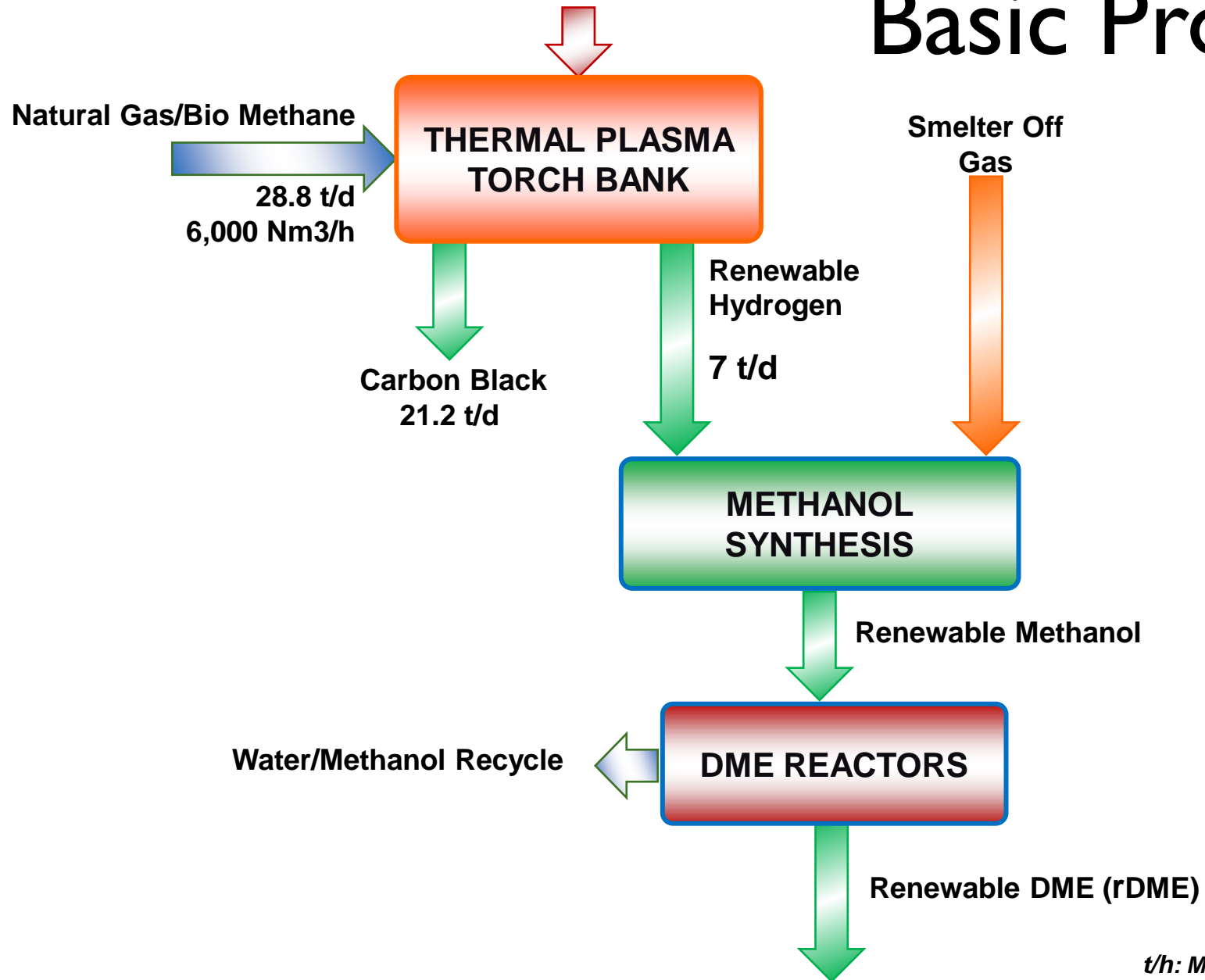
Bio Friends and H&H are planning to build a rDME plant in the United States by using bio methane and/or natural gas.

Renewable hydrogen production from bio methane or natural gas by using Plasma Technology: 7 tons/day of hydrogen and 21.2 tons/day of carbon black.

Renewable methanol production using renewable hydrogen and captured CO₂ from smelters or furnaces

Final production of renewable DME

Basic Process Design



t/h: Metric Tons per Hour

Conclusion: Paradigm Shift in DME

- The conventional DME is transitioning toward renewable DME market.
- Global propane suppliers are actively promoting Propane + rDME projects.
- Oberon is a leading rDME player in the United States, but the company has to show its capability in producing rDME from the commercial-scale rDME plant.
- The US rDME market needs to diversify its territory to cover bio-based and carbon capture-based renewable DME production.