Despite the global nature of these PROBLEMS, the SOLUTIONS are local. Cities & regions hold the key.
Solution

Utilize waste streams to create own energy supply…

- Landfill Gas
- Food Waste
- Industrial Waste Streams

…creating circular economies and local resiliency
Oberon Solution

Connecting feedstocks with end-use applications

- **Monetizing** waste stream with small-scale production units
- **Creating** regional markets that can use the end products, distributed production
  - Resiliency, sustainability, controlling own fuel supply
- **Developing** small-scale production unit to convert to higher-valued product such as DME
- **Establishing** a market for DME as a transportation fuel/diesel replacement
Oberon Solution: Small-Scale

Monetizing waste streams with small-scale production units
Oberon Solution: Small-Scale

Example: Food waste to fuel

- Food Waste: Transported to a central location where it is processed and added to an Anaerobic Digester to convert to biogas.
- Biogas: Fed into Oberon Process and Converted to DME.
- DME Fuels Local Fleet which can then collect more food waste. Excess fuel can be sold to other Fleets.
Why Another Fuel?

Driving force for DME is its SIMPLICITY...
Solution: DME

• Simple Fuel
  – Diesel-like performance
  – Clean burning, no soot generated
  – Made from methane and carbon dioxide

• Simple Engine
  – Efficiency & torque of diesel engine with no soot produced
  – Remove significant amount of after-treatment equipment

• Simple Infrastructure
  – Propane-like Handling (cylinders/tank, only change seal)
Development

- **Sweden**: 1st BioDME plant (2011)
- **United States**: 12,000 liter/day modular plant producing (2013)
- **India**: 265 ktpy planned
- **Uzbekistan**: 100 ktpy planned
- **Vietnam**: Project announced
- **Papua New Guinea**: 200 ktpy planned (2016)
- **China**: 11 mtpy capacity, 30 – 50% in operation
- **Indonesia**: 800 ktpy planned
- **Trinidad & Tobago**: 100 KTA plant planned

Courtesy of the International DME Association
DME Status

Technology

Regulatory Framework

Market Development
DME Production: Oberon Plant

Pilot Plant
Imperial Valley
Brawley, CA
4,500 gallons per day
17,034 liters per day
12.5 tons per day
107 barrels per day
Technology Development

1st Commercial DME Catalytic Distillation Column
Fuel Production: Large-Scale

• Distributed fuel production key to launching the market
• To reach true market penetration must be complemented with large-scale production

• Opportunities for:
  – Chemical producers?
  – Feedstock Suppliers?
  – Traditional fuel refiners?
  – End users?
DME Regulatory Development

ASTM Specification
Published 2014
ASTM D7901

Legal Fuel in CA
CDFA modified CA Code of Regulations to allow the legal sale of DME as a fuel effective January 1, 2015.

RINS Eligible
Renewable Fuel Standard (RFS) Pathway Approved

Tier 1 Report
As part of Multimedia Assessment process, CARB published DME Tier 1 report February 2015. Evaluated DME effects on air, soil, and water.

1st DME Truck Incentives in US
offered in Washington state.
Diesel-like Performance, Propane-like Handling

DME fuel pump at ENN service station (Shanghai)

BioDME Project

Partners include TOTAL, Preem, Delphi, ETC, Chemrec, & Haldor Topsoe
DME-powered Trucks
Demonstrations running in US

xME Project in Germany
FORD LEADS PROJECT TO DEVELOP NEAR ZERO PARTICULATE EMISSION DIESEL CARS THAT COULD RUN ON CONVERTED CO2

- Ford European Research & Innovation Center is to lead a €3.5 million project to investigate alternative fuels that could one day offer diesel car customers enhanced fuel efficiency while minimising environmental impact.
- The project consortium will develop the first passenger cars, based on a Ford Mondeo, to run on environmentally friendly dimethyl ether (DME), and oxymethylene ether (OME1).
- Both fuels can be generated from CO2 captured from the air that is combined with wind and sun power, or waste products.

Ford Motor Company is leading a €3.5 million research project to investigate the use of alternative fuels that could offer customers the power and performance of modern internal combustion engines with environmental benefits comparable to an electric vehicle.

The German government is co-funding the three-year project that will test the first-ever cars to run on dimethyl ether (DME), commonly used as a non-toxic propellant in aerosol spray gas, and oxymethylene ether (OME1), a byproduct of the petrochemical industry.
POWERING A MONDEO WITH CONVERTED CO$_2$: how ethers can be used as alternative fuels

DME: dimethyl ether, a gas

OME: OME$\textsuperscript{1}$
DME-powered Trucks
Demonstrations running in US

- Developed 2-stroke opposed piston engine
- Improves fuel economy by 32% vs. diesel

xME Project in Germany

DME engine
Builds prototype garbage truck and street sweeper
DME Moving Forward

DME Production
- Made by small- and large-scale processes
- Feedstock dependent on area

Multiple DME Fuel Markets
- Heavy-duty trucks, passenger cars, cooking fuel, stationary power generation

Addressing the world’s energy, waste, and environmental challenges without sacrificing performance
Contact Information

Rebecca Boudreaux, Ph.D.
President
rebecca@oberonfuels.com