

MSW to Liquid and co-products

*An Opportunity for Central
Connecticut*

- **Real and An Opportunity Now**
 - Sustainable Technologies in Place
 - Market in Place for Sustainable Jet
 - Resiliency via liquid and material coproducts
 - Supported by Fed RFS and Infrastructure investments
- **Central CT. Can be in the forefront now!**
 - Focused private sector supply chain
 - local control of MSW feed (ie. MIRA towns)
 - Mid to long term approach for critical
 - ***National public/private case study support viable***

Market in Place for Sustainable Jet

Globally, Nationally and in CT

- UN (ICAO) via CORSIA Plan in Place for 2050 Carbon Neutral Growth (2018)
- European Mandates for 1.4 B gals / year by 2030 (2021 IATA / FAA data) 2021
- US (A4A) goal of 2 B gals / Year by 2030. Net zero carbon 2050 (2021)
- **P&W (Middletown), FedEx (BDL) and BDL airlines can absorb current MIRA MSW mixed stream**



Sustainable Technologies Qualified / Commercial

Not “Science Projects”!

Seven sustainable , EPA RFS / RINS applicable jet pathways qualified since 2009 under ASTM 7566. All in commercial operation

Three commercial processes using and 24/7 MSW

- Fulcrum / Reno (DOE, USDA, DOD funded) DPA
- Enerkem / Edmonton (alcohol intermediate)
- Lanzajet / Soperton GA , Lanzatech alcohol intermediate



Fulcrum - Reno



Enerkem - Edmonton



Virgin Atlantic / Lanzatech

Resilency MSW to liquid coproducts**

*Electricity Market failed MIRA**

Sustainable Jet -

Green Diesel and Home Heating Oil

High quality Biochar

Green deicing fluid – replace ethylene glycol

Animal Feed

Fertilizer

Multiple specialty chemicals (low volume / pricing premium)



* 6X revenue for SAF sales vs. Electricity (Ref CCAT / USDA MIRA feasibility studies) at \$3.00/gal jet vs 2014 (Approx) electricity KW-HR market rates.

** Coproducts vary between candidate MSW to Liquid processes

FED RFS and Infrastructure investments

20 Year Commitment being Strengthened Now

- Federal EPA Renewable Fuel Standard in place since Bush Administration
- Value has been from \$1 to \$2 per gallon... purchased credits from Oil companies to renewable processors via Renewable Index Number Credits

Pending legislative and administrative opportunities

- support for projects in infrastructure program (support from Larson)
- national low carbon fuel standard (LCFS)- e.g. Cal., OR under eval. In NY
- national aviation fuel “challenge” from USDA, DOE, DOT (others)

Central Connecticut Can Be in the MSW-L forefront

- **Focused / Committed private sector supply chain**

Pratt and Whitney (Middletown production)

FedEx (BDL facility)

CEMA (Home heating oil and green diesel)

Can consume all of commercial offtake now!

Linde/Praxair major subsystem supplier to all
processor candidates

- **Local control of MSW feed (ie. MIRA towns)**

- **Critical Need for mid to long term approach for
region in 2nd half of the decade**



Candidate Market Transformation Case study

Under Discussion with National Private/Public Teams

- Public / Private team engaged include
 - University expertise (e.g. Michigan Tech, Georgia Tech)
 - Idaho National Lab (DOE)
 - Amp Robotics (AI separation technology)
 - CAAFI (Manufacturers , Airlines, Airport)
- 1 to 2 local MSW supplier case study selection, contract vehicle pending
- Can leverage data from NREL and similar studies
- No cost to Central CT / participation in an Advisory role

Opportunity for location specific CAAFI supported evaluation possible