SAF Southeast Working Group
July 18, 2019
Convened by Timothy Rials
Associate Dean & Director
University of Tennessee Institute of Agriculture

Sustainable Aviation Fuel for the Southeast
Vantage Point

- Sacramento Based Fuel and Carbon Law Attorney
  - Represent Alternative Jet Fuel Producers
  - CARB Rulemakings- Low Carbon Fuel Standard
  - Executive Director, Low Carbon Fuels Coalition
  - Track, Support, and Expand low carbon fuel policies
Market and Policy Overview

• Aviation Sector Faces Fundamental Challenge
  ➢ Consistent year-on-year growth of aviation sector and its fuel demand
  ➢ Fuel is major cost center and market is cost competitive
  ➢ Need to transition to lower-carbon, higher cost sustainable aviation fuels

• Policy is the Solution
  ✓ Federal Renewable Fuel Standard applies nationally
  ✓ State Level Policy is the Distinguishing factor- additional value
  ✓ California is the market leader due to Low Carbon Fuel Standard
Low Carbon Fuel Standard
Statutory and Regulatory Basis

State-Level Policy
- Federal law pre-empts state regulation of some sectors such as jet fuel
- Broadly empowers California Air Resources Board (CARB) to establish comprehensive suite of greenhouse gas reducing programs
- Concept papers and informal workshops with stakeholders
- Formal rulemaking process establishes regulations, CA GREET revisions
- ~1500 staff at CARB

Authorizing Legislation in California
- Rulemaking Engagement
- Rigorous Science with Peer Review
- Leading Laboratory of Greenhouse Gas Democracy

California State Laws
- **AB 32**
  - Reduce to 1990 levels by 2020
  - State met greenhouse gas reduction requirement in 2016
- **SB 32**
  - Reduce 40% below 1990 levels 2021-2030
  - LCFS-mandated reduction only 12.5% over same period
- **LCFS 3.0 + CA GREET 3.0**
  - 3-4 year amendment cycle
Clean Fuel Standard
Policy Design Fundamentals

Key Metric
Carbon Intensity of Transportation Fuels

Greenhouse Gas
emissions per mile

Approach
1% per year
10-20 years

Market-Based and Fuel-Neutral

NO REVENUE is collected by the state
Reductions are provided by lowest cost available fuels and vehicle technologies
Sustainability is addressed via Indirect Land Use Change (ILUC) factors, e.g. palm oil
Carbon Intensity (CI) Benchmarks for Aviation Fuel

Proposed Annual CI Benchmarks

- CaRFG
- Diesel
- Jet (new)
- Jet (ISOR)
Carbon Intensity (CI) Ranges, and Values

<table>
<thead>
<tr>
<th>Fuel</th>
<th>CI</th>
<th>California</th>
<th>Oregon</th>
<th>RIN</th>
</tr>
</thead>
<tbody>
<tr>
<td>Renewable Diesel</td>
<td>20</td>
<td>$1.88/gal</td>
<td>$1.49/gal</td>
<td>.39</td>
</tr>
<tr>
<td>Canola Biodiesel</td>
<td>55</td>
<td>$0.96/gal</td>
<td>$0.61/gal</td>
<td>.39</td>
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<tr>
<td>Corn Ethanol</td>
<td>70</td>
<td>$0.37/gal</td>
<td>$0.29/gal</td>
<td>.16</td>
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<tr>
<td>Sugarcane Ethanol</td>
<td>45</td>
<td>$0.77/gal</td>
<td>$0.61/gal</td>
<td>.33</td>
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<tr>
<td>Dairy RNG</td>
<td>-255</td>
<td>$71.84 mmbtu</td>
<td>$57.10 mmbtu</td>
<td>$27</td>
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<tr>
<td>Solar LD EV</td>
<td>0</td>
<td>$0.22/kWh</td>
<td>$0.18/kWh</td>
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<tr>
<td>Landfill Hydrogen</td>
<td>-12</td>
<td>$5.73/kg</td>
<td>$4.56/kg</td>
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</table>
Policy Results in California
Innovation and Fuel Diversification

Highlights

50% Decarbonization of Ethanol
4-5x National Rate of Electric Vehicle Adoption
10% Low Carbon Diesel Fuels
$195/ton Market Driver
Results to Date
2011 – 2018 Q1

38,000,000
tons of carbon pollution avoided... and growing

- **Petroleum**: 13.7 billion gallons avoided
- **Clean Fuels**: 74% increase in use
- **Market Value**: $2.8 billion invested in clean fuels production
- **Health**: $1.84 million in avoided public health impacts
Rewind Policy Landscape to 2018 To Discuss SAF Advocacy

- Renewable Fuel Standard
  - Alternative Jet Fuel as Additional= Opt-In Fuel
  - Conventional Jet Fuel does not create obligations
  - Private forestlands= Southeast Advantage
- No Crediting Under Low Carbon Fuel Standard (LCFS)
  - Jet Fuel Outside Scope of State Authority
  - Jet Fuel Exempted from LCFS Program
LCFS Initiative

• Joint Effort
  ✓ Alternative Jet Fuel Producer Group
  ✓ Airlines for America (A4A)
  ✓ Airlines, particularly United Airlines
  ✓ Airports, particularly SFO

• AJF Producer Group
  ✓ World Energy Paramount
  ✓ Fulcrum BioEnergy
  ✓ Gevo
  ✓ Neste
  ✓ Red Rock
  ✓ Velocys
Business Supports California’s LCFS

150+ companies supported the LCFS in letter to policymakers

• Including multinational companies, energy utilities, vehicle manufactures, fleet managers, and petroleum marketers (May 12, 2017)
Oregon Clean Fuels Program (CFP)

- Comparable Program
- Statutory Basis
- Department of Environmental Quality (DEQ)- small staff
- Began Five Years Later
- Leverages California Program
- Pathways are Comparable
- Also brought AJF into the CFP on opt-in basis
- Effective January 1, 2019
Feedstock Advantage: Southeast

Base-case scenario, $60 roadside, forestry resources, year 2040

Dry tons/year
- Less than 10 dt/SqMile
- 10-100 dt/SqMile
- 100-500 dt/SqMile
- 500-1000 dt/SqMile
- Greater than 1,000 dt/SqMile

Source: Oak Ridge National Laboratory
2019 LCFS Policy Expansion
Any Southeastern States?

Washington State

Regional Greenhouse Gas Initiative (RGGI) States

Midwestern States

Canadian Provinces

RenovaBio in Brazil
Key Policy Debate Issues

• Need to establish new LCFS- not just expand it.
• GHG Reduction Program-
  ✓ Is the wildfire hot enough?
  ✓ Is the water high enough?
• Recurring Policy Debate Issues
  ✓ Impact to consumers at the pump
  ✓ Air Quality improvement= Health Benefits
  ✓ Jobs and Economic Development
• Policy levers to pull
  ✓ Speed of GHG Reduction
  ✓ Scope of Policy- Petroleum Provisions