



The Feedstock Readiness Level (FSRL) Tool: A USDA-FAA Collaboration

Biomass Research and Advisory Board
Board Technical Advisory Committee
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UNITED STATES DEPARTMENT OF AGRICULTURE
Agricultural Research Service

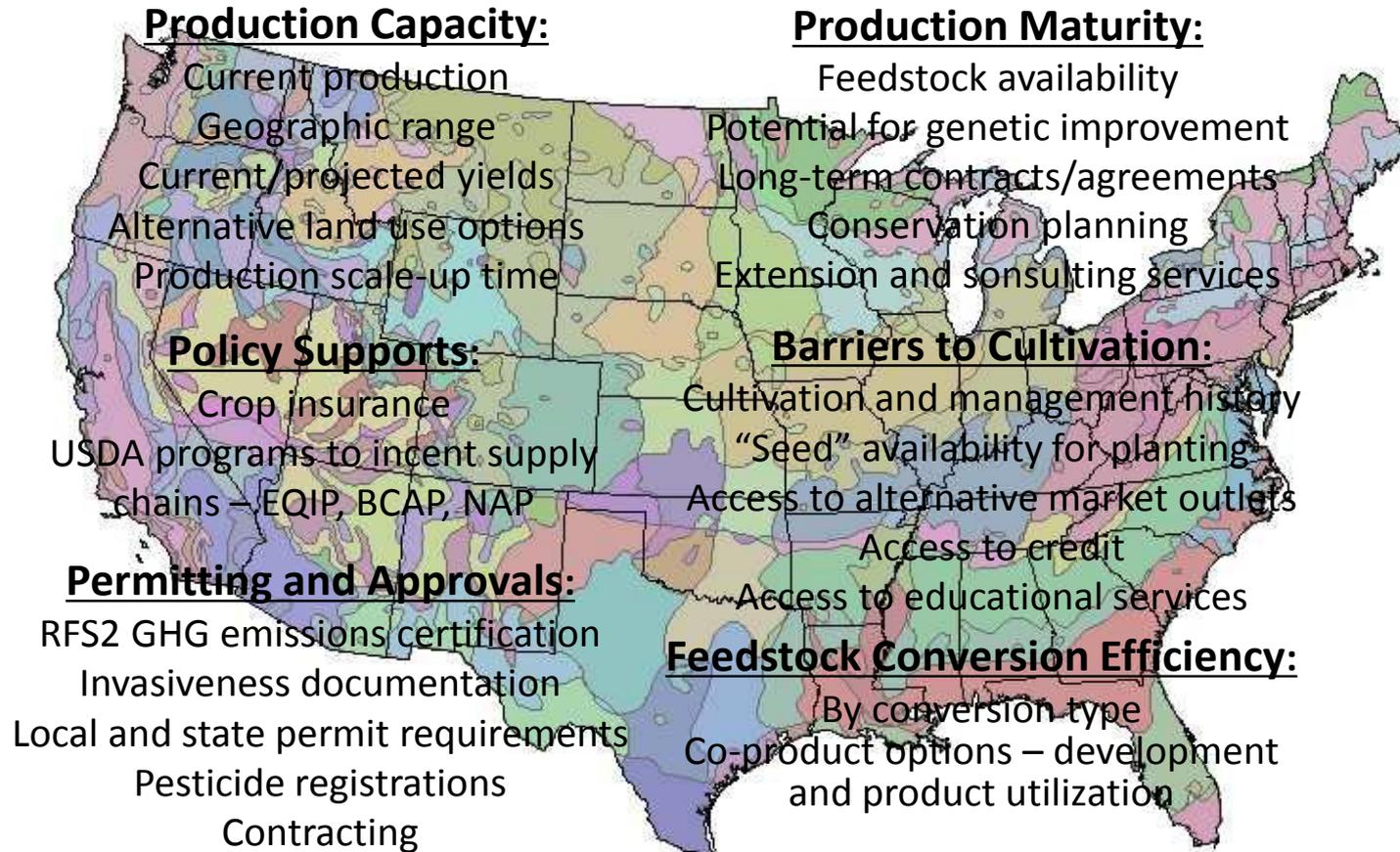


Many Feedstocks May Contribute to Aviation Fuels



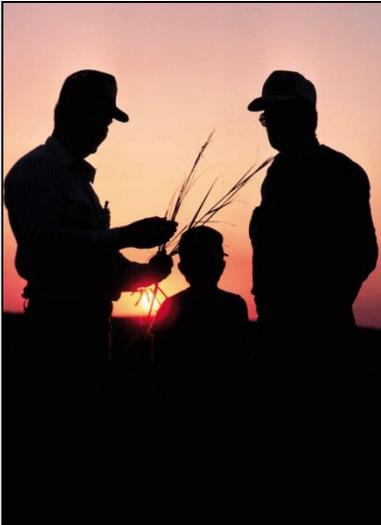
No one feedstock or region will meet all biofuel needs

Feedstock Production Complexity



A great deal of information is required to make decisions about the readiness of a feedstock

Need for Solutions Brought USDA and FAA Together



Small quantities of aviation biofuels successfully flight tested, but no short-term prospect of having sufficient feedstock supplies to make commercial-scale amounts of that fuel.

Therefore, CAAFI proposed the concept of the *Feedstock Readiness Level* to avoid disconnects between biofuel technical readiness and feedstock readiness.



Commercial Aviation Alternative Fuels Association (CAAFI[®])

CAAFI Request and Specifications

- Feedstock readiness recognized as a critical, uncaptured component of biofuel evaluation.
- Create a tool tied to the *Fuel Readiness Level* (FRL) that communicates feedstock readiness status.
- USDA was the most appropriate organization to develop a *Feedstock Readiness Level* (FSRL) concept.
- CAAFI would like to work with USDA to move the concept forward and into use.



CAAFI Request to USDA, February 26, 2010

Feedstock Readiness Level (FSRL) Tool

FEEDSTOCK READINESS LEVEL (FSRL) TOOL										
Feed Readiness Level (FRL)				Feedstock Readiness Level (FSRL)		FSRL Components with Tolerances				
FRL Scale	Description	Fuel Testing and Certification	Tolerance	Activity	Scale	Description	(1) Production	(2) Market	(3) Policy - Program Support and Regulatory Compliance	(4) Linkage to Conversion Process
1	Scale Prototype		Feedstock and process tests production facilities	Preliminary Feedstock Evaluation	1	Scale Prototype	Identify potential feedstocks for a specific conversion technology	Identify current feedstock producers, feedstocks and available uses, and volume	Identify regulatory requirements to produce a new feedstock	Identify potential conversion technologies to utilize feedstock
2	Concept Feedstock		Feedstock and conversion process facilities		2.1	Concept Feedstock	Identify study range of potential feedstocks and processes and associated feed uses	Identify potential conversion technology	Identify feedstocks for studies with regulatory requirements for study and conversion feed uses	Test feedstock quality for specific conversion technology
					2.2	Concept Feedstock	Identify production system requirements	Identify potential conversion technology	Identify feedstocks for studies with regulatory requirements for study and conversion feed uses	
					2.3	Concept Feedstock	Identify conversion technology for potential feedstock	Identify specific chemical requirements	Identify feedstocks for studies with regulatory requirements for study and conversion feed uses	
2.4	Concept Feedstock	Identify specific conversion of regional production, utilization, response to trade-offs	Identify feedstock producer costs	Identify feedstocks for studies with regulatory requirements for study and conversion feed uses	Identify with any feedstock pre-treatment requirements					
3	Proof of Concept		Feed test samples available from both feed producer and refinery	Proof of Concept	3.1	Proof of Concept	Develop feedstock growth scenarios for feedstock plant	Identify feedstock producer costs	Identify potential for a market conversion	Test feedstock in conversion process at the commercial feedstock
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4.1	Preliminary Feedstock Evaluation	Feedstock and Refinery Facilities	Refinery performance and regulatory results	Feedstock Requirements Testing	4.1	Preliminary Feedstock Evaluation	Identify conversion of regional feedstocks into feedstocks for plant, regulatory and conversion feed uses	Identify feedstocks for studies with regulatory requirements for study and conversion feed uses	Identify potential for a market conversion	Performance optimized for feedstock through a conversion process
					4.2	Preliminary Feedstock Evaluation	Identify specific conversion of regional production, utilization, response to trade-offs	Identify feedstocks for studies with regulatory requirements for study and conversion feed uses	Identify potential for a market conversion	Performance optimized for feedstock through a conversion process
4.3	Preliminary Feedstock Evaluation		Feed test samples available from both feed producer and refinery	4.3	Preliminary Feedstock Evaluation	Identify conversion of regional feedstocks into feedstocks for plant, regulatory and conversion feed uses	Identify feedstocks for studies with regulatory requirements for study and conversion feed uses	Identify potential for a market conversion	Performance optimized for feedstock through a conversion process	
4.4	Preliminary Feedstock Evaluation		Feed test samples available from both feed producer and refinery	4.4	Preliminary Feedstock Evaluation	Identify conversion of regional feedstocks into feedstocks for plant, regulatory and conversion feed uses	Identify feedstocks for studies with regulatory requirements for study and conversion feed uses	Identify potential for a market conversion	Performance optimized for feedstock through a conversion process	
5.1	Process Feedstocks		Refinery production development	Pre-commercial Feedstock Assessment	5.1	Process Feedstocks	Identify range of utilization for feedstock and identify production conversion	Identify feedstocks for studies with regulatory requirements for study and conversion feed uses	Identify potential for a market conversion	Performance optimized for feedstock through a conversion process
5.2					Process Feedstocks	Identify range of utilization for feedstock and identify production conversion	Identify feedstocks for studies with regulatory requirements for study and conversion feed uses	Identify potential for a market conversion	Performance optimized for feedstock through a conversion process	
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5.4					Process Feedstocks	Identify range of utilization for feedstock and identify production conversion	Identify feedstocks for studies with regulatory requirements for study and conversion feed uses	Identify potential for a market conversion	Performance optimized for feedstock through a conversion process	
6.1	Full-Scale Feedstock Evaluation		Refinery production development	Pre-commercial Feedstock Assessment	6.1	Full-Scale Feedstock Evaluation	Identify range of utilization for feedstock and identify production conversion	Identify feedstocks for studies with regulatory requirements for study and conversion feed uses	Identify potential for a market conversion	Performance optimized for feedstock through a conversion process
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7	Commercial Feedstock Approval (Domestic or Foreign)	Feed (Scale) linked to Conversion Feed Specifications	Feed (Scale) linked to Conversion Feed Specifications	7	Commercial Feedstock Approval	Identify range of utilization for feedstock and identify production conversion	Identify feedstocks for studies with regulatory requirements for study and conversion feed uses	Identify potential for a market conversion	Performance optimized for feedstock through a conversion process	
8	Commercial Feedstock Approval (Domestic or Foreign)	Feed (Scale) linked to Conversion Feed Specifications	Feed (Scale) linked to Conversion Feed Specifications	8	Commercial Feedstock Approval	Identify range of utilization for feedstock and identify production conversion	Identify feedstocks for studies with regulatory requirements for study and conversion feed uses	Identify potential for a market conversion	Performance optimized for feedstock through a conversion process	
9	Production Capacity Expansion	Feed (Scale) linked to Conversion Feed Specifications	Feed (Scale) linked to Conversion Feed Specifications	9	Production Capacity Expansion	Identify range of utilization for feedstock and identify production conversion	Identify feedstocks for studies with regulatory requirements for study and conversion feed uses	Identify potential for a market conversion	Performance optimized for feedstock through a conversion process	

Kristin Lewis – DOT, Research and Innovative Technology Administration

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Nathan Brown – FAA, Office of Environment and Energy

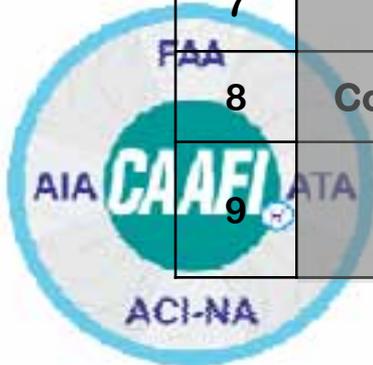
Jeffrey Steiner – USDA, Agricultural Research Service



Fuel Readiness Levels (FRL) – Descriptions and Criteria



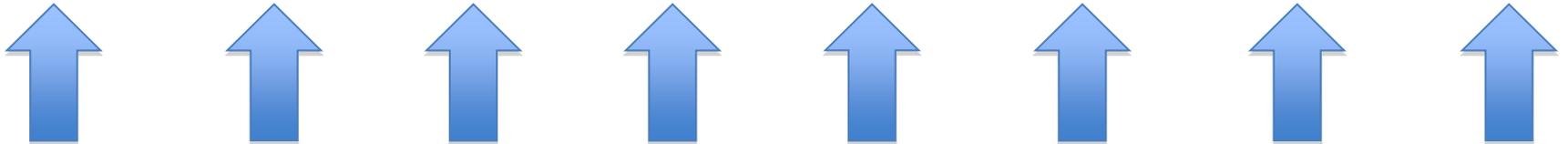
FRL	Description	FRL Tollgate Criteria
1	Basic Principles	Feedstock / Process Observed / Reported
2	Concept Formulated	Feedstock / Complete Process identified
3	Proof of Concept	Basic Fuel Properties Validated at Lab Scale Research & Development
4.1 4.2	Preliminary Technical Evaluation	System Performance & Integration Studies Entry Criteria/Specification Properties
5	Process Validation	Scaling from Laboratory to Pilot plant
6	Full-Scale Technical Evaluation	Fuel Properties, Rig and Engine Testing Qualification & Certification
7	Fuel Approval	Fuel Class/Type Listed in Int'l Fuel Standards
8	Commercialization	Commercial Purchase Agreements Business & Economics
9	Production Capability Established	Full Scale Plant Operational



Courtesy: Commercial Aviation Alternative Fuels Association (CAAFL)

Feedstock Readiness Level (FSRL) Tool Development

		Feedstock Readiness Level (FSRL) Components				Fuel Readiness Level (FRL)	
Technology Readiness Level (TRL)	FSRL Description	(1) PROD	(2) MARK	(3) POLY	(4) LINK	Conversion Process	Fuel Testing and Certification



FSRL use: FSRL desc: FSRL is described by four readiness components:
Fuel Readiness Level (FRL) fuel testing (1) Production; (2) Market; (3) Policy; and (4) Linkage

Feedstock Readiness Level (FSRL) tool modeled after and designed to complement the Fuel Readiness Level (FRL) tool

Feedstock Readiness Levels (FSRL) and Activities

Technology Readiness	Feedstock Readiness	FSRL Components with Tollgates			
		Production	Market	Program	Package
1	Basic Principles	Preliminary Evaluation			
2	Concept Formulated				

Commercialization

Feedstocks integrated with all biofuel supply chain components



Feedstock Development



Feedstock Production



Feedstock Logistics



Biofuels Conversion



Fuel Testing & Approval



Large Scale Deployment

7	Feedstock Availability	Commercial Deployment			
8	Commercialization				
9	Commercially Established				

Integrates

Utility of the Feedstock Readiness Level Tool

- Apply to any kind of biofuel supply chain – not just aviation fuels
- Facilitate communication between all supply chain participants – government and business contributors
- Plan and coordinate research around supply chain needs
- Integrate all supply chain activities and multi-agency programs
- Measure progress for commercial project development

