Department of Environmental Quality

Low Carbon Fuel Advisory Committee
April 15th, 2010

Low Carbon Fuel Standard

Federal Renewable Fuel Standard 2
Biomass Assessment
Fuels Assessment

Sue Langston
Oregon DEQ

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Low Carbon Fuel Standard: Fuels and Biomass Assessments

1. **Federal Renewable Fuel Standard 2**
2. **Biomass Assessment**
3. **Fuels Assessment**

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Federal Renewable Fuel Standard Required volumes in 2022:

RFS2 Category	Fuels included	Carbon Intensity	Federal Volume	Oregon Volume (fair share)
Cellulosic biofuels	Cellulosic ethanol or diesel; synthetic gasoline, or jet fuel; biogas	60% less	16 billion gal	188 million gal
Biomass-based diesel	Biodiesel (FAME), non-co-processed renewable diesel, cellulosic diesel	50% less	1 billion gal*	12 million gal
Other advanced	Anything listed above, plus lower-carbon ethanol.	50% less	4 billion gal	46 million gal
Renewable fuel	Facilities that commenced construction after 12/19/2007	20% less		

*The required biomass-based diesel volume might increase, but will not be less than 1 billion

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Control Cases for RFS2: Primary Control Case (2022 volumes)

RFS2 Category	Fuels included	EPA Estimate (billion gallons)	OR Volume (Million gallons)
Cellulosic biofuels	Cellulosic ethanol	4.92	58
	Cellulosic diesel	6.52	77
Biomass-based diesel	Biodiesel (FAME)	0.85	10
	Non-co-processed renewable diesel	0.15	2
Other advanced biofuel	Other biodiesel	0.82	10
	Imported ethanol	2.24	26

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Control Cases for RFS2:
Low Ethanol Control Case (2022 volumes)

RFS2 Category	Fuels included	EPA Estimate (billion gallons)	OR Volume (Million gallons)
Cellulosic biofuels	Cellulosic ethanol	0.25	3
	Cellulosic diesel	9.26	109
Biomass-based diesel	Biodiesel (FAME)	0.85	10
	Non-co-processed renewable diesel	0.15	2
Other advanced biofuel	Other biodiesel	0.82	10
	Imported ethanol	2.24	26

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Control Cases for RFS2:
High Ethanol Control Case (2022 volumes)

RFS2 Category	Fuels included	EPA Estimate (billion gallons)	OR Volume (Million gallons)
Cellulosic biofuels	Cellulosic ethanol	16.00	189
	Cellulosic diesel	0	0
Biomass-based diesel	Biodiesel (FAME)	0.85	10
	Non-co-processed renewable diesel	0.15	2
Other advanced biofuel	Other biodiesel	0.82	10
	Imported ethanol	2.24	26

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Biomass Assessment

Does Oregon have available biomass feedstock, or the ability to produce such feedstock for advanced biofuels?

Note: not all biofuels for a LCFS would need to come from Oregon

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Biomass Assessment

- Biomass Assessment based on five available OR statewide studies
- Available studies address 9 out of 45 potential biomass sources
- Some of studies are not recent
- All of the more recent studies had an economic component to address biomass collection and transport

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Types of Biomass

- **Wood**
  - Forest-derived (thinning to reduce fire hazard, logging residue)
  - Urban wood waste
  - Hybrid poplar plantations
  - Mill waste/residue
- **Municipal Solid Waste**
- **Biogas**
  - Wastewater Treatment
  - Organic Waste Digesters
  - Landfills

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Types of Biomass

- **Agricultural Residue**
- **Existing biofuels crops**
  - Corn
  - Canola
  - Camelina
  - Hybrid poplar
  - Sugar beets
- **Potential biofuels crops**
  - Hybrid poplars
  - Switchgrass and miscanthus.
  - Brassica juncea.
  - Camelina.

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Other Issues

- Highest and best use
- Sustainability
- Availability dependent on price
- Carbon intensity

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Potential for fuel produced from OR waste biomass

Biomass Source	Estimate of Quantity Available (Annual bone dry tons)	Millions gallons of gasoline equivalent/yr
Forest residue	924,418 to 2,100,369	58 to 132
Ag residue (corn & wheat)	194,272 to 481,825	13 to 32
Urban wood waste	182,532 to 304,220	11 to 19
Unused mill residues	16,320	1
Orchard & Vine. Prunings	94,564	6
Grass straw residue	500,000	33
Greenwaste	278,750	18
Mixed Waste Paper	652,536	41
Total	2,843,392 to 4,428,584	182 to 282

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Potential for fuel produced from OR biomass

Oregon has ample supply of biomass for fuel production

- **From waste sources:**
  - **182 to 282 million gallons, dependent on price**
  - **8% to 13% of Oregon's current gasoline and diesel consumption**
- **Competing uses could reduce this amount**

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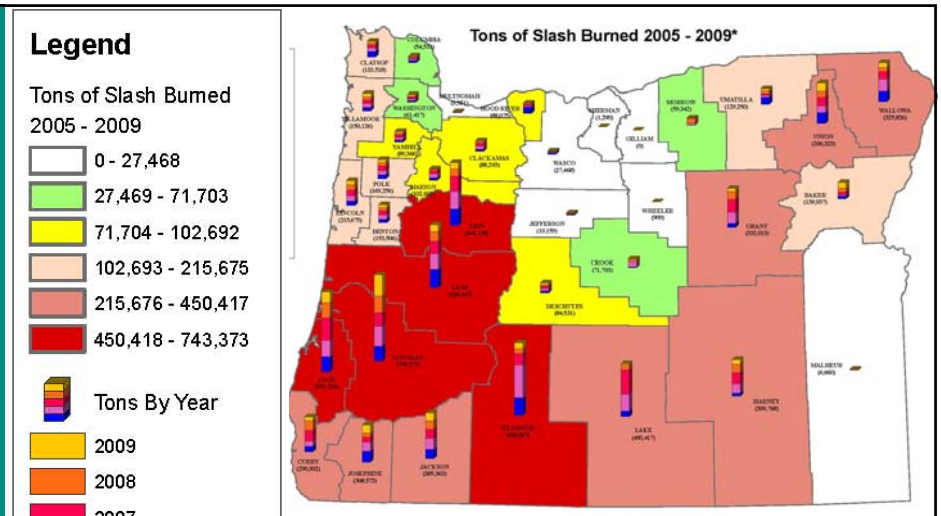

Oregon Department of Forestry: Smoke Management Program
***Tons of slash burned are ballpark figures only and often are based on ocular approximations rather than measured plot data**

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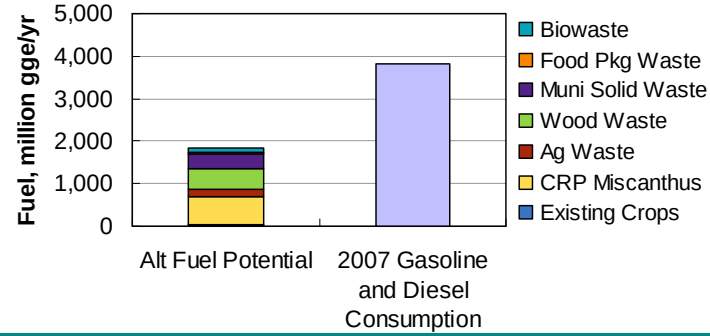
Washington Results



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Fuels Assessment Discussion
April 15th, 2010 goal

Advisory Committee Objective:

To give input on a low, moderate, and high estimate of availability/use for each fuel in the Fuels Assessment

Input due: Friday, April 30th, 2010

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Compliance scenario/fuel assessment

2010

Apr **May** **Jun**

April 15th Advisory Committee:
- Review fuels assessment
- Discuss fuel potential
- Input on compliance scenarios

June Advisory Committee:
- Assess feasibility
- Input on economic analysis assumptions

Step 1: Fuels Assessment → *Step 3: Compliance Scenarios* → *Step 4: Economic Analysis*

Step 2: Calculate Carbon Intensities → *Step 3: Compliance Scenarios*

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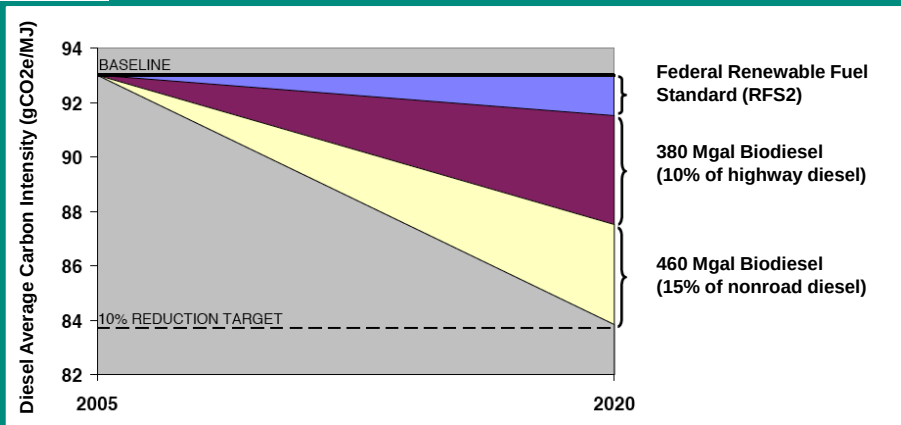
Compliance Scenarios



Example Diesel Compliance Scenario #D1 from East Coast States

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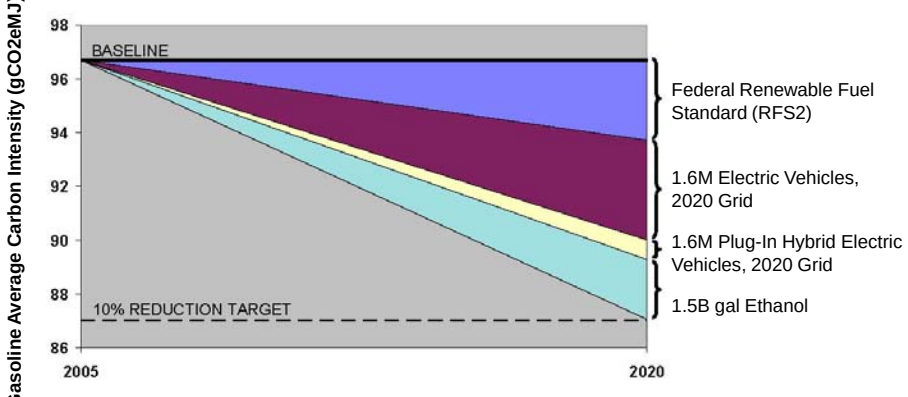
Compliance Scenarios



Example Gasoline Compliance Scenario #G2 from East Coast States

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Fuels Assessment

Purpose: estimate feasible alternative fuel use in 2022

- **Regulations**
- **Historic increases**
- **Trends in other areas**
- **Predictions**
- **Studies**
- **Oregon projects**

Input due: Friday, April 30th, 2010

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Fuels Included

Ethanol
- Starch- and Sugar-Based Ethanol
- Cellulosic Ethanol

Diesel
- Biodiesel (FAME)
- Renewable Diesel (Hydrogenation-Derived)
- Fisher-Tropsch and Other Synthetic Fuels (such as synthetic diesel, cellulosic diesel, or synthetic gasoline)

Electricity

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Fuels Included

Natural Gas
- Biogas
- Compressed Natural Gas (CNG)
- Liquefied Natural Gas (LNG)

Other
- Biobutanol/Butanol
- Hydrogen
- Algae

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Contents of Fuels Assessment

- Feedstock and Production Process
- Commercialization Status of Fuel and Vehicles
- Production
- Use of Fuel for Transportation Purposes
- Summary of Known Trends
- Preliminary Estimates of 2022 Use
- References and Further Reading

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Additional slides

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Contents of Fuels Assessment

- **Fuels not included?**

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Backup slide: Oregon consumption of gasoline and diesel

2007	US consumption (gallons per year)	Oregon consumption (gallons per year)	Oregon Percent of US
Gasoline	**142,349,298,000**	**1,587,600,000**	**1.12%**
On-highway diesel	*39,801,744*	*560,598*	*1.40848%*
Off-highway diesel	*2,512,394*	*22,925*	*0.91248%*
Total Diesel	**42,314,138,000**	**583,523,000**	**1.38%**
Total (Gasoline and Diesel)	**184,663,436,000**	**2,171,123,000**	**1.18%**