



Low Carbon Fuel Advisory Committee
November 16, 2010

**Low Carbon Fuel Standards
Draft Report**

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Oregon DEQ

Slide 1



Presentation Overview

1. Purpose of this Presentation
2. Purpose of Draft Report
3. Draft Report Structure
4. DEQ proposal for LCFS Program Design
5. Potential Impacts to Public Health and the Environment

Slide 2



Purpose of Presentation

Familiarize you with Draft Report

Review:

- DEQ's proposal for LCFS program design and rationale
- Alternatives considered and arguments in favor of alternatives

Seeking input from advisory committee on:

- Completeness of alternatives
- Completeness of arguments in favor
- Any new alternatives or information

**DEADLINE for comments on Draft Report:
December 1, 2010**



Purpose of Draft Report

1. Describe advisory committee process
2. Present DEQ's proposal and rationale for an LCFS, and alternatives considered
3. Check DEQ's understanding of alternatives
4. Explain policy issues, Compliance scenarios, economic analysis
5. Document technical work
6. Document advisory committee comments



Report Structure: Introduction and Summary Material

- I. Executive Summary (p. 7)
- II. Program at a Glance (*Summary of LCFS Program Design*) (p. 9)
 - DEQ Proposal, Rationale
 - Alternatives Considered
- III. HB 2186 Roadmap (p. 32)
- IV. Background (p. 36)



Report Structure

- V. LCFS Development Process (p. 42)
 - Advisory Committee Process
 - Interagency Team
 - Coordination with Other States



Report Structure – Policy Issues Discussion

- VI. LCFS Program Design (p. 48)
- VII. Calculation of Carbon Intensities (p. 113)
- VIII. Compliance Scenarios and Economic Analysis (p. 134)
- IX. Potential Impacts to Public Health and the Environment (p. 143)



Report Appendices

- Appendix A: Summary of Advisory Committee Input
(Summary of written comments **(NEW)** & meeting notes. **Addendum**)
- Appendix B: Lifecycle Analysis
(Discussion 12/3/09 and 6/23/10. Workshop 5/27/10. **Updated**)
- Appendix C: Infrastructure Cost Assumptions Memorandum
(Assumptions discussed 7/7/10 & 8/10/10. Draft TIAX memo 8/9/10. **Updated**)
- Appendix D: Economic Analysis
(Methodology discussions 12/3/09, 6/23/10 & 8/10/10. Draft results presented 10/14/10. Final results 11/16/10. **NEW**)
- Appendix E: Comparable Economic Studies in Other States
(JFA Report 10/14/10. **NOT updated**)



Report Appendices

- Appendix F: Compliance Scenario Documentation
(Methodology discussed 12/3/09, 2/24/10, 4/15/10. Input assumptions discussed 4/15/10, 7/7/10 & 8/10/10. Draft results 8/10/10. **Updated**)
- Appendix G: Indirect Land Use Change Comparative Analysis
(Report 9/28/10, Presentation and discussion 10/7/10. **NOT updated**)
- Appendix H: Fuels Assessment Discussion Paper
(discussion 4/15/10. **NOT updated**)
- Appendix I: Biomass Assessment
(discussion 4/15/10. **NOT updated**)
- Appendix J: Credit and Deficit Calculations
(discussion 1/27/20. **Examples will be updated** and made Oregon-specific)
- Appendix K: Review of Biodiesel and Renewable Diesel Use Considerations
(NEW)



Summary of LCFS Program Design (p.9)

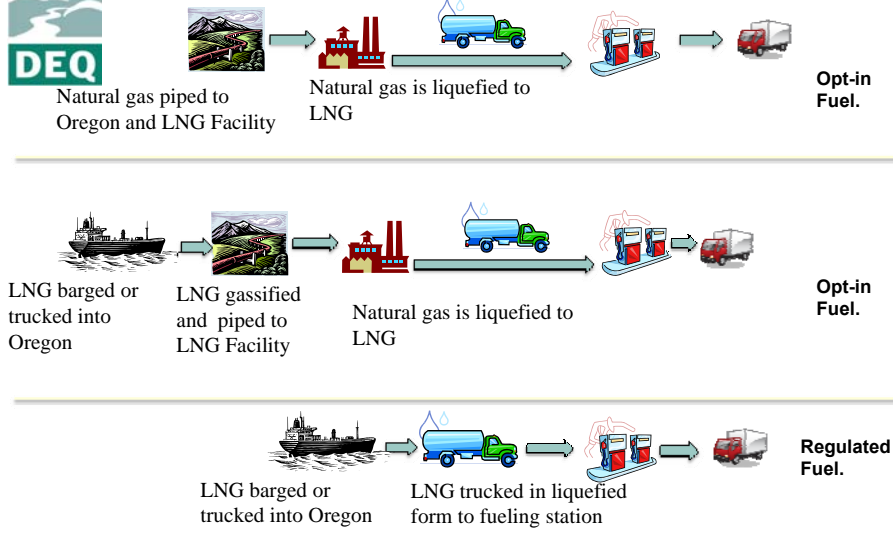
Table 1: Summary of LCFS Program Design

1) Covered Fuels and Regulated/Opt-in Fuels	
1a) Covered Fuels (See page 49 for details)	
<i>DEQ Proposal for LCFS Program</i>	<ul style="list-style-type: none"> • Diesel • Gasoline • Electricity • Hydrogen • Ethanol • Biomass-based diesel • CNG and LNG from fossil sources • CNG and LNG from biogas • Any other fuel used for transportation purposes not specifically excluded or exempt from the LCFS (This is a placeholder for future fuels that might be developed) <p>Fuels used for transportation include off-road fuel. Not covered: Propane</p>
<i>Alternatives Considered</i>	Advisory committee members requested that propane be included as opt-in to the low carbon fuel standard. <i>Arguments in favor — 1) Propane could assist regulated parties in meeting the LCFS</i>
<i>Rationale for DEQ Proposal</i>	House Bill 2186 specifically authorizes the exemption of propane from the LCFS.

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Fossil LNG

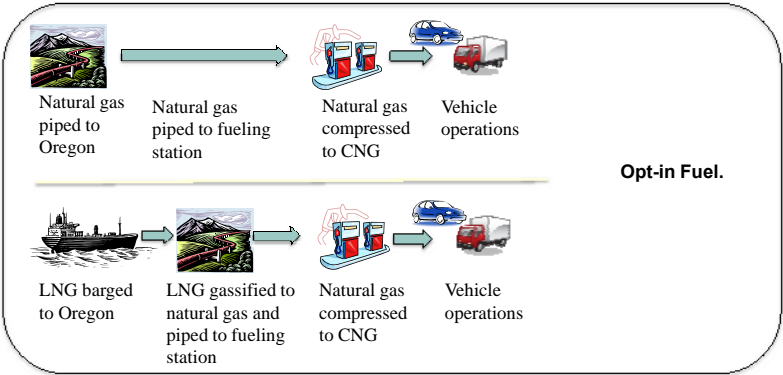


Slide 11

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Regulated and Opt-in Parties: Fossil CNG



Slide 12



Regulated Parties: Gasoline, Diesel, biofuels

- Producer
- Oregon Large Importer (more than 50,000 gal imported per year)
- Oregon Small Importer (less than 50,000 gal imported per year)

Slide 13



Regulated and Opt-in Parties

Owner of fuel dispensing equipment

- Fossil CNG
- Fossil LNG,
- Biogas CNG or LNG

Person who owns fuel at time finished fuel made or imported to Oregon

- Hydrogen

Slide 14



Opt-in Party: Electricity

Electricity

Opt-in priority:

1. Bundled services provider
2. Electricity provider
3. Owner of electric charging equipment

Slide 15



Calculation of Carbon Intensity

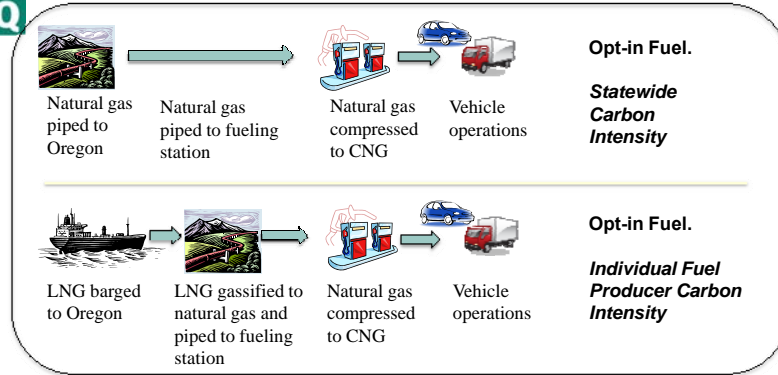
- Statewide: Gasoline, diesel, electricity, some compressed CNG
- Individual: Biogas CNG or LNG, Hydrogen, ethanol, biomass-based diesel, any new fuel

Slide 16

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Calculation of Carbon Intensity - CNG

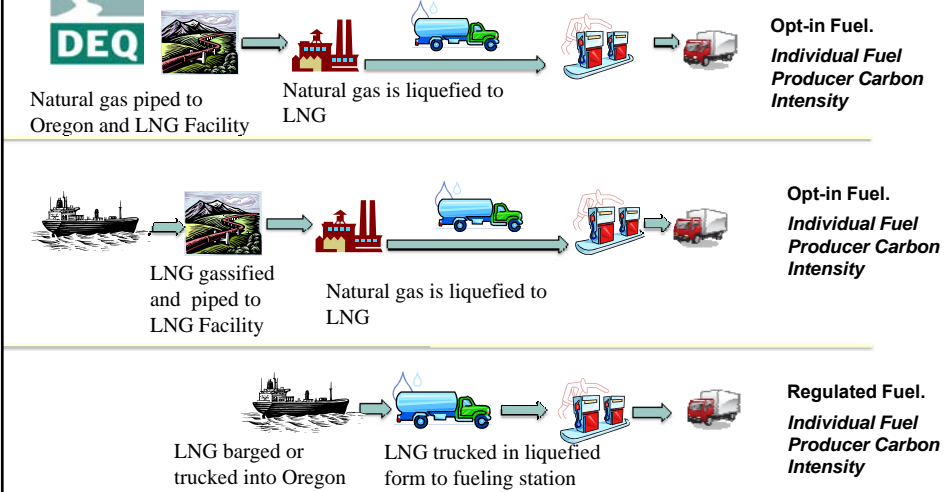


Slide 17

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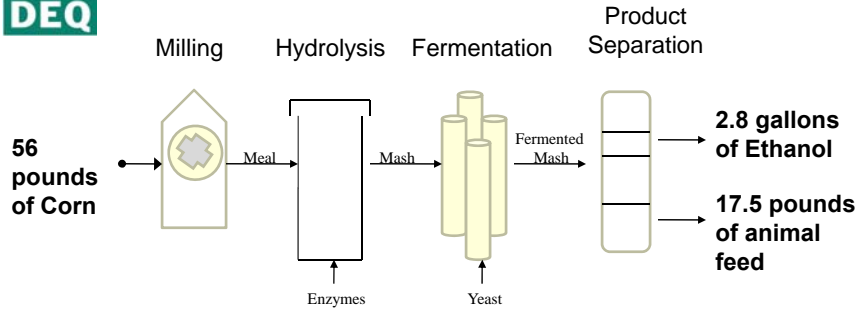
Calculation of Carbon Intensity - LNG



Slide 18



Co-products

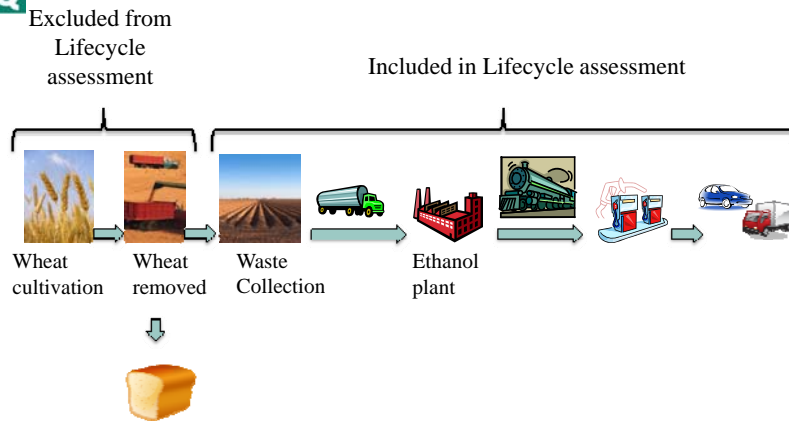


Adapted From: Analysis and Identification of gaps in research for the production of second-generation liquid biofuels. Schwietzke, et al. IEA Bioenergy. http://www.ftconferences.com/userfiles/file/Berndes%20Goran%20Gaps_in_the_Research_of_2nd_Generation_Transportation_Biofuels.pdf

Slide 19



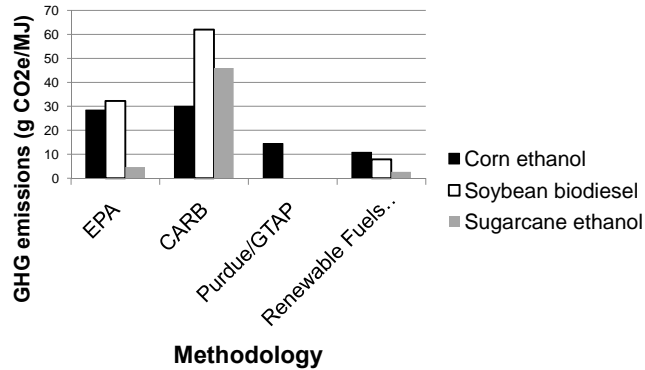
Fuel made from waste



Slide 20



Indirect land use change



Slide 21



Recalculation of banked credits when Indirect Land Use Change is added in the future

<i>Percent difference in carbon intensity when an indirect CI of 16 gCO₂e/MJ is added</i>	Carbon Intensity (gCO₂e/MJ)	Percent of Total Carbon Intensity	Number of Credits (metric tons)
Direct Carbon Intensity	64.82	80%	Before ILUC Added: 100
Indirect Carbon Intensity	16.00	20%	Adjust by 20%
New Carbon Intensity Total	80.82	100	After ILUC Added: 80

Slide 22



Energy Economy Ratios (EER)



Gasoline: 1 gallon = 115 MJ = approximately 30 miles

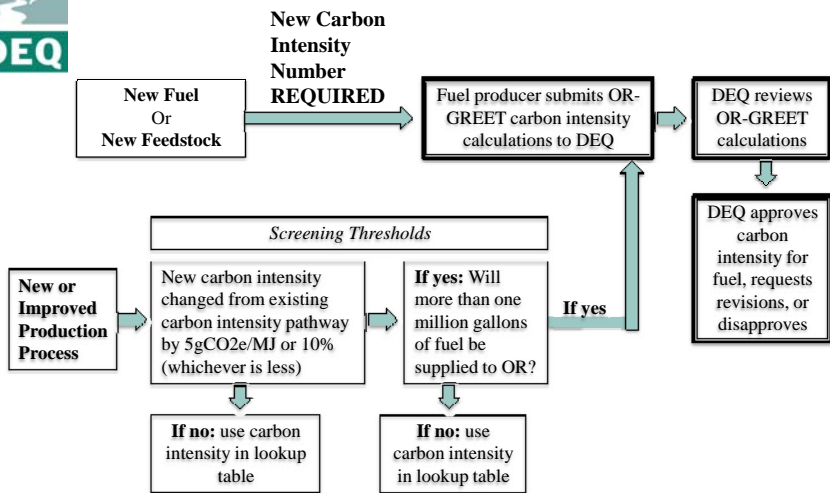


Electric Vehicle: 31kWh = 115 MJ = approximately 120 miles

Slide 23



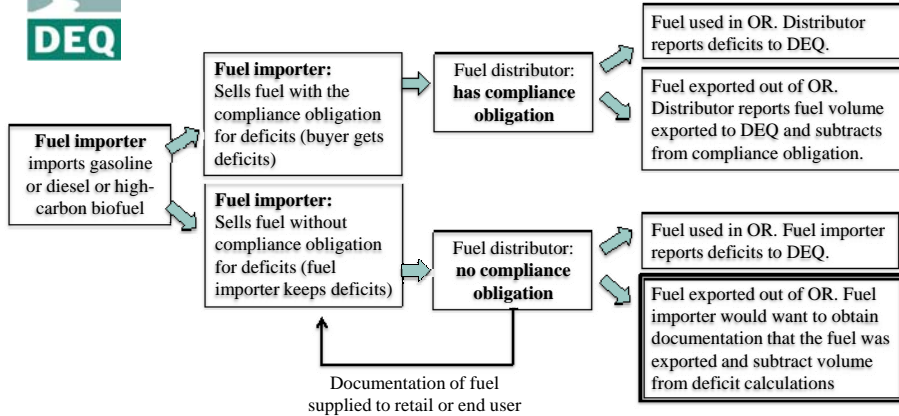
Adding a New Carbon Intensity Number



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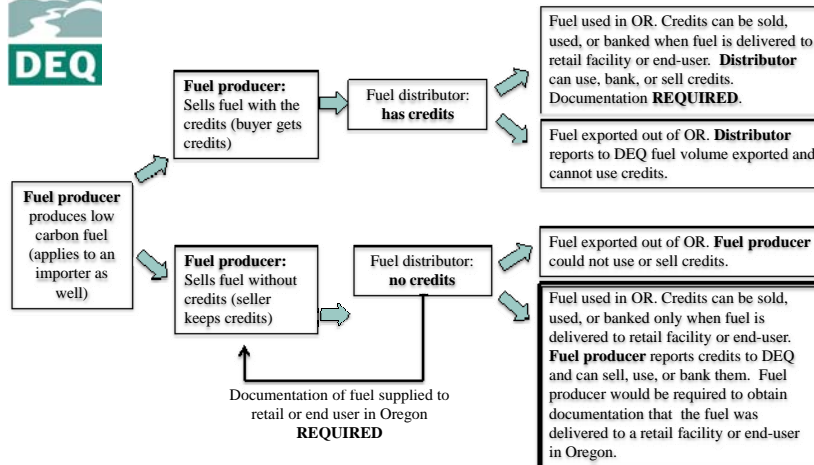
Deficits



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Credits





“Small” deficit carryover (less than 10% of total deficits for year)

EXAMPLE

- 20,000 total metric tons of deficit generated in a compliance year
- Used 19,000 metric tons of credit
- Net deficit = 1,000 metric tons (deficit).
- $1,000/20,000 = 5\%$, which is less than 10%
- Conclusion: Regulated party can carry over the 1,000 metric tons of deficit.

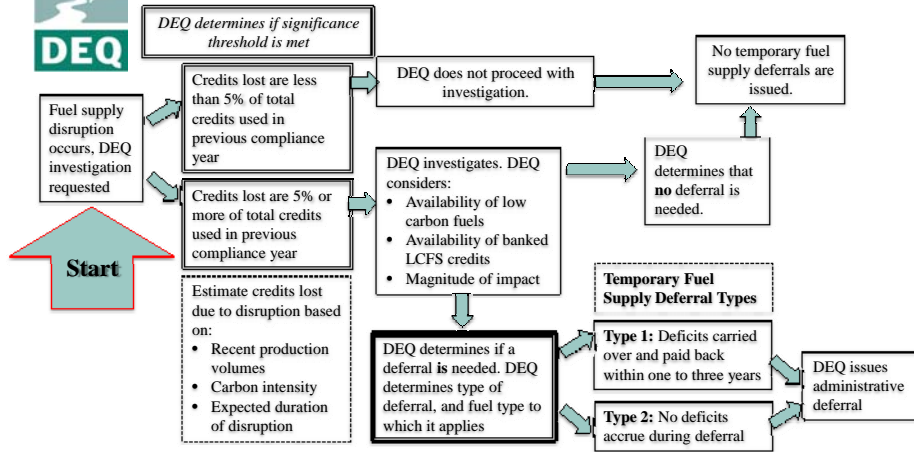


Type of Deferral	Purpose	Process	Timeframe
Temporary (fuel supply)	Program responds to situation prior to price rising	Administrative (DEQ)	Real time (ASAP)
Forecasted (fuel supply)	Program responds to situation prior to start of next compliance year prior to price rising	Smaller shortage: Administrative (DEQ)	Prior to following compliance year
		Large shortages: Rulemaking (EQC)	
Consumer Cost Safety Net (price)	Backstop. Protect consumers from a non-competitive price due to LCFS.	EQC Finding (statute)	Looks backwards. Because this is a 12-month rolling average, the problem will have been building.

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Temporary Deferrals

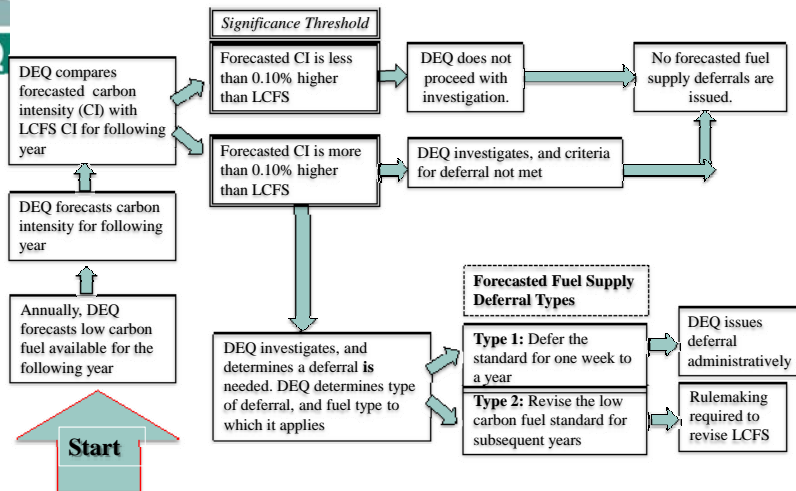


Slide 29

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Forecasted Deferrals



Slide 30



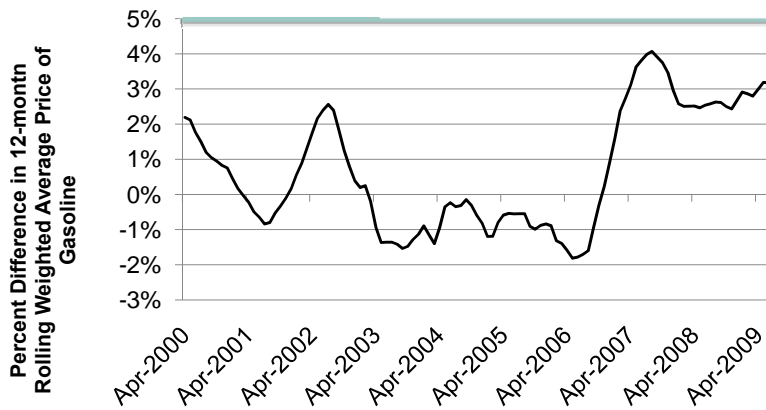
Forecasted Deferrals - Significance

Gasoline	Proposed LCFS	Significance Threshold for Forecasted Deferral (0.1%)
Baseline	92.40	
2012	reporting	
2013	92.17	92.26
2014	91.94	92.03
2015	91.48	91.57
2016	91.01	91.11
2017	90.09	90.18
2018	89.17	89.26
2019	87.78	87.87
2020	86.39	86.48
2021	85.01	85.09
2022	83.16	83.24

Slide 31



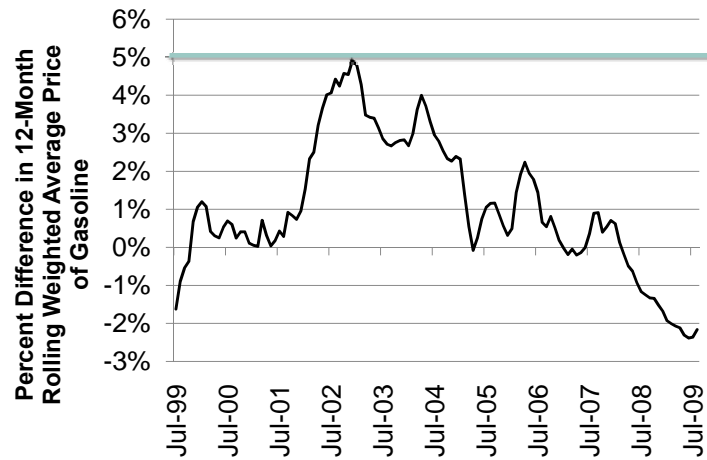
Percent difference: statutory PADD-5 and Oregon 12-month rolling weighted average retail gasoline



Slide 32



Percent difference: PADD-5 and Oregon 12-month rolling weighted average retail diesel



Slide 33



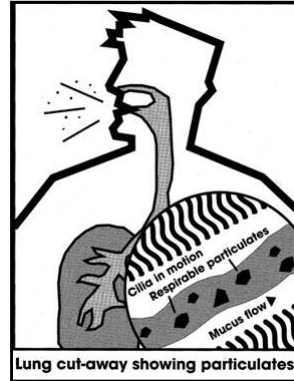
Potential Impacts to Public Health and the Environment

- Criteria Pollutants
- Air Toxics
- Effect of LCFS
- Other Environmental Impacts



Fine Particulate Matter (PM_{2.5})
NAAQS – 35 µg/m³, 24-hr avg; 15 µg/m³, annual avg

- Respiratory infections
- Decreased lung function
- Bronchitis
- Triggers asthma attacks
- Emphysema and similar lung diseases
- Heart diseases



If this were the diameter of a human hair (magnified)



This would be the size of a problem particle: 1/100th - 1/500th the size of a human hair (magnified)

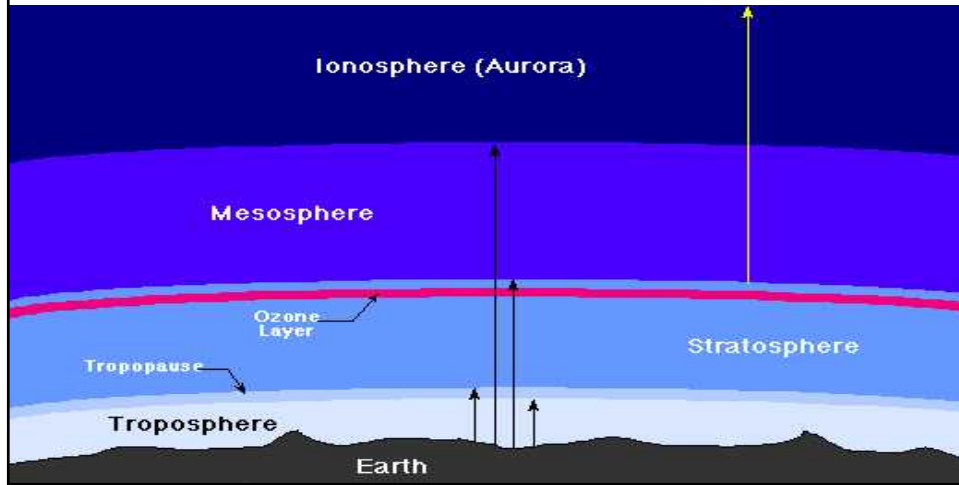


Carbon Monoxide (CO)
NAAQS – 35 ppm, 1-hr avg

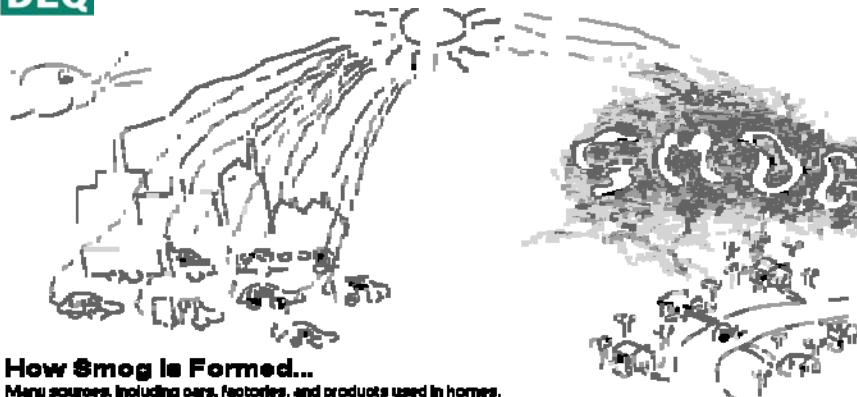




Good Ozone vs. Bad Ozone



Ozone Formation



How Smog is Formed...

Many sources, including cars, factories, and products used in homes, release smog-forming pollutants. Wind blows the pollutants away from the sources and, while the pollutants are being blown along, they undergo chemical reactions. Heat and sunlight increases the reactions. These reactions form ground-level ozone, the principal component of smog.

Hours after the smog-forming pollutants were released from their sources, smog pollutes the air, often miles away from where the smog-forming pollutants were released.



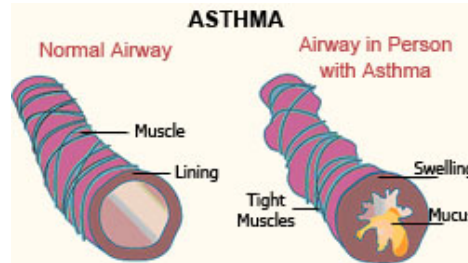
Ground-Level Ozone (O₃) or Smog NAAQS – 0.075 ppm, 8-hr average

Acute effects

- Triggers asthma attacks
- Burns eyes
- Reduces lung function

Chronic effects

- Damages lung tissue
- Causes delayed & abnormal lung development in children



Transportation-Related Air Toxics

	Health Effect	
	Acute	Chronic
Acetaldehyde	irritation of the eyes, skin, and respiratory tract	probable human carcinogen
1,3-Butadiene	nausea, dry mouth and nose, headache, decreased blood pressure and pulse rate.	increased risk of cancers of the stomach, blood, and lymphatic system
Benzene	drowsiness, dizziness, rapid heart rate, headaches, tremors, confusion	damage to bone marrow, red blood cells, immune system, excessive bleeding, leukemia
Diesel PM	irritation to eyes, nose, throat and lungs, lightheadedness, exacerbate asthma.	lung inflammation & cellular changes, immunological effects, likely carcinogen
Formaldehyde	irritation of the eyes, nose, throat, and skin	possible risk of nose and throat cancers



Burning more Ethanol

Fuel	PM	CO	SO ₂	NO _x	VOC	Ozone
Ethanol Blends	↓	↓	↓	↑	↓, ↑	

Fuel	Acetaldehyde	Benzene	1,3-Butadiene	Formaldehyde	PAHs	Toluene	Xylene
Ethanol Blends	↑	↓	↓	↑	↓	↓	↓



Burning more Biodiesel

Fuel	PM	CO	NO _x	VOC	Ozone	SO ₂	PAHs	Total Risk from Air Toxics
Biodiesel Blends	-	-	-	↓	-	↓	↓	↓



Electricity as a Transportation Fuel

The 2007 Oregon Renewable Portfolio Standard requires the largest utilities in Oregon to provide 25 percent of their retail sales of electricity from newer, clean, renewable sources of energy in 2025. It begins with 5% in 2011, increases to 15% in 2015, 20% in 2020.



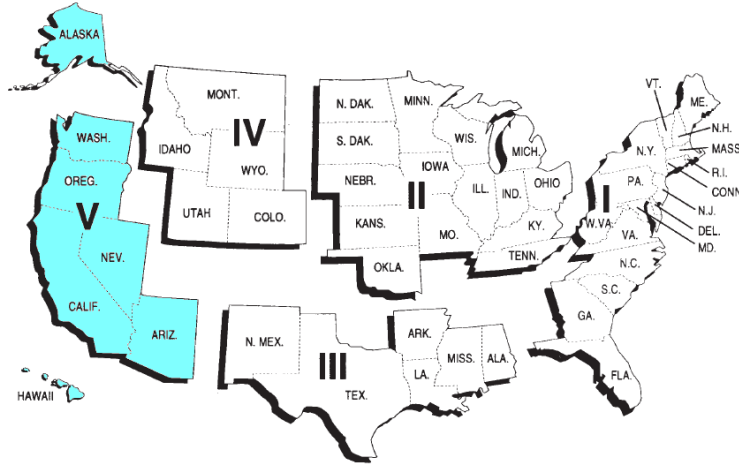
Other Environmental Impacts

- Water Quality & Quantity
- Food versus Fuel
- Ecological Effects



What is a PADD-5?

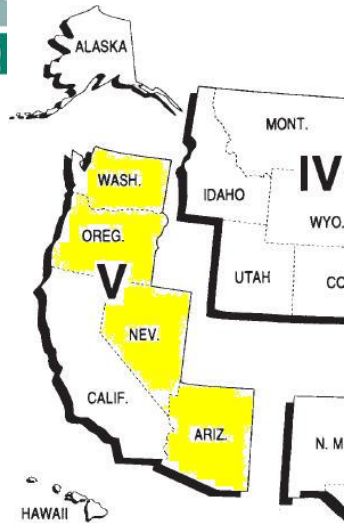
Petroleum Administration for Defense (PAD) Districts



Slide 45



House Bill (HB) 2186: Statutory PADD-5



SECTION 6. (1) (d) "PADD 5 region" means the Petroleum Administration for Defense District 5 states of:

- Arizona,
- Nevada,
- Oregon and
- Washington.

Slide 46