

**Economic Analysis Framework**  
**Test Application**  
*Draft Results*

Economic Analysis Forum  
BBC Research & Consulting

December 16, 2004

# Presentation Overview

- Background
- Project participants
- Strategy definitions
- Emission reductions
- Visibility improvements
- Economic benefits
- Strategy costs
- Benefit-cost comparison
- Economic impacts and distributional implications
- Next steps

# Background

- **WRAP Economic Analysis Framework**
  - Provides common regional approach
  - Supports policy decisions and strategy choices
  - Incorporates sound economic principles and best available data
- **Purpose of test application**
  - Demonstrate capabilities of framework and economic analysis in general
  - Refine framework where appropriate
  - Identify required resources

# Project Participants

## Economic Analysis Forum

- Project design
- Review, oversight

## States and Tribes

- Data sources
- Review, guidance

## BBC Research / Dr. Michael Mueller

- Lead consultants
- Research, analysis, reporting
- Integration

## Emissions Advantage

- Strategy design
- Cost information
- Emission reductions

## Emissions Forum

- Baseline emissions

## Air Quality Modeling Forum

- Analysis of air quality benefits

## Mobile Sources Forum

- Further analysis

# Areas Included in Test Application



# Strategy Definition

- Address existing off-road mobile source emissions
  - Agricultural engines > 175 hp
  - Construction engines > 75 hp
- Rely solely on today's diesel oxidation catalysts
  - Proven technology, no O&M, no fuel requirements
  - 35% PM reduction, 60% VOC and CO reduction
  - \$1,000 to \$2,500 per vehicle
- Apply statewide, except tribes
- Will include spillover effects to tribes

# Strategy Definition

- Two alternative scenarios
  - Mandatory
    - In effect by 2010
    - 80% compliance
    - 128,000 engines comprising 62% of emissions
  - Incentive
    - Implemented over 8-year period (2010-17)
    - Grants of \$1 million per state per year

# Annual Emission Reductions






	Arizona	Montana	North Dakota
<b>Mandatory Strategy</b>			
<b>PM Reduction (tons/yr)</b>	<b>290</b>	<b>290</b>	<b>650</b>
<i>% of Baseline*</i>	25%	20%	21%
<b>VOC Reduction (tons/yr)</b>	<b>550</b>	<b>460</b>	<b>1,020</b>
<i>% of Baseline*</i>	44%	36%	37%
<b>CO Reduction (tons/yr)</b>	<b>3,200</b>	<b>2,400</b>	<b>5,400</b>
<i>% of Baseline*</i>	44%	33%	34%
<b>Incentive Strategy</b>			
<b>PM Reduction (tons/yr)</b>	<b>80</b>	<b>55</b>	<b>55</b>
<i>% of Baseline*</i>	7%	4%	2%
<b>VOC Reduction (tons/yr)</b>	<b>150</b>	<b>95</b>	<b>100</b>
<i>% of Baseline*</i>	12%	7%	4%
<b>CO Reduction (tons/yr)</b>	<b>970</b>	<b>560</b>	<b>580</b>
<i>% of Baseline*</i>	13%	8%	4%

\*Percent of projected 2010 baseline emissions from agricultural and construction engines.

# Visibility Improvements of the Mandatory Strategy (average for entire month of July)



## Change in Deciviews

-  -0.150 to -0.117
-  -0.116 to -0.083
-  -0.082 to -0.049
-  -0.048 to -0.015
-  No change



# Arizona Economic Benefits 2010-2019\*

## (Mandatory Strategy)

<b>Area</b>	<b>Visibility</b>	<b>Health</b>
<b>Metropolitan Region</b>	\$4.9 - \$7.9	\$149 - \$239
<b>NW Region</b>	\$0.9 - \$1.5	\$10 - \$16
<b>SE Region</b>	\$0.2 - \$0.4	\$2 - \$4
<b>Arizona State Total</b>	<b>\$6.1 - \$9.7</b>	<b>\$161 - \$259</b>

\*Net present value of benefits to in-state residents in millions of 2004 dollars. Substantial visibility benefits also accrue to residents outside of Arizona. Ranges reflect alternative discount rates from 2% to 7%.

# Montana Economic Benefits 2010-2019\*

## (Mandatory Strategy)

<b>Area</b>	<b>Visibility</b>	<b>Health</b>
<b>Western Mtn. Region</b>	\$0.4 - \$0.6	\$2 - \$4
<b>Middle Trans. Region</b>	\$0.2 - \$0.3	\$2 - \$4
<b>Eastern Plains Region</b>	\$0.1 - \$0.1	\$1 - \$1
<b>Montana State Total</b>	\$0.7 - \$1.0	\$5 - \$9

\*Net present value of benefits to in-state residents in millions of 2004 dollars. Substantial visibility benefits also accrue to residents outside of Montana. Ranges reflect alternative discount rates from 2% to 7%.

# North Dakota Economic Benefits 2010-2019\*

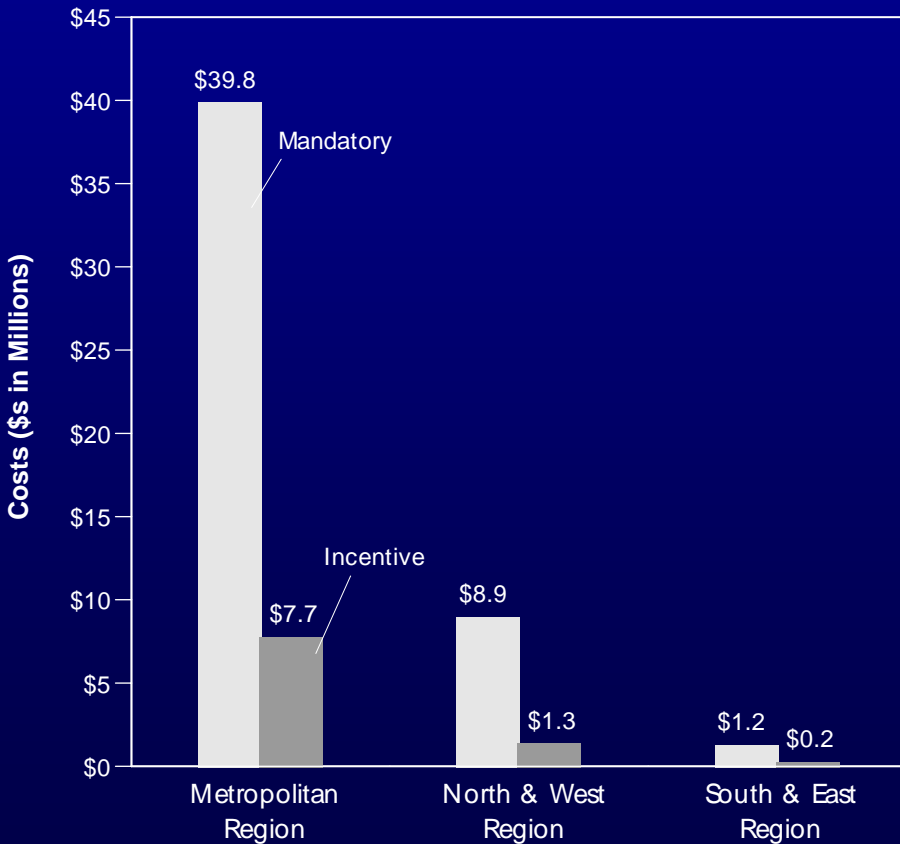
## (Mandatory Strategy)

Area	Visibility	Health
West Region	\$0.0 - \$0.1	\$1 - \$1
East Region	\$0.2 - \$0.3	\$12 - \$19
Central Region	\$0.2 - \$0.4	\$7 - \$11
<b>North Dakota Total</b>	<b>\$0.5 - \$0.8</b>	<b>\$20 - \$31</b>

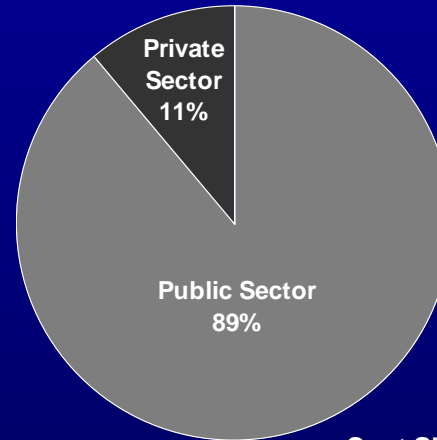
\*Net present value of benefits to in-state residents in millions of 2004 dollars. Substantial visibility benefits also accrue to residents outside of North Dakota. Ranges reflect alternative discount rates from 2% to 7%.

# Compliance Costs for Arizona (excluding administration)

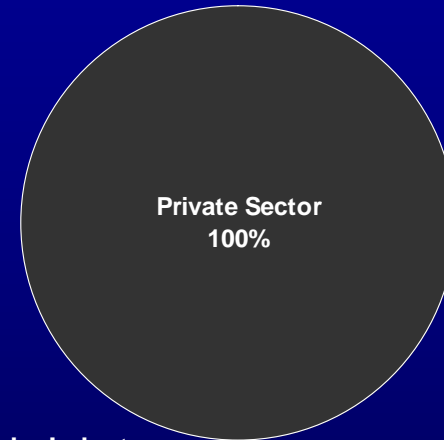
Estimated Costs by Program and Region in Arizona 2010 – 2019



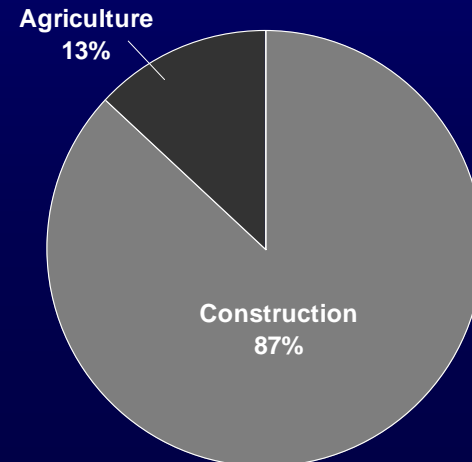
Who Bears Cost of Incentive Program?



Who Bears Cost of Mandatory Program?

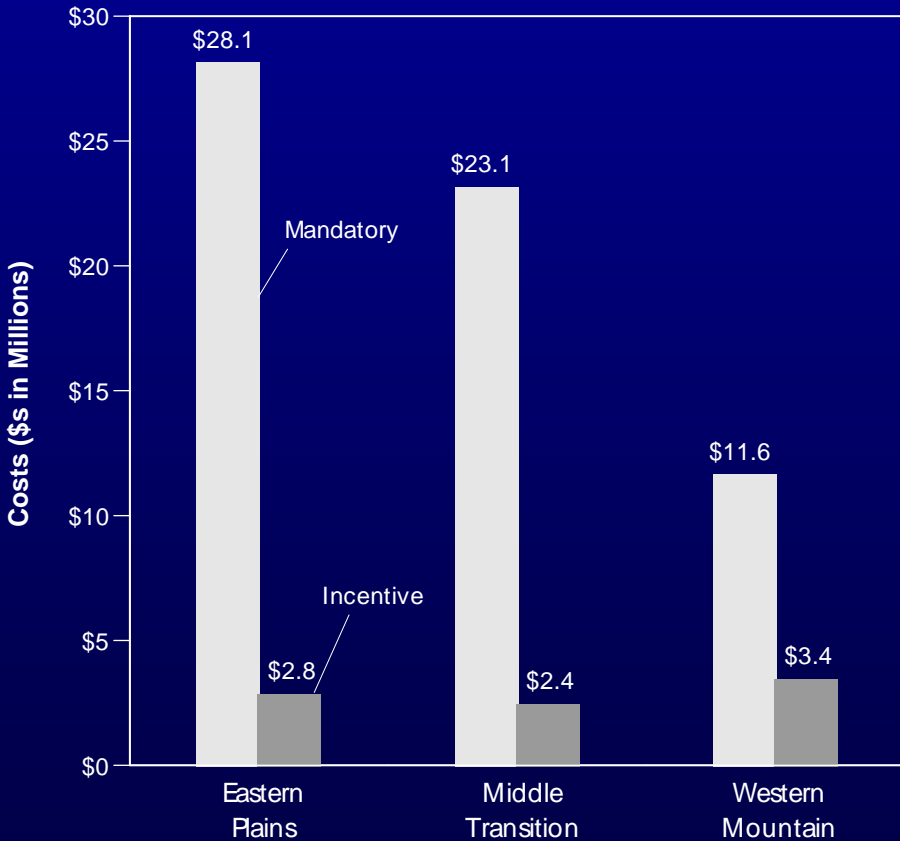


Cost Share by Industry for Mandatory Program

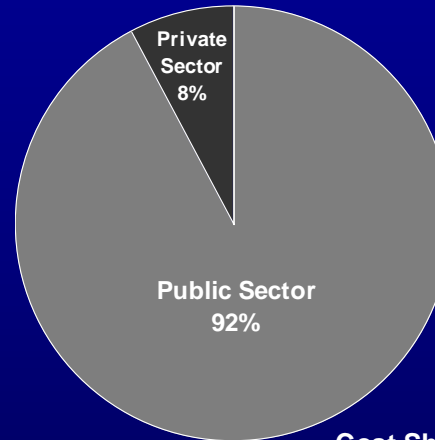


# Compliance Costs for Montana (excluding administration)

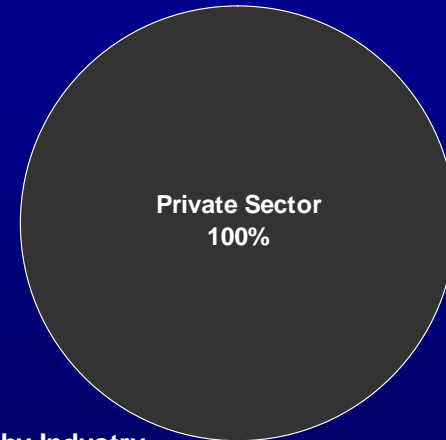
Estimated Costs by Program  
and Region in Montana 2010 – 2019



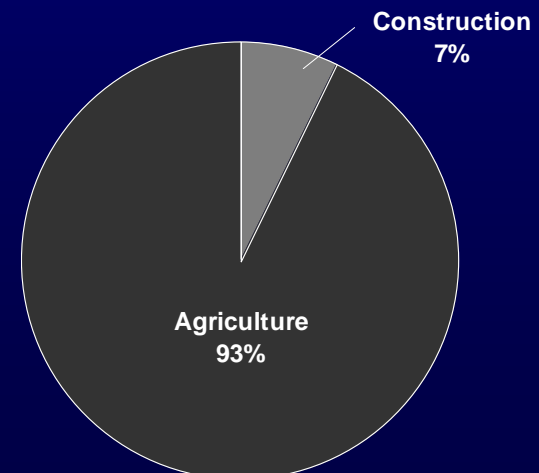
Who Bears Cost of  
Incentive Program?



Who Bears Cost of  
Mandatory Program?

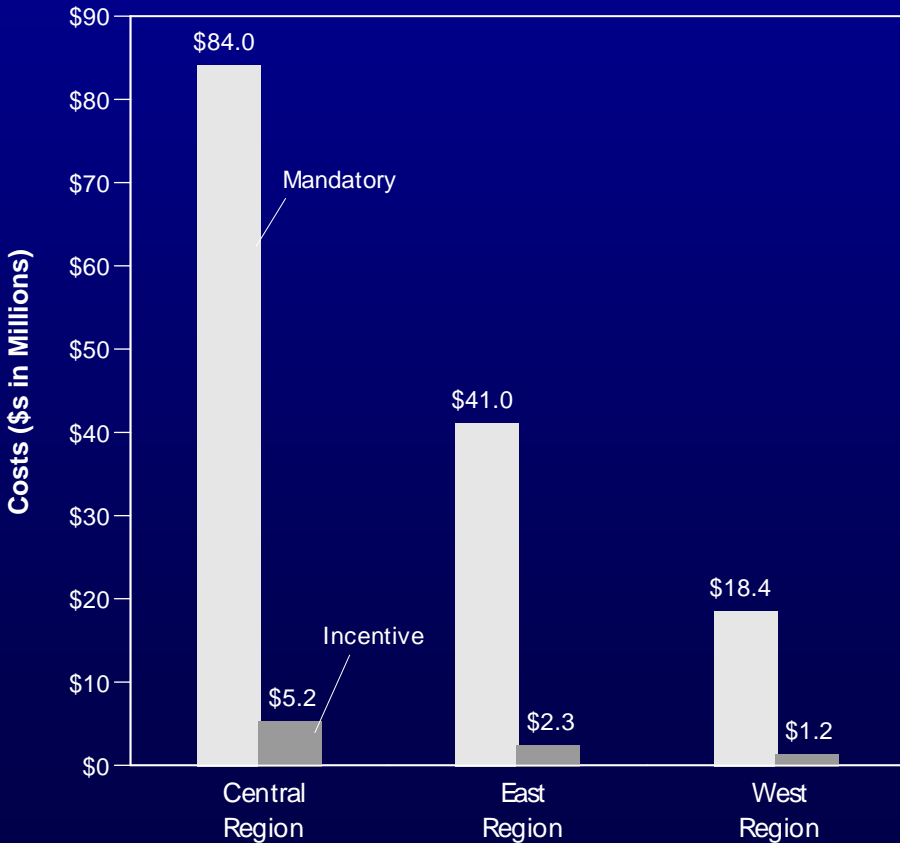


Cost Share by Industry  
for Mandatory Program

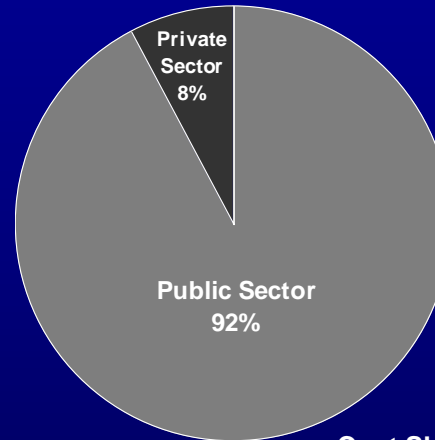


# Compliance Costs for North Dakota (excluding administration)

Estimated Costs by Program and Region in North Dakota 2010 – 2019



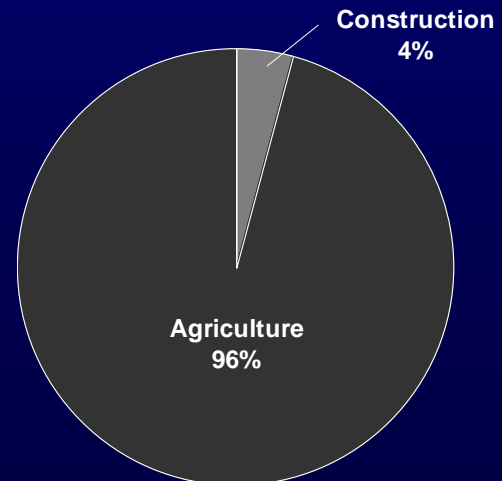
Who Bears Cost of Incentive Program?



Who Bears Cost of Mandatory Program?



Cost Share by Industry for Mandatory Program



# Arizona Annual Benefit-Cost Comparison 2010-2019 (Millions)\*

<b>Benefit/Cost</b>	<b>Mandatory</b>	<b>Incentive</b>
<b>Visibility</b>	\$1.2	\$0.2
<b>Health</b>	<u>\$31.6</u>	<u>\$5.8</u>
<b>Total Benefits</b>	\$32.8	\$6.1
<b>Cost</b>	<u>\$6.3</u>	<u>\$0.9</u>
<b>Net Benefit</b>	\$26.5	\$5.2

\*Excludes benefits accruing to residents outside of Arizona.

# Montana Annual Benefit-Cost Comparison 2010-2019 (Millions)\*

<b>Benefit/Cost</b>	<b>Mandatory</b>	<b>Incentive</b>
<b>Visibility</b>	\$0.1	\$0.02
<b>Health</b>	<u>\$1.1</u>	<u>\$0.15</u>
<b>Total Benefits</b>	\$1.2	\$0.17
<b>Cost</b>	<u>\$8.0</u>	<u>\$0.86</u>
<b>Net Benefit</b>	-\$6.7	-\$0.69

\*Excludes benefits accruing to residents outside of Montana.

# North Dakota Annual Benefit-Cost Comparison 2010-2019 (Millions)\*

<b>Benefit/Cost</b>	<b>Mandatory</b>	<b>Incentive</b>
<b>Visibility</b>	\$0.1	\$0.01
<b>Health</b>	<u>\$3.9</u>	<u>\$0.25</u>
<b>Total Benefits</b>	\$4.0	\$0.25
<b>Cost</b>	<u>\$18.2</u>	<u>\$0.87</u>
<b>Net Benefit</b>	-\$14.2	-\$0.61

\*Excludes benefits accruing to residents outside of North Dakota.

# Arizona Economic Impacts/Distributional Implications (Mandatory Strategy)

	Mandatory	Incentive
Public sector costs (annual)	*	\$1 M
Construction sector cost (annual)	\$5-\$6 M	\$0.1 M
Increased cost of services	< 0.01%	*
Reduced net income	0.01% - 0.02%	*
Total job loss	40 – 120	*
Agriculture sector costs (annual)	<\$1 M	*
Increased cost of product	< 0.01%	*
Reduced net income	0.01% - 0.02%	*
Total job loss	<5	*

\* No significant impacts

# Montana Economic Impacts/Distributional Implications (Mandatory Strategy)

	Mandatory	Incentive
Public sector costs (annual)	*	\$1 M
Construction sector cost (annual)	<\$0.6 M	*
Increased cost of services	< 0.01%	*
Reduced net income	0.01%	*
Total job loss	5 - 15	*
Agriculture sector costs (annual)	\$ 6-\$9M	\$0.1M
Increased cost of product	0% - 0.2%	*
Reduced net income	0.1% - 0.3%	*
Total job loss	20 – 65	*

\* No significant impacts

# North Dakota Economic Impacts/Distributional Implications (Mandatory Strategy)

	Mandatory	Incentive
Public sector costs (annual)	*	\$1 M
Construction sector cost (annual)	<\$0.9 M	*
Increased cost of services	< 0.02%	*
Reduced net income	0.01% - 0.03%	*
Total job loss	6 - 16	*
Agriculture sector costs (annual)	\$15-\$20 M	\$0.1M
Increased cost of services	0% - 0.2%	*
Reduced net income	0.1% - 0.4%	*
Total job loss	30 - 95	*

\* No significant impacts

# Why Do the Results Differ So Much Among the States?

- Large population in Arizona = bigger benefits
- Little air quality change in Montana
- Large agricultural sectors in Montana and North Dakota = higher costs
- Annual benefit per resident:  
AZ=\$5 MT=\$1 ND=\$6
- Annual cost per resident:  
AZ=\$1 MT=\$8 ND=\$27

# Potential Sources of Uncertainty in the Results

- Air quality modeling
- Concentration response functions (health benefits) and visibility willingness-to-pay estimates
- Market acceptance of incentive-based approach
- Market response to compliance costs
- Potential for technology cost reduction over time

# Next Steps

- Revise based on state and tribal feedback
- Incorporate analysis of spillover effects to tribes (if possible)
- Produce final report
- Refine Framework document where appropriate