Alaska Climate Mitigation Advisory Group

of the Governor's Climate Change Sub-Cabinet

Meeting #6a

May 14, 2009

Anchorage, Alaska

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Meeting Agenda

- **Welcome, Introductions & Objectives for the Day**
- **Introductory Remarks**
- **Review & Approve Policy Option Descriptions by TWG**
  - Energy Supply and Demand *(45 minutes)*
  - Oil and Gas *(45 minutes)*
  - Forestry, Agriculture and Waste *(25 minutes)*
  - Cross-Cutting TWG *(25 minutes)*
  - Transportation and Land Use *(20 minutes)*
- **Next Steps for the MAG and its Technical Work Groups**
  - Date and Time of Next MAG Meeting
- **Public Input and Announcements**
- **Wrap-Up and Adjourn**

Prospective Timetable: Climate Change Mitigation Advisory Group

Date	Action
May 15, 2008	1st Meeting: Launch Process; Review Inventory
July 15, 2008	2nd Meeting: Catalog of Potential Policy Options
September 22, 2008	3rd Meeting: Presentations; Some Selection of Priority Policy Options
November 6, 2008	4th Meeting: Select Priority Policy Options
February 5, 2009	5th Meeting: Approve Straw Proposals
April 2, 2009	6th Meeting: Initial Quantification of Options
May 14, 2009	**7th Meeting: Continue Quantification Review**
June 18, 2009	8th Meeting: Approve Recommended Options
Following Conclusion	Final Report to Sub-Cabinet
Between Meetings	Regular TWG teleconference meetings and possible face-to-face meetings

Stepwise Planning Process

1. Develop/revise baseline inventory and forecast
2. Identify a full range of possible actions ("catalog") and programs already in place
3. Identify initial priorities for analysis & development
4. Develop straw proposals
5. **Quantify GHG reductions and costs/savings (to the extent possible)**
6. **Identify mechanisms, feasibility issues, co-benefits or costs, etc.**
7. Develop alternatives if needed to enhance consensus
8. Iterate to final agreement
9. Finalize and report recommendations to Subcabinet

Policy Option Template

- *Policy Description (Concept)*
- *Policy Design (Goals, Timing, Coverage)*
- *Implementation Methods (parties, mechanisms)*
- *Related Programs and Policies (BAU)*
- **Estimated GHG Reductions and Costs/Savings Per MMTCO$_2$e**
  - **Data sources, methods, and assumptions**
  - **Key uncertainties**
- **Additional (non-GHG) Benefits and Costs, as Needed**
- Feasibility Issues, as Needed
- Status of Group Approval
- Level of Group Support
- Barriers to Consensus, if Any

Review & Approval of TWGs' Work & Quantification of Policy Options

- Energy Supply & Demand (ESD)
- Oil & Gas (O&G)
- Forestry, Agriculture & Waste (FAW)
- Cross-Cutting Issues (CC)
- Transportation & Land Use (TLU)

ESD TWG Policy Options

1. Transmission system optimization and expansion
2. Energy efficiency for residential and commercial customers
3. Implementation of renewable energy
4. Building standards & incentives
5. Efficiency Improvements for Generators
6. Energy efficiency for industrial installations
7. Implementation of small-scale nuclear power
8. R&D for cold-climate renewable technologies
9. Implementation of advanced supply-side technologies

ESD – Initial Quantification Results

	Policy Option	GHG Reductions ($MMtCO_2e$)				Gross Cost (Million $)	Gross Benefits (Million $)	Net Present Value 2010–2025 (Million $)	Cost-Effectiveness ($/tCO$_2$e)	Level of Support
		2015	2020	2025	Total 2010-2025					
ESD-1	Transmission System Optimization and Expansion	0.08	0.11	0.12	1.38	$279	($130)	$149	$108	
ESD- 2/4/6a	Energy Efficiency 1%	0.34	0.81	1.19	9.28	$322	($886)	-$564	-$61	
ESD- 2/4/6a	Energy Efficiency 2%	0.34	1.08	1.85	12.48	$423	($1,161)	-$738	-$59	
ESD-2	Energy Efficiency for Residential and Commercial Customers	*Quantified with ESD-4 and ESD-6*								
ESD-3	Implementation of Renewable Energy	1.09	1.24	2.75	19.82	$2,078	($1,610)	$468	$24	
ESD-4	Building Standards/Incentives	*Quantified with ESD-2 and ESD-6*								
ESD-5	Efficiency Improvements for Generators	*Moved to Research Needs*								
ESD-6	Energy Efficiency for Industrial Installations	*Quantified with ESD-2 and ESD-4*								
ESD-7	Implementation of Small-Scale Nuclear Power	*Moved to Research Needs*								
ESD-8	Research and Development for Cold-Climate Renewable Technologies	*Moved to Research Needs*								
ESD-9	Implementation of Advanced Supply-Side Technologies	*Moved to Research Needs*								
	Sector Total After Adjusting for Overlaps*									
	Reductions From Recent Actions									
	Sector Total Plus Recent Actions									

Alaska
Energy Supply and Demand
Policy Option Discussion

May 14, 2009

Policy Options Considered

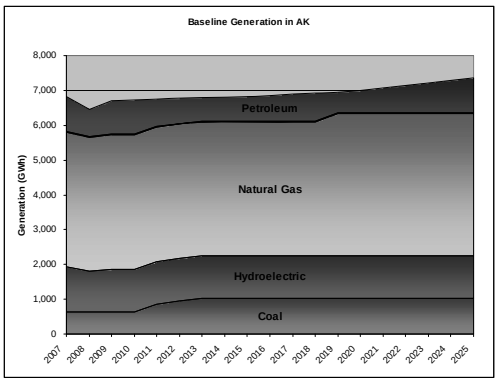
- ESD-1: Transmission Optimization and Expansion
- ESD-2/4/6: Energy Efficiency for Residential, Commercial, and Industrial Customers
- ESD-3: Implementation of Renewable Energy
- ESD-5: Efficiency Improvements for Utility-Size Generators *(moved to Research Needs)*
- ESD-7/8/9: Energy Supply Technology Research and Development *(moved to Research Needs)*

ES&D Results

Option #	GHG Reductions				Gross Cost (Million $)	Gross Benefits (Million $)	Net Present Value 2010–202	Cost-Effectiveness ($/tCO2e)
	2015	2020	2025	Total 2010-2025				
ES&D 1 Transmission	0.08	0.11	0.12	1.38	$279	-$130	$149	$108
ES&D 2/4/6a Energy Efficiency 1%	0.34	0.81	1.19	9.28	$322	-$886	-$564	-$61
ES&D 2/4/6a Energy Efficiency 2%	0.34	1.08	1.85	12.48	$423	-$1,161	-$738	-$59
ES&D 3 Renewable Energy	1.09	1.24	2.75	19.82	$2,078	-$1,610	$468	$24
ES&D 5 Generator Efficiency	*Moved to Research Needs*							
ES&D 7/8/9 R&D	*Moved to Research Needs*							

Inventory and Forecast

- Baseline fuel mix changes with discrete projects known or expected by TWG members:
  - HCCP comes online 2011-2013 (50 MW, displaces petroleum)
  - Fairbanks obtains a natural gas supply in 2019 (60 MW fuel switch from petroleum)



ES&D 1
Transmission Optimization and Expansion

Description

- a) Improved opportunities for renewable resource utilization;
- b) Enhanced coordination between electricity end-users and energy providers; and,
- c) Promote the reduction of electric energy losses associated with inadequate and aging infrastructure.

Goals

- Interconnection of major generation facilities within the applicable regions of Alaska
- Access to identified hydroelectric, wind, tidal and other non-fossil fired generation resources.
- Displacement of less-efficient industrial and commercial electrical generation facilities
- Improved access for combined heat and power production facilities at industrial locations.
- Reduced diesel-fired generation in remote locations.
- Electricity access for resource development such as mining, tourism, fisheries, and others in remote locations.
- Regional or micro grids supplied by specialized resources (e.g. geothermal facilities).

Analysis

- Rural Transmission
  - Village-to-village connectivity, assuming a fixed number of villages (172) in rural AK
  - 20 mi distance between village pairs
  - 15% energy savings per generator
  - Displaces oil only
  - Begin links in 2012, end in 2020
  - Distribution lines cost $300,000 per mile
  - No capital cost for new generators (assume replacement during turnover)

Analysis

- Transmission for RE Projects
  - AEA approved projects, Round 1 RE Fund
  - Only transmission-based projects (5)
  - Use project-specific assumptions (costs, benefits, displaced fuel)

Results

#	Policy	GHG Reductions (MMTCO2e) 2015	2020	2025	Total 2010-2025	Gross Cost (Million $)	Gross Benefits (Million $)	Net Present Value 2010-2025 (Million 2008$)	Cost Effectiveness ($/tCO2e)
ES&D-1a	Transmission, Rural	0.01	0.03	0.03	0.32	$243	-$93	$151	$473
ES&D-1b	Transmission, RE Grants	0.06	0.08	0.09	1.06	$36	-$38	-$2	-$2
ES&D-1	**Transmission Optimization and Expansion**	**0.08**	**0.11**	**0.12**	**1.38**	**$279**	**-$130**	**$149**	**$108**

ESD-1: Transmission Optimization and Expansion

Results

Carbon Cost Efficacy of Village-to-Village Interties ($/tCO$_2$e)				
		Expected Fuel Savings from Connecting Two Villages		
Average Distance Between Two Villages		5%	15%	25%
	20	$ 2,002	$473*	$167
	50	$5,443	$1,620	$855
	100	$11,178	$3,531	$2,002

Sensitivity on carbon cost efficacy

ES&D 2/4/6
Residential, Commercial and Industrial Energy Efficiency

Description

- …seeks to reduce electricity, natural gas and fuel oil consumption in the residential, commercial and industrial sectors through energy efficiency and demand-side management measures using a variety of programs and policies including state and utility efficiency programs, appliances standards, and building codes.
- Energy efficiency reduces energy consumption required by appliances and heating and cooling equipment while maintaining or improving upon the quality of energy services.
- Alaska has significant untapped energy efficiency resources compared to other states.

Goals

- Energy efficiency programs and policies to reduce energy consumption for electricity, natural gas and fuel oil based on two scenarios:
  - (1) the annual incremental energy savings increases to 1% of retail energy sales by 2015
  - (2) the annual incremental savings further increases to 2% by 2020.

Key Assumptions

- Discount Rate: 5% (real)
- Avoided electricity price: 9.5 cents/kWh as the weighted avg. cost of avoided electricity in different regions
  - Railbelt: 6 cents/kWh
  - Southeast: zero
  - Rural: 22 cents/kWh
    - Assuming $96/barrel of oil
- Avoided NG price: 6.54 $/mmBtu for city gate natural gas price
  - Price was projected and levelized through 2025 based on 2008 historical price and on AEO 2009 forecast

Key Assumptions

- **T&D Loss**:
  - 7% for electricity
  - 0% natural gas
- **Cost of Energy Efficiency Measures:**
  - 4.2 cents / kWh – inflated from "typical" price of EE in lower 48
  - $2.7 per MMBtu – inflated from average cost of saved NG (SWEEP '06)
- **Efficiency Measure Lifetime**: 12 years (average)
- **Displaced Emissions for Electricity (diesel gen)**:
  - 1646.52 lb. /MWh
  - 0.7468 MTCO2 per MWh

Analysis

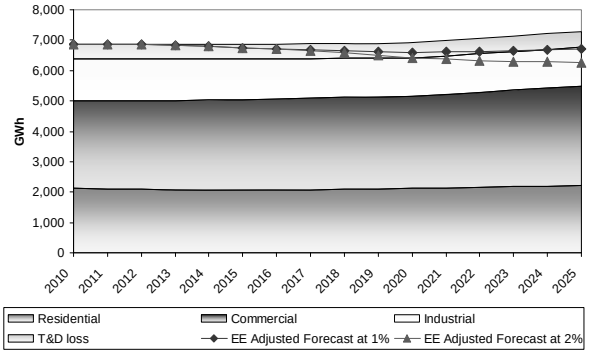


Figure E-1.1. Electricity Demand Forecast with/without Energy Efficiency Scenarios

Analysis

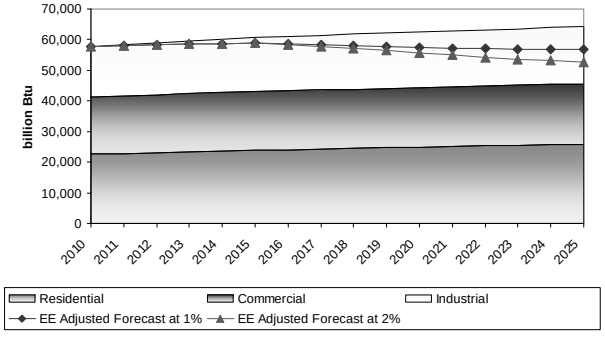


Figure E-1.2. Natural gas demand forecast with/without energy efficiency scenarios

Analysis

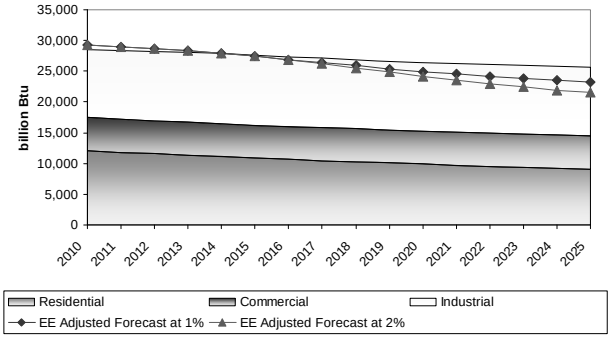


Figure E-1.3. Fuel Oil Demand Forecast with/without Energy Efficiency Scenarios

Results

Option #	GHG Reductions (MMtCO2e)				Gross Cost (Million $)	Gross Benefits (Million $)	Net Present Value 2010–2025 (Million $)	Cost-Effectiveness ($/tCO2e)
	2015	2020	2025	Total 2010-2025				
ES&D-2,4 & 6a - Electricity	0.16	0.38	0.56	4.35	$178	-$364	-$187	-$43
ES&D-2,4 & 6a - NG	0.11	0.26	0.39	3.03	$99	-$216	-$117	-$39
ES&D-2,4 & 6a - Oil	0.07	0.17	0.23	1.90	$45	-$306	-$260	-$137
ES&D-2,4,6 - Total	0.34	0.81	1.19	9.28	$322	-$886	-$564	-$61

Goal: 1% EE per Year

ESD-2/4/6: Energy Efficiency

Results

Option #	GHG Reductions (MMtCO2e)				Gross Cost (Million $)	Gross Benefits (Million $)	Net Present Value 2010–2025 (Million $)	Cost-Effectiveness ($/tCO2e)
	2015	2020	2025	Total 2010-2025				
ES&D-2,4 & 6a - Electricity	0.16	0.50	0.88	5.86	$234	-$480	-$246	-$42
ES&D-2,4 & 6b - NG	0.11	0.35	0.61	4.09	$130	-$285	-$155	-$38
ES&D-2,4 & 6c - Oil	0.07	0.22	0.36	2.53	$59	-$396	-$337	-$134
ES&D-2,4,6 - Total	0.34	1.08	1.85	12.48	$423	-$1,161	-$738	-$59

Goal: 2% EE per Year

ES&D 3
Implementation of Renewable Energy

Goal

- Fifty percent of all electricity in Alaska is generated from renewable sources by 2025.
- Maximum cost-effective implementation of renewable energy systems for direct heating, where “cost-effective” includes a monetized value of avoided GHG emissions as determined by prevailing national or state policy.

Methods

- AEA RE Grants Program
  - Technically achievable RE proposals identified by AEA RE Grant Program
    - Results of Round 1 released (1/22/2009)
  - Used AEA analysis assumptions for
    - Generation (kWh)
    - Displaced fossil fuel (gal)
    - Capital cost
    - Timeline
  - Chose projects where pilot or feasibility programs were funded by AEA in Round 1
  - Compiled results by year
- Large Hydro Project
  - Susitna (Low Watana dam option) used as proxy
  - Cost and project scope from HDR | DTA report (3/16/2009)
  - Project begins generation in 2022
  - Assume electricity displaces Railbelt natural gas generation
    - Used AEA RE Grant program assumptions for avoided cost of NG electricity

Assumptions

- Discount Rate: 5% (real)
- Avoided electricity price
  - AEA RE Grants: Program specific
  - Susitna Hydro: Avoided Railbelt NG generation
- RE Grants Program displaces mostly diesel (97%) and some NG (project-by-project)
- Renewable energy target of 50% by 2025
  - Hydro counts as RE
  - AK currently at 18.3% RE in total fuel mix.

Results

#	Policy	GHG Reductions (MMTCO2e)				Gross Cost (Million $)	Gross Benefits (Million $)	Net Present Value 2010-2025 (Million 2008$)	Cost Effectiveness ($/tCO2e)
		2015	2020	2025	Total 2010-2025				
ES&D-3a	Renewable Energy Grants, Round 1	0.58	0.71	0.84	9.33	$420	-$834	-$414	-$44
ES&D-3b	Renewable Energy Grants, Round 2	0.51	0.53	0.53	6.10	$24	-$338	-$314	-$51
ES&D-3c	Large Hydroelectric	0.00	0.00	1.38	4.39	$1,634	-$438	$1,196	$273
ES&D-3	**Implementation of Renewable Energy**	**1.09**	**1.24**	**2.75**	**19.82**	**$2,078**	**-$1,610**	**$468**	**$24**

O&G TWG Policy Options

1. Best Conservation Practices
2. Reductions in Fugitive Methane Emissions
3. Electrification of Oil & Gas Operations, with Centralized Power Production and Distribution
4. Improved Efficiency Upgrades for Oil & Gas Fuel Burning Equipment
5. Renewable Energy Sources in Oil & Gas Operations
6. Carbon Capture and Geologic Sequestration with EOR from High CO2 Fuel Gas at Prudhoe Bay
7. Carbon Capture and Geologic Sequestration with EOD in and near existing Oil or Gas Fields
8. Carbon Capture and Geologic Sequestration away from Known Geologic Traps

O&G – Initial Quantification Results

	Policy Option	Aggregate GHG Reductions ($MMtCO_2e$)	GHG Reductions ($MMtCO_2e$)			Net Present Value (million 2009$) 5% Discount Rate	Cost Effectiveness (2009$ / tCO_2e) 5% discount Rate
			2015	2020	2025	2010 to 2025	
OG-2	Reductions in Fugitive Methane Emissions	3.2	0.2	0.2	0.2	181.4	57
OG-3	Electrification of Oil and Gas Operations, with Centralized Power Production and Distribution	26.6	-	3.0	4.4	7,791.0	293
OG-4	Improved Efficiency Upgrades for Oil and Gas Fuel Burning Equipment	19.7	0.5	2.1	2.1	1,600.1	81
OG-5	Renewable Energy Sources in Oil and Gas Operations	8.0	0.7	0.7	0.7	2,603.4	327
OG-6	Carbon Capture (from North Slope High CO_2 fuel gas) and Geologic Sequestration with Enhanced Oil Recovery	7.8	-	0.9	0.9	1,368.8	176
OG-7	Carbon Capture (from exhaust gas at a centralized facility) and Geologic Sequestration with Enhanced Oil Recovery	19.7	1.8	1.8	1.8	3,094.1	157
OG-8	Carbon Capture (from exhaust gas) and Geologic Sequestration away from Known Geologic Traps	8.0	0.7	0.7	0.7	7,937.7	994

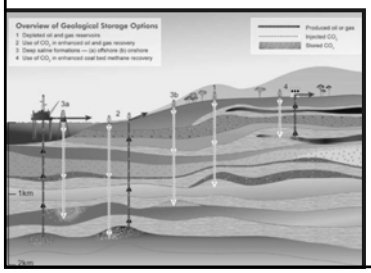
Oil and Gas Technical Work Group

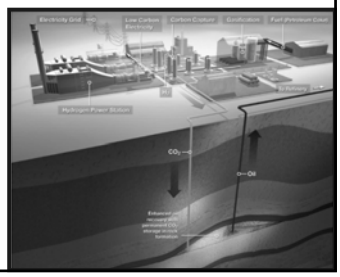
Governor's Sub-Cabinet for Climate Change

Quantification Status Report to the MAG

Options to Reduce GHG Emissions from O&G Operations

May 14, 2009 Anchorage





OG TWG working Options May 14, 2009

Conservation	1	Overall conservations activities, ie reduce liquid fuel consumption, other best practices
	2	Reduce Fugitive Methane Emissions
Thermal Energy Efficiency	3	Electrification of Oil and Gas Operations, with Centralized Power Production and Distribution
	4	Improved Efficiency Upgrades for Oil and Gas Fuel burning Equipment
	5	Use of Renewable Energy Sources in Oil and Gas Operations
Carbon Capture and Sequestration (CCS)	6	CCS from High CO2 Fuel Gas on North Slope
	7	CCS from Combustion Sources in and near Existing Oil and Gas Fields - Focus North Slope
	8	CCS away from Known Geologic Traps - (Interior Alaska)

Quantification Methodology

- Ground up, first principles approach
- Good internal discussions and refinements, though significant uncertainties remain
- Good methodology for gross order of magnitude estimates

Detailed Approach:

1. Estimate current emissions

   Used DEC DRAFT Inventory based on 2002 emissions for all options except OG-2 Fugitive

2. Estimate expected emissions reductions

   Taken from field experiences or literature values and based on a realistic inventory from step 1

3. Estimate costs

   For each defined step, bottom-up costs were estimated from field experiences and literature; allowing some comparison and confirmation to similar independent studies IE IPCC, or report on North Slope EOR.

Cost-Effectiveness Summary

	Policy Option *	Aggregate GHG Reductions (MMtCO2e)	GHG Reductions (MMtCO2e)			Net Present Value (million 2009$)	Cost Effectiveness (2009$ / tCO2e)	Confidence
			2015	2020	2025	2010 to 2025		
OG-1	Conservation	N/A	N/A	N/A	N/A	N/A	N/A	
OG 2	Reductions in Fugitive Methane Emissions	3.2	0.2	0.2	0.2	181.4	57	
OG 3	Electrification of Oil and Gas Operations, with Centralized Power Production and Distribution	26.6	-	3.0	4.4	7,791.0	293	
OG 4	Improved Efficiency Upgrades for Oil and Gas Fuel Burning Equipment	19.7	0.5	2.1	2.1	1,600.1	81	
OG 5	Renewable Energy Sources in Oil and Gas Operations at a Centralized Power Facility	8.0	0.7	0.7	0.7	2,603.4	327	
OG 6	Carbon Capture (from North Slope High CO2 fuel gas) and Geologic Sequestration with Enhanced Oil Recovery	7.8	-	0.9	0.9	1,368.8	176	
OG 7	Carbon Capture (from exhaust gas at a centralized facility) and Geologic Sequestration with Enhanced Oil Recovery	19.7	1.8	1.8	1.8	3,094.1	157	
OG 8	Carbon Capture (from exhaust gas) and Geologic Sequestration away from Known Geologic Traps	8.0	0.7	0.7	0.7	7,937.7	994	

* See Notes

Common Economics Notes

• Results are gross economics that do not include consideration of taxes or royalties.

• Value of carbon assumed to be zero

• Well head price Natural Gas $6 (also tested 2 and 4)

• Discount rate 5% (also tested 11%)

• Amortization date **2035** (also tested 2025)

Sensitivity Example – Option 4

Option 4	$6 2035	$2 2035	$6 2025	$2 2025
5%	**81**	134	123	142
11%	128	130	142	**154**

2025 original assumption

2035 TWG assumption used in final report

Bottom Line : Assumptions usually exerted downward pressure on cost efficiency.

Sensitivity Example – Option 7

Option 7	$6 2035	$2 2035	$6 2025	$2 2025
5%	157	153	171	169
11%	175	173	179	178

2025 original assumption

2035 TWG assumption used in final report

Bottom Line : Assumptions usually exerted downward pressure on cost efficiency.

	Policy Option *	Aggregate GHG Reductions (MMtCO2e)	GHG Reductions (MMtCO2e)			Net Present Value (million 2009$)	Cost Effectiveness (2009$/tCO2e)	Confidence
			2015	2020	2025	2010 to 2025		
OG-1	Conservation	N/A	N/A	N/A	N/A	N/A	N/A	

- Encourage oil and gas workforce in continued energy conservation efforts
- Ensure that companies' ongoing efforts are creditable under any future GHG regulatory program

	Policy Option *	Aggregate GHG Reductions (MMtCO2e)	GHG Reductions (MMtCO2e)			Net Present Value (million 2009$)	Cost Effectiveness (2009$/tCO2e)	Confidence
			2015	2020	2025	2010 to		
OG 2	Reductions in Fugitive Methane Emissions	3.2	0.2	0.2	0.2	181.4	57	

Key Sensitivities/Uncertainties

- North Slope methane fugitive comparability with lower 48 leak rate data
- Types and sizes of leaks/ emissions
- Value of North Slope Natural Gas at well head = $0 until 2020. From 2020-2035 =$6 per mscf.

	Policy Option *	Aggregate GHG Reductions (MMtCO2e)	GHG Reductions (MMtCO2e)			Net Present Value (million 2009$)	Cost Effectiveness (2009$/tCO2e)	Confidence
			2015	2020	2025	2010 to 2025		
OG 3	Electrification of Oil and Gas Operations, with Centralized Power Production and Distribution at a centralized gas facility	26.6	-	3.0	4.4	7,791.0	293	

Key Sensitivities/Uncertainties

- Regulatory environment / lease conditions / ‘utility’ issues
- Value of North Slope Natural Gas at well head = $0 until 2020. From 2020-2035 =$6 per mscf.
- The size and scope of the electrification project
- Facility costs, both for the new and for the retrofit
  $2,500/KW construction of new power plant,
  $1,500/KW replace gas turbines with electric motors
- 25% Capital contingency (expected permitting delays, cross unit lease issues, logistical complexity of very large project, production losses during construction…)

	Policy Option *	Aggregate GHG Reductions (MMtCO2e)	GHG Reductions (MMtCO2e)			Net Present Value (million 2009$)	Cost Effectiveness (2009$/tCO2e)	Confidence
			2015	2020	2025	2010 to 2025		
OG 4	Improved Efficiency Upgrades for Oil and Gas Fuel Burning Equipment	19.7	0.5	2.1	2.1	1,600.1	81	

Key Sensitivities/Uncertainties

- Regulatory environment
- Value of North Slope Natural Gas at well head = $0 until 2020. From 2020-2035 =$6 per mscf.
- $1,500/KW to upgrade turbines.
- Discount Rate (5%) and amortization date (2035)
- 50% capital contingency (likely permitting delays, huge unknowns in upgrading 163 different turbines, space issues, and production losses during construction)

	Policy Option *	Aggregate GHG Reductions (MMtCO2e)	GHG Reductions (MMtCO2e)			Net Present Value (million 2009$)	Cost Effectiveness (2009$/tCO2e)	Confidence
			2015	2020	2025	2010 to 2025		
OG 5	Renewable Energy Sources in Oil and Gas Operations at a Centralized Power Facility	8.0	0.7	0.7	0.7	2,603.4	327	

Key Sensitivities/Uncertainties

- The size and scope of the electrification project needed so that the electrical power generated by the renewable can be utilized
- Regulatory environment
- Value of North Slope Natural Gas at well head = $0 until 2020. From 2020-2035 =$6 per mscf.
- 25% Capital Contingency (first of it's kind on NS project, permitting risk, unknowns such as potential impact on migrating birds…)

	Policy Option *	Aggregate GHG Reductions (MMtCO2e)	GHG Reductions (MMtCO2e)			Net Present Value (million 2009$)	Cost Effectiveness (2009$	Confidence
						2010		
OG 6	Carbon Capture (from North Slope High CO2 fuel gas) and Geologic Sequestration with Enhanced Oil Recovery	7.8	-	0.9	0.9	1,368.8	176	

Key Sensitivities/Uncertainties

- Value of EOR
- Cost of New and Facilities upgrades to capture, transport, and inject CO2
- Value of North Slope Natural Gas at well head = $0 until 2020. From 2020-2035 =$6 per mscf.
- Regulations for CCS currently under development (permitting, long term monitoring…)
- Cross unit operations issues
- 25% Capital contingency (NOx increases due to burning leaner gas, triggering EPA regs, likely decrease in field life with higher cost structure.)

	Policy Option *	Aggregate GHG Reductions (MMtCO2e)	GHG Reductions (MMtCO2e)			Net Present Value (million 2009$)	Cost Effectiveness (2009$ / tCO2e)	Confidence
			2015	2020	2025	2010 to 2025		
OG 7	Carbon Capture (from exhaust gas at a centralized facility) and Geologic Sequestration with Enhanced Oil Recovery	19.7	1.8	1.8	1.8	3,094.1	157	

Key Sensitivities/Uncertainties

- **Value of EOR** (and can we use all the CO2?)
- Cost of Facilities upgrades
- Value of North Slope Natural Gas at well head = $0 until 2020. From 2020-2035 =$6 per mscf.
- Regulations for CCS currently under development (permitting, long term monitoring...), Cross unit operations issues
- **50%** Capital contingency (likely decrease in field life with higher cost structure, additional technical risk of capture from exhaust gases)

	Policy Option *	Aggregate GHG Reductions (MMtCO2e)	GHG Reductions (MMtCO2e)			Net Present Value (million 2009$)	Cost Effectiveness (2009$/tCO2e)	Confidence
			2015	2020	2025	2010 to		
OG 8	Carbon Capture (from exhaust gas) and Geologic Sequestration away from Known Geologic Traps	8.0	0.7	0.7	0.7	7,937.7	994	

Key Sensitivities/Uncertainties

- **Pipeline length vs Exploration program**
- Cost of Facilities upgrades
- Regulations for CCS currently under development – commercial project could not presently be permitted.
- Regulatory environment (permitting, long term monitoring…)
- **Public acceptance**
- 25% Capital Contingency (Technical Uncertainty capturing CO2 from exhaust gases, high risk and complicated logistics of very large and complex project.)

Cost-Effectiveness Summary Notes

•Due to the analysis methodology, 'Cost Effectiveness' is likely lower than the break even cost of carbon needed to make a project economic.

•These specific Cost Effectiveness Values do not apply in Cook Inlet due to vastly different production life, geographic distribution and physical constraints.

•None of these analyses considered the impacts on short term production losses to implement the option (Options 2-7)

•All these Options are potential technical opportunities for reducing Greenhouse Gas emissions that require further evaluation.

Overarching Considerations/Recommendations

•Evaluate how possible Federal GHG regulation program (cap-and-trade, carbon tax, command and control) could impact the O&G industry in Alaska

•The State should work with the federal government to ensure the economic vitality of Alaska (including new capital investments) by engaging in the national debate on GHGs and rule making to support the Cook Inlet and North Slope O&G industry;

•Any emissions reductions in the Alaska O&G sector should be creditable toward a federal program;

•Alaska should not preempt the federal legislation and rule making by creating potential conflicting state regulations;

•Assure up front planning for budget, staffing, etc… in State agencies;

•Consider streamlined permitting that allows permits for projects that offer GHG emissions reductions to be expedited;

Thank You

FAW TWG Policy Options

1. Forest Management Strategies for Carbon Sequestration
2. Expanded Use of Biomass Feedstocks for Energy Production
3. Advanced Waste Reduction and Recycling

FAW – Initial Quantification Results

Option No.	Policy Option	GHG Reductions ($MMtCO_2e$)				Net Present Value 2010–2025 (Million 2005$)	Cost-Effective-ness ($/tCO_2e$)	Level of Support
		2015	2020	2025	Total 2010–2025			
FAW-1	Forest Management Strategies for Carbon Sequestration							
	A. Coastal Management Pre-Commercial Thinning	Included under FAW-2, along with all options using biomass in other sectors						Pending
	B. Boreal Forest Mechanical Fuels Treatment	Included under FAW-2						Pending
	C. Community Wildfire Protection Plans	Included under FAW-2						Pending
	D. Boreal Forest Reforestation	0.09	0.12	0.15	1.6	$150	$92	Pending
FAW-2	Expanded Use of Biomass Feedstocks for Energy Production							
	A. Biomass Feedstocks to Offset Heating Oil Use	0.01	0.03	0.04	0.3	$17	$55	Pending
	B. Biomass Feedstocks for Electricity Use	0.07	0.12	0.18	1.5	$59	$38	Pending
	C. Biomass Feedstocks to Offset Fossil Transportation Fuels	0.03	0.06	0.09	0.8	$41	$52	Pending
FAW-3	Advanced Waste Reduction and Recycling	0.27	0.45	0.65	5.3	-$43	-$8	Pending

Changes to FAW Quantification

Biomass Resource and Supply Assessment

- Updated delivered cost/ton estimates of biomass resources.
- Overall biomass demand estimates to meet the goals of FAW-2 have changed.
- A graph was inserted to illustrate Alaska's historical timber harvest.

Changes to FAW Quantification (cont'd)

FAW-1

- Additional discussion was added on the link between forest management/pre commercial thinning and carbon sequestration in timber.
- Overall quantification numbers in FAW-1 have not changed.

Changes to FAW Quantification (cont)

FAW-2

- Option 2A (Biomass for Heating)
  - Has been scaled down in size.
  - Cost estimates are now included, and account for heat distribution costs.
  - Electricity sold now reflects rural electricity prices.

•Option 2B (Biomass for Electricity) has increased in size to account for less electricity generation though CHP in FAW-2A.

•Overall quantification numbers have not changed from 2C (Biofuels)

•Additional discussion of uncertainty and additional costs/benefits involved in FAW-2 assessments.

Changes to FAW Quantification (cont)

FAW-3

- Overall quantification has not changed in FAW-3.

NS-6 (from Adaptation Advisory Group)

- Discussion of Natural Systems Option #6 (an Adaptation option) has been added to the FAW POD.

CC TWG Policy Options

1. Establish an Alaska GHG Emissions Reporting Program
2. Establish goals for state-wide GHG emission reduction
3. Identify and Implement State Government Mitigation Actions
4. Integrate Alaska Climate Change Mitigation Strategy with the State Energy Plan
5. Explore Various Market-Based Systems to Manage GHG Emissions
6. Create an Alaska Climate Change Program that Coordinates State Efforts for Addressing Climate Change

CC TWG Policy Options

Option No.	Policy Option	GHG Reductions ($MMtCO_2e$)			Net Present Value 2007–2020 (Million $)	Cost-Effectiveness ($/tCO_2e$)	Status of Option
		2012	2020	Total 2007–2020			
CC-1	Establish an Alaska Greenhouse Gas Emission Reporting Program	*Not Quantified*					Pending
CC-2	Establish Goals for Statewide GHG Emission Reduction	*Not Quantified*					Pending
CC-3	Identify and Implement State Government Mitigation Actions	*Not Quantified*					Pending
CC-4	Integrate Alaska's Climate Change Mitigation Strategy with the Alaska Energy Plan	*Not Quantified*					Pending
CC-5	Explore Various Market-Based Systems to Manage GHG Emissions	*Not Quantified*					Pending
CC-6	Create an Alaska Climate Change Program that Coordinates State Efforts for Addressing Climate Change	*Not Quantified*					Pending

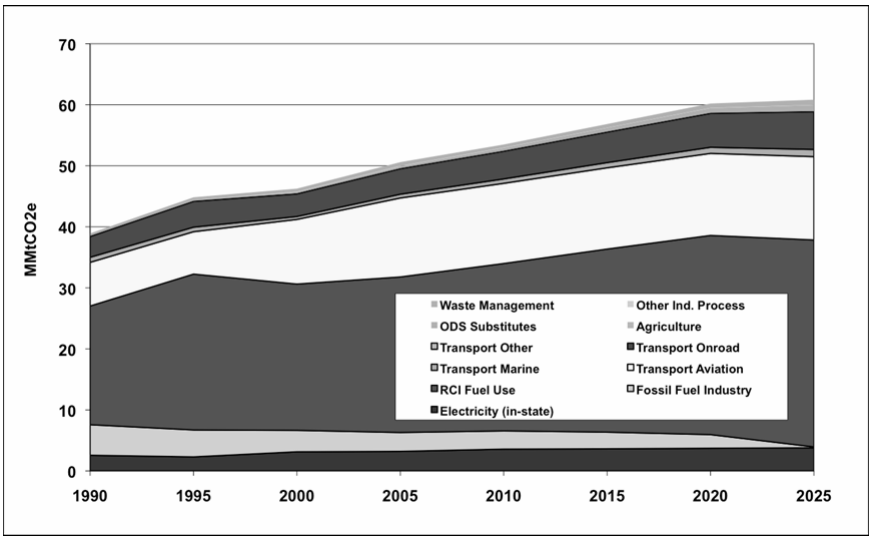
TLU TWG Policy Options

1. Transit, ridesharing, and commuter choice programs
2. Heavy-duty vehicle idling regulations and/or alternatives
3. Transportation system management
4. Promote efficient development patterns (Smart Growth)
5. Promotion of alternative fuel vehicles
6. VMT and GHG reduction goals in planning
7. On-road heavy-duty vehicle efficiency improvements
8. Marine vessel efficiency improvements
9. Aviation emission reductions
10. Alternative fuels R&D

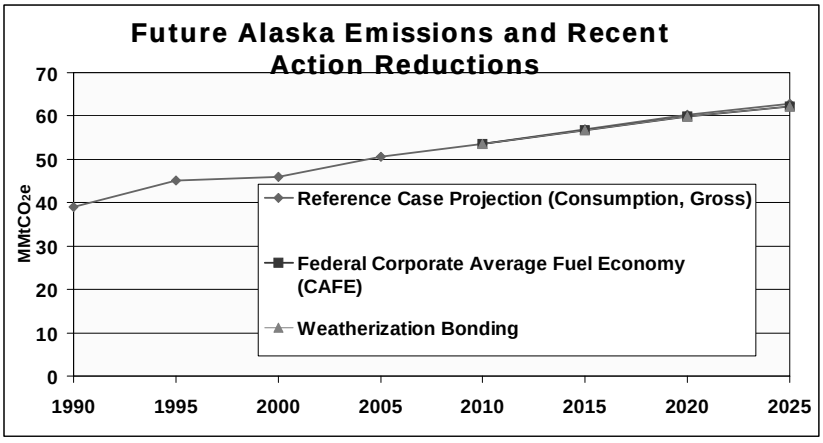
TLU – Initial Quantification Results

Option No.	Draft Policy Option		GHG Reductions ($MMtCO_2e$) 2015	2020	2025	Total 2008–2025	Net Present Value 2008–2025 (Million $)	Cost-Effectiveness ($/tCO$_2$e)	Level of Support
TLU-1	Transit, Ridesharing, and Commuter Choice Programs		0.002	0.003	0.005	0.046	29.9	651	Pending
TLU-2	Heavy-Duty Vehicle Idling Regulations and/or Alternatives		0.004	0.009	0.009	0.095	24.3	255	Pending
TLU-3	Transportation System Management		0.006	0.006	0.006	0.092	-10.8	-117	Pending
TLU-4	Promote Efficient Development Patterns (Smart Growth)		0.019	0.043	0.066	0.501	Net Savings	NQ	Pending
TLU-5	Promotion of Alternative Fuel Vehicles		0.026 - 0.084	0.054 - 0.173	0.09 - 0.288	0.669 - 2.139	207.3 - 350.4	135 - 524	Pending
TLU-6	VMT and GHG Reduction Goals in Planning		0.019	0.043	0.066	0.501	NQ	NQ	Pending
TLU-7	On-Road Heavy-Duty Vehicle Efficiency Improvements	a. SmartWay	0.050	0.075	0.084	0.930	-52.3	-56	Pending
		b. Phase Out	0.025	0.012	0.000	0.198	2.1	11	
		c. Public Fleets	0.016	0.033	0.037	0.364	NQ	NQ	
TLU-8	Marine Vessel Efficiency Improvements		0.012	0.022	0.032	0.269	20.4	76	Pending
TLU-9	Aviation Emission Reductions		NQ	NQ	NQ	NQ	NQ	NQ	Pending
TLU-10	Alternative Fuels R&D		NQ	NQ	NQ	NQ	NQ	NQ	Pending
	Sector Total Before Adjusting for Overlaps		0.21	0.36	0.50	4.44	296	67	
	Sector Total After Adjusting for Overlaps		0.19	0.31	0.42	3.85	296*	77*	
	Reductions From Recent Actions (CAFE stds)		0.23	0.53	0.73	6.00	NQ	NQ	
	Sector Total Plus Recent Actions		0.41	0.84	1.15	9.84	NQ	NQ	

Alaska Gross GHG Emissions



Future AK GHG Emissions and Reductions



Next Steps for MAG & TWGs

- 1-2 TWG calls between now and June meeting to:
  - Refine quantification per MAG feedback today
  - Complete policy option templates
- Final MAG approval to Alaska Inventory and Forecast
- Final MAG approval of policy option recommendations at June meeting
- Post-Meeting review of Final Report draft documents for accuracy and clarity (but not substantive changes)

Public Input & Announcements

Final MAG Meeting

- Agenda
  - Final approval of all policy option recommendations to forward to the Climate Change Subcabinet
  - Final approval of Alaska GHG Inventory & Forecast
- Date and Location
  - June 18, 2009
  - Anchorage

The Center for Climate Strategies
Helping States and the Nation Tackle Climate Change

Thank you
for your continuing
time and effort!

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