Alaska Climate Mitigation Advisory Group

of the Governor's Climate Change Sub-Cabinet

Meeting #6

April 2, 2009

Anchorage, Alaska

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Meeting Agenda

- **Presentation: Overview of EPA's New GHG Reporting Regulations**
- **Welcome, Introductions & Objectives for the Day**
- **Introductory Remarks**
- **Process Update**
- **Review and Approve Priority Option Descriptions by TWG**
  - Cross-Cutting TWG *(45 minutes)*
  - Forestry, Agriculture and Waste *(45 minutes)*
  - Energy Supply and Demand *(45 minutes)*
- **Lunch**
- **Review and Approve Priority Option Descriptions by TWG**
  - Transportation and Land Use *(45 minutes)*
  - Oil and Gas *(45 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 Adjournment**

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**
June 18, 2009	7th 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

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

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

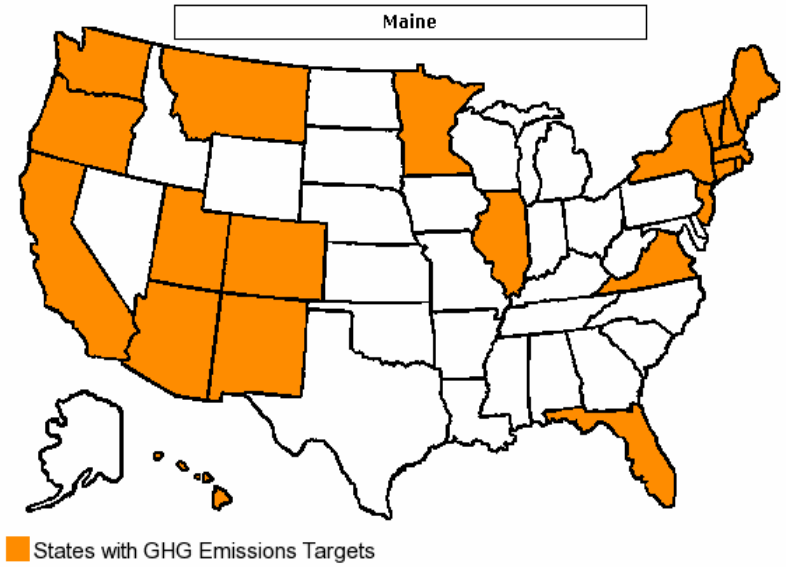
CC-1. Establish an Alaska Greenhouse Gas Emissions Reporting Program

- This option would establish a reporting program that ensures accurate, verifiable, and transparent reporting of GHG emissions data within Alaska
- Develop and publish an Alaska GHG inventory and forecast every three years
- **Recommend holding on further action on this option for now. A draft federal GHG Reporting Rule was released on March 10th. Review of this rule is underway. The final rule will likely impact this option.**

CC-2. Establish Goals for Statewide Greenhouse Gas Reduction

- Many other states have adopted GHG reduction goals (see next two pages)
- There is support among Alaska industry representatives for GHG goals for Alaska
- **The TWG will do additional analysis based on possible reductions reported by other TWGs at this meeting**
- **The Subcabinet should consider adoption of goals:**
  - **Begin to reduce GHG emissions by 2012**
  - **Achieve reductions of 14-20% percent below 1990 levels by 2020**
  - **Reduce GHG emissions by 60-80% below 1990 levels by 2050**

Greenhouse Gas Emissions Targets



A greenhouse gas emissions target refers to the emission reduction levels that states set out to achieve by a specified time. For example, a state may set a target of reducing emissions to 1990 levels by 2020, and to 50 percent below 1990 levels by 2050.

Click to download to PDF
Updated: February 27th, 2009

Summary by State GHG Reduction Goals and Targets

State, Province, or Region	1990-2020 GHG Forecast	State Goals	Climate Plan Coverage
Arizona	144%	• 2000 levels by 2020; 50% below by 2040 • 15% below 2005 levels by 2020 (WCI)	106%
California	40%	• E.O.: 2000 level by 2010; 1990 by 2020; 80% below 1990 by 2050 • AB-32: 1990 levels by 2020 • 15% below 2005 levels by 2020 (WCI)	100%
Colorado	71%	• 20% below 2005 level by 2020; 80% below by 2050	75%
Connecticut	32%	• 1990 level by 2010; 10% below by 2020; 75% below by 2050	100%
Florida	?	• 2000 level by 2017; 1990 level by 2025; 80% below 1990 by 2050	?
Massachusetts	?	• 1990 level by 2010; 10% below by 2020; 75% below by 2050	?
Maine	34%	• 1990 level by 2010; 10% below by 2020; 75% below by 2050	100%
Maryland	42%	• Recommended: 10% below 2006 levels by 2012; 15% below 2006 levels by 2015; 25% (enforceable)-50% (science based) below 2006 levels by 2020; 90% below 2006 levels by 2050.	100%
Minnesota	48%	• Next Generation Energy Act: 15% below 2005 levels by 2015; 30% by 2025; 80% by 2050	TBD
Montana	30%	• 1990 level by 2020; 80% below by 2050 (consumption & production)	89%-105%
North Carolina	113%	?	TBD
NEG/ECP	?	• 1990 level by 2010; 10% below by 2020; 75% below by 2050	TBD

Summary by State GHG Reduction Goals and Targets

State, Province, or Region	1990-2020 GHG Forecast	State Goals	Climate Plan Coverage
New Jersey	28%	• E.O. 54: 1990 level by 2020; 80% below 2006 levels by 2050	TBD
New Mexico	65%	• 2000 level by 2012; 10% below by 2020; 75% below by 2050 • 15% below 2005 levels by 2020 (WCI)	133%
New York	24%	• 5% below 1990 by 2010	?
Ontario	?	• 6% below 1990 by 2014	n/a
Oregon	61%	• 10% below 1990 by 2020; 75% below 1990 by 2050 • 15% below 2005 levels by 2020 (WCI)	85%
Puget Sound	37%	• 1990 level by 2010; 10% below by 2020; 75% below by 2100	100%
Rhode Island	35%	• 1990 level by 2010; 10% below by 2020; 75% below by 2050	100%
South Carolina	87%	• Recommended: 5% below 1990 levels by 2020	99%
Vermont	26-59%	• 25% below 1990 levels by 2012; 50% below 1990 by 2028; 75% below by 2050	TBD
Utah	95%	• 15% below 2005 levels by 2020 (WCI)	TBD
Washington	40%	• E.O.: 1990 levels by 2020; 25% below 1990 by 2035; 50% below 1990 by 2050 • 15% below 2005 levels by 2020 (WCI)	TBD
WCI	54%	• 15% below 2005 levels by 2020 (AZ, NM, CA, OR, UT, WA, BC, MB)	TBD
British Columbia	69%	• 15% below 2005 levels by 2020 (WCI)	TBD
Manitoba	TBD	• 15% below 2005 levels by 2020 (WCI)	TBD

CC-3. Identify and Implement State Government Mitigation Actions

- The State implements low cost “Early Actions” that can be taken without significant new funding or legislative approval to reduce GHG emissions
- The State publicizes successes through a “Report Card” to encourage others to act and to generate political momentum
- **The TWG will estimate general costs for initial actions identified in the option by working with State Agency contacts**
- **The Subcabinet should encourage Agencies to adopt the actions (likely with reallocation of funding)**

CC-4. Integrate Alaska's Climate Change Strategy with the Alaska Energy Plan

- Develop an "Energy Database" to track commercial, residential, industrial, and transportation energy consumption and production
  - Currently, *no single state agency* in Alaska has responsibility for tracking energy consumption and production for Alaska
  - Estimated costs: $300,000 to $500,000, depending on whether the State can modify an existing incomplete database
- Develop an Alaska "Climate Protection & Energy Plan"
  - Integrate the Climate Action Strategy with the Alaska Energy Plan
  - Outline mitigation objectives/energy consumption goals through 2020
- **The Subcabinet should initiate discussions to accomplish this and allocate funding for building the database**

CC-5. Explore Various Market Based Systems to Manage Greenhouse Gas Emissions

- There is a potential for a federal GHG market-based program – how would various programs impact Alaska?
- A study will help to:
  - Examine interactions of market-based programs with existing and proposed emission reduction measures in AK
  - Consider means to oversee and manage revenues generated by a future market-based approach and consider needed changes to existing laws
- **The Subcabinet should allocate funding (up to $50,000) to conduct a study to determine the effects of market approaches to carbon on AK**

CC-6. Create an Alaska Climate Change Program that Coordinates State Efforts

- The Subcabinet and AG/TWG structure was established as a temporary solution. Numerous agencies are conducting climate change activities. Alaskans do not know where to turn for climate change information. There is a need to provide focus and coordination among State climate change activities
  - Coordinate policy, regulatory, and reporting activities
  - Organize and improve access to information, including reporting on state activities via a Web portal
  - Develop education and outreach materials*
    - Establish a framework through K-12 education to improve public understanding of the causes/consequences of climate change in Alaska
    - Conduct directed outreach and partnering with stakeholders
    - Provide training for natural resource managers

* **overarching interest – also supported by TWG addressing Adaptation**

CC-6. Create an Alaska Climate Change Program that Coordinates State Efforts

- The Subcabinet should support formation of an Alaska Climate Change Program that coordinates the various climate change activities previously listed across State Agencies
- The Subcabinet should allocate approximately $650,000 annually to manage this effort (5 FTE + operating expenses)

Thank you!

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Break

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						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	0.08	0.14	0.20	1.7	TBD	TBD	Pending
	B. Biomass Feedstocks for Electricity Use	0.03	0.07	0.11	0.8	$32	$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

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

Option No.	Policy Option	GHG Reductions ($MMtCO_2e$)				Net Present Value 2010–2025 (Million 2005$)	Cost-Effectiveness ($/tCO_2e$)	Level of Support
		2015	2020	2025	Total 2010–2025			
ESD-1	Transmission System Optimization and Expansion	*TBD*	*TBD*	*TBD*	*TBD*	*TBD*	*TBD*	Pending
ESD-2	Energy Efficiency for Residential and Commercial Customers	*TBD*	*TBD*	*TBD*	*TBD*	*TBD*	*TBD*	Pending
ESD-3	Implementation of Renewable Energy (electricity – focus)	*TBD*	*TBD*	*TBD*	*TBD*	*TBD*	*TBD*	Pending
ESD-4	C. Community Wildfire Protection Plans	*TBD*	*TBD*	*TBD*	*TBD*	*TBD*	*TBD*	Pending
ESD-5	Building Standards/Incentives	*TBD*	*TBD*	*TBD*	*TBD*	*TBD*	*TBD*	Pending
ESD-6	Efficiency Improvements for Generators	*TBD*	*TBD*	*TBD*	*TBD*	*TBD*	*TBD*	Pending
ESD-7	Energy Efficiency for Industrial Installations	*TBD*	*TBD*	*TBD*	*TBD*	*TBD*	*TBD*	Pending
ESD-8	Research and Development for Cold-Climate Renewable Technologies	*TBD*	*TBD*	*TBD*	*TBD*	*TBD*	*TBD*	Pending

Electricity Supply and Demand

Policy Option Quantification – Preliminary Results

Alaska CCS

April 2, 2009

ES&D 1: Transmission Expansion

- Quantification Method
- Assumptions
- Results
- Analysis

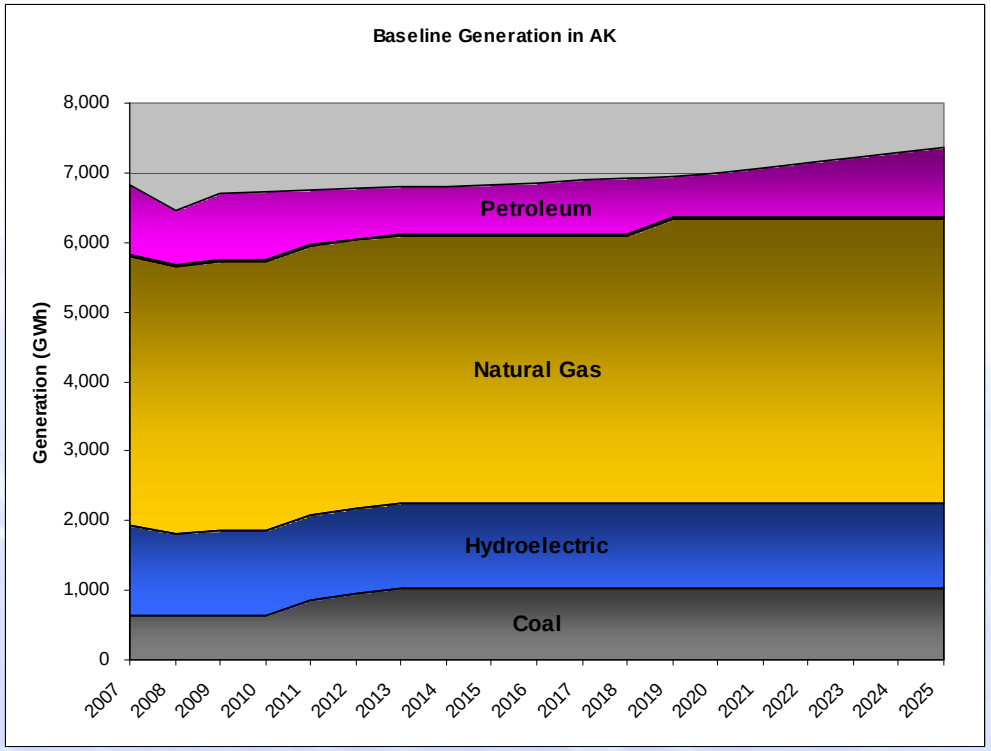
ES&D 1 - Methods

- Technically achievable RE intertie proposals identified by AEA RE Grant Program
  - Results of Round 1 released (1/22/2009)
- Used AEA analysis assumptions for generation, displaced fossil fuel, cost, and timeline
- Chose projects where pilot or feasibility programs were funded by AEA in Round 1 and project specifically funds an intertie
- Compiled results by year

- Rural Village to Village microgrids
  - 200 villages, each connected to one other village to increase efficiency
  - Estimated 15% fuel savings from larger load centers (eased load-following)
- Assumptions for microgrid scenario are almost all “rough” estimates

ES&D 3 - Assumptions

- 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 3 - Assumptions

- Village-to-village micro-grids
  - Increase efficiency of affected generators 15%
  - Villages are ~20 miles from each other
  - Each village is hooked up to one partner (no-multi-village grids)
  - Distribution lines cost $300,000 per mile
  - No capital cost for new generators (assume replacement during turnover)
  - Program starts in 2015, ends in 2020
- Discount Rate: 5% (real)

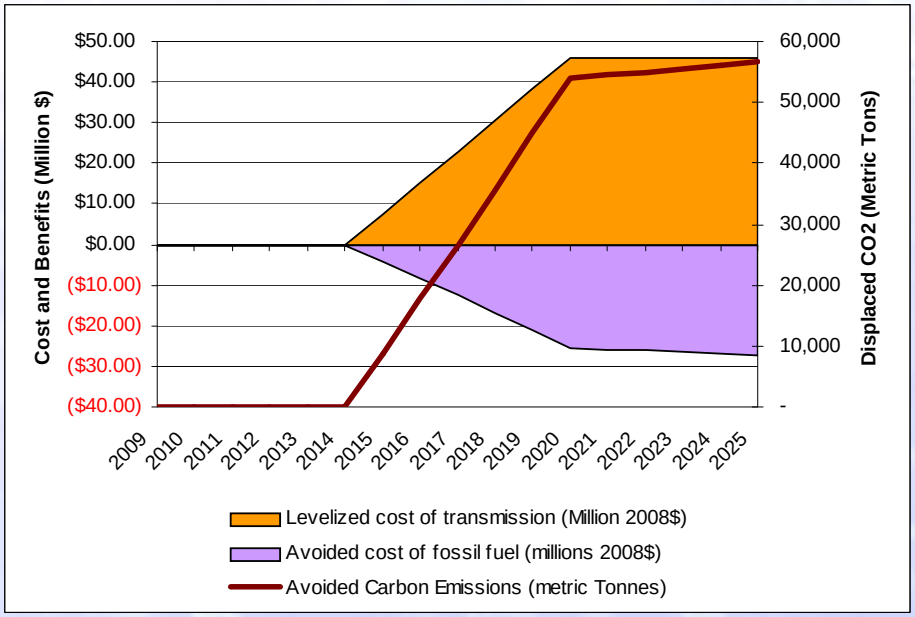
ES&D 3 - Assumptions

- Renewable Energy Grants Program (AEA)
  - Only programs which will fund interties counted
    - Metlaktla-Ketchikan
    - North Prince of Wales
    - Kake – Petersburg
    - Nome (wind)
    - Lake and Peninsula Borough
  - Use AEA analyses for
    - Capital costs (levelized)
    - O&M costs (levelized)
    - Expected generation (kWh)
    - Displaced fuel (gallons)
    - Year of implementation and operation

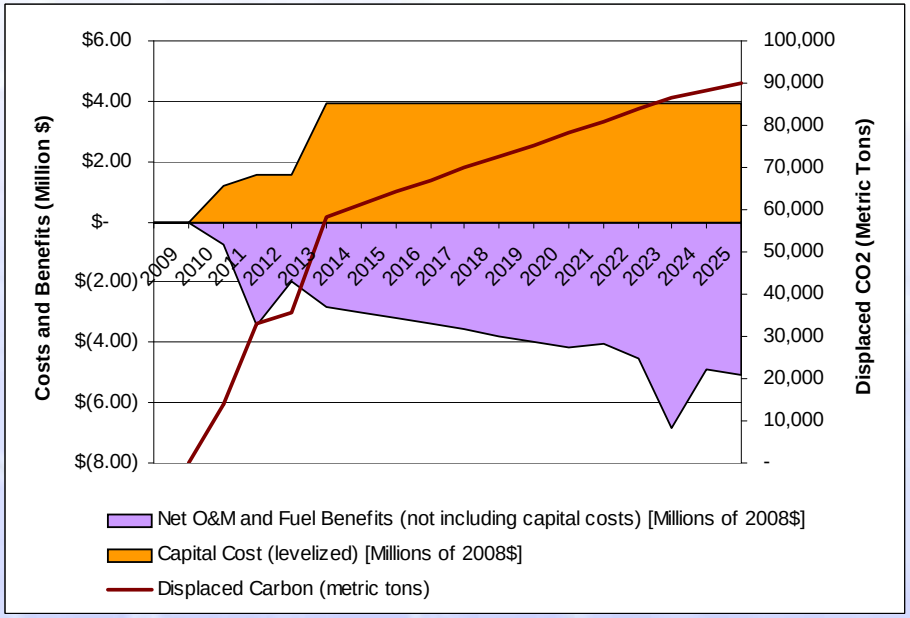
ES&D 3 – Results

Option #	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-1, Rural Trans.	0.01	0.05	0.06	0.46	$229	-$129	$100	$214.07
ES&D-1, RE Grants (Trans)	0.06	0.08	0.09	1.06	$36	-$38	-$2	-$1.70
ES&D-1, Total	**0.07**	**0.13**	**0.15**	**1.52**	**264.76**	**-167.03**	**97.73**	**$64.16**

ES&D-3, Rural Transmission



ES&D-1, RE Grants (AEA)



ES&D 2/4/6: Energy Efficiency

- Policy Design
- Quantification Methods
- Key Assumptions
- Results

ES&D 2/4/6 - Policy Design

- **Goals:** Energy efficiency programs to reduce electricity and natural gas use each year equal to (A) 1% of projected annual sales by 2015 and maintain at this level until 2025, or (B) further increasing to 2% by 2020 and maintain at this level by 2025

Annual Incremental Target

Scenario	2010	2015	2020	2025
1% per year	0.20%	1%	1%	1%
2% per year	0.20%	1%	2%	2%

Approximate Cumulative Target

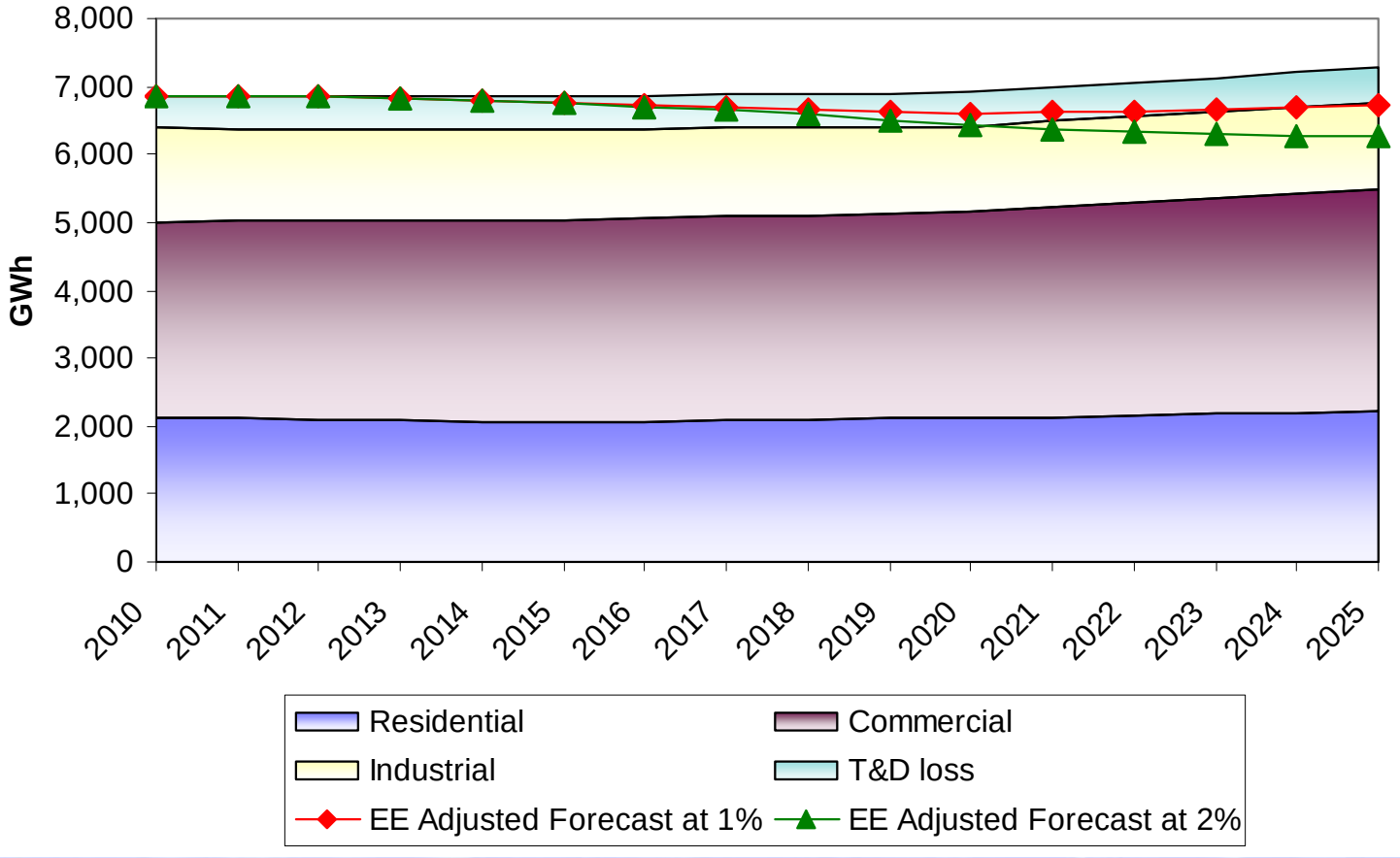
Scenario	2010	2015	2020	2025
1% per year	0.20%	3%	8%	11%
2% per year	0.20%	3%	11%	18%

Level of Energy Savings in Other States

Jurisdiction or Entity	Annual Savings (%)	Year(s)	Source
Interstate Power & Light (IPL) (MN)	3.0	2001	Garvey, E. 2007. "Minnesota's Demand Efficiency Program."
San Diego Gas & Electric (SDG&E) (CA)	2.1	2005	SDG&E 2006. Energy Efficiency Programs Annual Summary
Minnesota Power	1.9	2005	Garvey, E. 2007
Sacramento Municipal Utility District (SMUD) (CA)	1.9	1994	Data provided by SMUD
Vermont	1.8	2007	Efficiency Vermont 2008. 2007 Preliminary Results and Savings Estimate Report
Southern California Edison (SCE)	1.7	2005	SCE 2006. Energy Efficiency Annual Report
Western Mass. Electric Co. (MA)	1.6	1991	MA Dept. of Telecommunications & Energy (DTE) 2003. Electric Utility Energy Efficiency Database
Pacific Gas & Electric (PG&E) (CA)	1.5	2005	PG&E 2006. Energy Efficiency Programs Annual Summary
Massachusetts Electric Co.	1.3	2005	MECo 2006. 2005 Energy Efficiency Annual Report Revisions
Connecticut IOUs	1.3	2006	CT Energy Conservation Management Board (ECMB). 2007
Commonwealth Electric (MA)	1.2	1990	MA DTE 2003.
Cambridge Electric (MA)	1.1	2000	MA DTE 2003.
Seattle City Light (WA)	1.0	2001	Seattle City Light 2006. Energy Conservation Accomplishments: 1977-2005
Eastern Edison (MA)	1.0	1994, 1998	MA DTE 2003.

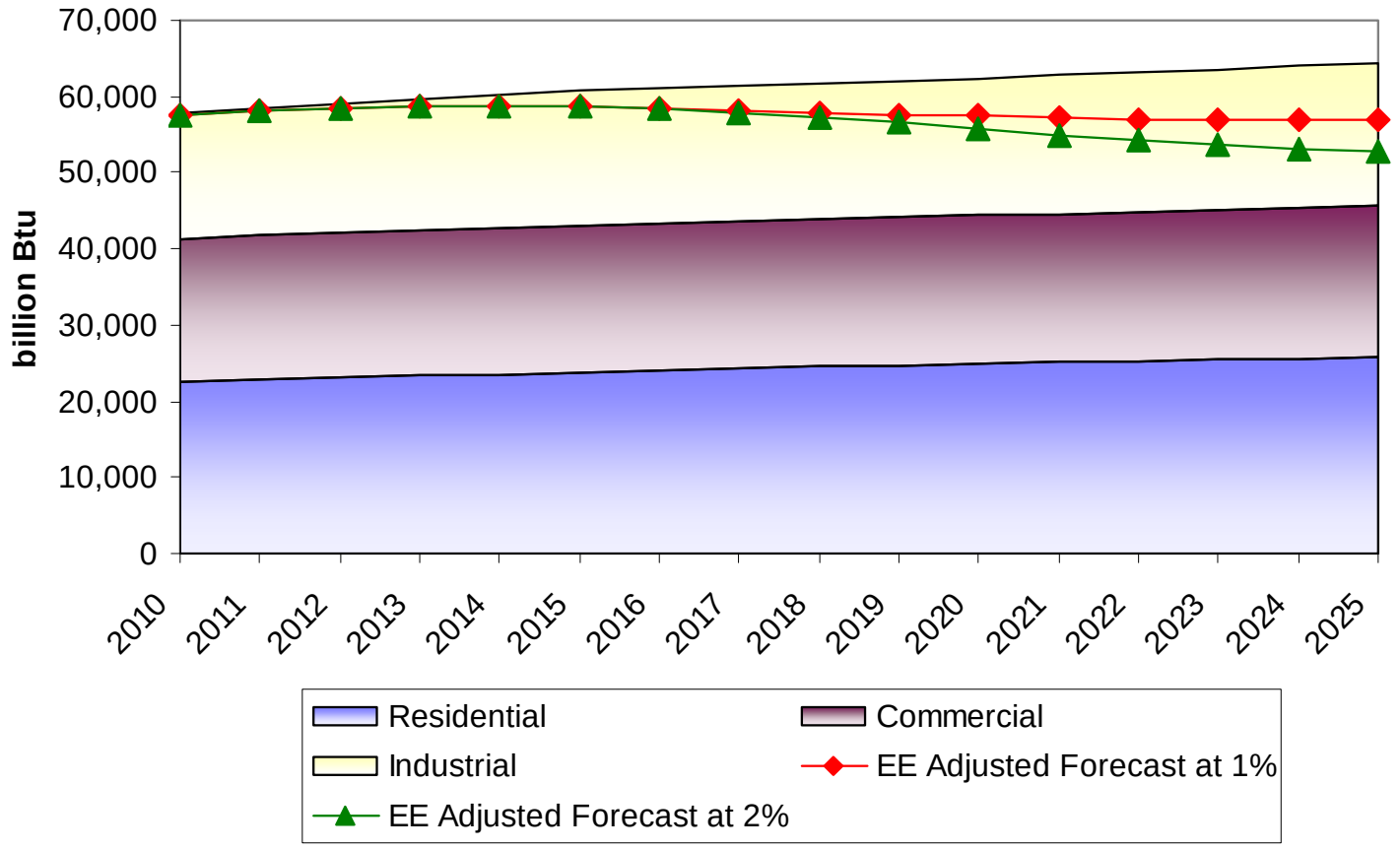
Source: K. Takahashi and D. Nichols 2008.

ES&D 2/4/6 Demand Forecast (Electric EE)



Utility Sales Only – growth from AEO 2009 Pacific Region

ES&D 2/4/6 Demand Forecast (Gas EE)



ES&D 2/4/6 - Quantification Methods

- Project energy savings based on two scenarios on “annual incremental” savings from new EE programs
  - A 1% per year reduction in annual sales by 2015, maintaining until 2025
  - A 1% per year reduction in annual sales by 2015, increasing to 2% by 2020, maintaining until 2025
- Estimate the total cost of energy savings using state-specific or region-specific data on cost of saved energy from electric energy efficiency measures.
- Estimate the GHG emission reductions through energy efficiency measures.

ES&D 2/4/6 - 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

ES&D 2/4/6 - 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

ES&D 2/4/6 - Results

1% EE by 2015, hold at 1%

Option #	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)
RES	0.06	0.14	0.14	1.44	$51	-$110	-$59	-$41.00
COM	0.09	0.21	0.21	2.06	$74	-$158	-$84	-$41.00
IND	0.04	0.09	0.09	0.89	$32	-$68	-$36	-$41.00
ES&D-4, Electrical EE (1%)	**0.18**	**0.44**	**0.44**	**4.38**	**$157**	**-$336**	**-$180**	**-$41.00**

1% EE by 2015, 2% by 2020

Option #	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)
RES	0.06	0.19	0.19	1.80	$63	-$136	-$72	-$40.33
COM	0.09	0.28	0.28	2.57	$91	-$194	-$104	-$40.33
IND	0.04	0.12	0.12	1.11	$39	-$84	-$45	-$40.33
ES&D-4, Electrical EE (2%)	**0.18**	**0.59**	**0.59**	**5.48**	**$193**	**-$414**	**-$221**	**-$40.33**

ES&D 3: Implementation of Renewable Energy

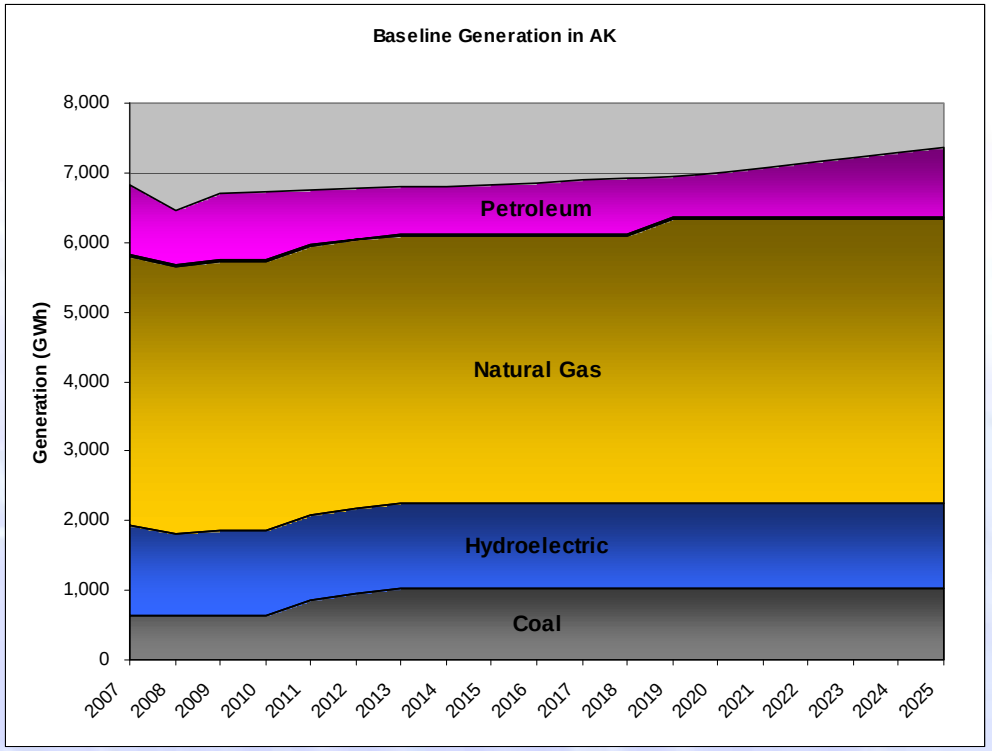
- Quantification Method
- Assumptions
- Results
- Analysis

ES&D 3 - 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

ES&D 3 - Assumptions

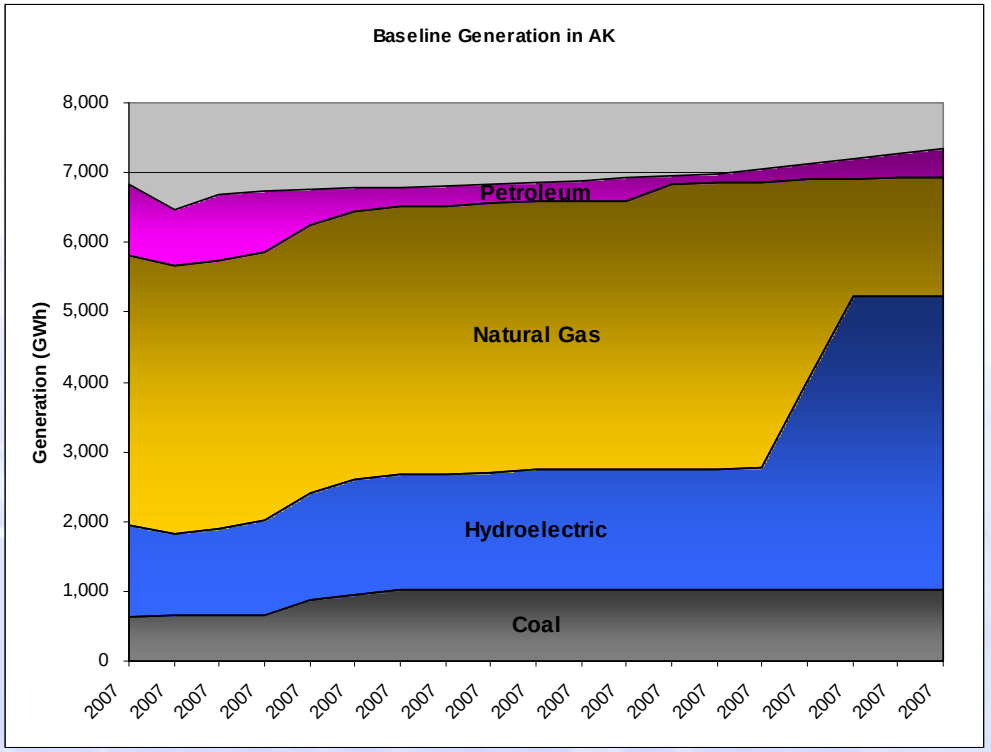
- Baseline fuel mix changes with discrete projects known or expected by TWG members:
  - HCCP comes online 2011-2013 (50 MW, displaces petroleum)
  - Fairbanks obtains a natural gas supply in 2019 (60 MW fuel switch from petroleum)



Baseline Fuel Mix (Generation, GWh) in AK
EIA for 2007 & 2008

ES&D 3 - 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.

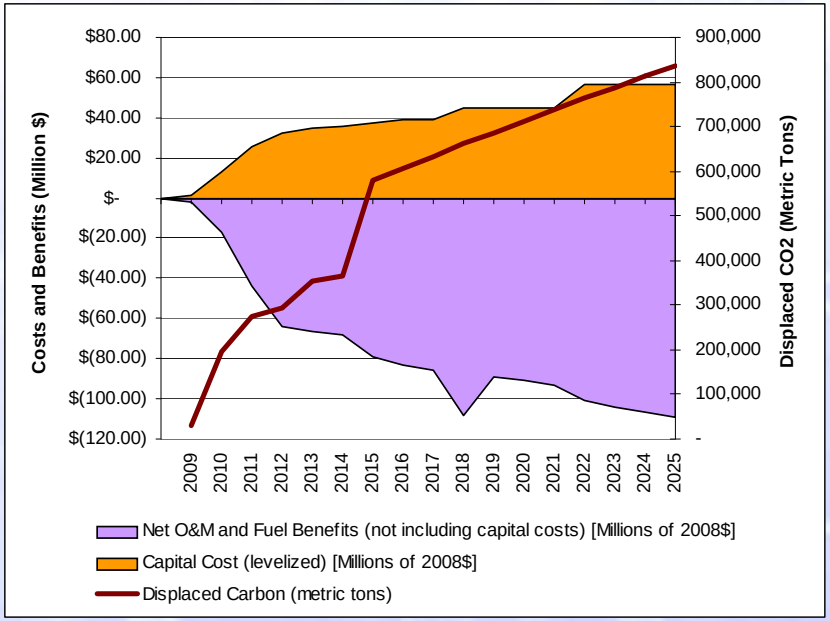


ES&D 3 Fuel Mix (Generation, GWh) in AK
EIA for 2007 & 2008

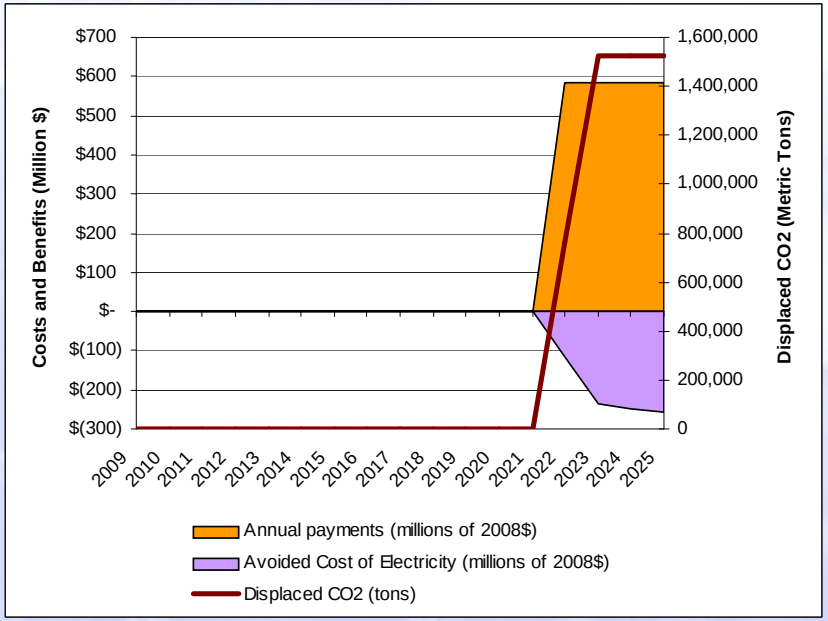
ES&D 3 – Results

Option #	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-3, RE Grants (RE)	0.58	0.71	0.84	9.33	$420	-$834	-$414	-$44.35
ES&D-3, Large Hydro	0.00	0.00	1.38	4.83	$2,067	-$438	$1,629	$336.91
ES&D-3, Total	**0.58**	**0.71**	**2.22**	**14.17**	**$2,487**	**-$1,272**	**$1,215**	**$85.74**

ES&D-3, RE Grants Program



ES&D-3, Large Hydro



Break

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

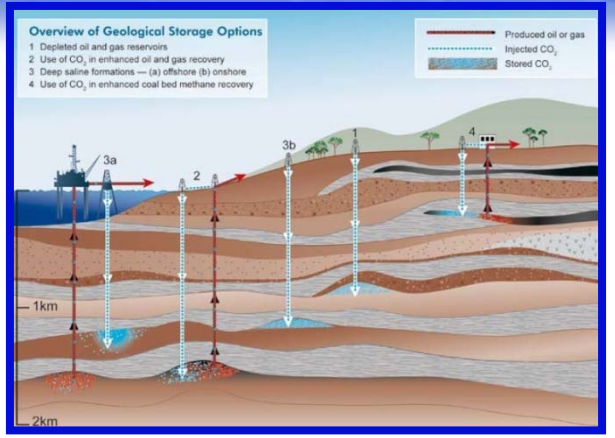
Option No.	Draft Policy Option	GHG Reductions ($MMtCO_2e$)				Net Present Value 2008–2025 (Million $)	Cost-Effective-ness ($/tCO_2e$)	Level of Support
		2015	2020	2025	Total 2008–2025			
TLU-1	Transit, Ridesharing, and Commuter Choice Programs	0.002	0.003	0.005	0.041	62.8	1,549	Pending
TLU-2	Heavy-Duty Vehicle Idling Regulations and/or Alternatives	0.004	0.009	0.009	0.095	24.3	255	Pending
TLU-3	Transportation System Management	0.005	0.005	0.005	0.078	-16.3	-208	Pending
TLU-4	Promote Efficient Development Patterns (Smart Growth)	Included in T-6				Net Savings	NQ	Pending
TLU-5	Promotion of Alternative Fuel Vehicles	0.024 –0.075	0.050 –0.160	0.082 – 0.263	0.611 – 1.954	163 – 501	116 – 820	Pending
TLU-6	VMT and GHG Reduction Goals in Planning	0.017	0.039	0.061	0.454	NQ	NQ	Pending
TLU-7	On-Road Heavy-Duty Vehicle Efficiency Improvements	0.070	0.100	0.100	1.22	NQ	NQ	Pending
TLU-8	Marine Vessel Efficiency Improvements	0.001	0.003	0.003	0.029	56.7	1,964	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

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

Option No.	Policy Option	GHG Reductions ($MMtCO_2e$)				Net Present Value 2010–2025 (Million 2005$)	Cost-Effectiveness ($/tCO_2e$)	Level of Support
		2015	2020	2025	Total 2010–2025			
OG-1	Best Conservation Practices	*TBD*	*TBD*	*TBD*	*TBD*	*TBD*	*TBD*	Pending
OG-2	Reductions in Fugitive Methane Emissions	*TBD*	*TBD*	*TBD*	*TBD*	*TBD*	*TBD*	Pending
OG-3	Electrification of Oil and Gas Operations, with Centralized Power Production and Distribution	*TBD*	*TBD*	*TBD*	*TBD*	*TBD*	*TBD*	Pending
OG-4	Improved Efficiency Upgrades for Oil and Gas Fuel Burning Equipment	*TBD*	*TBD*	*TBD*	*TBD*	*TBD*	*TBD*	Pending
OG-5	Renewable Energy Sources in Oil and Gas Operations	*TBD*	*TBD*	*TBD*	*TBD*	*TBD*	*TBD*	Pending
OG-6	Carbon Capture and Geologic Sequestration with Enhanced Oil Recovery from High CO2 Fuel Gas at Prudhoe Bay	*TBD*	*TBD*	*TBD*	*TBD*	*TBD*	*TBD*	Pending
OG-7	Carbon Capture and Geologic Sequestration with Enhanced Oil Recovery in and near existing Oil or Gas Fields	*TBD*	*TBD*	*TBD*	*TBD*	*TBD*	*TBD*	Pending
OG-8	Carbon Capture and Geologic Sequestration away from Known Geologic Traps	*TBD*	*TBD*	*TBD*	*TBD*	*TBD*	*TBD*	Pending

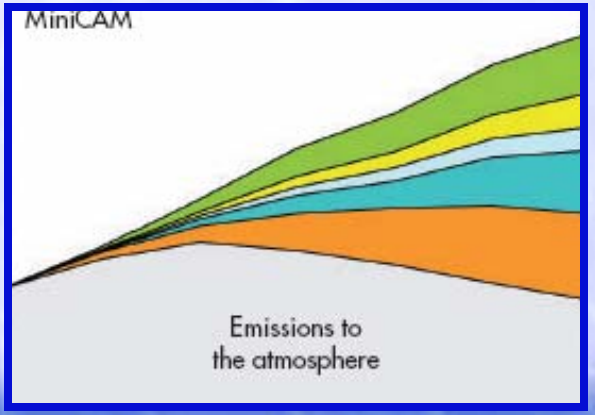


Oil and Gas Technical Work Group

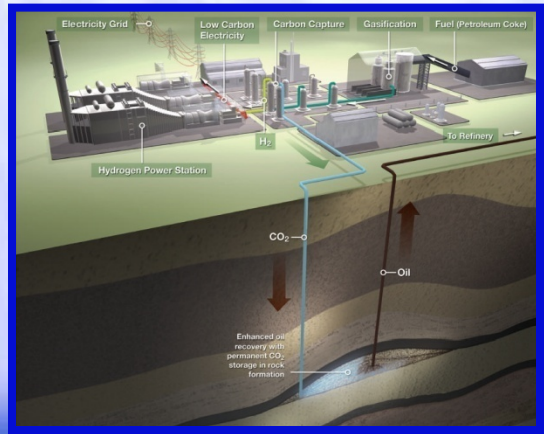
Governor's Sub-Cabinet for Climate Change

Status report to the MAG -

Options to reduce GHG emissions from O&G Operations



April 2, 2009 Anchorage



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Overview

- Enduring Themes
- Progress on Quantification
- Timeline
- Option Review / Quantification Status
- Learnings / Summary

Enduring Themes in Options to Reduce GHG Emissions in Alaska

- Support economic vitality of Alaska
- Encourage capital investment
- Ensure regulatory simplicity

Progress to date

- TWG has been meeting since last MAG. Most options in second and third iterations.
- Excellent support from ICF and industry experts. Meetings very productive.
- Preliminary results of quantification still under analysis, gaining a better understanding of significant assumptions and economic drivers. Results vary widely based on the assumptions .
- Parameters for prioritization not yet finalized, however ranking should be achievable as the quantification gets more refined.

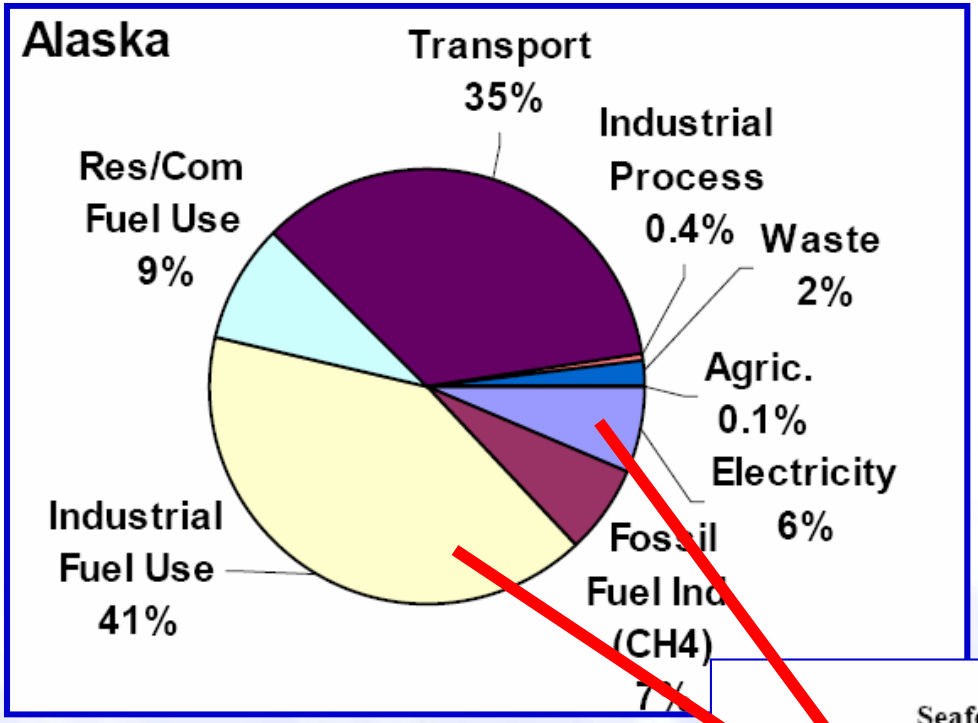
Timeline

- March 26 - April 23 High level quantification estimates completed, final TWG review
- March 26 - May 9 Reformat and complete documentation of options, determine ranking methodology
- April 23 - May 9 Final quantification review
- April 23 - May 9 Develop recommendations on incentives to improve option viability
- May 14 Proposed interim presentation to MAG
- May 15 - June 11 Rework and rank options
- June 18 Final MAG presentation

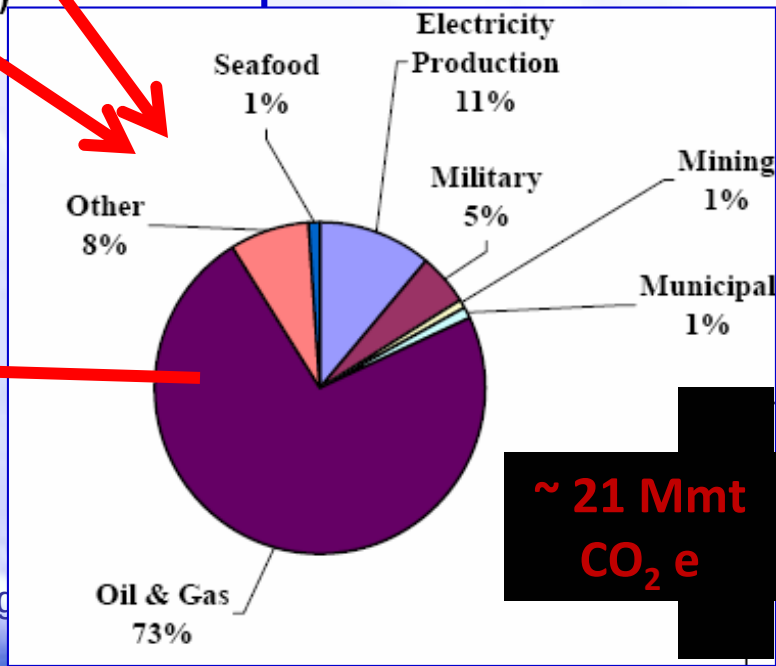
Alaska Gross GHG Emissions by Sector (2005)

~ 52 Mmt CO_2 Equivalent

(~0.7% US Emissions)

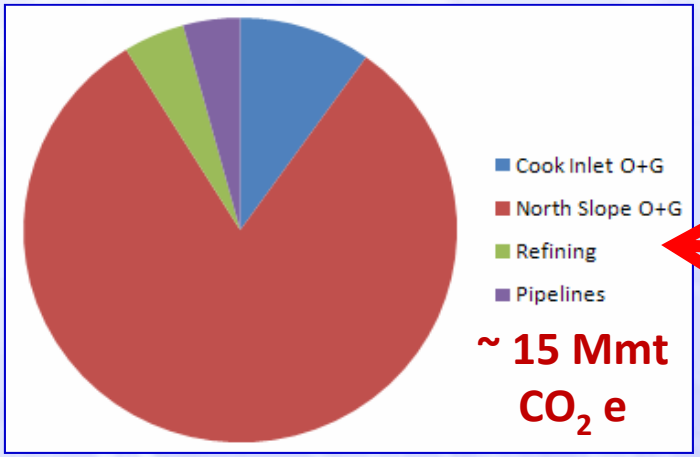


Alaska Title V GHG Emissions



~ 21 Mmt CO_2 e

O+G GHG Emissions

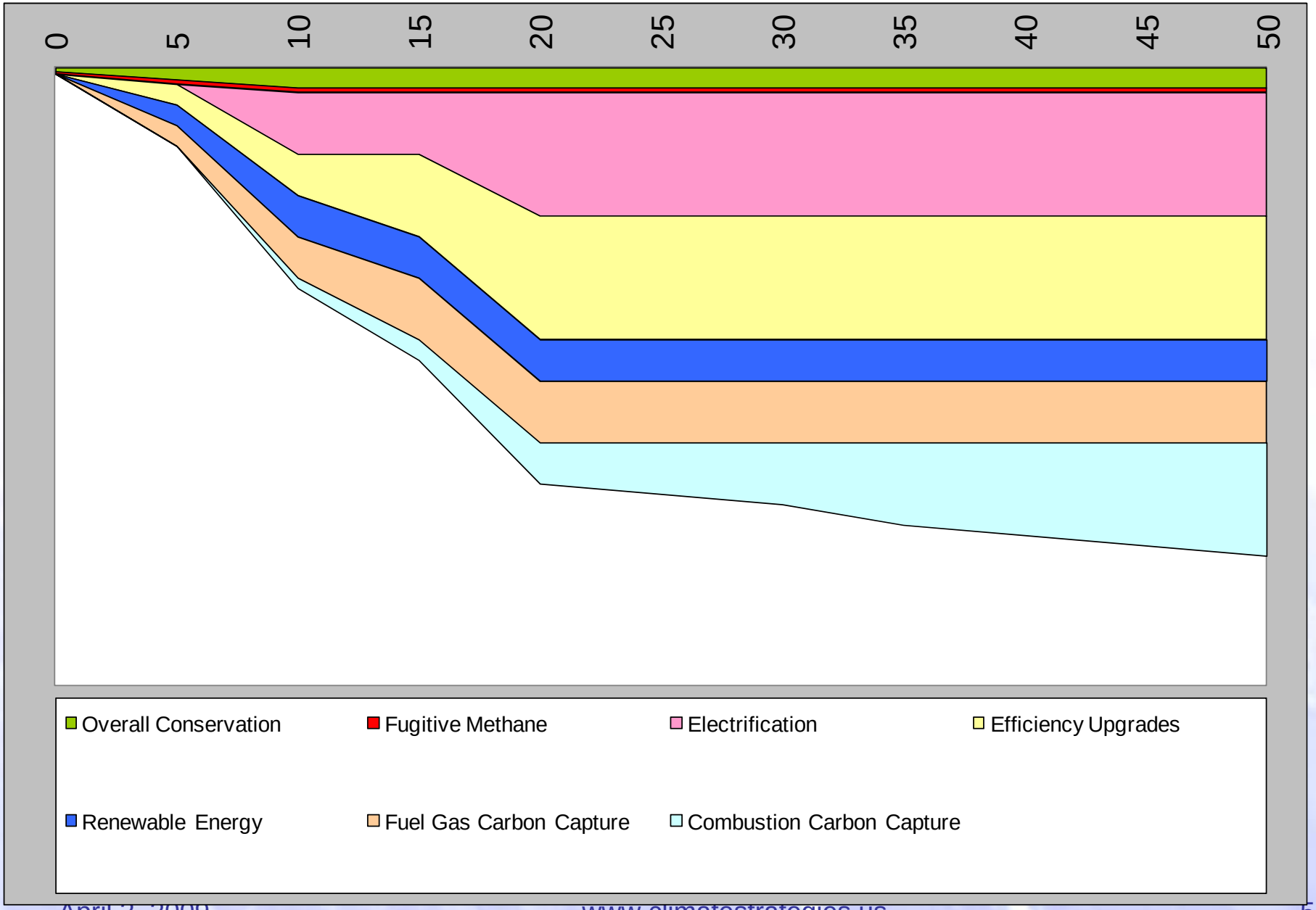


~ 15 Mmt CO_2 e

TWG working Options April 2, 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 at Prudhoe Bay
	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)

O&G TWG Conceptual GHG Reduction Timeline



Conservation / Waste Reduction

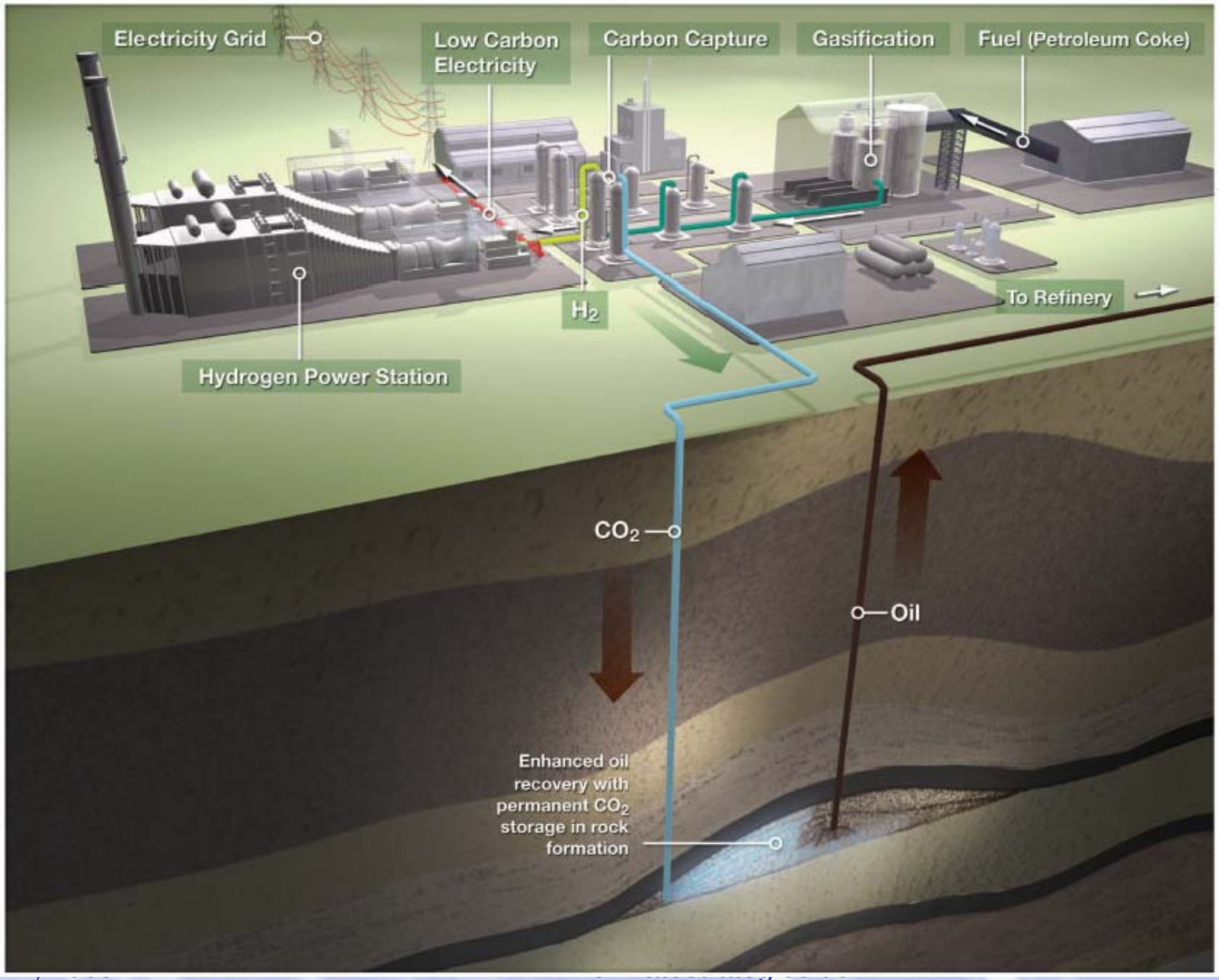
1) Conservation- Minimize, optimize, and reduce energy consumption, liquid fuels, gas, and electricity use.

2) Reduce Fugitive Methane Emissions--Assess potential reductions of fugitive methane;

Quantification Status—approach, complexities, challenges, issues

- No attempts to quantify conservation, keep as qualitative
- Fugitive methane quantification costs/reductions ongoing
  - Major uncertainties exist in fugitive methane estimates, but appear much less than original CCS/DEC reports. Numbers small when compared to other options.

Thermal Energy Efficiency at Oil and Gas Operations



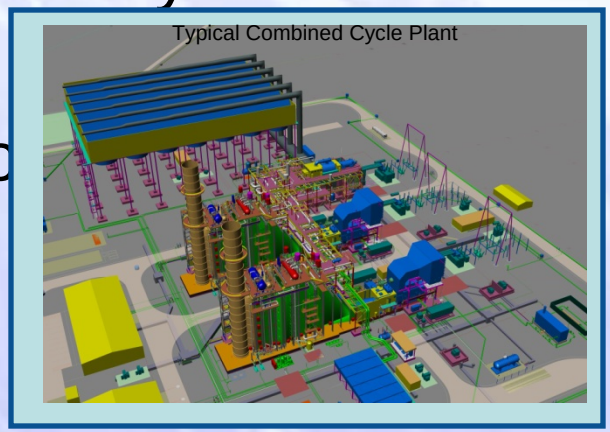
Thermal Energy Efficiency

3) Electrification of North Slope facilities with centralized power production and distribution
4) Improved efficiency upgrades for fuel burning equipment
5) Use of renewable energy sources for power generation

Electrification of North Slope facilities with centralized power production and distribution

Quantification Issues

- Requires major upgrade and expansion of the entire grid infrastructure on the North Slope
- Will have an overall major efficiency improvement meaning less gas burned and thus significantly reduced GHG emissions.
- Some equipment is already currently at a reasonable thermal efficiency
- Quantification Status Discussio
  - Approach
  - Complexity
  - Challenges



Quantification Issues

- Efficiency improvements mean less gas burned, resulting in reduced GHG emissions.
- Improvements can be made through upgrading existing industrial gas turbines to modern aero-derivatives, or by addition of waste heat to existing turbines (only former is being quantified.)
- Some equipment is already at its optimal or near optimal (not all equipment is included)
- Quantification Status Discussion
  - Approach
  - Complexity
  - Challenges

Use of renewable energy sources for power generation

Quantification Issues

- The focus is on the North Slope, but it may have application to oil and gas operations elsewhere, including onshore Cook Inlet facilities.
- Wind power is a potential resource, but is an unproven industrial technology for North Slope operations.
- Could be effective in augmenting power generation for electricity by reducing gas usage and GHG emissions as part of a more comprehensive hybrid option combining aspects of 1-4 and 6.
- Quantification Status Discussion
  - Approach
  - Complexity
  - Challenges

Carbon Capture and Geologic Sequestration

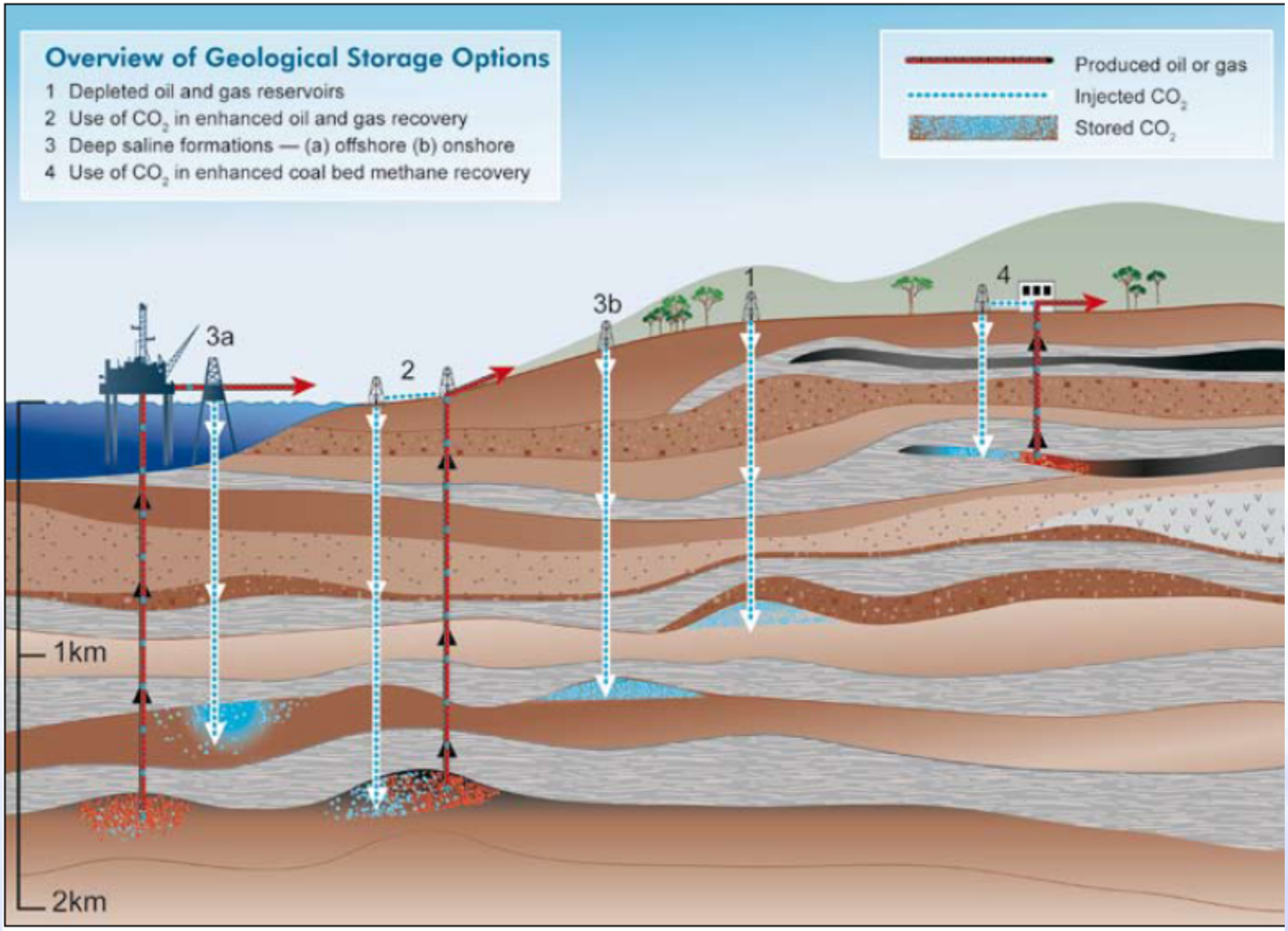


Figure TS.7. Methods for storing CO_2 in deep underground geological formations. Two methods may be combined with the recovery of hydrocarbons: EOR (2) and ECBM (4). See text for explanation of these methods (Courtesy CO2CRC).

IPCC Special Report on Carbon Dioxide Capture and Storage,2005

Carbon Capture and Geologic Sequestration

6) Remove CO_2 from fuel gas at Prudhoe Bay. Use for EOR.

7) Remove CO_2 from exhaust gas at Prudhoe Bay. Use for EOR.

8) Remove CO_2 from exhaust gas at Interior Power Plants or refineries. Ship CO_2 to known reservoir or explore for nearby sequestration site.

- Note: This is mostly non oil and gas facilities

66

1) Find appropriate storage reservoir

2) Drill Injection Wells

3) Capture CO_2

4) Compression and dehydration

5) Pipelines for Transport

6) Compression and Injection

7) Long Term Monitoring

1) Find appropriate storage reservoir

2) Drill Injection Wells

3) Capture CO_2

4) Compression and dehydration

5) Pipelines for Transport

6) Compression and Injection

7) Long Term Monitoring

CCS in oil/gas fields – may already have some of the needed facilities

Remove CO_2 from fuel gas at Prudhoe Bay. Use for EOR

Quantification Issues

- Option supports early enhanced oil opportunities and provides reduced CO2 emissions.
- Could be stand alone.
- Technology will be needed/required for eventual gas sales (acts as big pilot for major gas sales)

Lessons learned

- Biggest drivers are CO2 capture costs and value from additional oil from EOR
- Choice of field for EOR critical (infrastructure, reserve potential, etc.)
- Parasitic energy losses for capture likely compensated by EOR gains

Remove CO_2 from exhaust gas at Prudhoe Bay. Use for EOR

Quantification Issues

- Supports early enhanced oil opportunities and provides reduced CO2 emissions.
- **Considerably** more efficient and cost effective to first maximize energy efficiency options. (Realistically only practical when combined with centralized energy efficiency.)

Lessons learned

1. Gas line impacts **supply**/demand aspect of CO2 for EOR.
2. Biggest drivers are CO2 capture costs and value from EOR.
3. Choice of field for EOR critical – cross unit boundary issues.
4. Considerable uncertainty exists in technology application.

Remove CO_2 from exhaust gas away from O&G fields. Ship CO_2 to known reservoir or explore for nearby sequestration site.

Quantification Issues

- Reduces CO2 emissions.
- Primary focus on coal power generation, some refineries
- MUCH more efficient to first maximize energy efficiency.
- Could be required to meet ambitious long-term GHG reduction goals being discussed in Federal Government.

Lessons Learned

1. Capital costs huge , can be twice cost of plant w/out CCS
2. Unknowns: Exploration Costs, Pipeline length/costs, Regulatory requirements for long term storage.
3. DOE / NETL in large scale testing mode
4. Recommend we defer quantification step until more information on costs and regulations are available.

Summary Options –Stand alone*

#	Option Description	Estimated target emissions (in MMT CO_2e)	Remainder after max reductions (2-5-09)	Current Working Estimate (4-2-09)	Comments/ Assumptions	Final Estimates
	Conservation (NS)	**12.0**	~11.4	**?**		
1	Best Conservation Practices	12.0	~11.5	**?**		TBD?
2	Reduce Fugitive Methane	12.0	~11.9	**~11.9**	No actual measurements available	TBD
	Thermal Energy Efficiency (NS)	**12.0**	~4.0			TBD
3	Electrification, Centralized Power	12.0	~4.0	**~6**	27-52% efficiency improvement	TBD
4	Improved Efficiency Equipment	12.0	~6.0	**~9**	27-37% efficiency improvement	TBD
5	Renewable Energy	12.0	~11.0	**?**		TBD
	Carbon Capture and Storage (NS)	**12.0**	~.5-1.0			
6	CCS from High CO_2 fuel at Prudhoe	12.0	~11.0	**~11**		TBD
7	CCS from Combustion Sources	12.0	~.5-1.0	**?**	Very expensive, ability to implement on NS uncertain	TBD
8	CCS away from O&G fields	**3.0**	~2.5	**~2.5**		TBD?

*All numbers are rounded approximations only

Total NS emissions ~ 12 MMT, Total Interior emissions ~ 3 MMT

Incentives for long term viability for GHG reductions – Initial discussions

- Encourage capital investment
- Streamline/simplify (in some cases identify) regulatory environment
- Encourage maximization of ultimate hydrocarbon recovery
- Prepare for implications of potential Federal Carbon regulations to Alaska

Note: All GHG emission estimates based on Title V stationary source emissions based on fuel burned from 2002. ie no accounting for new developments or gas pipeline

Summary - Implementation Challenges/Issues

- Economics
- Many options are Mega Projects - Significant overlapping resource requirements among options, and with construction related to major gas sales.
  - **So - Even with no economic constraints, we can't do everything.**
- Cross Unit issues will delay full implementation– affects power generation, CO2 transport, regulated power utility issues, commercial issues between different owners.
- Most options are not stand alone, but may be most effectively implemented as some kind of a hybrid scheme
  - ie improving energy efficiency of individual pieces of equipment while centralizing power, thereby adding carbon capture technology to the fewest pieces of machinery, etc.

Enduring Themes in Options to Reduce GHG Emissions in Alaska

- Support economic vitality of Alaska
- Encourage capital investment
- Ensure regulatory simplicity (consistency!)

Timeline

- March 26 - April 23 High level quantification estimates completed, final TWG review
- March 26 - May 9 Reformat and complete documentation of options, determine ranking methodology
- April 23 - May 9 Final quantification review
- April 23 - May 9 Develop recommendations on incentives to improve option viability
- May 14 Proposed interim presentation to MAG
- May 15 - June 11 Rework and rank options
- June 18 - Final MAG presentation

Questions

Break

Next Steps for MAG & TWGs

- 2-3 TWG calls between now and June meeting to:
  - Refine quantification per MAG feedback today
  - Complete policy option templates
- Possible interim MAG conference call in May
- MAG gives final approval to Alaska Inventory and Forecast
- MAG gives final approval of policy option recommendations at June meeting

Public Input & Announcements

Next 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

Thank you
for your continuing
time and effort!

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