Energy Supply and Demand

Policy Option Quantification – Preliminary Results

Alaska CCS

April 2, 2009

ES&D 1: Transmission Expansion

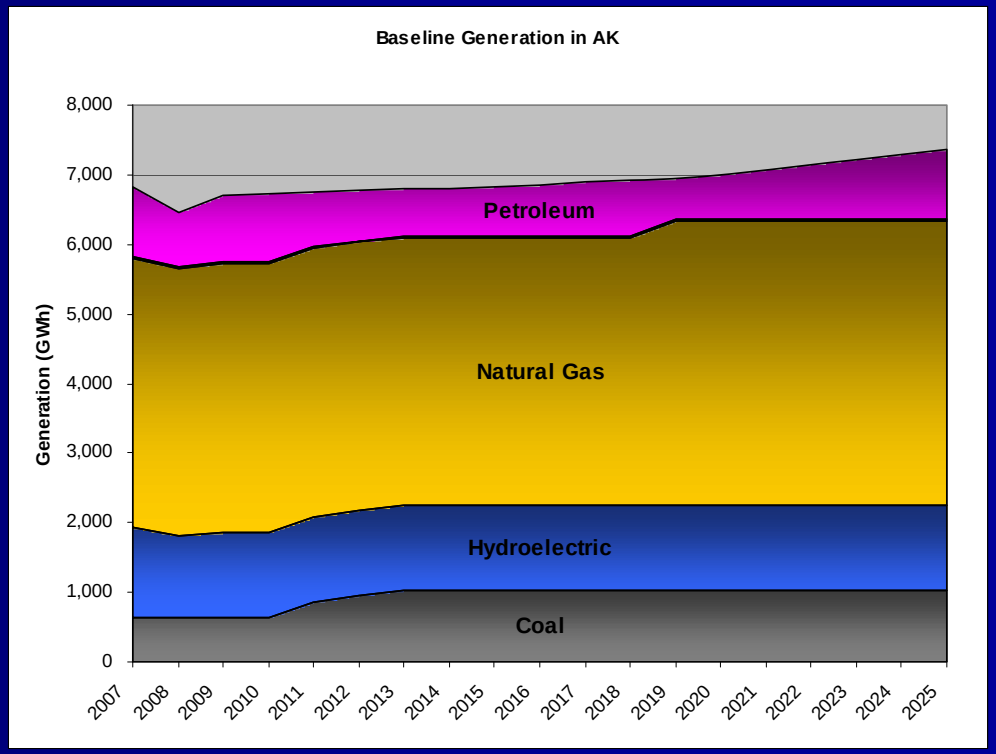
- Quantification Method
- Assumptions
- Results
- Analysis

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 1 - 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 1 - 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)

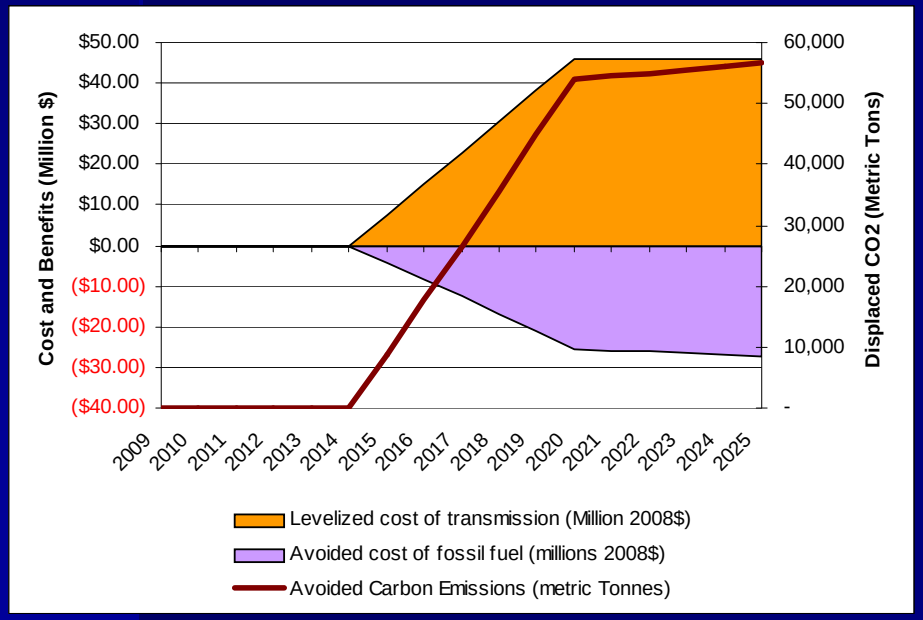
ES&D 1 - Assumptions

- 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

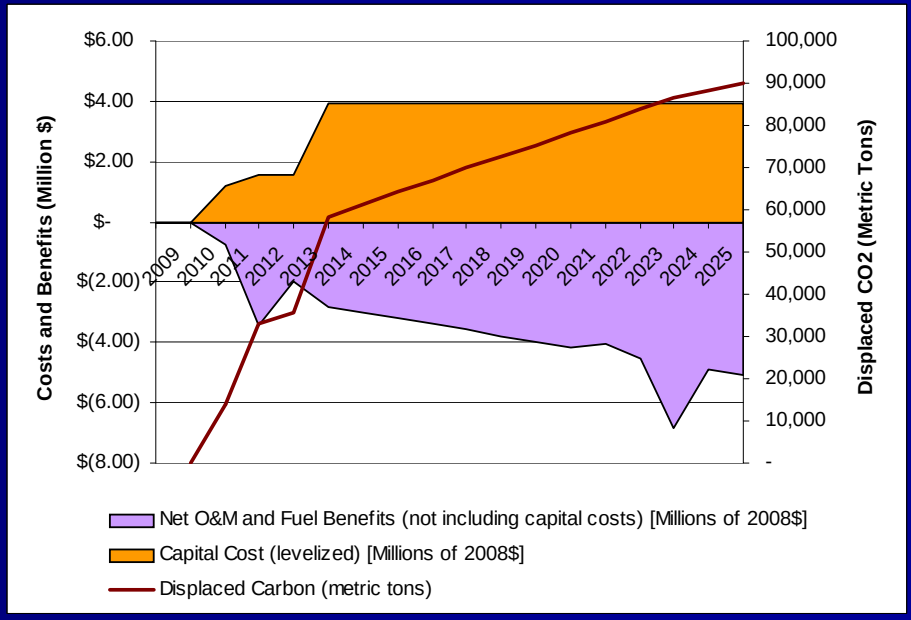
ES&D 1 – Results

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

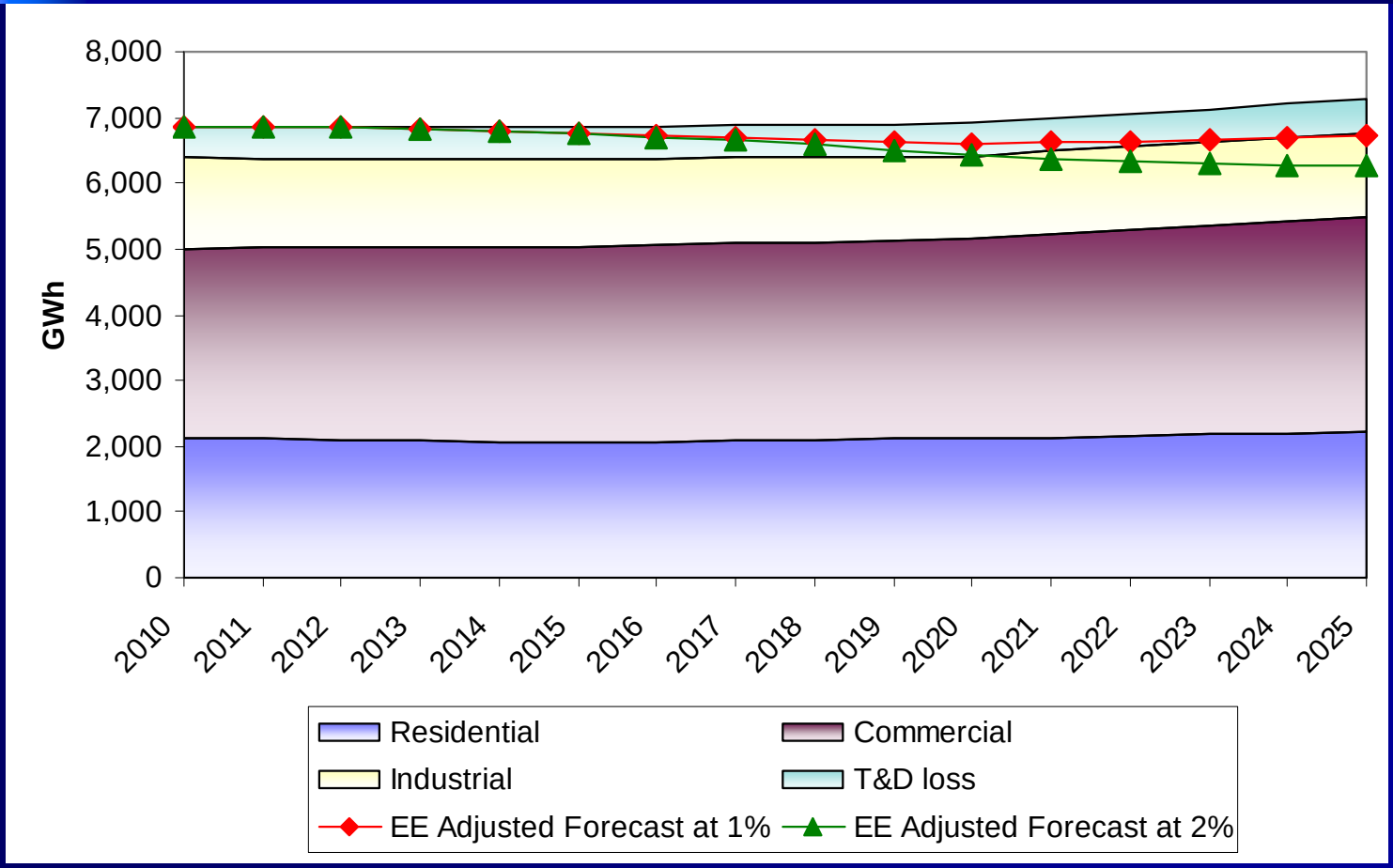
Scenario	2010	2015	2020	2025
1% per year	0.20%	3%	8%	11%
2% per year	0.20%	3%	11%	18%

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.

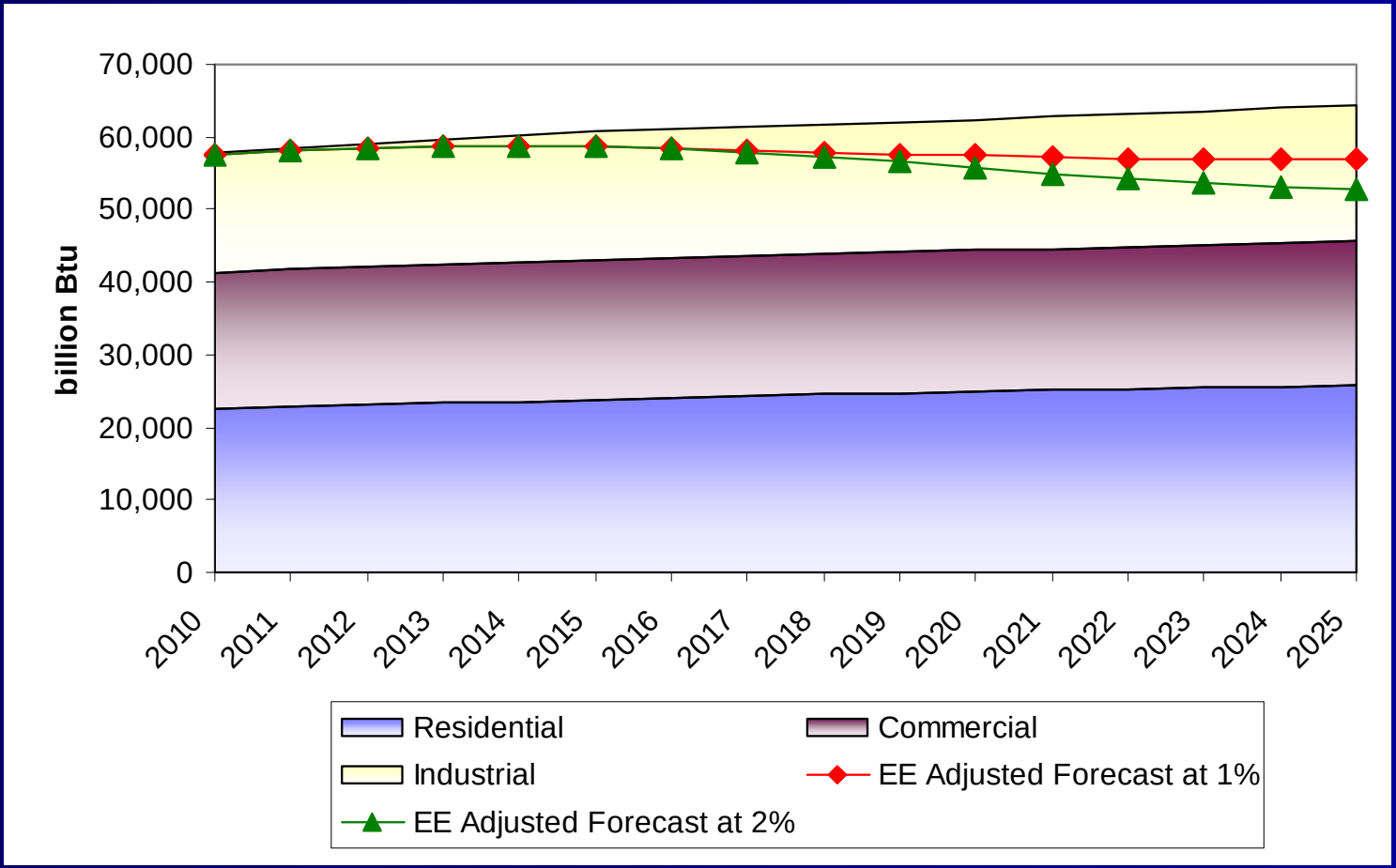
Source: K. Takahashi and D. Nichols 2008.

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

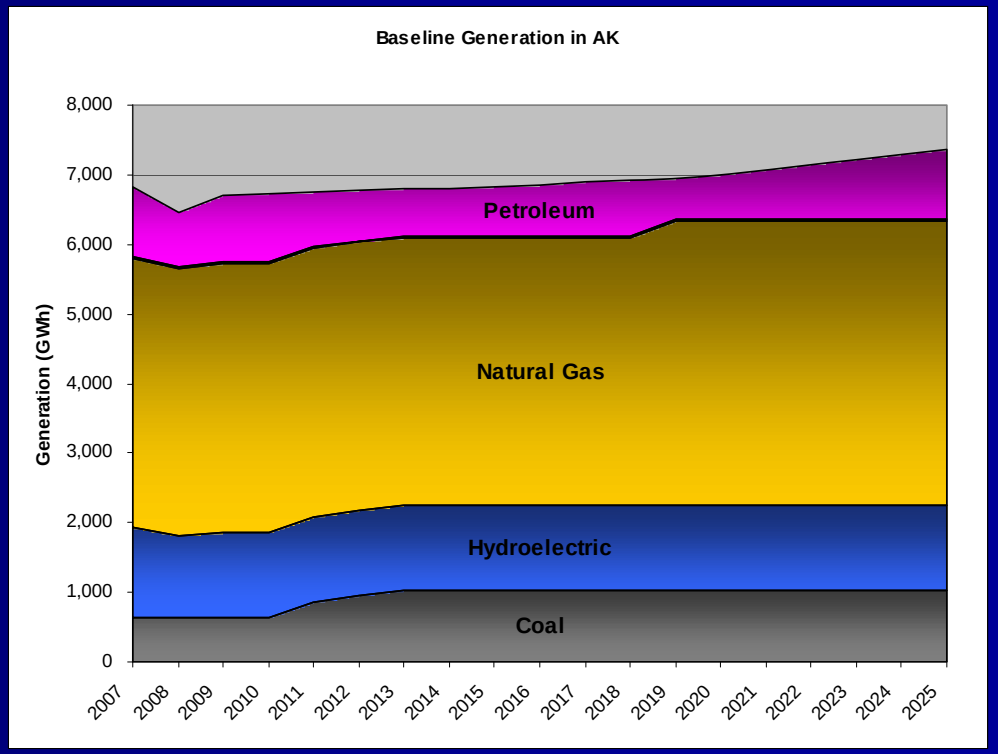
- Quantification Method
- Assumptions
- Results
- Analysis

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

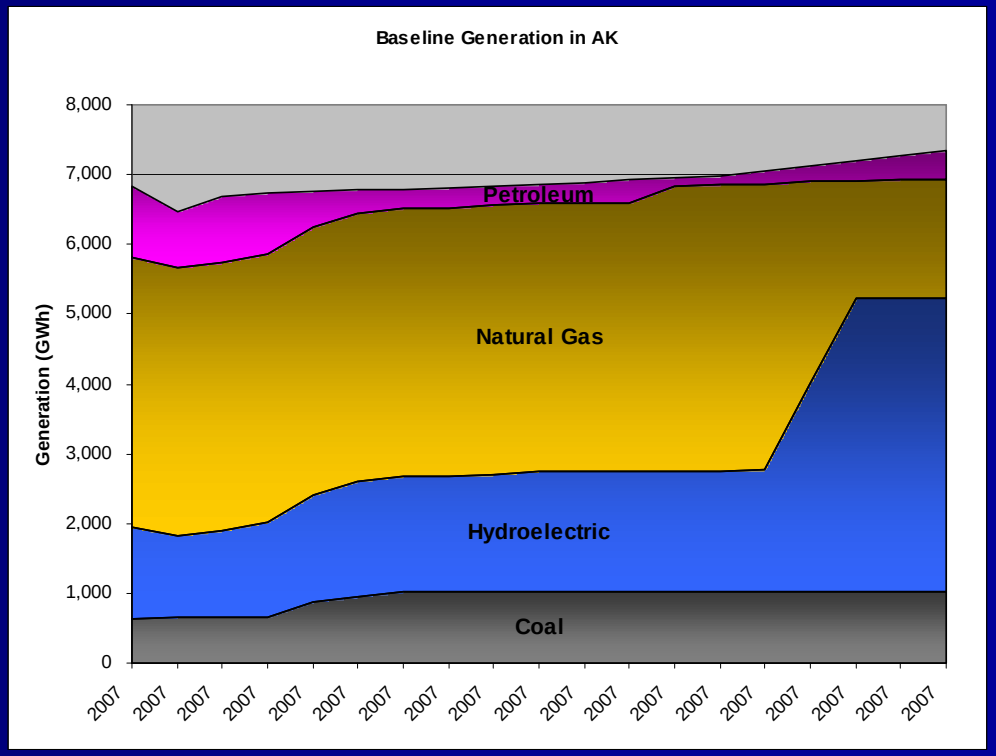
- Baseline fuel mix changes with discrete projects known or expected by TWG members:
  - HCCP comes online 2011-2013 (50 MW, displaces petroleum)
  - Fairbanks obtains a natural gas supply in 2019 (60 MW fuel switch from petroleum)



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.

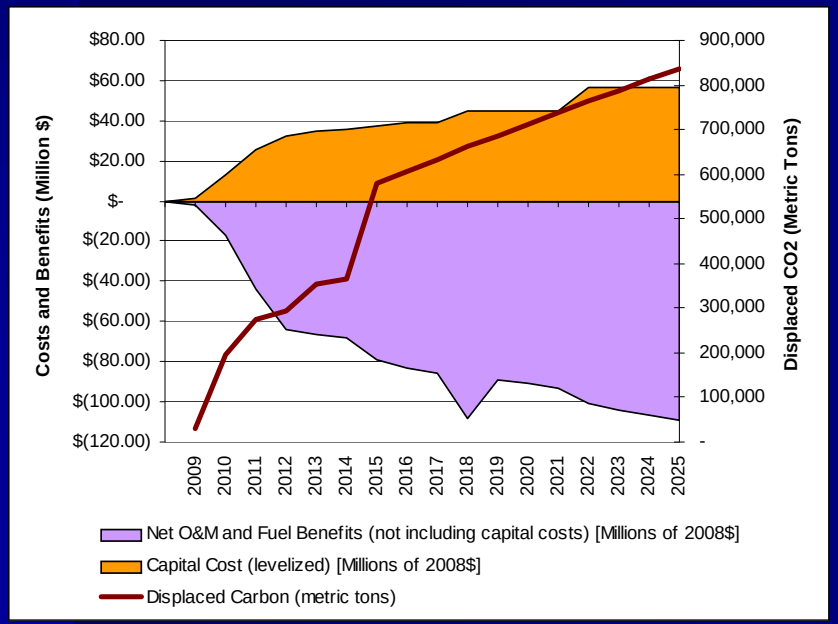


ES&D 3 Fuel Mix (Generation, GWh) in AK
EIA for 2007 & 2008

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