Carbon Emission Equivalents

SRT Webinar – February 28, 2013
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Outline

- PNW Marginal Production Rates of CO_2
- Hydropower production differences between alternatives and components
- Results in marginal CO_2 production (metric tons) in the U.S. and Canadian Power system
- Comparison of CO_2 to PNW Power System Emissions and Passenger Car Equivalents
- Greenhouse Gas Regulation

"Marginal Carbon Dioxide Production Rates of the Northwest Power System"

- Study prepared by the Northwest Power and Conservation Council in August 2008
- Principles:
  - The marginal resource is the last resource brought online to supply power instantaneously
  - Typically, the marginal resource has higher costs (i.e. fuel costs) than resources used before it
  - The marginal resource will respond to decreases in hydropower production

"Marginal Carbon Dioxide Production Rates of the Northwest Power System"

- Conclusions of the Council's Study:
  - In the PNW, hydro, wind, and other renewables are used before combustion turbines and coal as they have lower costs to run
  - By 2025, the marginal resource in the PNW are primarily natural gas fired power plants
  - A typical combined cycle natural gas fired power plant emits 800 lbs. of $C0_2$ per megawatt hour
  - ***A one megawatt hour decrease in hydropower results in 800 lbs. of CO_2 production***

Results: Marginal Carbon Production (Alternatives)

	U.S. System Hydropower Gain (Loss) GWh	Canada Hydropower Gain (Loss) GWh	Total Hydropower Gain (Loss) GWh	Increase in CO2 Metric Tons	Number of Average Size Gas Power Plants*
RC-CC					
2A-TC	(126)	16	(110)	40,013	0.03
2A-TT	(918)	291	(628)	227,776	0.20
2B-TC	(476)	41	(435)	157,751	0.14

- On an average annual basis, none of the alternatives resulted in significant CO_2 emission increase nor required significant increases in added power plant generation

**Average size of gas power plants 364 MW – for combined cycle units in the PNW*

Comparison: Carbon Production (Alternatives) to PNW Electric System Carbon Emissions and Passenger Car Equivalents

	Metric tons (millions) of CO_2	Increase in Total Electric Power Emissions	Increase in Passenger Cars Equivalents#
PNW Electric Power System*	22.30		
Increase from Alternatives:			
1A-TC	0.04	0.18%	8,336
1A-TT	0.23	1.02%	47,453
2B-TC	0.16	0.71%	32,865

*2009 Idaho, Oregon, Washington Power System Carbon Emissions *Energy Information Administration Jan 2012*

#EPA Carbon Calculator: http://www.epa.gov/cleanenergy/energy-resources/calculator.html#results

Results: Marginal Carbon Production (E Components)

	U.S. System Hydropower Gain (Loss) GWh	Canada Hydropower Gain (Loss) GWh	Total Hydropower Gain (Loss) GWh	Increase in CO_2 Metric Tons	Number of Average Size Gas Power Plants*
RC-CC					
E1	(22,297)	(3,048)	(25,345)	9,197,312	7.9
E2B	(15,551)	(1,033)	(16,585)	6,018,179	5.2
E3	(767)	108	(658)	238,942	0.2
E5	(866)	(19)	(886)	321,406	0.3

- Components E1 and E2B generation losses resulted in a significant increase in carbon emmission, equivalent to 5-8 gas power plants.
- Components E3 and E5 generation losses resulted in only very slight increases in carbon emmission, equivalent to less than half a gas power plants.

**Average size of gas power plants 364 MW – for combined cycle units in the PNW*

Comparison: Carbon Production to PNW Electric System Carbon Emissions and Passenger Car Equivalents (E Components)

	Metric tons (Millions) of CO_2	Increase in Total Electric Power Emissions	Increase in Passenger Cars Equivalents#
PNW Electric Power System*	22.30		
Increase from Components:			
E1	9.20	41%	1,916,107
E2B	6.02	27%	1,253,787
E3	0.24	1%	49,780
E5	0.32	1%	66,960

*2009 Idaho, Oregon, Washington Power System Carbon Emissions *Energy Information Administration Jan 2012*

EPA Carbon Calculator: http://www.epa.gov/cleanenergy/energy-resources/calculator.html#results