MEMORANDUM

To: *Technical Leads, Washington State Climate Action Team (CAT) process*:
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From: *CAT Technical Coordination Team*:
Hedia Adelsman, Dept of Ecology
Michael Lazarus and Roel Hammerschlag, SEI/CCS

Re: Common approaches for quantification of draft CAT/IWG actions

Date: September 15, 2008

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1. Introduction

This memo summarizes some recommended approaches for quantifying the impacts on Washington greenhouse gas (GHG) emissions of actions being considered by the Implementation Working Groups (IWG), and the net costs of same. As we are all aware, there are many nuances and complexities to estimating and attributing impacts and costs/savings to proposed actions, and an abundance of different potential methodologies. There are also state efforts beyond the CAT process that involve analysis of GHG emissions and economic impacts of policies, measures, investments, and actions.

This memo is specifically focused on the CAT process, and its rapid timeline, with the recognition that the Department of Ecology is engaged in a broader and longer-term coordination effort, of which the CAT process is just one part.

This memo is organized as follows:

2. <u>Accounting Standards</u>

2.1 Core Principles

- Reflect “best practice” in analysis methods, and maximize accuracy to the greatest extent possible, given data and other constraints. Rely where appropriate on reviewed sources.

- Provide transparency in methods and assumptions.
  - Clearly document your methods and assumptions.
  - Where possible use a central repository (*e.g.* Central Desktop or a Microsoft *Sharepoint* site) for technical documentation, especially calculations spreadsheets.
  - Identify, if not necessarily quantify, key uncertainties.

- Ensure consistency and/or compatibility of methods and assumptions, to the extent possible, across options and sectors.

- Document and justify proposed departures from the methods and data used in the 2007 CAT process core documents:
  - **The final report**: *Leading the Way: A Comprehensive Approach to Reducing Greenhouse Gases in Washington State, Recommendations of the Washington Climate Advisory Team*;[1]
  - **The state inventory**: *Greenhouse Gas Inventory and Reference Case Projections, 1990-2020*;[2] (hereinafter "*Inventory & Projections*") and
  - **Policy option documents for each TWG**.[3]

- Where you use approaches or assumptions not prescribed in this memo, actively seek peer review from the other technical team members. Also seek out input from other technical team members when you see the opportunity for synergy, or potential for inconsistency, with other IWG/CAT technical analyses.

2.2 Accounting Period

Projections of IWG measure impacts shall cover the period January 1, 2008 to December 31, 2020. Where possible, project impacts (whether environmental, social or economic) for each calendar year in the accounting period, but at a minimum for the years 2012 and 2020.

Note that the accounting period may be extended to 2025 or 2030, so it would be wise to do estimates out to 2030 wherever it is feasible.

2.3 Definition of the Reference Case

Since emission reduction and cost-effectiveness assessment are based on differences from a business-as-usual or as-expected baseline, the use of a consistent reference case is essential. The 2007 CAT analysis was based on set of assumptions regarding future economic and demographic growth, existing policies, and other factors that influence "business-as-usual" GHG trajectories through 2020, as detailed in *Inventory & Projections*. However, several developments in the past year have changed that outlook, most notably: a) higher energy prices and projections; b) their impact on energy use and supply, as well as on economic factors; and c) the impact of federal legislation adopted in 2007, in particular, the Energy Independence and Security Act of 2007.

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1 Available at: http://www.ecy.wa.gov/climatechange/CATdocs/020708_InterimCATreport_final.pdf.

2 Available at: http://www.ecy.wa.gov/climatechange/docs/WA_GHGInventoryReferenceCaseProjections_1990-2020.pdf.

3 Available at: http://www.ecy.wa.gov/climatechange/cat_twg_overview.htm.

2.3.1 Parameters Reported in the *Inventory & Projections*

The following Reference Case parameters (1990-2020) are reported in *Inventory & Projections*, and shall continue to be used for calculations by the IWGs:

Key Parameter	1990-2005	2005-2020	Sources
Population	1.7%	1.5%	The State of Washington, Office of Financial Management
Employment			Washington State Employment Security Department
Goods	0.8%	1.1%	
Services	2.1%	0.9%	
Electricity Sales	-0.6%	1.3%	EIA data for 1990-2005, Projections based on information from Northwest Power and Conservation Council and Utility plans (see Appendix A)
Vehicle Miles Traveled	1.9%	2.0%	Washington State Department of Transportation

Source: *Inventory & Projections*, p. 13

Similarly, the following growth rates for electricity sales should be applied by sector:

	Historic		Projections	
	1990-2000	2000-2005	2005-2010	2010-2020
Residential	1.4%	0.1%	0.9%	0.9%
Commercial	2.7%	0.0%	2.3%	2.3%
Industrial	-1.4%	-9.0%	0.9%	0.9%
Total	**0.6%**	**-2.9%**	**1.4%**	**1.3%**

Source: *Inventory & Projections*, p. A-9

The above growth rates are based on projections as of mid-2007. Since that time, WA DOT has revised its VMT growth projections downward, largely in response to high fuel prices. In contrast, the draft Sixth Northwest Power and Conservation Council Plan forecast of electricity sales suggests slightly higher overall electricity sales growth, especially in the residential sector.

These changes, and the likelihood that similar adjustments will continue to occur in coming months given the current volatility of fuel prices, underscore the inherent uncertainty of emissions and emission reduction estimates. Nonetheless, the effect of changing growth rate projections is likely to be relatively limited for most CAT actions being analyzed.[4] In order to maintain consistency between estimates of the emission reductions associated with CAT actions and the statewide emission estimates and projections with which they are compared, it is thus recommended that the values from the *Inventory & Projections* document continue to be used.

[4] For example, a decline in growth rate of 1% per year (in say, vehicle miles travelled, from 2% to 1% per year) over the 2008-2020 period would result in an 11% reduction (in VMT). Therefore, if they are in fact 1% per year too high, using the current growth rates for actions that are directed at reducing overall VMT would overstate emission reductions by about 10%.

These estimates can then be fully and consistently updated at the time of the next inventory/projection update, currently expected to be completed in 2010.

2.3.2 Parameters Affected by Developments in 2007-2008

The following Reference Case parameters (1990-2020) are updates based on recent changes in economic outlooks, and shall replace any assumptions inferred from *Inventory & Projections*.

Fuel cost

Fuel costs shall be scaled to the values reported in the U.S. DOE's Annual Energy Outlook 2008, revised early release.[5] The relevant values are copied below for convenience; the units are 2006 dollars per million Btu, but keep in mind that in most cases the units will be unimportant as these numbers will be used by TWGs to scale changes or growth over time from a known quantity in (most likely) 2005.

	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
Residential																
Fuel Oil	16.98	17.94	19.32	21.92	17.86	17.21	16.50	15.80	15.12	14.84	14.27	13.84	13.86	14.00	14.16	14.27
Natural Gas	12.85	13.40	12.52	12.66	12.65	12.15	11.86	11.67	11.46	11.30	11.20	11.17	11.28	11.38	11.48	11.39
Commercial																
Fuel Oil	13.82	14.59	16.63	19.03	15.86	15.24	14.82	14.10	13.52	13.38	12.88	12.44	12.46	12.63	12.96	13.24
Natural Gas	11.53	11.50	10.75	11.08	11.15	10.59	10.31	10.14	9.93	9.77	9.68	9.66	9.76	9.87	9.97	9.91
Industrial																
Fuel Oil	14.50	15.33	17.18	19.96	16.30	15.72	15.70	14.92	14.44	14.40	13.95	13.53	13.56	13.75	14.22	14.62
Natural Gas	8.37	7.66	7.04	7.42	7.60	7.21	6.89	6.69	6.46	6.27	6.15	6.10	6.16	6.23	6.29	6.21
Coal	2.22	2.34	2.42	2.49	2.48	2.42	2.39	2.35	2.34	2.32	2.31	2.29	2.29	2.28	2.28	2.28
Transportation																
E85	23.89	24.81	25.49	24.88	25.16	23.58	22.11	23.21	21.21	18.96	17.61	17.64	16.55	16.72	18.54	18.15
Gasoline	19.28	21.19	22.52	24.51	22.71	21.23	20.69	20.07	19.51	19.40	18.80	18.30	18.40	18.61	19.16	19.64
Jet Fuel	13.30	14.83	15.00	15.74	16.27	15.77	15.50	14.72	14.08	13.74	13.16	12.75	12.82	12.97	13.13	13.27
Diesel Fuel	18.09	19.72	20.49	22.77	20.33	19.68	19.38	18.58	18.11	18.09	17.65	17.18	17.19	17.35	17.86	18.26

Electricity avoided cost

Electricity avoided costs shall be scaled to the values reported in the U.S. DOE's Annual Energy Outlook 2008, Supplemental Tables for Census Division 9.[6] The relevant values are copied below for convenience; the units are 2006 dollars per million Btu, but keep in mind that in most cases the units will be unimportant as these numbers will be used by TWGs to scale changes or growth over time from a known quantity in (most likely) 2005.

	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
Residential	31.25	34.20	32.77	33.15	33.33	32.66	31.78	31.13	31.15	31.29	31.30	31.28	31.35	31.41	31.47	31.39
Commercial	31.05	33.03	30.87	31.41	31.44	30.64	29.51	28.82	28.27	27.93	27.80	27.73	27.71	27.68	27.66	27.45
Industrial	22.38	23.11	21.58	22.22	22.20	21.69	20.97	20.45	20.11	19.93	19.86	19.81	19.82	19.83	19.85	19.71
Transportation	29.13	27.63	28.01	28.84	28.80	28.08	27.12	26.45	25.96	25.68	25.59	25.54	25.53	25.52	25.52	25.34

5 Available at: http://www.eia.doe.gov/oiaf/aeo/.

6 Available at: http://www.eia.doe.gov/oiaf/aeo/supplement/index.html.

2.3.3 Impacts of the 2007 Energy Bill

Impacts of the Energy Independence and Security Act of 2007 have been incorporated into the Annual Energy Outlook values reported above for fuel costs. It is as yet unclear whether this is also the case for the Census Division 9 Supplemental Tables for electricity costs. Generally a review of the energy bill's impacts on WA emissions through 2020, and interaction with prior estimates for WA existing policies and CAT options, is warranted. This is a sophisticated analysis probably impossible within the time constraints of the IWG process.

2.4 Interaction/Aggregation of Impacts across Options

Options may overlap in terms of coverage, both within and across sectors. In order to avoid double counting of GHG reduction potential and costs (for example, where more than one option addresses the same emissions source), interactive effects should be estimated where possible, and emissions reduction totals will reflect these overlaps. In other words, the total emissions reductions for the state will be lower than the sum of the results for individual options.

Provide early indication of interactions that need to be quantified and planned approaches to Hedia Adelsman (ECY) and Michael Lazarus (CCS).

3. <u>Measuring GHG Reduction Potential</u>

3.1 Definition and Units

GHG reduction potentials shall be reported in million metric tons of carbon dioxide equivalent (MMtCO_2e) using Intergovernmental Panel on Climate Change (IPCC) 100-year global warming potentials (GWP) from the Second Assessment Report.[7] Specifically, the GHGs to be included and their GWPs are:

Gas	100-year GWP
Carbon dioxide (CO_2)	1
Methane (CH_4)[b]	21
Nitrous oxide (N_2O)	310
HFC-23	11,700
HFC-125	2,800
HFC-134a	1,300
HFC-143a	3,800
HFC-152a	140
HFC-227ea	2,900
HFC-236fa	6,300
HFC-4310mee	1,300
CF_4	6,500
C_2F_6	9,200

[7] Values from the Second Assessment Report are used to be consistent with the US EPA National GHG inventory and the United Nations Framework Convention on Climate Change.

C_4F_{10}	7,000
C_6F_{14}	7,400
SF_6	23,900

Source: IPCC (1996)

3.2 Reference Standards

Where emission factors or calculation methodologies are not specified in this document, draw them instead from the following documents, by order of preference:

1. The Climate Registry, *General Reporting Protocol*, Version 1.1, May 2008.[8]

2. U.S. EPA, *Inventory of U.S. Greenhouse Gas Emissions and Sinks: 1990-2006*, April 2008.[9]

3. International Standards Organization, *Greenhouse gases -- Part 1: Specification with guidance at the organization level for quantification and reporting of greenhouse gas emissions and removals*, ISO 14064-1:2006, March 2006.[10]

4. Intergovernmental Panel on Climate Change, *2006 IPCC Guidelines for National Greenhouse Gas Inventories*, 2006.[11]

3.3 Location of Emissions

GHG reductions associated with IWG actions should be estimated regardless of the physical location of the emissions reductions. For instance, a major benefit of recycling is the reduction in material extraction and processing (e.g. aluminum production). While a policy option may increase recycling in Washington State, emissions may decrease in other states or countries where materials are produced. Such policy options contribute to overall global emission reductions; at the same time, emission reductions that occur outside the state due to state actions will not show up in future state emissions reporting or inventories.

Separate reported GHG reductions into in-state, regional (e.g. Western North America or WCI), or global reductions, depending on where analysis and judgment suggests the majority of emission reductions will occur. Where regional or global are indicated, indicate the rationale. For example, many recycling emission reductions are likely to fall in the global bin, while electricity energy efficiency reductions are likely to fall in the regional bin.

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8 Available at: http://www.theclimateregistry.org/protocols.html

9 Available at: http://www.epa.gov/climatechange/emissions/usinventoryreport.html

10 Must be purchased at: http://www.iso.org/iso/iso_catalogue.htm; cost is CHF 96.00.

11 Available at: http://www.ipcc-nggip.iges.or.jp/public/2006gl/index.html

3.4 Life-cycle Analysis for Biofuels, Waste, and Building Materials

Life-cycle analysis should applied wherever emissions impacts upstream (e.g., production, extraction) or downstream (e.g. waste disposal) from a specific activity constitute a significant fraction of a policy option's emissions impacts, and where data from existing studies are sufficient to enable this estimation. For example, lifecycle analysis should be used to estimate the emissions benefits of biofuels relative to the fossil fuels they might substitute for. Similarly, actions that significantly affect the stocks or flows of building materials or harvested wood products may require the use of life-cycle methods.

If data from existing studies to support life-cycle GHG assessment are not available, but life-cycle GHG impacts are believed to be significant, they should be reported qualitatively in the External Benefits category.

Life-cycle analysis is subject to considerable uncertainty, with different studies occasionally suggesting quite different implications for actions such as paper recycling, shifting the choice of building materials, or promoting biofuels. Since such actions may stretch across working groups coordination here will be essential, ideally to establish consistent methodologies, and at a minimum to understand how different methods and assumptions affect the results. Transparent statements of all methodologies used are critical when life-cycle assessment is involved. Because life-cycle analysis includes indirect emission, these calculations could lead to some emissions or emissions reductions being counted twice. Coordination across work groups will be needed to accurately distribute emission reductions to individual strategies. For example, reducing the energy to produce construction materials could be considered an improvement in construction or an improvement in industrial processes.

3.4.1 Biofuels

Continue to use the life-cycle GHG reductions for biofuels that formed the basis for reduction estimates of recommended CAT actions. Specifically, these are:

Fuel/Technology	Blend	Feedstock	Reduction (GHGs per mile)*	Normalized Reduction (100% blend)
Ethanol	E10	corn	1.5%	15.0%
Ethanol	E10	cellulosic	7.2%	72.0%
Ethanol	E85	corn	17.6%	20.7%
Ethanol	E85	cellulosic	83.2%	97.9%
Biodiesel	B20	soy	9.9%	49.5%
Biodiesel	B20	canola	11.2%	56.0%
Biodiesel	B20	palm	12.0%	59.9%
Biodiesel	B100	soy	53.9%	53.9%

* Ethanol reductions estimated relative to gasoline; biodiesel reductions estimated relative to diesel fuel. Actual reductions depend on many factors in the production, distribution, and use of fuels.

Source: GREET v1.7 outputs

3.4.2 Embodied Emissions of Building Materials

The embodied emissions associated with the use of building and other materials can be significant, as are the opportunities to reduce emissions through decreased use and substitution for more emissions-intensive materials by less-emissions intensive ones. The assessment of embodied emissions is complex, based on life cycle assessment and highly sensitive to assumptions regarding the provenance, manufacturing, and fate of materials. At present, there are several tools and studies available to assist in the assessment of embodied emissions. These include, among others:

- ATHENA® *Impact Estimator for Buildings*, http://www.athenasmi.org/tools/impactEstimator/index.html.
- U.S. NIST *BEES* (*Building for Environmental and Economic Sustainability*) version 4.0, http://www.bfrl.nist.gov/oae/software/bees/.
- *Construction Carbon Calculator*, www.buildcarbonneutral.org.
- Consortium for Research on Renewable Industrial Materials (CORRIM), http://www.corrim.org/.
- Perez-Garcia, J., B. Lippke, D. Briggs, J. Wilson, J. Bowyer, and J. Meil. 2005. "The Environmental Performance of Renewable Building Materials in the Context of Residential Construction." *Wood Fiber Sci*. Vol 37 Dec. 2005: p3-17.

Given the uncertainties, complexity, and evolving tools in the field of assessing embodied emissions, no specific tool or methodology is recommended for the quantification of relevant CAT actions. It is recommended that working groups considering such quantification, review the available tools, select and use one or more deemed most appropriate, and indicate the rationale for this selection.

3.4.3 Waste Management

Life-cycle impacts of waste management options shall be evaluated with the U.S. EPA Waste Reduction Model (WARM), version 8.

3.5 Electricity Emissions

3.5.1 Marginal Emission Rate

A wide variety of actions could impact electricity use and the emissions associated with delivering this electricity. Unlike with specific fuels, however, there is no single method to calculate an emission factor for electricity. In fact, the range of methods that may be used can lead to a wide variance in emission factors and resulting emission reduction estimates, especially in a state like Washington, with its high proportion of low-cost, low-emission hydroelectricity. An average emission rate reflecting all electricity sources currently used in WA will be quite low. However, for this analysis, we are interested in the marginal or incremental impact on electricity generation that might result from specific actions, reducing demand or providing electricity from other sources. Thus a marginal emission rate is more appropriate. Such a rate should reflect the types of electricity generation sources that are avoided as the result of the suite of actions contemplated. In a state like Washington, the marginal emission rate will be considerably higher than the average emission rate, since it is unlikely that a significantly fraction of the hydroelectricity, at least from existing facilities, will be “on the margin”, as it is low-cost resource (water won’t be spilled over the dam as the result of greater efficiency or renewable energy).

For analysis of CAT actions, we recommend continuing to use the marginal emission rate of 0.5 $MTCO_2e/MWh$ for all years, as used for the 2007 CAT process. This value represents the notion that energy efficiency, renewable energy, and other actions reducing (or increasing, in the case of electric vehicles) the demand from conventional sources of grid power will largely displace (or increase) the generation of natural gas fired power (which typically has an emission rate in the range of 0.3 to 0.5 $MTCO_2e/MWh$. As noted in the 2007 Energy Supply TWG Priority Options Document, there is considerable uncertainty in how utilities and power suppliers would respond to a significant reduction in the need for conventional power sources, especially when considering a load-based perspective.[12] For the 2007 analysis, two possible response scenarios were considered: a) that utilities reduce their portfolio and purchases of *fossil fuel resources* (except cogeneration), proportionately to their current mix, and b) that utilities reduce *all resources* (except new renewable generation) in proportion to the existing mix of resources. The average of these two methods also yielded an emission factor close to 0.5 $MTCO_2e/MWh$.[13]

3.5.2 Transmission & Distribution Losses

Assume transition and distribution losses consistent with those used for the *Inventory & Projections*, as follows:

2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
8.9%	7.7%	7.6%	7.6%	7.5%	7.4%	7.3%	7.2%	7.2%	7.1%	7.0%	7.0%	7.0%	7.0%	7.0%	7.0%

Source: <WA common assumptions Oct 18, 2007.xls>

[12] http://www.ecy.wa.gov/climatechange/interimreport/122107_TWG_es.pdf

[13] In June 2008, the Northwest Power and Conservation Council released a report examining *Marginal Carbon Dioxide Production Rates of the Northwest Power System.* This report found a marginal emission rate for the Northwest power system of 0.4 $MTCO_2e/MWh$ (0.8lb/kWh) in 2025. The report also found that a carbon cost of \$43/tCO_2 starting in 2012 might increase this rate to 0.9 $MTCO_2e/MWh$ (1.8lb/kWh), as this would increase the cost of coal power and make it the marginal resource during more hours of the year. (Note that if this carbon cost were the result of an overall cap and trade system, then it would become difficult to attribute emission savings to particular actions.) This analysis suggests that the 0.5 $MtCO_2e/MWh$ marginal emission rate recommended here is likely to be a reasonable approximation, and it highlights that the actual emissions impact of electricity-related policy measures will be dependent on a number of uncertain factors.

4. Measuring Cost

4.1 Definition and Units

Report net present value (NPV) cost (or cost savings) for the period 2008–2020 in 2006 constant dollars, using a 5% annual real discount rate.[14] Positive numbers represent options with net costs; negative numbers represent options with net cost savings. Include direct, economic costs from the perspective of the state as whole (e.g., avoided costs of electricity production and delivery rather than consumer electricity prices). Favor a bottom-up approach that is amenable to transparency and is capable of reflecting the costs (and cost savings) associated with individual policy options, in contrast to macroeconomic analysis, which aims to capture flows and interactions across all sectors of the economy.

Also report the cost per quantity of emissions reduced (or removed) in units of dollars per metric ton of carbon dioxide equivalent ($/t$CO_2$e). This figure represents the NPV cost over the entire period 2008-2020, divided by the cumulative emission reductions over the entire period 2008–2020. This practice reflects the general approach of cost-effectiveness, as widely applied to GHG mitigation policy options.[15]

4.2 Included Costs

- Capital costs levelized (amortized) where appropriate, e.g. for improved buildings, vehicles, equipment upgrades, new technologies, manure digesters and associated infrastructure, ethanol production facilities, mass transit investment and operating expenses (net of any saved infrastructure costs such as roads).

- Operation, maintenance, and other labor costs (or incremental costs relative to standard practice).

- Fuel and material costs, e.g. for natural gas, electricity, biomass resources, water, fertilizer, material use, electricity transmission and distribution.

- Other direct costs administrative and other costs (where readily estimated), such as the grid integration costs for renewable energy technologies, or the costs of administering an energy efficiency project, or of implementing smart growth programs (net of saved infrastructure costs).

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[14] Capital investments with lifetimes longer than 2020 should be represented in terms of levelized or amortized costs, in order to avoid "end effects." Note that the 2008-2020 period is suggested to maximize consistency with the 2007 CAT report analyses. *[Further explanation may be needed here.]*

[15] See, for example, Section 2.4 of the IPCC Fourth Assessment Report, Working Group III, for more discussion of various economic analysis approaches. http://www.MDp.nl/ipcc/pages_media/AR4-chapters.html

4.3 Excluded Costs

- External costs such as the monetized environmental or social benefits/impacts (value of damage by air pollutants on structures, crops, etc.), quality-of-life improvements, or improved road safety, or other health impacts and benefits.
- Energy security benefits.
- Macroeconomic impacts related to the impact of reduced or increased consumer spending, shifting of cost and benefits among actors in the economy.
- Potential revenues from participation in a carbon market.

5. Measuring External Benefits

Note key, external benefits, as well as risk, qualitatively or quantitatively as existing studies or other information allow. Examples of external benefits include:

- Energy security benefits;
- Collateral reductions in traditional pollutants; or
- Health impacts.

Examples of external risks (risks that cannot be represented by dollar costs per Section 0 above) include:

- Ecosystem degradation/biodiversity loss; or
- Job or corporate income losses due to shifting macroeconomic patterns.

For some actions, you may be able to provide additional analysis, such as the financing requirements, state budget impacts, or other implications. These should be reported separately so that they are not confused with the cost terms to be reported as above.

6. Measuring Distribution of Impacts

Describe potential macroeconomic impacts, costs, or benefits that fall disproportionately on specific groups or actors. Distributional issues will usually be noted qualitatively, though quantitative estimates are encouraged if relevant existing studies or other information are available to inform estimates. Examples of distributional issues include benefits or costs that are distributed unevenly among:

- rural vs. urban populations; or
- poor vs. wealthy populations; or

- Native Americans vs. non-Native Americans.

7. Reporting and Review Process

7.1 Documenting Assumptions

Key data sources, methods, and assumptions should be presented in bulleted fashion, referring to the common factors noted here.

Use consistent terminology and present similar results in similar manners.

- Be careful to note that we are conducting cost-effectiveness or cost analysis, rather than cost-benefit analysis.

- Where there are other, non-quantified (or non-quantifiable) factors that may shift the results of cost-effectiveness analysis, acknowledge/identify them, and note the likely direction, if not magnitude, of their impact on the analysis.

7.2 Formatting

The results for GHG emissions and costs should be represented in table format as shown here:

IWG	Action	GHG Emission Reductions ($MMTCO_2e$)				NPV (2008-2020) ($ Million)	Cost Effectiveness ($/$tCO_2$)
		2012	2020	Cumulative (2008-2020)	Location		
	Short Description	x.x	x.x	x.x	In-state / regional / global	$xx	$xx

7.3 Protocol

Assuming that the guidelines described here, suitably revised, will work for all of the technical leads, there are three key points where IWG members will need to call on the coordination team (initially contacting Hedia Adelsman (ECY) and Michael Lazarus (CCS)):

- **Proposed changes** to *the Inventory & Projections*, or specific assumptions and methods described here. In these cases, email the coordination team with your proposed changes and we can seek input from other technical team members, discuss and revise this or other documents accordingly.

- **Additional technical issues** not identified here. Email the coordination team, and we will follow up.

- **Review of results of analysis across groups:** Ideally well in advance of wide distribution (date TBD), please email draft analyses to the technical team so that we can do a brief review and comparison across the working groups, and have a chance to iterate with you and ensure maximum consistency (or understand the reason for any inconsistencies) prior to the Sept 18-19 CAT meeting.

In addition, we would like to receive, by Sept 5, an early indication of which CAT actions are likely to be quantified, and such information is available, how the quantification will be done. A brief email from each IWG will suffice.