Energy Supply Technical Work Group
Summary List of Recommended High Priority Mitigation Options

#	Mitigation Option Name	Feedback from CAT
ES-1	Grid-based renewable energy incentives and/or barrier removal (originally 2.2)	Reviewed and affirmed by CAT during August 7th meeting
ES-2	Distributed renewable energy incentives and/or barrier removal (originally 2.3)	Reviewed and affirmed by CAT during August 7th meeting
ES-3	Efficiency improvements at existing renewable and power plants (originally 2.9 and 3.3)	Reviewed and affirmed by CAT during August 7th meeting
ES-4	Technology Research & Development, plus Technology-Focused Initiatives (originally 1.6, 2.8, and 3.4)	Reviewed and affirmed by CAT during August 7th meeting
ES-5	CCSR (including pre and post-combustion) incentives, requirements and/or enabling policies plus R&D (originally 5.1, 5.2, and 3.1a and b)	CAT called for revisions to Straw Proposal to ensure that actions do not overlap SB6001 (TWG revisions in progress)
ES-6	**Transmission system capacity, access, efficiency, and Smart Grid (originally 6.1, 6.2, and 6.5)**	**Straw proposal ready for CAT review**
ES-7	**Combined Heat and Power (CHP) and Thermal Energy Recovery and Use (originally 2.5)**	**Straw proposal ready for CAT review**
ES-8	*Incorporated into ES-5* (originally 3.1a)	

Note from TWG regarding future Natural Gas Prices and Supply:

Natural gas supply and price issues are not specifically addressed among the ES options, since direct opportunities for new GHG emission reduction initiatives appear somewhat limited. At the same time, it is important to recognize that if the availability of affordable natural gas supplies is limited, this could have negative consequence both for the state's economy as well as GHG emissions. It is recommended that complementary efforts be undertaken in other venues to address these concerns.

ES-6. Transmission System Capacity, Access, Efficiency, and Smart Grid

Based on ES Catalog Options 6.1, 6.2, and 6.5.

Mitigation Option Description

This option comprises three main elements: 1) increasing transmission system capacity for, and access to the grid by, clean energy technologies[1]; 2) improving efficiency and reducing line losses in the electric transmission and distribution system; and 3) providing support to "smart grid"[2] technologies that optimize the electricity grid (and unlock additional renewable resource alternatives) through devices that help manage electricity demand and supply;

Mitigation Option Design

1. **Provide financial incentives and remove barriers for implementing smart grid technologies that reduce GHG emissions.** Incentives may be necessary to counter any additional risk of bringing new smart grid solutions on line; incentives must be comparable for private and public utilities, as well as relevant non-utility actors. Utility regulators and managers should work together to identify smart energy technologies with ratepayer benefits such as improved reliability and efficiency, and environmental benefits in terms of reduced or avoided GHG emissions. Any barriers to adoption of these technologies, including potential regulatory challenges of retiring resources that have not been fully depreciated or that are still operating cost-effectively, need to be addressed. (Note that option RCI-5 suggests pilot smart meter programs that could complement this option.)

2. Provide incentives and remove barriers to improving the efficiency of the T&D system and components and to reducing line losses. [3] Regulations, incentives, and/or support

[1] According to the Wind Integration Study conducted by the Northwest Power Planning and Conservation Council, transmission capacity currently available to Northwest is only sufficient to support anticipated wind project development through 2009. Additional transmission capacity will be needed to achieve the 6000 MW of wind envisioned in the Council's plan and to open up new areas for wind development, which could provide access to better wind resources, diversify wind production, and as a result, lower the costs of wind generation and integration. Although transmission is regulated at the federal level, state policies should encourage such investments. http://www.nwcouncil.org/energy/Wind/library/2007-1.pdf

[2] Smart Grid technologies can involve, for instance, devices that "turn off" non-essential power when demand, and subsequent electricity prices, are high. Also technologies are used to co-ordinate a range of small scale distributed generation (including electric vehicles) and/or intermittent power, such as wind. For a discussion of Smart Grid technologies, see "Poised for Profit in Clean Energy Report: Powering Up the Smart Grid" www.climatesolutions.org/pubs/pdfs/PoweringtheSmartGrid.pdf

[3] Utilities use a variety of components throughout the transmission and distribution system to reduce losses. Increasing the efficiency of these components can further reduce losses. Vermont State, for example, offers a rebate to encourage users to install energy efficient transformers.

programs can be applied to achieve greater efficiency of transmission and distribution system components. Utility regulatory commissions should encourage utilities to identify opportunities to optimize transmission and distribution networks to minimize line losses through the replacement of or additions to existing facilities. *Policies should be designed to ensure that costs and benefits are equitably shared by utilities and customers, and such that incentives for public and private utilities are comparable.* [TWG may not be in agreement over wording of last sentence]

3. **Develop and apply procedures** to ensure that utilities can fairly and transparently assess "non-wires options", such as distributed generation or demand management, that can avoid or otherwise free up transmission and distribution capacity. Place these "non-wires" technologies on a level playing field when considering upgrades in traditional pole and wire infrastructure. (see Related Policies/Programs in Place, below, for examples on current pilot programs)

4. To help implement the above goals,

- Examine the Oregon Public Utility Commission's UM1129 decision as a possible approach to achieving the above goals and consider how similar approach can be applied to public utilities.
- Designate staff to track and recommend emerging technologies of potential benefit to stakeholders and ratepayers including distributed generation, combined heat and power, load management and end-use efficiency.
- Place a priority, where appropriate, on employing smart grid technologies such as voltage reduction to optimize delivery networks for minimal line losses.
- Work with public utility organizations, clean energy advocates and Bonneville Power Administration to overcome obstacles to local generation created by interconnection rules and losses of BPA power allocations.

The following recommendations were not discussed at the Aug 30th TWG:

5. **Investigate products and policies that make better use of existing transmission lines and transmission corridors.** Conditional firm and voluntary economic re-dispatch, that could enable new wind or other low GHG projects to come on line before new transmission lines are constructed, or extend the time until transmission construction is required. *Opportunity exists to increase transmission line carrying capacity as much as threefold through the implementation of new construction and retrofit activities on the transmission grid including incorporating advanced composite conductor technologies, capacitance technologies, and grid management software. Policy measures could provide incentives to utilities to upgrade transmission systems and reduce barriers to siting of new transmission lines.*

6. **Increase the capability, and reducing the costs, of integrating intermittent resources in the grid.** The cost of wind integration services can be reduced through generally four types of actions: (1) developing more cooperation between regional utilities to spread the variability of wind more broadly; (2) developing markets that will reward entities who choose to market their

surplus flexibility; (3) making more low-cost flexibility such as that provided by hydroelectric resources available; and (4) development and application of new flexibility technologies. Achieving these goals will require coordinated actions similar to those required to establish the Pacific Northwest Coordination Agreement of the Columbia River Treaty. Specifically, the Council's integration plan suggests that the:

- "four Northwest state regulatory commissions to review and amend as necessary regulatory policies to remove barriers to more efficient use of transmission for wind and other renewable resources, … and the
- Northwest Power and Conservation Council, working with BPA and other interested organizations, should establish a Northwest Wind Integration Forum to facilitate implementation of the actions called for in this *Action Plan.*"

7. This option could also include **reductions in use and leakage of SF_6** from distribution system transformers, plus efficient transformers and other materials and equipment.

- **Goals:** TBD

- **Timing:**
- **Coverage of parties**
    - Electric Utilities
    - Utility and Transportation Commission
    - Bonneville Power Administration
    - Northwest Power and Conservation Council
    - Northwest Power Pool or other regional transmission authorities and regional control area operators.
    - Coordinate with:
        - Northwest Energy Technology Collaborative
        - Northwest Center for Electric Power Technologies
        - Western Regional Climate Action Inititive
        - Energy Facility Site Evaluation Council
- **Other:**

Implementation Mechanisms

Related Policies/Programs in Place

BPA NonWires Solutions – is a highly advanced effort to replace costly transmission line upgrades with smart energy technologies.

Pacific Northwest GridWise Testbed – intends to provide an institutional structure for developing and hosting smart grid demonstration projects.
WA CTED is developing a SmartGrid Roadmap for Washington

Type(s) of GHG Reductions

There are emissions reductions related to improved operations of electric power generation and improved access for renewables.
(Depending on whether it's included here: Emissions of SF_6 related to electric power transmission and distribution from WA GHG inventory, currently about 0.3 MMtCO2e.

Estimated GHG Savings (in 2020) and Costs per $MtCO_2e$

- **Data Sources:**
  - Poised for Profit in Clean Energy Report: Powering Up the Smart Grid, by Patrick Mazza
  - Northwest Wind Integration Action Plan, conducted by the Northwest Power and Conservation Council: http://www.nwcouncil.org/energy/Wind/library/2007-1.pdf
  - Smart Meters: Commercial, Policy and Regulatory Drivers, by Gill Owen and Judith Ward, which reports on experience with smart meters in the UK, and reports one to several percent net savings in electricity consumption from implementation of smart meters, as well as peak reduction impacts. Dated March 2006, Published by Sustainability First, and available as http://www.sustainabilityfirst.org.uk/docs/smart%20meters%20pdf%20version.pdf
- **Quantification Methods:**
- **Key Assumptions:**

Contribution to Other Goals

- **Contribution to Long-term GHG Emission Goals (2035/2050):**
- **Job Creation:** The Poised for Profit II Partnership found at least 225 companies in the Northwest representing 14% of the $15 billion global smart energy market. Additionally, the high regional concentration of software, semiconductor and wireless companies could find new opportunities and innovation in the energy sector.
- **Reduced Fuel Import Expenditures:**

Key Uncertainties

[Insert text here]

Additional Benefits and Costs

- Could eliminate $46-$117 billion in US peaking infrastructure investments over the next 20 years. (Poised for Profit in Clean Energy Report: Powering Up the Smart Grid, Climate Solutions, pg 8)

- Improves reliability of power grid
- Reduces losses from power lines
- Improves ability to utilize waste heat from power generation.
- Improves utilization of renewable generation

Feasibility Issues

- Issues associated with "access" and "planning" are subject to FERC jurisdiction and may not be appropriate to explore in the CAT venue.
- Reliance on new technologies which require extensive field testing.
- Can create shift from centralized power production to localized power production.
- Can have disruptive impacts on traditional utility business models that base revenue flows on gross throughput. Regulatory and ratemaking framework could create disincentives for adopting new technologies.

Status of Group Approval

TBD

Level of Group Support

TBD

Barriers to Consensus

TBD

ES-7. Combined Heat and Power and Thermal Energy Recovery and Use

Based on ES Catalog Option 2.5.

Mitigation Option Description

Combined heat and power (CHP) and thermal energy recovery and distribution can reduce GHG emissions by increasing the overall efficiency of fuel use, by reducing energy losses (where facilities are located near heat and power demands). These emissions benefits can be particularly significant where CHP and thermal facilities utilize low GHG fuels and feedstocks (e.g. biomass resources such as organic pulping byproducts). There are opportunities to recover thermal energy from CHP, industrial or municipal waste heat or renewable energy sources.[4] District energy systems provide a key infrastructure for conveying this "recycled" energy from the sources to energy consumers.

Policies can be adopted to encourage cost-effective CHP and waste heat recovery ("recycling") by ensuring that the full cost (including related electric energy transmission and distribution infrastructure costs plus transmission losses) of the alternative technology generation (typically a combined cycle plant) is compared to the cost of generating electricity at a CHP site (with the cost of heat sales to the thermal energy consumer covering any additional capital and operating expenses of the CHP project).

Mitigation Option Design

Recommended policies to promote CHP and thermal energy use, and ensure equitable comparison with electricity-only technologies, include:

1. Incentives to encourage, new CHP facilities, as well to expand and/or repower existing facilities. [*Current avoided costs are too low to incent CHP – TWG members are in discussion on wording of this sentence*]. The state should specifically consider establishing CHP tax credits under existing B&O tax system or form other sources to provide investment incentives. These incentives should be equally accessible to public as well as private power suppliers. Oregon's Business Energy Tax Credit (BETC) program provides a useful example for the State to consider.[5] Other potential financial incentives to implement CHP programs include:

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[4] A variety of industries, such as pulp and paper mills, saw mills, steel mills, and aluminum smelters, alternative fuel generation plants, cement plants and other facilities, produce waste heat at temperatures suitable for building heating. Additionally, municipal operations produce byproduct energy in the form of landfill gas (which can be combusted in CHP engines or turbines) or sewage effluent (which can be converted to usable heat with heat pumps).

[5] For example, in Oregon there is a $20 million per project tax incentives program established under BETC system. Tax credits can be sold to third parties, enabling public utilities to take advantage of the program as well. Examples of incentives for CHP for avoided cost calculations include: Thermal efficiency - $7/MWh; GHG savings of 1092

- Siting Incentive Programs;
- Low-cost bonding or loan guarantee programs;
- Tax credits for investment in CHP;

2. **Amended procedures for streamlined permitting of CHP and thermal energy recovery facilities, without compromising other environmental goals**. (Seek input from air agencies on this and the following recommendation.)

3. *When regulating air emissions and GHGs (including GHG trading under a cap and trade program) consider* ***basing requirements on useful energy output rather than fuel input, so as to capture the benefits of higher end-use efficiency****. [TWG members are discussing whether the performance standard used in SB6001 is sufficient to override the need for this point]*

4. Financial incentives to implement district energy thermal distribution infrastructure, waste heat recovery and renewable thermal energy systems through a variety of programs including:

- Property owner incentives to join waste heat based district heating systems;
- Low-cost bonding or loan guarantee programs;
- Tax credits for *investment* in thermal energy projects, and/or for *production* of recycled energy;
- Incentives for buildings to connect to district energy systems established to use or convert to renewable energy or recover waste energy; and
- Incentives to upgrade existing steam district energy systems to hot water district energy distribution to enhance system performance and improve efficiencies.
- Encouragement of public/private partnerships for thermal energy transmission and distribution infrastructure installation.

5. Pro-active information/education/outreach communications are needed to address the importance of removing barriers to optimizing existing and CHP generation and district energy development. We need to overcome real or perceived barriers about such important issues as avoided cost barriers, regulatory barriers, lack of integrated community energy planning, and lack of financial sector misunderstanding of these systems.

- **Goals:** The goal will be expressed as an achievable fraction of technical or economic potential (see below).
- **Timing:**
- **Coverage of parties:**
- **Other:**

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pounds of CO2 - $ 8/MWh; T&D incremental cost savings plus 8% loss - $ 10/MWhn; Credit for not needing hydro backup compared with wind- $12/MWh; Renewable fuel credit - $ 10/MWh; System security distributed energy credit – $5/MWh; Avoided fuel (natural gas price risk adjustment) UM 1129 (Oregon State Ruling)

Implementation Mechanisms

TBD

Related Policies/Programs in Place

PURPA, 1978.
B & O Taxes.
Business Energy Tax Credits (BETC) in Oregon.

Senate Bill 6001 includes language to recognize the output of cogeneration, which could be modified for other policy design elements:
Section 5 (6) The department shall establish an output-based methodology to ensure that the calculation of emissions of greenhouse gases for a cogeneration facility recognizes the total usable energy output of the process, and includes all greenhouse gases emitted by the facility in the production of both electrical and thermal energy. In developing and implementing the greenhouse gases emissions performance standard, the department shall consider and act in a manner consistent with any rules adopted pursuant to the public utilities regulatory policy act of 1978 (16 U.S.C. Sec. 824a-3), as amended.

Senate Bill 6631 – Thermal Energy Companies – Exemption from Utilities and Transportation Commission Authority.

House Bill 114 – Regulation of District Heating Systems and Services

Chapter 35.97 RCW – Heating Systems

UM1129 Oregon Public Utilities Commission final order issues August 20th, 2007

Types(s) of GHG Reductions

By recovering waste heat and reusing it, the equivalent amount of new fossil-based energy will be displaced resulting in a more energy efficient energy production program and significantly less GHG production per MWh generated.

Estimated GHG Savings (in 2020) and Costs per $MtCO_2e$

- **Data Sources:**

  State wide IRP used to determine potential for CHP.

CHP market potential

- **Combined Heat and Power in the Pacific Northwest: Market Assessment** This 2004 report provides: 1) A comprehensive review of current CHP capacity in the Pacific Northwest including a database by each state; 2) A review of the economic and technical market potential for additional CHP; 3) A review of barriers and incentives to CHP; and

4) Recommended actions to increase CHP deployment.
http://www.chpcenternw.org/NwChpDocs/Chp_Market-Assessment_In_PNW_EEA_08_2004.pdf

- **Washington State CHP Technical Potential (2002-2022) MW:**

	Existing Facilities	New Facilities	Total	Economic Potential
Large Industrial	1,230	57	1,287	**High**
On-Site *Export*	*360* *870*	*57* *N/A*	*417* *870*	
Small Industrial	745	304	1,049	**Low to Moderate**
Commercial	2,885	2,473	5,358	**Low**
Resource Recovery	27		27	**Moderate to High**

Estimated Economic Potential (using 10-year payback):

731 MW (Business as Usual assumptions – current cost and performance specs, $3-4 /kW/month CHP Stand-by charges, no financial incentives)

2,847 MW (Accelerated Case assumptions – 2020 cost and performance specs, no stand-by charges, financial incentives equal to about 15% of capital costs)

Source: *Combined Heat and Power in the Pacific Northwest: Market Assessment* (Energy and Environmental Analysis Inc. 2004)

Northwest Power Council 5th Power Plan – estimates potential for CHP but need to consider the impacts of incentives and barrier removal on the CHP projections.

Technical Market Potential for CHP in the Pacific Northwest. This is an overview of CHP market potential by sectors.
http://www.chpcenternw.org/NwChpDocs/CHP_Market_Potential_in_PNW_Eng_Int_ORNL_rpt_07_2003.pdf

Waste Heat Recovery Market Potential

- Turbosteam looked at the waste heat potential of just 5 key waste heat potentials in a number of states including Washington. This report reviews the potential for generating electricity from waste heat processes and determined that 235 MW and 1553 GWh's annually could be achieved by 2020. This would result in an annual reduction of almost one million tCO2e. (Turbosteam Corporation 161 Industrial Blvd. Turners Falls, MA 01376)

  SEE WORKSHEET POSTED ON ENERGY SUPPLY TWG WEBSITE FOR AUGUST 30TH MEETING http://www.ecy.wa.gov/climatechange/cat_twg_energy.htm

- There does not appear to be a similar comprehensive analytical study of all the waste heat potential not used for electricity generation in Washington.

Other potential data sources

- Western Governor's Association 2006 (WGA 2006) *Task Force Reports from the Clean and Diversified Energy Initiative,*[6] Energy Information Administration,[7]; and, Energy Trust of Oregon.[8]
- **Quantification Methods:**
- **Key Assumptions:**

CHP is typically 1/3 more efficient than conventional stand-alone generating systems, where electric energy is generated and transmitted long distances from a centrally located generation facility. On-site CHP equipment is used to meet process system requirements, heating and cooling loads. The most efficient CHP systems provide generation efficiencies of 70-80%, a dramatic improvement over conventional power generation that currently averages 31% nationwide with associated reductions in GHG emissions. In addition, transmission and distribution infrastructure costs plus transmission losses are generally eliminated with CHP because these facilities are located on-site at the load centers.

Natural gas fuel savings for CHP include a an estimate by the California Cogeneration Council (testimony before the California Energy Commission) that 5,000 MW's of new CHP would reduce California's natural gas demands by 9%. The thermal efficiency for a CHP plant can be as high as 89%, significantly better than the 57% thermal efficiency associated with generating plant with a stand-alone steam boiler. [Need to check the above assumptions with the 2004 CHP report]

Contribution to Other Goals

- **Contribution to Long-term GHG Emission Goals (2035/2050):**
- **Job Creation:**
- **Reduced Fuel Import Expenditures:**

Key Uncertainties

No significant CHP capacity has been built during the past 15 years due to a number of important economic and policy barriers that need to be overcome:

- Dispatchabilty control by utilities can be a concern for the plant owner. Mutually agreeable dispatch protocols should be negotiated between the plant owner and the host utility.

[6] http://www.westgov.org/wga/initiatives/cdeac/index.htm
[7] http://www.eia.doe.gov/oiaf/aeo/assumption/index.html

[8] *A Comparative Analysis of Community Wind Power Development Options in Oregon*
http://www.oregon.gov/ENERGY/RENEW/Wind/docs/CommunityWindReportLBLforETO.pdf

- Grid interconnection standards and associated costs should be streamlined by Washington State where applicable.
- High transaction costs associated with CHP projects, high financing costs because of lender unfamiliarity and perceived risk,
- "Split incentives" between building owners and tenants, and utility-related policies like interconnection requirement, high standby rates, exit fees, etc.
- Consistent, long term clear incentives supporting CHP and waste energy recovery.

Need for a pro-active public information campaign to educate and inform the public of the benefits of CHP to Washington and the NW economy.

Additional Benefits and Costs

[Insert text here]

Feasibility Issues

[Insert text here]

Status of Group Approval

TBD

Level of Group Support

TBD

Barriers to Consensus

TBD