Energy Sector Technical Work Group
Policy Option Recommendations

Summary List of Policy Option Recommendations

	Policy Option	GHG Reductions ($MMtCO_2e$)			Net Present Value 2008–2020* (Million $)	Cost-Effective-ness ($/$tCO_2e$)
		2012	2020	Total 2008 2020		
ES-1	Grid-based renewable energy incentives and/or barrier removal	0.9	3.1	17.2	$668	$39
ES-2	Distributed renewable energy incentives and/or barrier removal	0.1	0.3	2.3	$119	$52
ES-3	Efficiency improvements at existing renewable and power plants	0.2	0.7	4.9	*Not quantified*	
ES-4	Technology Research & Development, plus Technology-Focused Initiatives	*Not quantified*				
ES-5	CCSR (including pre and post-combustion) incentives, requirements and/or enabling policies plus R&D	*Not quantified*				
ES-6	Transmission system capacity, access, efficiency, and Smart Grid	*Not quantified*				
ES-7	Combined Heat and Power (CHP) and Thermal Energy Recovery and Use	0.5	2.1	12.1	-$317	-$26
	Reductions from Recent Actions* **					
	I-937 Renewable Energy	0	4.0	15.9		
	SB-6001					
	Sector Total (including Recent Actions) adjusted for overlap**	**1.1**	**7.9**	**38.2**		

* All costs are reported in 2006 constant dollars, net present value is calculated using a 5% real discount rate. For more information on quantification methods, see http://www.ecy.wa.gov/climatechange/CATdocs/100407Policy_Option_Quantification_Methods.pdf.

****** Note that the emissions reduction and cost estimates shown for each individual option presume that each option is implemented alone. Many options interact extensively, as they target the reduction of energy use or emissions from the same sources. Therefore, if multiple options are implemented, the results will not simply be the sum of each individual option result. After individual option assessments were complete, a "combined policies" assessment was conducted to estimate total emission reductions, and to capture the overlaps among policies that are reported here.

*** For a discussion of recent actions (I-937, building codes, efficiency standards, etc.), see the memo "Contribution of Recent Actions to Washington State GHG Mitigation" on the CAT website. The estimates in this memo has been updated as part of the combined policies assessment noted above.

Note: Negative values in the Net Present Value and the Cost-Effectiveness columns represent net cost **savings** associated with the options. Also note that totals in some columns may not add to the totals shown due to rounding.

Combined Impact on Electricity Emissions Across Sectors

Electric Sector	GHG Reductions ($MMtCO_2e$)			Net Present Value 2008–2020* (Million $)	Cost-Effective-ness ($\$/tCO_2e$)
	2012	2020	Total 2008 2020		
Impact of ES Options	1.1	7.9	38.2		
Impacts of RCI and Transportation Options	3.3	7.8	56.6		
Total Impact on Electric Sector (including other policy options and Recent Actions)	**4.4**	**15.7**	**94.8**		

* All costs are reported in 2006 constant dollars, net present value is calculated using a 5% real discount rate. For more information on quantification methods, see http://www.ecy.wa.gov/climatechange/CATdocs/100407Policy_Option_Quantification_Methods.pdf.

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. Therefore, natural gas conservation, which is included in options both here (options that avoid electricity generation from natural gas fired facilities) and in the RCI TWG, may be critical. It is recommended that complementary efforts be undertaken in other venues to address these concerns.

The TWG considered a number of options, before selecting the seven options reported above as ones with the highest priority for TWG discussions and analysis. Several other options received significant interest from the TWG but were either not considered high priority or were considered elsewhere. The medium priority options are listed below, along with relevent initiatives that have been started or suggested:

Climate change education initiatives – the Department of Ecology is discussing next steps for developing over-arching climate change education initiatives

Green power purchases and marketing – this option was considered as part of the RCI TWG options.

Renewable energy development issues – The TWG included several implementation options under ES-1 and ES-2 but also acknowledged that there was limited ability for state actions

Carbon offsets markets to promote additional renewable energy development – this option is being considered in other discussions on market based mechanisms through the Western Climate Initiative (WCI)

Coal-to-gas production – the TWG had no further discussion of this option

LNG policies and infrastructure – the TWG felt that this should be covered by an approach for overall natural gas supply policies (see above).

Approach Used for Quantifying the Suite of Electricity Demand Options

This section discusses the quantification approach for integrating the options across all Technical Working Groups that have an impact on electricity demand.

Projecting the impacts of the mix of policy instruments (Energy Supply (ES), Residential, Commercial and Industrial (RCI) and Transportation – through plug-in hybrids) on electricity emissions is particularly complex in the case of Washington state. First and foremost among the reasons is the fact that WA electricity emissions are being tracked on a load (consumption) basis. While the impact of a mix of demand and supply-side policies on the sources and emissions of electricity production can be readily modeled and estimated, as is often done, the impact on the mix of resources that utilities use to supply electricity to WA consumers – what a load-based (or fuel-mix) approach seeks to measure – raises a number of additional uncertainties.

To the extent that new resources brought on as the result of the CAT's suite of ES, RCI and Transportation options, as well as recent actions – demand-side efficiency, power system efficiency, renewable energy, or new lower carbon coal or gas power – displace the need for new conventional resources (i.e. meet new load growth or any retirements), the analysis can be rather straightforward. However, our analysis reveals that this suite of options is sufficient to displace, or free up, some existing resources as well, possibly up to 20% on average across the state by 2020. The question is then, how would the market and utilities (and consumers) respond, and should we account for it in these estimates?

To examine this further consider two simple response options:

Scenario A: Utilities reduce their portfolio and purchases of *fossil fuel resources* (except cogeneration), proportionately to their current mix. This scenario accounts for hydro and nuclear being resources with low operating costs that utilities are unlikely to forego.

Scenario A does not reflect the fact that many utilities may have long-term contracts with fossil fuel generation facilities (that meet SB 6001 criteria) that they may be obligated or otherwise choose to hold for financial or strategic reasons. Utilities may also want to sell some of their hydro for use in other regions (especially if they too have load-based emission obligations).

Scenario B: takes an alternative approach where utilities reduce *all resources* (except new renewable generation) in proportion to the existing mix of resources. This scenario does not attempt to estimate the utilities' choices regarding reductions, noting that the cost-effective decisions will depend on currently unknown policy choices by Washington State and by neighboring states that trade electricity with Washington.

Note that, in each scenario, the renewable generation is sufficient to meet not only I-937 but also the extended renewables goal of ES-1, 20% of electricity demand in 2020.

While a more sophisticated analysis, with additional time and resources, might provide a more precise estimate, the basic uncertainties would remain. If, and as, a regional or national electricity emissions cap-and-trade system is designed, this will also provide greater clarity. For the purposes of this preliminary analysis, we recommend simply taking the average of the two scenarios above. While each of the two scenarios is plausible, it seems more likely that utilities and consumers will respond with a mixture of strategies for reducing existing resources.

The Energy Supply Options table above shows the updated results based on using the average of the reduction scenarios.

Appendix B at the end of this document shows the analysis of the two scenarios and the "average" scenario.

ES-1 Grid-based[1] Renewable Energy Incentives and/or Barrier Removal

See also ES-2 and ES-7 for Distributed Energy and CHP applications and ES-6 for Transmission Requirements

Mitigation Option Description

This policy option addresses the barriers to and possible incentives for expanding grid-based renewable resources. Renewable resources, be they grid-scale or small-scale, can provide an important contribution to achieving the overall emission targets for Washington State. "Barriers" in this context should be thought of as institutional barriers to developing cost effective renewable resources or actions that will lead to grid-scale renewable resource being more economic. Such institutional barriers may include wind integration, transmission policies, interconnection policies, or regulatory cost recovery policies, or economic policy drivers. Financial incentives help address barriers such as higher upfront costs of these technologies.

Mitigation Option Design

The policy's objective is to *add the maximum amount of feasible renewable generation to the Washington State grid, taking into account the economic, environmental impacts and system reliability constraints.* This option should remove any barriers in existing regulations that limit achievement of the goal. In addition, the option should consider financial incentives to activities that exceed any legal requirements (for example I-937) for grid-based renewables. I-937 and SB 6001 are prescriptive policy measures to increase renewables and/or decrease GHGs. The policy changes discussed below would make increasing the supply of new renewables more attractive regardless of prescriptive policies.

Potential design elements are described below:

<u>Reduce Regulatory Uncertainty</u>

<u>Development Costs:</u> Urge the WUTC to re-evaluate policies and procedures to ensure that they are compatible with the State Climate action goals and reflect current or expected future markets. In particular, provide guidance to utilities on how different types of prudently incurred development costs for renewable development and related infrastructure costs will be recovered in rates before utilities make such expenditures.

<u>Transmission Cost Barriers</u>: The state could provide no-interest loans or loan guarantees to utilities and non-utility generators for upfront transmission infrastructure charges related specifically to renewables.

<u>Barriers to Non-Utility Generators</u>: High interconnection costs, power dispatchability and regulatory barriers need also to be understood. Consider OR Public Utility Commission ruling under UM 1129, so that the state can provide direct tax savings for energy efficient CHP and processes that reduce GHGs, where the benefits to the non-utility generators are in $/MWH.

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[1] Grid-based means > 2 MW for these policy options, while Distributed Generation in ES-2 means up to 2 MW.

This will result in greater supply without burdening the utility customer with higher costs. See further notes under ES-7.

Incentives to directly support development of renewable resources This can be through some combination of tax supports to renewable developers, that may be bid into utility RFP's. The tax supports or other direct support could also be provided to utilities, that could be used for self-owned or non-utility renewable energy, which would help ensure energy and green attributes of such state-supported renewable resources stay in the state. Washington currently provides a sales tax exemption on renewable energy equipment for electricity generation. Additional potential incentives could include changes to Business and Occupation (B&O) taxes. Also consider if a system like Oregon's BETC could be modified for Washington or county level incentives, such as strategic investment plans.

Availability and Diversity of Resources: Legislative actions to expand geographical limits for renewables. For example, new polices could expand the requirements for renewable resources to account for energy coming to Washington from areas including Canada, Montana and California and renewable resources should be allowed from equally diverse and distant locations. This can be accomplished in one of two ways. One would be to update the geographic scope (eg, all of Western Electricity Coordinating Council) and renewable targets in the RPS (I-937)—this would not represent a consensus recommendation by the TWG. A second way would be to add another layer to the existing legislation.

Incentives and Other Strategies for Publicly Owned Utilities: Publicly-owned utilities do not operate for a profit, and therefore, incentives must be in the form of reduced taxes and/or zero-interest loans. At the state level, several taxes are assessed on a percent of retail sales, energy generated or materials purchased. These taxes could be reduced based on the percent of energy generation from renewable resources (e.g. if 15% of the retail load was served by renewable energy, then taxes would be reduced by an equal amount). In addition, sale taxes on materials purchased for eligible renewable energy projects could be waived. Finally, the state could develop a system of providing zero-interest loans for eligible renewable energy projects.

The state of Washington could provide public power utilities in the state with a renewable energy tax credit. For example, PUDs could receive a $0.003/kWh credit against the Public Utility Tax (PUT) for renewable energy delivered to retail customers, and a $0.001/kWh credit against the PUT for renewable energy credits ("Green Tags"). This could be a 10-year tax credit program per project.[2]

Incentives for Investor Owned Utilities: Utilities could be provided a rate of return kicker (or financial equivalent for purchases) for grid-based renewable resources and distributed generation.[3]

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[2] The current U.S. Tax Code provides tax incentives to private, for-profit utilities and developers to invest in renewable energy projects and new, efficient technologies. However, these tax incentives are not available to not-for-profit public power utilities because they have no federal income tax to offset. Congress passed the Renewable Energy Production Incentive (REPI) to provide public power with a comparable incentive. However, this program requires a congressional appropriation, which is severely under funded.

[3] For example, utilities could be allowed to earn at least 2% more on renewable resource rate base or equivalent expense, comparable to what was allowed at one time for conservation resources (One utility has recently applied to the UTC to capitalize a portion of their conservation expenditures. It is more common for utilities to expense their

Utilities could be allowed to retain revenue from selling RECs generated/acquired in excess of those needed to comply with the RPS. This would provide positive incentives to comply with physical RPS targets early and in the long-term. Such an incentive could be coupled with a process to provide a cap on expenditures.

Policies that target non-or low-emission resources through financial incentives should include financial safeguards to ensure that the most cost competitive resources are developed and that end-use customers are protected from paying unreasonable costs.

Increase the capability and reduce 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."

Jurisdictional authority may belong to FERC, the Bonneville Power Administration, and the North American Electric Reliability Council.

Goals: *Add the maximum amount of feasible grid-based renewables, taking into account the economic, environmental impacts and system reliability*

Timing:

Coverage of parties:

Other:

Implementation Mechanisms

None cited

Related Policies/Programs in Place

The Energy Independence Act (Initiative 937) passed by the state's voters in 2006 established renewable portfolio standards. Large utilities (25,000 customer and over) are required to obtain 15% of their electricity from new renewable resources, such as solar and wind, by 2020 (3% in

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conservation costs). Applying this type of incentive for renewables was considered in the previous legislative session for SB6001, but was not included in the final version. Concerns regarding the incentive included (1) public utilities not having a similar incentive, (2) providing incentives for mandated renewable investments, and (3) whether the incentives could be applied to other non-renewable investments.

2012, 9% in 2016 and 15% in 2020). Additionally, utilities must undertake cost-effective energy conservation. The RPS affects 95% of the electric generation in the state.

See ES-2 below. See Senate Bill 6001 (April 2007), section 4d) and 4e),

Incentives for Non-Utility Generators—Combined Heat and Power incentives are discussed under ES-7

Type(s) of GHG Reductions

CO_2, CH_4 and N_2O emission are reduced by avoided electricity generation from fossil fueled sources.

Estimated GHG Savings (in 2020) and Costs per Mt CO_2e

#	Policy	Reductions ($MMTCO_2e$)*			NPV (2008-2020) ($ Million)	Cost Effective-ness ($/t$CO_2$)
		2012	2020	Cumulative Reductions (2008-2020)		
ES-1	Additional Grid-based Renewables	0.9	3.1	17.2	$662*	$38*

* - Costs for renewable energy are highly dependent on cost and policy assumptions that have large uncertainties as noted below. The analysis of these uncertainties indicates that the cost-effectiveness of this option could range from net benefits to almost $60/ metric ton CO_2e, depending on the values assumed for capital costs of power plants and the potential extensions of the federal production tax credit.

Data Sources:

- Northwest Power Council 5th Power Plan (2005) and Biennial Monitoring Report (2007) – projections of costs and resource availability. http://www.nwcouncil.org/energy/powerplan/default.htm
- Integrated Resource Plans from Utilities http://www.nwcouncil.org/energy/Biennial/(P4-3)IRP%20Status.doc
- Union of Concerned Scientists. *The Washington Clean Energy Initiative: Effects of I-937 on Consumers, Jobs and the Economy.* http://www.ucsusa.org/clean_energy/clean_energy_policies/washington-clean-energy-i-937.html
- Renewable Energy Technology potential and costs from Western Governor's Association 2006 (WGA 2006) *Task Force Reports from the Clean and Diversified Energy Initiative,*[4] Energy Information Administration (EIA) Annual Energy Outlook (AEO),[5] National Renewable Energy Laboratory.[6]
- Draft RFP submitted by Puget Sound Energy to the Washington Utilities and Transportation Commission on October 11, 2007, "Table H.1 levelized.xls"

[4] http://www.westgov.org/wga/initiatives/cdeac/index.htm
[5] http://www.eia.doe.gov/oiaf/aeo/assumption/index.html
[6] http://www.nrel.gov/analysis/power_databook/

Quantification Methods: Analysis of the additional grid-based renewable generation involves the following steps: (1) estimate the maximum feasible renewable generation (2) identify the type of renewable generation that would most likely be used to meet the renewable energy requirements; (3) estimate the costs associated with each type of renewable technology; (4) estimate the type, cost and GHG emissions of the conventional generation that would be avoided by the increased energy efficiency and renewable energy; and (5) calculate the difference in costs and GHG emissions between the Additional Renewables scenario and the reference case (including I-937).

Costs and emission reductions are calculated as incremental to the reference case, which includes energy efficiency savings and renewable generation expected from I-937.

Key Assumptions:

- **Maximum feasible renewable generation**: As a placeholder we have used 20% of total sales (after accounting for energy efficiency from I-937) in 2020
- **Renewable energy mix** For this analysis it is assumed that the renewable mix will consist of 88% wind, 2% solar thermal and 10% biomass. These assumptions result in total capacity in 2020 (including I-937) of 6350 MW of wind (32% of estimated peak electricity demand), 300 MW solar thermal, and 360 MW of biomass. These assumptions do not imply limits on types of renewable resources in this option. Other renewable resources, such as geothermal, tide or wave, could also contribute to this mix depending on costs and decisions by utilities with little impact on the emission reductions that are estimated here.
- **Renewable energy costs:** The costs of the new renewable systems are based on those used in the EIA Annual Energy Outlook for 2007, except where better (e.g., updated or more local) data are available. The cost of renewable generation includes costs associated with connecting renewable technologies to the electric grid, and transmitting the renewable generation to loads (see below). The cost of wind generation also includes costs associated with integrating wind onto the system, as detailed below.
- **Production Tax Credit:** For qualifying renewable energy technologies, a federal tax credit of $18/MWh (inflated) is assumed for the first ten years of operation for new facilities that commence operation by the end of 2010. Following the UCS analysis we adjusted this value as follows "However, because the PTC is a credit on tax liability rather than a dollar of taxable income, this value does not account for its full tax benefits. To capture the additional tax benefits of the PTC, we assumed that it has a 20-year levelized value of 2.2 cents/kWh."[7]
- **Transmission Expansion Costs**: Since many renewable resources are located away from existing transmission lines, additional transmission would likely be needed. Since the precise nature of those additional costs would require calculations beyond the scope of the current analysis, we propose using an average cost of $80/kW for all new resources,

[7] http://www.ucsusa.org/clean_energy/clean_energy_policies/washington-clean-energy-i-937.html

based on a recent scenario analysis by the WGA CDEAC.[8] *Washington-specific estimates would be helpful if available.*

- **Reference Technology Costs:** Technology costs from Puget Sound Energy and Tacoma Power were utilized.

Technology Parameters							
	2012			2020			
Technology	Total Overnight Cost ($/kW)	Variable O&M (mills/ kWh)	Fixed O&M ($/kW)	Total Overnight Cost ($/kW)	Variable O&M (mills/ kWh)	Fixed O&M ($/kW)	Project Life (Years)
Biomass	2,155	3.0	50	2,066	3.0	50	30
Solar Thermal	2,959	0	52	2,784	0	43	25
Wind	2,000	0	31	2,000	0	26	20
All costs are expressed in year 2005 dollars and represent expectations as of late 2006. Source: Wind: Puget Sound Energy and Tacoma Power. *The Washington Clean Energy Initiative: Effects of I-937 on Consumers, Jobs and the Economy.*[9] Solar: Ken Dragoon, RNP (based on information from Tacoma Power) and Biomass: *Puget Sound Energy 2007 Integrated Resource Plan*[10]							

- **Wind Integration costs**: The cost of integrating wind at various levels of wind penetration is estimated based on studies by utilities in the Northwest (Avista, Idaho Power, Puget Sound Energy and Pacificorp) as compiled for the *Northwest Wind Integration Action Plan* (March 2007)[11]. In general, wind integration costs rise with increasing penetration of wind in the grid, as shown below. However, these estimates are subject to uncertainty – see discussion below under "key uncertainties."

Wind Capacity Fraction of System Peak	Average Wind Integration Cost ($/MWh of Wind Generation)
0%	0.0
5%	$3
10%	$6
20%	$8
30%	$12.5

- **Avoided costs:** $64.2/MWh Based on an analysis from Puget Sound Energy and TWG affirmation.
- **Avoided electricity emissions:** 0.5 metric ton CO_2/MWh, placeholder value (reflecting largely avoidance of natural gas) awaiting further consultation with NW Power and Conservation Council and TWG as analysis proceeds.

[8] CDEAC Transmission Report in the High Renewables case has an average incremental transmission cost of 80/kW compared to the reference case, i.e. 84,641 MW incremental capacity with additional transmission expansion costs of $6,786 million.
[9] http://www.ucsusa.org/clean_energy/clean_energy_policies/washington-clean-energy-i-937.html
[10] http://pse.com/energyEnvironment/2007IRP/Appendices/I-ElectricAnalysis.pdf

[11] http://www.nwcouncil.org/energy/Wind/library/2007-1.pdf

Contribution to Other Goals

Contribution to Long-term GHG Emission Goals (2035/2050): New renewable generation plants will continue to reduce emissions through 2035 at least.

Job Creation: New renewable generation facilities will add to clean energy jobs in the State.

Reduced Fuel Import Expenditures: Not applicable

Key Uncertainties

None cited

Additional Benefits and Costs

None cited

Feasibility Issues

None cited

Status of Group Approval

TBD

Level of Group Support

TBD

Barriers to Consensus

TBD

ES-2 Distributed Renewable Energy Incentives and/or Barrier Removal

This option is considered jointly with the RCI TWG group.

Mitigation Option Description

Distributed electricity generation sited at residences and commercial and industrial facilities, which is powered by renewable energy sources (typically solar, but also wind, small hydroelectric power sources, or biomass or biomass-derived fuels), displaces fossil-fueled generation and avoids electricity transmission and distribution losses, thus reducing greenhouse gas emissions. This policy can also encourage consumers to switch from using fossil fuels to using renewable fuels in applications such as water, process, and space heating. Potential technologies include: solar photovoltaic systems, solar water heating/space heating systems, wind power systems, particularly for rural areas, biomass-fired generation, space, or water heating systems.

There are numerous barriers to distributed renewable energy, including inadequate information, institutional barriers, community barriers, limited number of qualified contractors, high technology costs high transaction costs because of small 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. The lack of recognition for emissions reduction value provided also creates obstacles. Increasing the use of renewable energy applications in homes, businesses, and institutions in Washington can be achieved through a combination of regulatory changes and financial incentives.

The cost of distributed renewable generation is high relative to standard utility rates in the state and region; the economic and financial “barriers” to distributive generation investment by customers may be higher in Washington than elsewhere because of comparatively low electricity rates. This economic obstacle is difficult to overcome and may continue to represent a challenge unless utilities can be encouraged and empowered to capitalize and install distributed generation projects.

Mitigation Option Design

Potential elements of this option could include:

- The primary barrier to new small DG (<2 MW)[12] is the high initial cost which must be borne by the customer-generator. Tax credits, no-interest loans, rebates for specified technologies, and other mechanisms to make distributed renewable resources more economically viable are important to develop non-traditional resource alternatives.

- Washington already has uniform interconnection standards for small DG resources. The existing regulatory construct can discourage direct utility capital investment in DG; those barriers should be examined.[13] [14]
- Consider amending the net metering statute (RCW 80.60) to: (1) increase the size of qualifying [agricultural] systems from 100 kW to 200 kW (currently net metering is available generally up to 100 kW); (2) accelerate the timeline for increasing the cumulative generating capacity available to renewable net metered systems[15]; and (3) ensure a simplified process for customer-generators to utilize net metering.
- Efforts to simplify and standardize permitting for industrial and large commercial DG systems, as well as support for County and city land use prescreening efforts to facilitate siting.
- Training/certification programs for installers/contractors
- Consider requiring new connections representing a load greater than a certain threshold (x kW) to evaluate distributed generation options

Goals:

- Overcome barriers posed by high up-front costs and other aspects of distributed renewable energy systems, in order to promote stronger market for Washington.
- Establish targets, if/as appropriate, for technologies and resources, such as solar PV, small wind, solar hot water, geothermal, biomass, and landfill gas, among others. For the purposes of quantification (below), some indicative targets have been developed by the TWG, but the TWG recognizes that further analysis is needed to set any specific goals that might be adopted by the state.

Timing:

Coverage of parties:

Other:

Implementation Mechanisms

Expansion and/or extension of tax incentives provided under SB 5101 (2005).

Conduct analysis to determine availability of DG supply.

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[13] Other "incentives" aimed at increasing market penetration of DG and certain energy efficiency technologies could be more effectively targeted at utilities, rather than individual consumers; utilities could be encouraged to create the market if they (IOUs) have the proper incentives to do so. Such incentives could be included under ES-1 or through DSM programs in RCI TWG.

[14] High interconnection costs and regulatory access barriers can be shifted from the customer-generator to the general population with appropriate legislation. [a specific recommendation to accomplish this action is needed]

[15] 80.60.020(1) says: "… On January 1, 2014, the cumulative generating capacity available to net metering systems will equal 0.5 percent of the utility's peak demand during 1996. Not less than one-half of the utility's 1996 peak demand available for net metering systems shall be reserved for the cumulative generating capacity attributable to net metering systems that generate renewable energy".

Consider establishing additional tax credit programs, patterned after successful programs in other states (e.g. Oregon's Business Energy Tax Credit (BETC), which is 35% of eligible project costs[16]

Consider incentives that provide a payback period of 5 years[17]

Increasing the current net-metering cap from 100 kW to 1 MW, and allow aggregation if appropriate in commercial and/or agricultural applications.

Other potential financial incentives to implement distributed renewables programs include:

- Siting Incentive Programs;
- Low-cost bonding or loan guarantee programs;
- Expanding incentives offered under the existing law to residential consumers to include commercial systems
- Increase utility rates of return for investments in distributed renewables (under certain circumstances under I-937, a qualifying utility may count distributed generation at double the facility's electrical output)
- Encouraging the creation of and support for biomass fuels markets.

In Oregon, UM1129 took several steps toward supporting small-scale systems, including net metering changes and allowing combining of meters that are on the same property. Similar aspects could be considered in Washington.

Related Policies/Programs in Place

In 2005, the Legislature enacted the Renewable Energy System Cost Recovery (RCW 82.16.110) and Tax on Manufacturers or Wholesalers of Solar Energy Systems (RCW 82.04.294). The legislation provides incentives for the purchase of locally-made renewable energy products and provides a preferential rate under the business and occupation tax. Furthermore, tax exemptions under RCW 82.08.02567 and RCW 82.12.02567 incent the purchase and use of machinery and equipment used directly to generate electricity using fuel cells, wind, sun, or landfill gas. Similarly, RCW 82.08.835 and RCW 82.12.835 incent the purchase and use of solar hot water systems. Other renewable energy incentive programs include the federal income tax credit of 30% for one year (max $2,000).

Incentive payments are provided by electric utilities to customers generating renewable energy (i.e., solar, wind) on their property. For example, the Chelan County PUD Sustainable Natural Alternative Power Producers Program encourages customers to install power generators such as solar panels and wind turbines and connect them to the PUD distribution system; Avista Utilities provides a production credit of 14 cents per kWh for one year; Bonneville Environmental Foundation Green buys "tags" for five cents per kWh for up to five years (see additional information at end of this document).

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[16] Oregon Department of Energy – Conservation Division, *Business Energy Tax Credits*, www.oregon.gov/ENERGY/CONS/BUS/BETC.shtml (accessed September 25, 2007)

[17] Heron, Hollis of Flack + Kurtz, *POSITION PAPER – Washington State Photovoltaic Incentives*, August 28, 2007, Memo to Bert Gregory

A statewide biomass inventory and assessment was completed in 2005 by the U.S. Department of Energy (DOE) and Washington State University (WSU). The inventory identified nearly 17 million dry weight tons of annually renewable biomass resources across the state, with woody biomass as the dominant resource. Estimates indicate this organic resource is capable of supplying -- through combustion and anaerobic digestion -- about 50% of Washington annual residential electrical needs. In 2006, the Washington legislature authorized the “Waste to Fuels Technology” project, a partnership between the U.S. DOE and WSU, to evaluate the potential energy production from biomass feedstock, identify specific bio-fuels recovery technologies, and assess market development economics for organic resources.

Executive Order 05-01 mandates 10% reduction in State Agency energy purchases from 2003 levels by 9/1/2009, including through use of renewable energy

Initiative 937 allows qualifying utilities to count distributed generation at double the facility's electrical output if the utility meets one of two conditions:

1. The utility owns or has contracted for the distributed generation and the associated renewable energy credits; or
2. The utility has contracted to purchase the associated renewable energy credits.

Type(s) of GHG Reductions

CO_2, CH_4 and N_2O emission are reduced by avoided electricity generation from fossil fueled sources.

Estimated GHG Savings (in 2020) and Costs per MtCO2e

		Reductions	($MMtCO_2e$)*			
	Policy	**2012**	**2020**	**Cumulative Reductions (2008–2020)**	**NPV (2008–2020) $ millions**	**Cost-Effectiveness $/tCO₂**
ES-2	Renewable DG	0.13	0.31	2.3	$119	$52
Results by Technology Type						
	Solar Hot Water	0.06	0.11	1.0	$4	$4
	Wind	0.02	0.05	0.3	$2	$5
	Solar PV	0.01	0.02	0.1	$107	$885
	Biomass, Landfill gas	0.04	0.13	0.9	$5	$5

Note: results may need to be adjusted to avoid potential double-counting with I-937.

Data Sources: Western Governors Association’s *Clean and Diversified Energy Initiative*; EIA *Annual Energy Outlook 2007* assumptions; Energy Trust of Oregon *A Comparative Analysis of Community Wind Power Development Options in Oregon*; input from TWG.

Quantification Methods: Starting with the goals for each technology (see below), assumptions regarding the annual penetration of new distributed systems are generated. Estimates of cost and performance for different kinds of renewable systems and costs/emissions of avoided electricity are then used to estimate the overall net GHG emissions reduction and net cost of the policy.

Key Assumptions:

Target levels used for the analysis purposes:

- Rooftop solar photovoltaic (PV) systems: 20 MW by 2020.
- Small wind: 30 MW by 2020.
- Solar Hot Water: have systems installed in 0.8% of new homes by 2015, based on Western Governors' Association estimate of an achievable goal of 500,000 systems installed by 2015 for entire region. The WA fraction accounts for electricity use, solar insulation [the amount of sunlight/solar radiation], and population growth.
- Biomass and landfill gas: 49 MW by 2020 has been estimated for biomass based on review of NW Council 5th Power plan resource assessment and 2.5 MW by 2020 for landfill gas, based on EPA's Landfill Methane Outreach Program,[18] assuming that 5% of the potential capacity could be achieved by this option.

Technology costs: Obtained from Western Governors' Association 2006 (WGA 2006) Task Force Reports from the Clean and Diversified Energy Initiative,[19] Energy Information Administration[20]; and Energy Trust of Oregon.[21]

Costs for Distributed Energy Technologies

Technology	Capital Cost ($/kW)	Capacity Factor	Project Life (Years)	Source/Notes
Solar PV	Residential: $8,000 (2012) $8,000 (2020) Commercial $5,600 (2012) $5,600 (2020)	20%	20	Input from TWG
Solar Hot Water	$2,534 (2012) $2,200 (2020)	75%	20	EIA Annual Energy Outlook assumptions
Wind	$2,149 (2012) $1,194 (2020)	35%	20	Energy Trust of Oregon for 2020, 2010 rough estimate
Biomass	$2,500 (2012) $2,200 (2020	57%	20	Placeholder, need input from forestry TWG
Landfill	$2,000 (2012) $1,500 (2020	57%	20	Placeholder

Avoided costs: $64.2/MWh Based on an analysis from Puget Sound Energy and TWG affirmation.

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[18] http://www.epa.gov/lmop/proj/index.htm#2

[19] http://www.westgov.org/wga/initiatives/cdeac/index.htm

[20] http://www.eia.doe.gov/oiaf/aeo/assumption/index.html

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

Avoided electricity emissions: A placeholder value of 0.5 metric ton CO_2/MWh, largely reflecting avoidance of natural gas, is being used while awaiting further consultation with NW Power and Conservation Council and TWG as analysis proceeds.

Contribution to Other Goals

Contribution to Long-term GHG Emission Goals (2035/2050): Likely dependent on how key uncertainties noted below are resolved over time. Level of contribution to long term goals dependent on how broadly DG technologies are utilized, which are in turn highly dependent on per kW cost of systems.

Job Creation: Washington is home to many companies, such as REC and Xantrex, that manufacture solar energy and other DG system components. Expansion of the market for DG systems should help grow this fledgling industry in Washington and create more jobs in places like Moses Lake, Arlington and Vancouver.

Reduced Fuel Import Expenditures: Distributed renewable energy can contribute to reductions in natural gas imports.

Key Uncertainties

Growth in utilization of DG technologies will depend, in part, on new technologies, increased manufacturing efficiencies with existing technologies and increase in markets to drive economies of scale that will reduce system costs. The contribution of some technologies, such as geothermal and landfill gas, to energy production and GHG reductions will depend on resource supply.

Additional Benefits and Costs

Distributed energy can increase energy supply reliability, although integrating intermittent technologies within the grid must be managed carefully (see Option ES-6).

Reductions in overall electricity consumption and the shift from fossil fuel generation as a result of new renewables would lead to reductions in criteria air pollutants and, consequently, reduce health costs associated with those pollutants.

Renewables can provide a fuel price hedge effect against fossil fuel price volatility, particularly natural gas.

The operating costs of renewable generation, primarily maintenance, are generally spent locally and can provide a direct boost to local and state economies.

Feasibility Issues

Any distributed generation involving combustion may have an adverse impact on air quality, at least in the area close to the generator. Existing air quality rules may need to be changed to accommodate distributed generation and protect air quality.

Status of Group Approval

TBD

Level of Group Support

TBD

Barriers to Consensus

TBD

ES-3 Efficiency Improvements, Capacity Additions and Fuel Switching at Existing Renewable and Fossil Power Plants

Mitigation Option Description

Efficiency improvements refer to increasing electric generation output at existing projects through incremental improvements at existing renewable projects (e.g. hydro, biomass, solar or wind) and at existing fossil plants (e.g., more efficient boilers and turbines, improved control systems, or combined cycle technology). Efficiency improvements at existing projects include incremental operational and equipment changes that result in more electric energy output using the same amount of fuel.

Capacity additions refer to adding electric generation capacity to any existing renewable projects. Fuel switching refers to switching to lower or zero emitting fuels at existing fossil plants. This may include the use of biomass or natural gas in place of coal or oil. (repowering is not fuel switching)

All of these (efficiency improvements, capacity additions and fuel switching) are effective ways of achieving lower GHG emissions and should be encouraged as part of state policy (*See additional information at end of this document*). Policies to encourage improvements at existing plants could include: new policies and principles, new laws and regulations, market-driven incentives, and financial incentives.

Mitigation Option Design

Potential elements of this option could include:

- Policies and Principles – establish policies and principles through the Governor that define and promote efficiency improvements at existing projects. Encourage optimal use of our existing resources and investments in new resources, consistent with appropriate new source review under the State's Clean Air Act.
- Laws and Regulations – develop implementing legislation or guidelines that provide the necessary market-driven incentive to accomplish overall goal.
- Market-driven incentives – provide incentives through future environmental attributes market (e.g. renewable energy credits, green power, and carbon offsets) that encourage and reward the efficient use of our energy resources.
- Financial incentives – provide incentives through reduced taxes and low-interest loans and other financial incentives.
- Explicit credit for GHG emission reduction could be a part of the prudence decision-making process, which could then result in more such improvements occurring.
- Incentives could be provided using investment and production tax credits, government loan guarantees, low interest loans and grants. Oregon's Business Energy Tax Credit

system works well to encourage renewable energy generation and energy efficiency projects at commercial sites and industrial plants.

- To address potential efficiency improvements at plants under federal authority, the regional Governors and state delegations could, working with BPA, secure federal funding to first study and identify the potential efficiency improvements in the Bonneville hydro system and then obtain funding for implementation.

Goals: Implement the achievable, cost-effective efficiency potential at Washington's existing power plants. Reduce GHG emissions by substituting higher GHG fuels with lower GHG fuels.

Timing: To establish policies on or before January 1, 2009.

Coverage of parties:

Other:

Implementation Mechanisms

Additional Design Considerations:

- Focus on efficiency improvements, capacity additions for renewable energy and fuel switching at existing renewable and fossil facilities. This could also include co-firing with biomass
- Need to clarify financial incentives. Favor utilizing incentives where appropriate.
- Under I-937, a qualifying utility may only count the incremental power from an upgrade made to its own hydroelectric projects against the renewable energy standard. It must also retain all renewable energy credits associated with that upgrade in order to count the incremental power against the standard. When a non-qualifying utility that serves retail electric load in the state upgrades a hydropower facility it owns, any power or renewable energy credits it may sell to a qualifying utility should count against the qualifying utility's renewable energy obligation. TWG members disagree on whether changes should be made within I-937 to address this restriction or new policy/legislation should be developed to encourage efficiency improvements at hydro plants.
- Ensure full participation in the WREGIS trading system to establish market standards that prevent potential double-counting of renewable energy generation.
- Explore methods to recover capital expended on existing fossil-fueled resources that facilitate a transition to lower GHG-emitting resources.
- Changes to cost-benefit analysis of efficiency projects at existing projects to more directly reflect the benefits of the value of avoiding GHG emissions during any pre-approval or prudence review.
- A system that incorporates changes in the Washington's B&O tax to provide tax incentive credits similar to BETC could provide the tipping-force to move GHG reduction projects forward.
- Need to ensure financial incentives are equally available to both private and publicly-owned utilities.

- Consider whether avoided GHG emissions attributable to efficiency improvements, capacity additions and fuel switching at existing plants prior to any mandate or that exceed an operating permit limitation could be creditable as early actions within the context of a regional mechanism to achieve GHG reductions.

Related Policies/Programs in Place

Senate Bill 6001 (April 2007), sections 4c) and 11.

Implementation of the Energy Independence Act (RCW 19.285)

Type(s) of GHG Reductions

CO_2, CH_4 and N_2O emission are reduced by avoided electricity generation from fossil fueled sources.

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

	Policy Option	GHG Reductions ($MMtCO_2e$)			Net Present Value 2008–2020 (Million $)	Cost-Effective-ness ($/t$CO_2$e)
		2012	2020	Total 2008 2020		
ES-3	Efficiency improvements at existing renewable and power plants	0.2	0.7	4.9	Not Quantified	

Data Sources: Northwest Power and Conservation Council, *Carbon Dioxide Footprint of the Northwest Power System,* November 2007 http://www.nwcouncil.org/library/2007/2007-15.pdf

Quantification Methods: This estimate is based upon the NW Power Council's estimate of the additional capacity that would result from efficiency improvements at existing power facilities.

Key Assumptions:

Efficiency improvement can add approximately 390 aMW by 2020, mixture of hydro and natural gas generation.

Contribution to Other Goals

Contribution to Long-term GHG Emission Goals (2035/2050):

Job Creation:

Implementation of efficiency improvements will produce high-quality technical and trade jobs.

Reduced Fuel Import Expenditures:

Key Uncertainties

None cited

Additional Benefits and Costs

None cited

Feasibility Issues

The estimated percent of efficiency improvements needs to be confirmed. An energy audit of existing projects to identify operational and equipment efficiency improvements and to identify new generation resources needs to be completed. Potential energy savings (aMW) and expected costs associated with those savings needs to collected and compiled before informed decisions can be made.

Status of Group Approval

TBD

Level of Group Support

TBD

Barriers to Consensus

TBD

ES-4 Technology Research, Development & Demonstration and Technology-Focused Initiatives

This option also relates to Options in other TWGs including Forestry and Agriculture.

Mitigation Option Description

Drive advances in technologies that would develop cleaner energy supplies and make existing fossil fuel energy sources less GHG emitting. Encourage deeper investments in implementation opportunities for these new technologies. Establish an emerging energy technology program to set the stage for wider-scale adoption of these emerging and break through clean energy and efficiency technologies. This may involve strengthening an existing program, such as the **Washington Technology Center, or creating a new stand-alone entity.**

Mitigation Option Design

Establish an emerging energy technology program to help develop and deploy advanced technologies:

- Provide opportunities and incentives to invest in, test, and deploy new technologies.
- Promote research and development of cost-effective breakthrough technologies.
- Support technology demonstration projects to help commercialize technologies that have already been developed but are not yet in widespread use.

Criteria for the Program

- Program investments must target efforts that reduce GHG, reduce energy imports and create clean energy jobs and economic development.
- Increase collaboration between existing institutions for RD&D on technologies and support public and private partnerships. Create centers of technology excellence.
- Implement a bi-annual strategic planning requirement (such as the Washington Technology Center conducted in 2001 to develop roadmap http://www.watechcenter.org/downloads/strategicplan_200308.pdf) to develop a rational and comprehensive approach to energy supply R&D needs in the State. Use this to prioritize research needs on a bi-annual basis.
- Use an open bidding procedure (i.e., driven by bids received rather than by a focused strategy to develop a particular technology) within the sideboards provided by the bi-annual planning exercise.
- Could consider opportunities for private sector companies to provide funding for this program
- Stimulate partnerships with clean technology companies (and utilities) in WA

- o Develop statewide centers to advance basic research in this area, such as Solar Power, Sustainable Design, and Fuel Cells.
- o Establish an educational program to prepare students to work in these industries.

The emerging energy technology program should be inclusive of legitimate technologies that among others, result in:

- o Efficiencies in power generation, fuel transport and co-firing
- o Efficiencies in power use
- o Advance energy storage systems
- o Carbon capture, storage and reuse
- o Alternative clean energy development

Research Development and Demonstration Costs: The WUTC could be required to establish policies, guidelines, and procedures for reviewing, approving, and establishing accounting treatment for utility proposed RD&D projects. The process could clarify how costs of prudently managed, utility proposed RD&D projects may be recovered. HB 1032, which was considered but not passed in WA legislature last session, includes suggested criteria and considerations for recovering RD&D funding from customers.[22]

Goals:

- o Build on existing state partnerships and initiatives. $10 million Emerging Energy Technology fund for advanced clean energy technologies is suggested based on TWG input and limited discussion with WSU Energy Program.
- o Shared funding partnership with state, federal, and private sector partners to ensure the most effective deployment of these technologies.

Timing: TBD

Coverage of parties: State agencies, Washington Universities, private companies, utilities, Federal laboratories

Other: None cited

Implementation Mechanisms

State program that partners with all levels of government, utilities, energy suppliers, and technology development companies.

Related Policies/Programs in Place

See Senate Bill 6001 (April 2007), various sections.

Northwest Energy Technology Collaborative

Washington Technology Center

Washington State University Energy Extension Service

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[22] http://apps.leg.wa.gov/billinfo/summary.aspx?bill=1032&year=2007

Community Trade and Economic Development - Energy Policy Division

Pacific Northwest National Laboratory

In 2006, the Washington legislature authorized the "Waste to Fuels Technology" project, a partnership between the U.S. DOE and WSU, to evaluate the potential energy production from biomass feedstock, identify specific bio-fuels recovery technologies, and assess market development economics for organic resources.

Type(s) of GHG Reductions

This option is an enabling strategy for achieving reductions estimated for other options, and is not quantified directly.

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

As indicated above, GHG savings are not quantified for this option

Contribution to Other Goals

Contribution to Long-term GHG Emission Goals (2035/2050): Effective R&D is designed to substantially contribute to long-term GHG emissions goals by enabling GHG reductions identified in other options and creating new opportunities for GHG reductions.

Job Creation: Jobs connected to the R&D program will directly contribute the State's Clean Energy Job Creation goals.

Reduced Fuel Import Expenditures: R&D indirectly contributes to reducing fuel import expenditures by enabling other options.

Key Uncertainties

None cited

Additional Benefits and Costs

None cited.

Feasibility Issues

Review the achievements of other R&D programs to better understand the key components of successful R&D programs and seek to include these elements

Status of Group Approval

TBD

Level of Group Support

TBD

Barriers to Consensus

TBD

ES-5 Carbon Capture, Storage, and Re-use Incentives, Requirements and/or Enabling Policies and Research & Development (including pre-combustion technologies)

Mitigation Option Description

Carbon dioxide (CO_2) capture and storage or reuse (CCSR) is a process consisting of the separation of CO_2 from industrial and energy-related sources, transport to a storage location and long-term isolation from the atmosphere. The CO_2 from large point sources can be compressed and transported for storage in geological formations, in the ocean, in mineral carbonates, or for reuse in industrial processes. Captured carbon can be reused for enhanced recovery of oil and gas extraction or as a feedstock for industrial processes. Technological and financial barriers exist to implementation of CCSR.

For the electricity generation sector, current carbon capture technologies are immature, therefore, incentives need to be established that encourage the development of full scale pre-combustion and/or post-combustion carbon capture technologies. And, while separation, capture and transport of CO_2 are reasonably mature technologies only three industrial-scale storage projects are currently in operation. Further R&D funding to improve CCSR technologies and evaluation studies to identify geologically sound reservoirs technologies will be needed.

Mitigation Option Design

The key recommendation of this option is to develop a report, by one or more advisory groups, to either the Governor or the legislature identifying the various regulatory and/or legal barriers to the commercialization of CCSR projects (i.e., for coal, natural gas, and biomass) and estimating the potential for GHG reductions in Washington through these technologies and practices.[23] Based on the results of that report, a subsequent near-term goal could be an Executive Order or legislation addressing various regulatory and/or legal barriers.

CCSR raises new legal and regulatory risks associated with siting and permitting projects, CO_2 transportation, injection and storage.[24] These risks are not yet fully understood, nor are uniform standards or government regimes in place to address and mitigate them. Among the key questions to be addressed in the development of a consistent regulatory framework for CCSR

[23] California recently adopted Assembly Bill 1925 (2006), directing the California Energy Commission to recommend standards to accelerate the adoption of long-term management of industrial CO_2. A copy of the draft staff report may be found at http://www.energy.ca.gov/2007publications/CEC-500-2007-100/CEC-500-2007-100-SD.PDF. Similarly, New Mexico Governor Richardson's Executive Order 2006-69 required the New Mexico Energy, Minerals, and Natural Resources Department (EMNRD) to coordinate with a stakeholder group to explore and identify statutory and regulatory requirements needed to geologically sequester anthropogenic CO_2. The interim report may be found at: http://www.emnrd.state.nm.us/OCD/documents/InterimReportCO2Sequestration.pdf

[24] Robertson, K., Findsen, J., Messner, S., Science Applications International Corporation. June 23, 2006. "International Carbon Capture and Storage Projects Overcoming Legal Barriers", prepared for the National Energy Technology Laboratory (see http://www.netl.doe.gov/energy-analyses/pubs/CCSregulatorypaperFinalReport.pdf)

are: potentially applicable criminal and civil environmental penalties; property rights, including the passage of title to CO_2 (including to the government) during transportation, injection and storage; long-term CO_2 liability, insurance coverage for short-term CO_2 liability; the licensing of CO_2 transportation and storage operators, intellectual property rights related to CCSR, and monitoring of CO_2 storage facilities. Better understanding of the magnitude of the potential GHG reductions - based on Washington's technologies, geology and transportation opportunities - is also needed and would be covered by the initial report.

A. Regulatory Issues

Engrossed Substitute Senate Bill 6001 (ESSB 6001) includes a process for developing regulatory requirements for carbon capture and sequestration plans for new electricity generation. The Washington Department of Ecology has announced a formal ESSB 6001-related rulemaking[25] and the establishment of a work group as part of its process. The rulemaking seeks to first amend "Chapter 173-407 WAC - carbon dioxide mitigation program for fossil-fueled thermal electric generating facilities", to establish the level and effectuate ESSB 6001. The deadline for adopting the standard by rule is June 30, 2008. The rulemaking also seeks to amend "Chapter 173–218 WAC - underground injection control program" to establish criteria for evaluating carbon capture and sequestration plans to be undertaken within Washington. The Washington Energy Facility Site Evaluation Council is also expected to promulgate regulations complementing the rules eventually adopted by the Department of Ecology. The TWG believe these rulemakings are the beginning of an effort to develop a predictable state permitting process for CCSR projects.

B. Long-term Ownership and Liability Issues - Determine which party(ies) will be liable over the long-term

The issue of who will assume the responsibility for long-term CO_2 storage in underground reservoirs was not addressed within ESSB 6001. The TWG believes this issue must be decided before storage technology can become widely deployed. We know that long-term ownership of CO_2 is an issue that must be resolved, with some suggesting that such ownership should be transferred to the state or federal government in order to provide an appropriate long-term incentive to site and store CO_2. Among the options it should explore is that adopted by Texas, which transfers the title (and any liability post-capture) to CO_2 captured by CCS to the Railroads Commission of Texas.[26]

Although the prospect of a catastrophic leakage event from a well-selected, designed and managed storage reservoir is low, liability for such an event must be resolved. In addition, liability for other potential issues -- such as incremental leakage to the atmosphere and shallow water sources, contamination of deep water aquifers and ecosystems from the displacement of mineral and other solutions by CO_2 injection, concerns with ground heave or subsidence, and damage to unclaimed hydrocarbon reserves -- must also be resolved. Additional experience with demonstrations of large-scale CCSR will likely provide important guidance about which of – and how -- these potential issues must be addressed to make CCS commercially feasible.

[25] See, http://www.ecy.wa.gov/laws-rules/activity/wac173407_218.html

[26] Texas H.B. 149 (2006).

C. Pipeline Issues - Assist to resolve pipeline siting issues

When a suitable reservoir is not located near the power plant, CO_2 will have to be transported via pipeline to its final storage site. Although there are presently 3,000 miles of CO_2 pipelines in the U.S. for Enhanced Oil Recovery purposes, additional and likely larger pipelines will be necessary. The siting of a CO_2 pipeline should be similar to siting a natural gas pipeline and will require federal and/or state eminent domain or rights-of-way in order to build. Unfortunately, state siting requirements were not addressed within ESSB 6001. Currently, natural gas pipeline companies are required to secure rights to use private land (rights-of-way) through negotiation and payment for that right, with eminent domain as a last resort. The negotiations and payments cover everything from gaining access to the land, to laying the pipeline, to restoring the land to its former state. Building a natural gas pipeline can take years, even with eminent domain.

D. Property Rights - Establish greater certainty about property ownership rules for potential CO_2 storage sites in Washington

The ownership of underground pore space (i.e., potential reservoirs for CO_2 storage) varies from state to state. In states with past or current oil and gas exploration and production, underground property rights are well established.[27] Unfortunately, clarification of ownership rights was not accomplished within ESSB 6001. An assessment of the geologic storage capacity in Washington that includes an assessment of the legal accessibility to the sites should be undertaken. Greater certainty about property ownership rules for potential CO_2 storage sites in Washington is needed.

E. Public Acceptance and Communications Issues - Educate the public about CCSR technologies

Public awareness of CCSR technologies is low. There is a need for public education about the potential benefits and impacts of CCSR technologies. The experience of successful large-scale storage demonstrations, together with a sound and reasonable regulatory framework, are needed to give the public confidence in the safety of storage. Otherwise, failure to gain public acceptance could jeopardize timely deployment of CCSR technologies.

F. Incentives for CCSR - Investigate potential incentives for CCSR in the medium term to long term (2015+), pending analysis in the short term points A. – E.

Incentives for CCSR are required to ensure innovation and full participation by all generating sources: Including, but not limited to investor-owned utilities, public power, and independent power producers. Potential ideas for incentives are listed below and provided in greater detail in Appendix A. These are results of TWG brainstorming and do not reflect TWG consensus. The following ideas have been suggested as potential incentives. TWG has divergent views on the inclusion of individual incentives.

- Enact State or jointly advocate for Federal tax incentives to encourage new IGCC and CCSR project development to serve Washington customers.
- Consider “pay as you go” cost recovery for use of IGCC and other CCSR technologies.

[27] However, even in these states, agreement by all affected parties may be required. For example, in Illinois, there are 69 owners of the storage reservoir that the potential FutureGen plant would utilize, and all owners must agree before the reservoir can be accessed.

- o Develop a transmission credit system that allows non-utility generators to recover development and operating costs for carbon capture technologies.
- o Consider early action credits for avoided GHG emissions attributable to CCSR technologies placed into operation prior to any mandate

Goals: The goal of this option is to gain clarity on points A. – F. above

Timing: Develop increased understanding and decisions on issues A. – E. in the near term (2008-2015); pending some of these short-term outcomes seek development of early demonstration projects; leading to broader deployment in the medium-term, possibly including financial incentives, (2015-2029) and eventually long-term commercialization (2030+).

Coverage of parties:

Other:

Implementation Mechanisms

None cited

Related Policies/Programs in Place

See Senate Bill 6001 (April 2007), sections 4b, 7 and 5

Type(s) of GHG Reductions

CCSR is likely focused exclusively on CO_2 capture and storage

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

Data Sources:

- Pacificorp White Paper "Proposed IGCC/CCS Incentives for Washington" (May 2007)[28]
- Recently released MIT report, "The Future of Coal" (2007)[29] which provides estimates of costs and emissions savings from various coal technologies with and without carbon capture and storage.
- The IPCC Special Report on Carbon Dioxide Capture and Storage (2006)[30] which provides other estimates, including rough estimates of the costs of CO_2 transport and storage.
- EPA report, "Environmental Footprints and Costs of Coal-Based Integrated Gasification Combined Cycle and Pulverized Coal Technologies," July 2006, which contains cost and performance estimates for various coal plant types and CO_2 capture, accounting also for high elevation issues with IGCC as might be encountered in Washington.
- Advanced Coal Task force report and spreadsheets from Western Governor's Association 2006 (WGA 2006) *Clean and Diversified Energy Initiative*[31]

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[28] http://www.pacificorp.com/File/File75668.pdf

[29] http://web.mit.edu/coal/

[30] http://www.ipcc.ch/activity/srccs/index.htm

[31] http://www.westgov.org/wga/initiatives/cdeac/index.htm

- California Energy Commission draft Staff Report, “Geologic Carbon Sequestration Strategies for California: The Assembly Bill 1925 Report to the Legislature” (September 2007)[32]
- New Mexico Energy, Minerals, Natural Resources Department Oil Conservation Division “Carbon Dioxide Sequestration: Interim Report on Identified Statutory and Regulatory Issues” (June 2007)[33]
- Robertson, K., Findsen, J., Messner, S., Science Applications International Corporation. “International Carbon Capture and Storage Projects Overcoming Legal Barriers”, prepared for the National Energy Technology Laboratory (June 23, 2006)[34]

Quantification Methods: This option has not been quantified since the immediate goal is a study. In the longer term, the choice of CCSR technologies is uncertain and dependent on the incentives, policies and technology development. Note that current research and development of technologies indicates that carbon capture rates of commercial plants could be in the range of 70% to 90%.

Key Assumptions:

Contribution to Other Goals

Contribution to Long-term GHG Emission Goals (2035/2050):

Job Creation:

Reduced Fuel Import Expenditures:

Key Uncertainties

None cited

Additional Benefits and Costs

None cited

Feasibility Issues

None cited

Status of Group Approval

TBD

Level of Group Support

TBD

Barriers to Consensus

TBD

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[32] http://www.energy.ca.gov/2007publications/CEC-500-2007-100/CEC-500-2007-100-SD.PDF

[33] http://www.emnrd.state.nm.us/OCD/documents/InterimReportCO2Sequestration.pdf

[34] http://www.netl.doe.gov/energy-analyses/pubs/CCSregulatorypaperFinalReport.pdf

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

Mitigation Option Description

This option comprises three main elements: 1) increasing transmission system capacity for, and access to the grid by, clean energy technologies[35]; 2) improving efficiency and reducing line losses in the electric transmission and distribution system; and 3) providing support to "smart grid"[36] technologies that optimize the electricity grid (and unlock additional renewable resource alternatives) through devices that help manage electricity demand and supply.

Mitigation Option Design

Develop a report, based on input from an advisory group, to investigate potential incentives and/or barrier removal to expanding transmission capacity, and how that can maximize or enable emission reductions. Options might include, among others, identification and targeting of renewable energy development zones for transmission capacity expansion, energy storage technologies, and property tax exemptions around transmission corridors to lessen landowner concerns.

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 the RCI TWG proposes option RCI-5, which suggests pilot smart meter programs and the Transportation TWG proposed option T-10 – Actions to Accelerate and Integrate Plug-In Hybrid Electric; both of these options could complement ES-6.)

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[35] 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

[36] 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

Provide incentives and remove barriers to improving the efficiency of the T&D system and components and to reducing line losses. [37] Regulations, incentives, and/or support programs can be applied to achieve greater efficiency of transmission and distribution system components. Regulators and governing boards should encourage utilities to identify opportunities, beginning with pilot projects, to optimize transmission and distribution networks to minimize line losses through the replacement of or additions to existing facilities. Similarly, regulators and governing bodies should encourage utilities to consider distributed generation, combined heat and power, load management and end-use efficiency. If necessary, regulatory guidance could be provided by utility regulatory bodies.

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)

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.

  http://apps.puc.state.or.us/edockets/orders.asp?OrderNumber=07-360

- Propose a multi-faceted study, perhaps predicated on local pilot projects, to evaluate the potential benefits to shareholders and ratepayers of deploying emerging technologies
- Employ smart grid technologies such as voltage reduction to optimize delivery networks for minimal line losses where appropriate.
- 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.

This option could also include **reductions in leakage of SF_6** from distribution system transformers, plus efficient transformers and other materials and equipment. *(This element is covered by the RCI TWG, option RCI-11).*

Goals: Increased understanding of the technologies and practices to improve the transmission system and the barriers to uptake of these improvements.

Timing:

[37] 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.

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 Initiative
- Energy Facility Site Evaluation Council

Other: None cited

Implementation Mechanisms

TBD

Related Policies/Programs in Place

BPA NonWires Solutions – is a highly advanced effort to replace costly transmission line upgrades with smart energy technologies. http://www.transmission.bpa.gov/PlanProj/Non-Wires_Round_Table/

Pacific Northwest GridWise Testbed – intends to provide an institutional structure for developing and hosting smart grid demonstration projects. http://gridwise.pnl.gov/

WA CTED is reviewing best practices for investing in smart-grid technologies

Type(s) of GHG Reductions

There are emissions reductions related to improved operations of electric power generation and improved access for renewables.

Emissions of SF_6 related to electric power transmission and distribution from WA GHG inventory is currently about 0.3 $MMtCO_2e$. *Note: This reduction may be reassigned to another policy option.*

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
- Strategic Transmission Investment Plan, Final Commission Report, This 2007 Strategic Transmission Investment Plan describes the major immediate actions that California must take to develop and maintain a cost-effective, reliable transmission system that is also capable of responding to important policy challenges such as mitigating global climate change. The achievement of state greenhouse gas policy objectives by the electricity sector will depend to a large degree on the interconnection and integration of renewable resources into the state's transmission grid. This report was published on November 15 and its recommendations were not discussed with the TWG or included in this write-up. http://www.energy.ca.gov/2007_energypolicy/documents/index.html

Quantification Methods: This option has not been quantified since a) further study in Washington is required and b) the majority of the actions that would lead to reductions are covered by other options in the Energy Supply TWG (ES-1 for grid-size renewables and ES-2 and ES-7for Non-wires options) and other TWGs (RCI-5, which suggests pilot smart meter programs, RCI-11 covers SF6 reductions from electricity transmission and distrtibution; the Transportation TWG option T-10 covers Actions to Accelerate and Integrate Plug-In Hybrid Electric).

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: None cited

Key Uncertainties

None cited

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

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.[38] 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:

Incentives to encourage, new CHP facilities, as well to expand and/or repower existing facilities. No significant CHP system has been built in Washington in the last 15 years, in part due to the costs of CHP systems being higher than current avoided costs. In order to provide incentives to reduce GHG emissions through CHP, 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.[39] Other potential financial incentives to implement CHP programs include:

[38] 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).

[39] 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 pounds of CO2 - $ 8/MWh; T&D incremental cost savings plus 8% loss - $ 10/MWhn; Credit for not needing hydro

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

Amended procedures for streamlined permitting of CHP and thermal energy recovery facilities, without compromising other environmental goals.

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.

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: For preliminary analysis, the goal is to install 976 MW of new and retrofitted existing natural gas CHP capacity by 2020 and 206 MW of new and retrofiited existing biomass CHP capacity. Note that the quantification of this option did not exhaust all resources for CHP generation.[40]

Timing: None cited

Coverage of parties: None cited

Other: None cited

Implementation Mechanisms

State wide IRP used to determine potential for CHP.

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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)

[40] For example, municipal solid waste can be used to fuel CHP systems, which could lead to significant GHG reductions. The TWG did not evaluate this source but individual members briefly voiced dissenting arguments on its pros and cons. Future analysis of this source could be considered.

Leveraging of attractive financing arrangements, tax benefits such as the existing sales and use tax incentive for machinery and equipment used for cogeneration facilities (RCW 82.08.02565[41] and RCW 82.12.02565[42]) and other incentives to promote CHP technologies.

Interconnection issues: Removing high interconnection cost and regulatory access barriers similar to OR Public Utility Commission ruling under UM 1129. See Appendix A of UM1129, Order 07-360, Entered 08/20/07.
http://apps.puc.state.or.us/edockets/orders.asp?OrderNumber=07-360

Permitting and siting: Supporting county and city land use prescreening efforts to support siting.

Government lead-by-example: Addressing lack of funding for design of CHP and waste heat utilization systems associated with state facilities and university campuses.

Waste heat capture/recycling:

- A Washington State inventory of waste heat resources, evaluating the full renewable thermal energy potential in the State
- Incentives for new or existing waste heat generators to (re)locate adjacent or close by to heat users

Related Policies/Programs in Place

PURPA, 1978.

B & O Taxes.

Business Energy Tax Credits (BETC) in Oregon.

The Washington UTC has an interconnection standards process underway with provisions for comments

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

[41] http://apps.leg.wa.gov/RCW/default.aspx?cite=82.08.02565

[42] http://apps.leg.wa.gov/RCW/default.aspx?Cite=82.12.820

Chapter 35.97 RCW – Heating Systems

RCW 82.35, which expired in 1984, included tax credits for CHP facilities. Reports may be available on the approach for the credits and on their impacts on CHP uptake.

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 $MtCO_2e$

		Reductions	($MMtCO_2e$)*			
	Policy	**2012**	**2020**	**Cumulative Reductions (2008–2020)**	**NPV (2008–2020) $ millions**	**Cost-Effective-ness $/$tCO_2$**
ES-7	CHP	0.51	2.1	12.1	-$317	-$26

Data Sources:

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 Estimated Economic Potential (using 10-year payback): Two estimates of economic potential for CHP in Washington were provided by a recent report, based on two sets of assumptions on technology costs and performance, including assumptions on stand-by charges and financial incentives (see below). The assumptions for the Accelerated Case more closely reflect the policy design described above, so the quantification was based on economic potential of 2,847 MW in 2007.

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

CHP

Quantification Methods : Starting with an estimate for Washington's share of CHP potential in the Pacific Northwest, as provided in the *Market Assessment* report (Energy and Environmental Analysis Inc. 2004) referenced above, assumptions regarding the penetration of and fuel shares for new CHP systems, and estimates of future capacity of CHP developed under the policy, are generated. Estimates of CHP cost and performance for different kinds of systems are then used to estimate the overall net GHG emissions reduction and net cost of the policy.

Key Assumptions: Key assumptions are the CHP potential in Washington, the analysis is based on a potential of 2,847 MW (per the *Market Assessment* source above)[43]; this potential grows with commercial and industrial loads; and the potential and can be realized at a rate of about 2-3% [2% per year through 2012, increasing linearly to reach 3% in 2020] of total potential per year.

Technology characteristics of new CHP equipment.

Size	Capital Cost ($/kW)		Fraction of New CHP capacity	
	2012	2020	2012	2020
<1 MW	$ 1,396	$ 1,073	14%	14%
1-4.9 MW	$ 1,046	$ 929	24%	24%
5-24.9 MW	$ 990	$ 879	19%	19%
25-39.9 MW	$ 890	$ 784	13%	13%
40-259.9 MW	$ 781	$ 734	15%	15%
>259.9 MW	$ 656	$ 589	16%	16%

Technology	Capital Cost ($/kW)		Fraction of New CHP capacity	
	2012	2020	2012	2020
Natural Gas	$ 964	$ 839	94%	94%
Biomass	$ 1,214	$ 1,089	6%	6%
Oil	$ 964	$ 839	0%	0%
Coal	$ 964	$ 839	0%	0%

Source: Energy and Environmental Analysis, Inc for Oak Right National Laboratory (2004) *Combined Heat and Power in the Pacific Northwest: Market Assessment*, based on average costs of the range of sizes of gas turbines; biomass assumed to be $250 higher; coal assumed to be equal to gas turbine

[43] An alternate estimate of CHP potential is 1092 MW from a 2004 analysis by the Western Resource Advocates, *A Balanced Energy Plan for the Interior West.* http://www.westernresourceadvocates.org/energy/clenergy.php

Avoided costs and emissions: See ES-2

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 in Washington. This analysis is being updated and expanded; for more information contact:

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Cell: (630) 347-5300
Fax: (630) 590-6037
Website: www.Recycled-Energy.com

Other potential data sources

Western Governor's Association 2006 (WGA 2006) *Task Force Reports from the Clean and Diversified Energy Initiative,*[44] Energy Information Administration[45]; and, Energy Trust of Oregon.[46]

Contribution to Other Goals

Contribution to Long-term GHG Emission Goals (2035/2050): None cited

Job Creation: Installation and maintenance of CHP systems will contribute to clean energy jobs in Washington

Reduced Fuel Import Expenditures: Impact of CHP systems on fuel import expenditures in unknown, dependent on the source of avoided electricity..

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:

- Dispatchability 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.

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

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

- Washington State could seek to influence and streamline grid interconnection standards and associated costs, where applicable. Standards are set be FERC and NERC rather than the State.
- 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.

There is a 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

None cited

Feasibility Issues

Local opposition to siting of facilities in areas where CHP would work - relatively high density areas with large thermal load needs

Air Quality impacts of CHP proposals will need to be evaluated. Local land use and zoning rules may need to be adjusted to encourage the use of CHP in providing both power and community heating/cooling energy to commercial operations and to planned residential communities.

Status of Group Approval

TBD

Level of Group Support

TBD

Barriers to Consensus

TBD

APPENDIX A

ITEMS FOR FUTURE FOLLOW-UP ON INDIVIDUAL OPTIONS

The information provided here reflects contributions by TWG members about which the TWG did not agree or have time to fully consider, but that the TWG feels should be maintained, since they are the important points to further consideration of individual options.

ES-2. Distributed Renewable Energy Incentives and/or Barrier Removal

PSE offers two incentive programs that provide ongoing, annual benefits. Net Metering (Schedule 150) allows the energy produced by a customer's renewable-energy system to offset the customer's usage of PSE-provided electricity over the course of a year at the retail rate of ~9 cents per kWh. For months in which a customer's self-generated renewable energy exceeds the amount of PSE electricity consumed, that excess production is rolled over to offset PSE power usage in other months. Typically, high summer production of renewable energy can offset high winter usage of PSE-provided power. In addition to Net Metering, PSE elected to create a separate incentive program as authorized by State Senate Bill 5101 (2005) and Washington Administrative Code 458-20-273. PSE provides all of the consumer benefits allowed under the state law. The PSE program (called the Renewable Energy Advantage Program under Schedule 151) provides a payment for Production Metering. The purpose of this program is both to encourage small-scale renewable-energy generation and to induce in-state production of renewable-energy system components. The Production Metered payments to customers can range from 12 cents/kilowatt hour (kWh) to 54 cents/kWh if the parts of a particular renewable energy system were manufactured in Washington. The law set an annual cap of $2,000 in incentive payments per installation.

ES-5 Carbon Capture, Storage, and Re-use Incentives, Requirements and/or Enabling Policies and Research & Development (including pre-combustion technologies)

A broad regulatory framework is required that supports the identification, development and deployment of technologies that capture, sequester or reuse CO_2. In order for Washington State and the USA to achieve CO_2 reduction goals a multi-sector approach is required, but within the electricity supply sector three technologies are emerging as near-term scalable technologies.

Pre and Post CO_2 Combustion Capture

Technologies

- Do not try to pick a single winning technology. It is important to create a framework in which industry will invest in a broad range of low emitting technologies. It will take a sum total of all technologies to achieve long-term CO_2 reduction roles
- Proper incentives allow and encourage industries to take early risks inherent in new technologies. A broad range of incentives should be pursued which will apply to different technologies, and technologies at different stages of deployment.
- In the absence of long-term clarity, higher emitting generation will likely continue to be built, and may face extraordinary environmental costs later in life. Effort must be made to avoid stranding assets due to the financial implications on utility companies and the end customers.

- Current and new policies must be able to adapt to the latest changes, and continue to adapt as technology continues to be developed and implemented. Failure to do so is likely to stall, if not impede, the construction of billion of dollars of productive infrastructure in the US.
- Three technology branches appear to offer the best near-term solution to low-GHG emitting base load electricity:
    - Ultra supercritical [*coal-fired generation*] with carbon capture
    - IGCC [*integrated gasification combined-cycle plants using coal, sometimes with biomass co-firing*] with carbon capture
    - Nuclear [*power*] *[TWG members are not in agreement about including nuclear power here]*
- The net reduction of emissions to the atmosphere through CCSR depends on the fraction of CO_2 captured, the increased CO_2 production resulting from loss in overall efficiency of power plants or industrial processes due to the additional energy required for capture, transport and storage, any leakage from transport and the fraction of CO_2 retained in storage over the long term. The most viable of these technologies today appears to be Integrated Gasification Combined Cycle (IGCC) combined with carbon capture and storage and reuse (CCSR) technology. There are also emerging CCSR technologies that show promise for capturing carbon emissions from traditional pulverized coal fired boilers. These emerging technologies include chilled ammonia scrubbing and oxy-fuel combustion. Carbon capture technologies have the potential to remove approximately 90 percent of a coal plant's CO_2 emissions.
- R&D for the CCSR technologies is also vital for their larger scale commercialization. R&D funding can also be made available to CCSR technologies through an open bidding procedure (i.e., driven by bids received rather than by a focused strategy to develop a particular technology.) Funding can also be given for demonstration projects to help commercialize technologies that have already been developed but are not yet in widespread use. Funding could be provided to increase collaboration between existing institutions for R&D on these technologies.
- The important role of advanced clean coal technology is recognized in the Western Public Utility Commissions' Joint Action Framework on Climate Change, signed on December 1, 2006 by the Washington, Oregon, California and New Mexico public utility commissions.47 The Framework's Statement of Shared Principles includes five principles, the second of which is "Development and use of low carbon technologies in the energy sector." The third of six Action Items is: "Explore ways to remove barriers to development of advanced, low-carbon technologies for fossil fuel-powered generation capable of capturing and sequestering carbon dioxide emissions."

[47] Western Public Utility Commissions' Joint Action Framework on Climate Change (December 1, 2006), located at http://www.puc.state.or.us/puc/news/2006/2006026jointaction.

CO_2 Storage

Technologies

Liability

- There are significant legal barriers to carbon sequestration related to environmental and other legal liability and property rights. Many of these fall into areas traditionally governed by state law and, hence, must be addressed if carbon sequestration is to become reality in the state.
- Avoided GHG emissions attributable to CCS equipment placed into operation prior to any mandate or that exceed an operating permit limitation should be creditable as early actions within the context of a regional mechanism to achieve GHG reductions
- Emphasize the need for Washington to support near term CCS demonstration projects (Similar to the arguments in the PacifiCorp white paper).
- Washington's large basalt formation may hold significant CO_2 sequestration capacity. Developing a carbon sequestration industry in Washington will bring long-lasting benefits. Industries created around reusing CO_2 should also have a high priority.
- There are significant technological challenges associated with post-combustion capture. Consequently, if this technology is going to emerge it will require much broader support

Ideas for Potential Financial Incentives

The following ideas have been suggested during a TWG volunteer group brainstorming session as potential incentives. TWG has divergent views on the inclusion of individual incentives.

- Enact State or jointly advocate for Federal tax incentives to encourage new IGCC and CCSR project development to serve Washington customers. The most effective combination of tax incentives for development of CCSR technologies is a tax credit (i.e., modeled after the renewables Section 45 production tax credit) plus accelerated depreciation. Enact State or jointly advocate for comparable incentives for public power (i.e., interest free construction bonds and higher funding levels for the Renewable Energy Production Incentive or REPI payments).
- Executive Order or legislation directing the Washington Utilities and Transportation Commission to implement changes to Washington's traditional least cost/least risk regulatory standard and the "used and useful" statute (i.e., mandating "pay as you go" cost recovery) in order to advance the use of IGCC and other CCSR technologies.
- Develop a transmission credit system that allows non-utility generators to recover development and operating costs for carbon capture technologies.
- Eventual cap and trade program design considerations:
    - Incentives to encourage early action recovery mechanisms?
    - Credits granted for plants that are permanently shut down?

    - Method to ensure credits are certified to ensure a robust and fair trading mechanism including the prevention of speculative trading that are in aggregate above any global, national or regional caps?
    - Credit to recognize avoided emissions due to energy conservation programs?

- Consider whether avoided GHG emissions attributable to CCSR technologies placed into operation prior to any mandate or that exceed an operating permit limitation should be creditable as early actions within the context of a state or regional mechanism to achieve GHG reductions.

APPENDIX B

FURTHER INFORMATION ON INTEGRATION OF ELECTRICITY OPTIONS

This section includes our assumptions on the mix of avoided generation resources, along with charts of the results of the three scenarios described above (see section, *Approach used for Quantifying the Suite of Electricity Demand Options*, pages 3-4).

Scenario A – existing resources that are reduced are mix of fossil fuel resources (excluding cogeneration, which is not reduced)

Scenario B – existing resources that are reduced reflect average mix of generation from all resources (excluding wind and biomass)

Average – represents the mid-point of the reductions identified using Scenario A and Scenario B.

Mix of Resources Reduced based on Reduced Electricity demand for new and existing generation

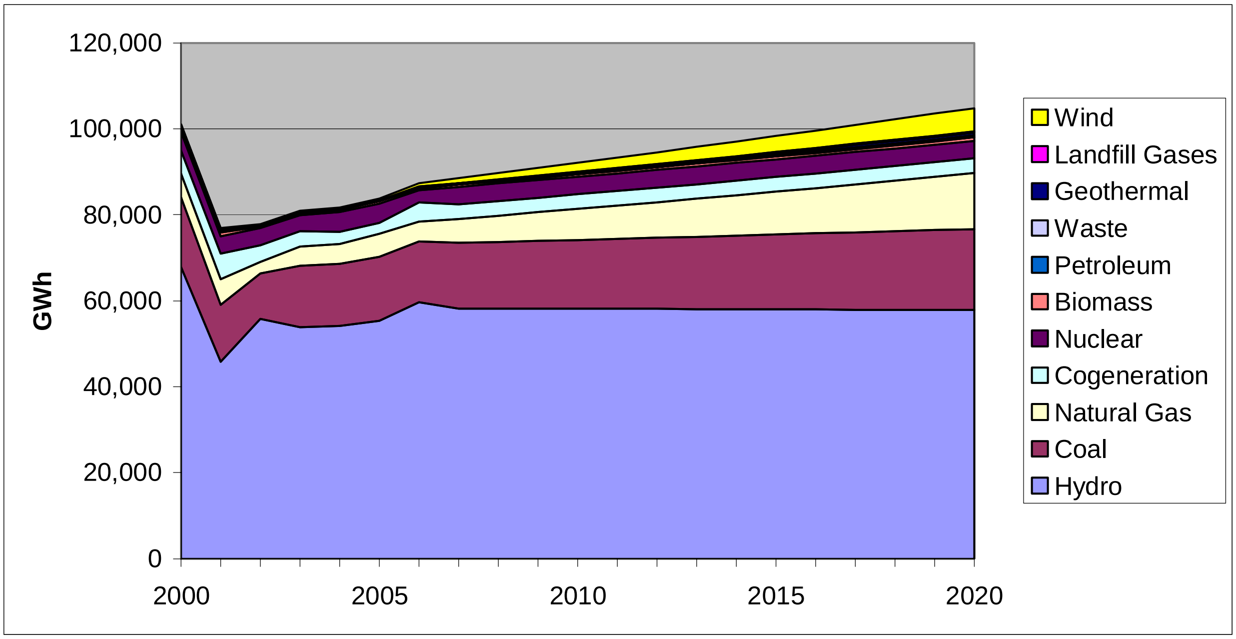
	New Resources	**Existing Resources**	
		Scenario A (excluding nuclear, hydro, wind and biomass)	**Scenario B (all resources except wind and biomass)**
Hydro			71%
Coal	32%	74%	18%
Natural Gas	68%	25%	6%
Nuclear			5%
Petroleum	0.2%	0.3%	0.1%
Waste		1%	0.2%
Total	*100%*	*100%*	*100%*

Biomass, Wind, Geothermal, landfill gases, natural gas cogeneration, and solar generation are not reduced in any scenario. Note that electricity demand reductions are assumed to avoid new fossil generation first, then existing resources. The estimated electricity demand reductions from recent actions (I-937, appliance standards, state green buildings and building code (electricity portions)) are sufficient to avoid most of the new generation in the reference case projections so the ES and RCI TWG options mostly avoid existing generation.

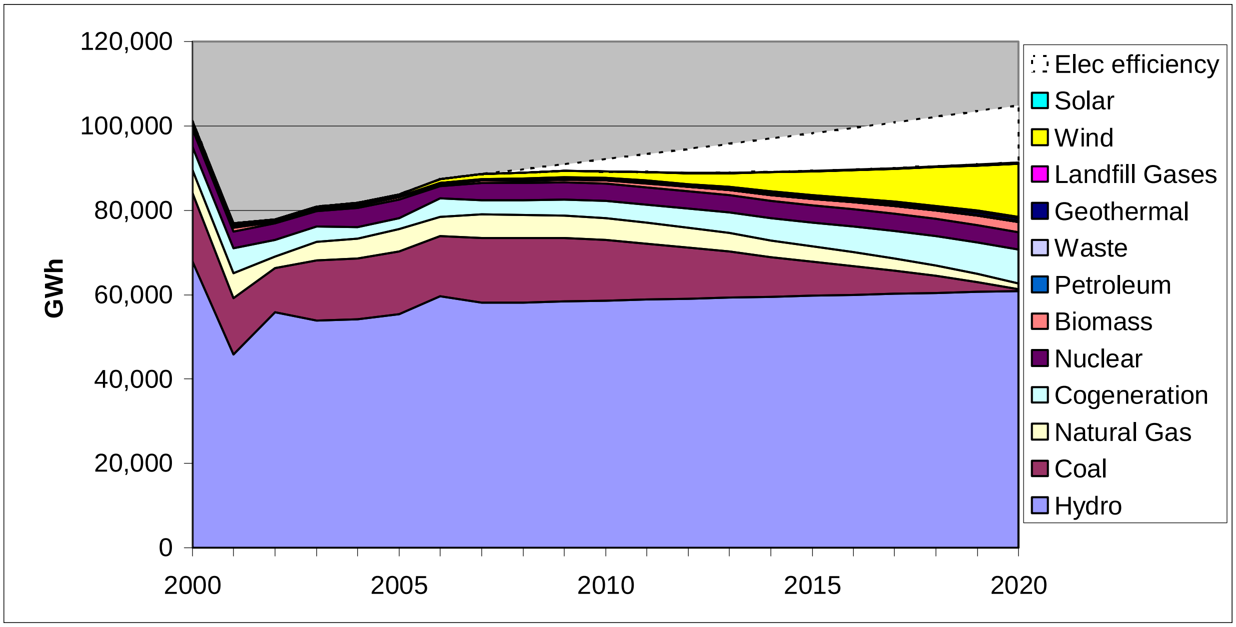
Washington Load-based Electricity Generation

The following 4 charts present the estimated electricity generation to meet Washington's electricity demand through 2020. This generation is a mix of electricity generated in-state and trade in electricity with other states ("Load-based" electricity generation). The first chart shows our estimates for the reference case, using Fuel Mix Disclosure information for 2000 to 2006 and projections based on NW Power Council analysis for 2007 to 2020. The next three charts show three alternative estimates for the effects of the options that reduce electricity demand and increase renewable generation. The major difference lies in assumptions on whether Washington will "reduce" hydro generation through increasing hydro sales to other states.

Washington Load-based Electricity Generation, Reference Case

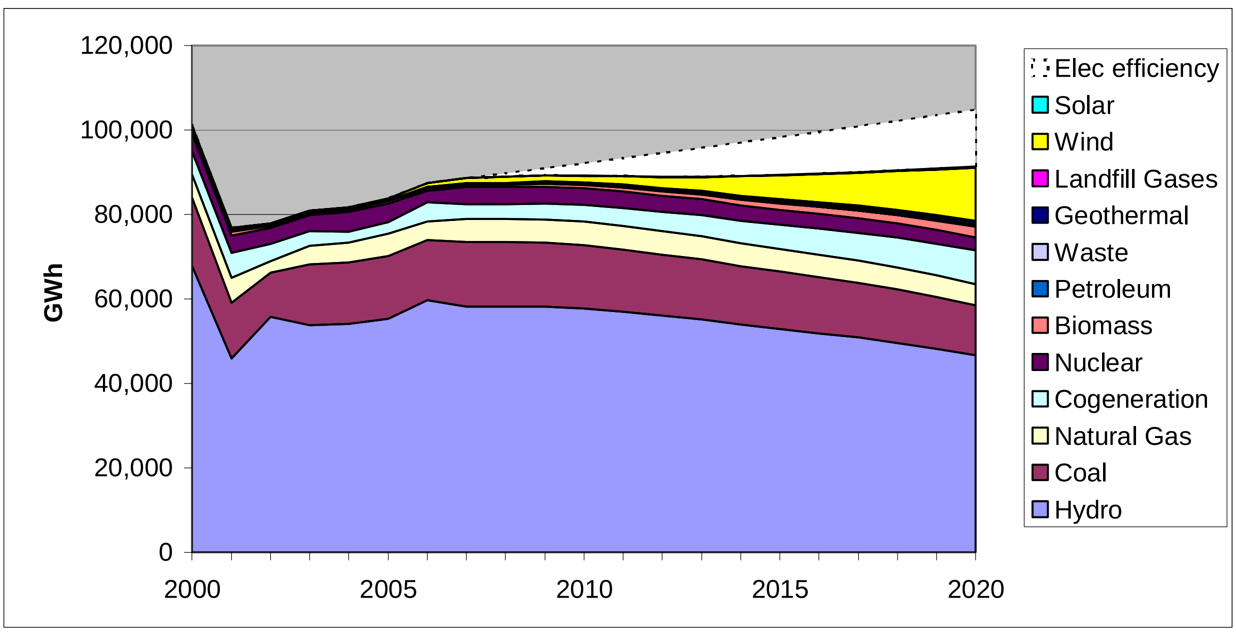


Washington Load-based Electricity Generation, Policy Case using Scenario A (avoid fossil fuel generation)



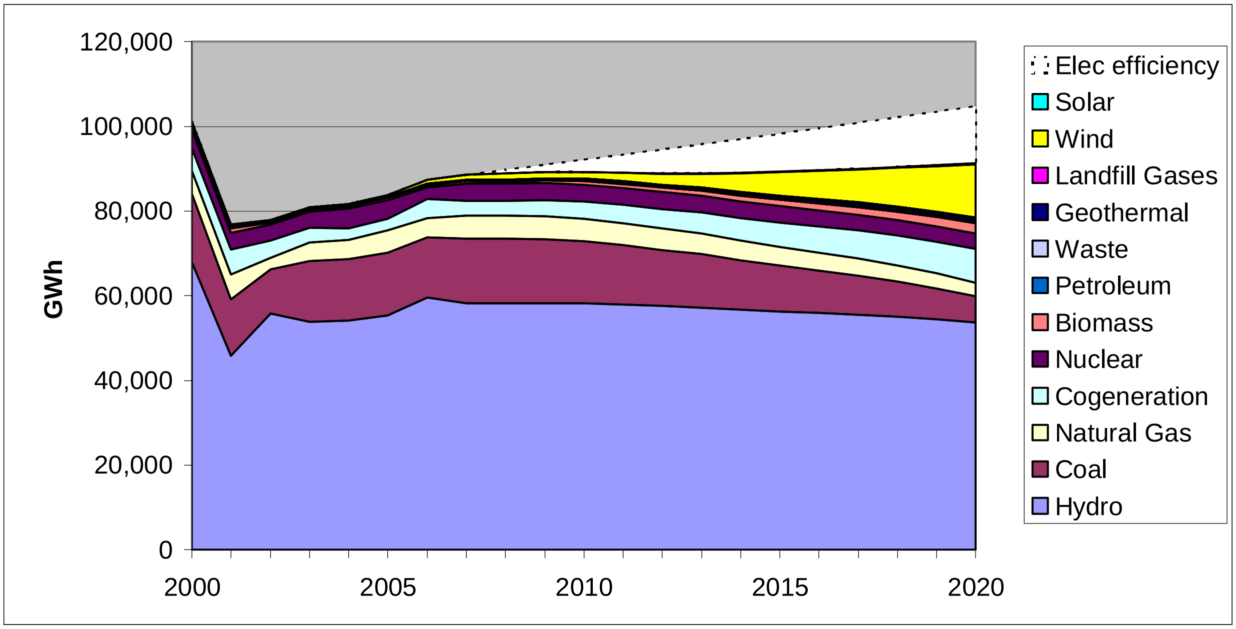
Note: "Elec efficiency" refers to demand-side electricity efficiency improvements through I-937 and RCI options

Washington Load-based Electricity Generation, Policy Case using Scenario B (avoid all resources in proportion to average mix of existing generation)



Note: "Elec efficiency" refers to demand-side electricity efficiency improvements through I-937 and RCI options

**Washington Load-based Electricity Generation
Policy Case using Average of Scenario A and B**

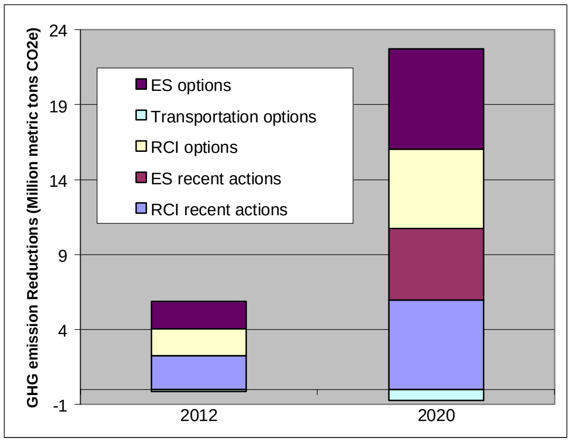


Note: "Elec efficiency" refers to demand-side electricity efficiency improvements through I-937 and RCI options

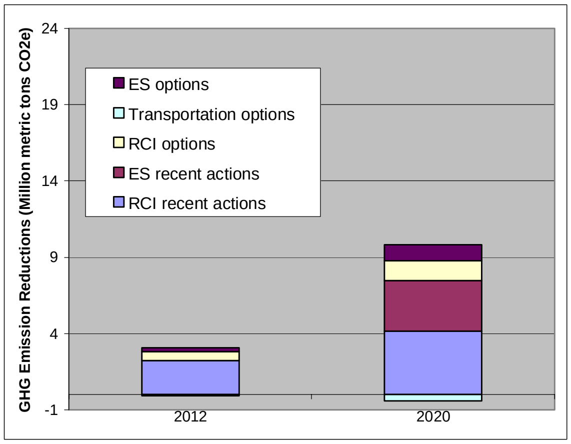
GHG Emission Reductions

The following charts show the emission reductions based on the different assumptions for reductions of existing resources. Note that the Transportation option leads to increased emissions from electricity generation because the plug-in hybrids lead to increased electricity demand (though decreased gasoline consumption, which is accounted for under the Transportation TWG).

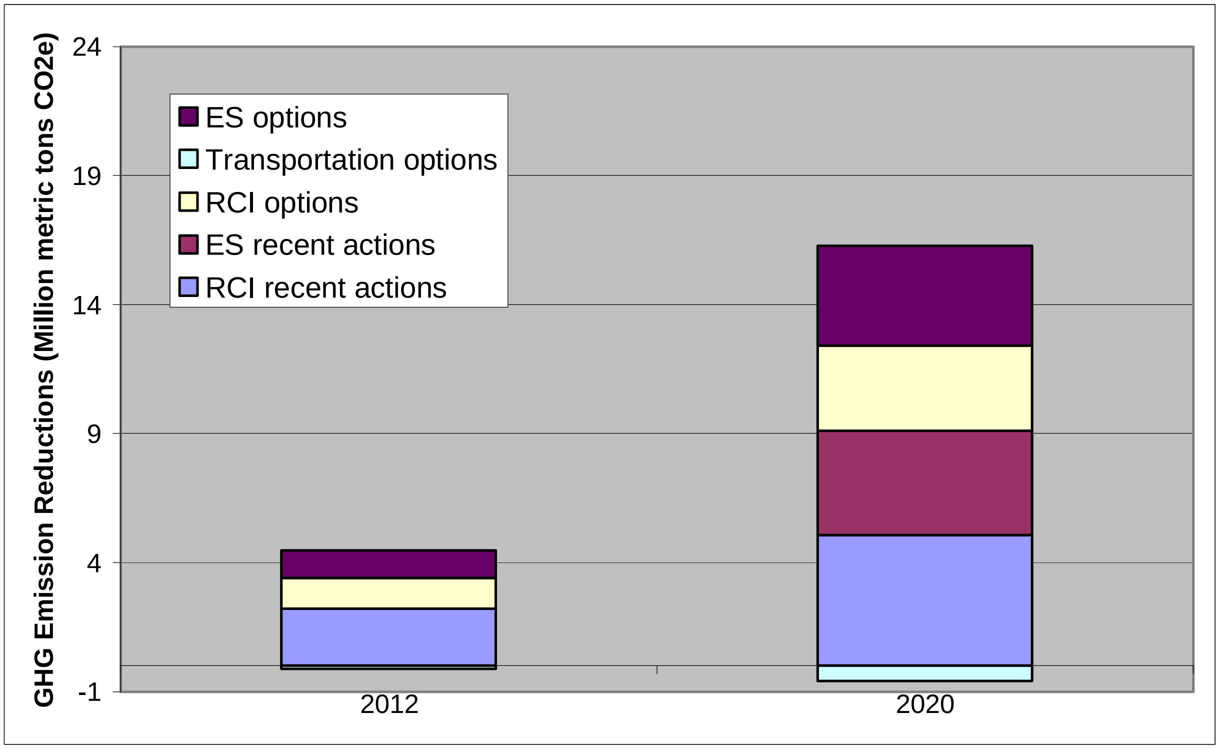
Scenario A



Scenario B



GHG emission reductions, Average of Two Scenarios
(used in reporting total results in ES table above)



The results of the above bar chart are represented annually from 2000 to 2020 in the following chart

GHG emission reductions, Average of Two Scenarios