

Memorandum

**Re: Contribution of recent actions to Washington State GHG mitigation:
preliminary analysis**

Date: July 30, 2007

Background

Executive Order 07-02, Section 2, enumerates several recent actions that were expected to achieve at least 60% of the greenhouse gas (GHG) reduction target set for 2020 in the Executive Order (E.O.). This memo provides a quantitative analysis of those and other recent actions for the purpose of assessing their relative and total contributions to Washington State's greenhouse gas reduction goals.

Nine actions lend themselves to quantitative estimates of reductions and are analyzed in this memo.¹ These are:

1. Working to ensure cars sold in Washington meet stringent emission standards beginning with 2009 models [first bullet in E.O., Section 2]; *Note: this action may be delayed depending on actions of the U.S. EPA; see discussion on page 4.*
2. Working with farmers, entrepreneurs, fuel distributors and retailers to assure that: biofuel feedstocks are grown in Washington; refiners, blenders and distributors of biofuels create family wage jobs in Washington; and the public can purchase fuel blends that reduce our dependence on imported fuel [third bullet in E.O., Section 2];
3. Reducing energy use by state agencies by achieving the goals established in Executive Order 05-01, Establishing Sustainability and Efficiency Goals for State Operations [ninth bullet in E.O., Section 2];
4. Cleaner Energy Act [not in E.O.];
5. Constructing high performance green buildings [fourth bullet in E.O., Section 2];

¹ The Executive Order enumerates a total of nine actions, seven of which are evaluated in this memo. The two that are not included cannot be quantified at this point in time; they are:

- Retrofitting the most polluting diesel engines in school buses and local government vehicles [second bullet in E.O., Section 2]; and
- Pursuing new water resources in Eastern Washington, including water conservation projects, developing new storage and new creative water management alternatives [eighth bullet in E.O., Section 2];

The ninth bullet in the Executive Order, Section 2 also implies quantification of GHG reductions due to changes in office paper consumption and disposal. Though office paper reduction and the use of environmentally preferable products will reduce GHG emissions, the size of the reduction is small and extremely difficult to calculate because it depends on lifecycle data relating to manufacture and disposal of many different streams of paper.

6. Maintaining the highest levels of efficiency in our state’s energy code and regularly updating and enhancing those standards [fifth bullet in E.O., Section 2];
7. Examining compliance with appliance efficiency standards and updating and enhancing those standards [sixth bullet in E.O., Section 2];
8. Implementing the requirements of the Energy Independence Act by adopting rules that help utilities to succeed in meeting their renewable energy targets [seventh bullet in E.O., Section 2]; and
9. GHG emission performance standard [not in E.O.].

Figure 1 below illustrates the current estimate of Business As Usual (BAU) growth in Washington State’s greenhouse gas inventory. BAU growth represents the path Washington State’s greenhouse gas emissions would take if all policies remained exactly as they were prior to the nine recent actions and the state’s population and economy continued to grow at their current rates. Figure 1 also shows a hypothetical path, labeled “target,” returning to 1990 emission levels by 2020. The line labeled “existing actions” represents the forecast emissions, after accounting for the reductions estimated in this memo.

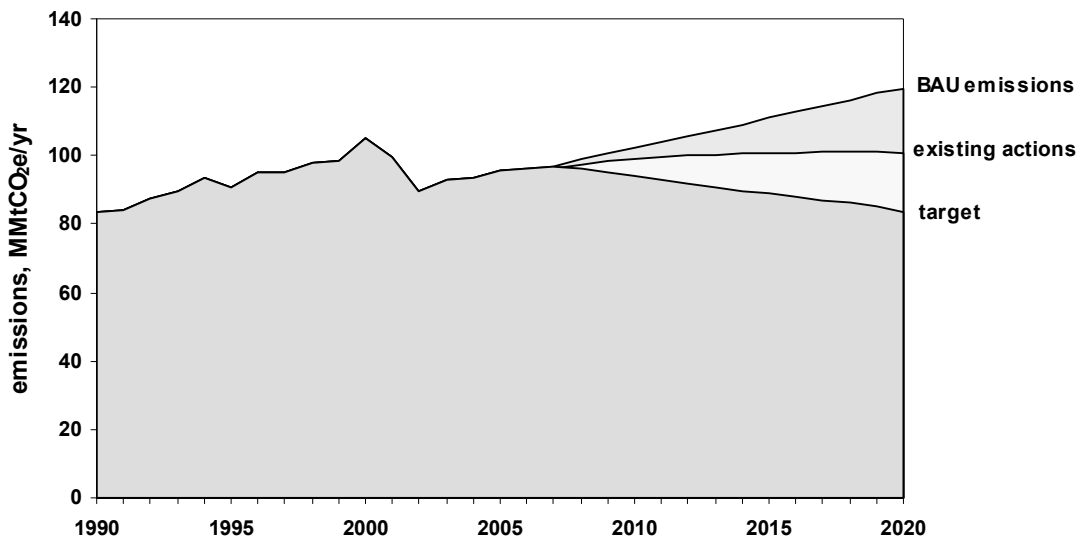


Figure 1 – Historical and projected Washington State emissions, 1990-2020. “BAU” means Business As Usual. “Target” represents a hypothetical path to achieve 1990 emissions by 2020. “Existing actions” is the path expected after accounting for the reductions quantified in this memo.

Figure 2, below is a detail of the reduction lines in Figure 1, showing the contributions of each of the prior actions separately. Only the five items labeled in the figure produce sufficient savings to be visible at this scale.

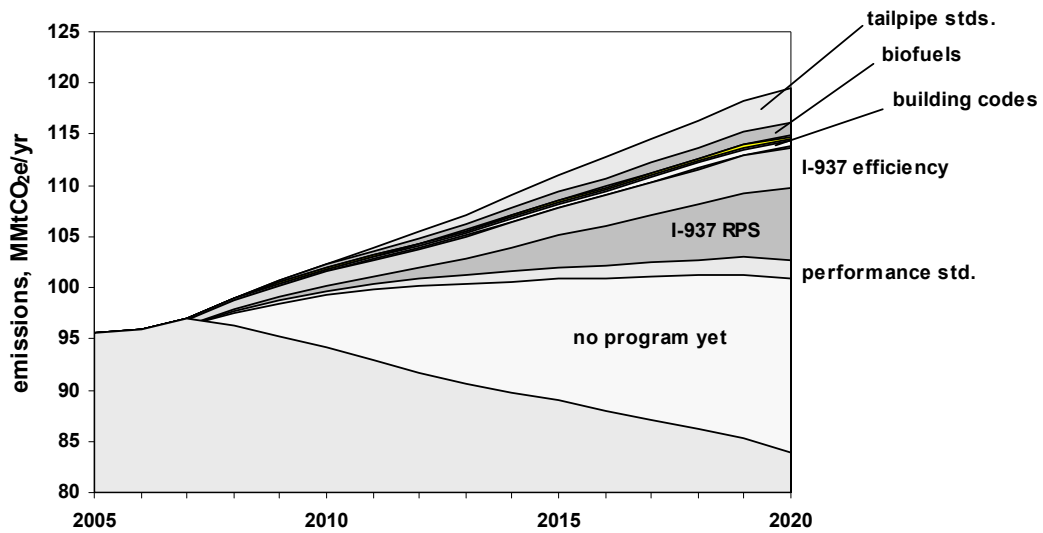


Figure 2 – Effects of recent policy actions on future Washington GHG emissions, as quantified in this memo.

The Washington State GHG inventory and projections to 2020 are still under development, but remaining adjustments are not likely to significantly affect the broad conclusions of this memo. Currently, gross 1990 Washington State GHG emissions are estimated to be 84 million metric tons of CO₂ equivalents (MMtCO₂e), and the 2020 business-as-usual (BAU) projection of total emissions is estimated to be 120 MMtCO₂e. Therefore, GHG emissions in the year 2020 would need to be reduced by 36 MMtCO₂e from BAU levels in order to reach the state’s goal of returning to 1990 levels by that time.²

As described below, the prior actions are estimated to avoid 19 MMtCO₂e by 2020, and thus contribute slightly over 50% of the emissions reductions needed to meet the State’s 2020 target. This estimate falls short of the 60% contribution projected at the time of the Executive Order principally because recent updates to the state GHG inventory and projection have resulted in an increase in emissions reductions needed to meet the state goals. At the time the Executive Order was released, 1990 emissions were estimated at 79 MMtCO₂e, and 2020 emissions at 106 MMtCO₂e, implying that the need to reduce emissions by only 27 MMtCO₂e below BAU levels in 2020.

² Throughout this memo, totals may differ slightly due to rounding.

Transportation-related actions

Transportation emissions contribute 45 MMtCO₂e to the 2005 GHG inventory, and originate from various sources as shown in Figure 3. They are expected to grow to 57 MMtCO₂e by 2020.

Existing measures affecting transportation can collectively avoid about 5.0 MMtCO₂e of GHG emissions by 2020; this is 8.8% of the projected transportation emissions, and about 14% of the statewide 2020 target.

1. Emission tailpipe standards for automobiles

Emission tailpipe standards for automobiles will result in approximately 3.4 MMtCO₂e in avoided emissions in calendar year 2020, or 9.5% of the 2020 reduction goal.

Description of the action

The 2005 Legislature enacted the Motor Vehicle Emissions Standards Act recognizing the importance of mitigating climate change by limiting emissions of GHGs from motor vehicles and directing Ecology to adopt California motor vehicle emission standards.³ Beginning January 1, 2009, new cars and light trucks sold in the state must meet the strict vehicle emission standards. Ecology adopted the clean car rule in 2006.⁴

In order for any state, including California, to implement the motor vehicle emissions standards, EPA must issue California a waiver from the Clean Air Act. California's waiver request is currently pending before EPA and the agency is not expected to take action before the end of the 2007 calendar year. That, coupled with lawsuits from auto dealers and auto manufacturers, threatens to delay their deployment. Hence the projections estimated here should be understood as the most optimistic, as they assume no such delays. If delay occurs, each year of delay would remove approximately 0.4 MMtCO₂e of the anticipated 2020 reduction.

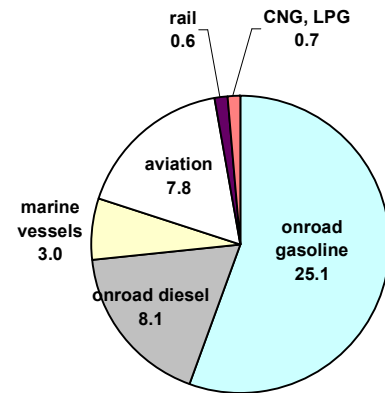


Figure 3 – 2005 transportation emissions in Washington State, MMtCO₂e .

³ Chapter 295, Laws of 2005 (ESHB 1397), available at <http://www.leg.wa.gov/pub/billinfo/2005-06/Pdf/Bills/Session%20Law%202005/1397-S.SL.pdf>. The Act has been informally referred to as “Cal Cars,” “Clean Car Act of 2005,” “tailpipe emissions standards,” or “Pavley;” the last of these refers to California Assemblywoman Fran Pavley, who introduced California Assembly Bill 1493 in 2002.

⁴ Washington Administrative Code ch. 173-423.

Methodology

The Washington Department of Ecology conducted a cost-benefit analysis during its rulemaking process that included estimates of the fuel savings for each year from 2009 to 2030.⁵ The annual fuel saving for 2020 was estimated at 390 million gallons, and for 2030 at 700 million gallons. These fuel savings estimates were used directly in preparing the estimates of fuel savings presented in this analysis. The California model (EMFAC—emission factor) was used to estimate vehicle emissions resulting from the vehicle emission standards. Ecology assumed similar economic conditions and population growth to California.

Though the emissions standards set by the California Air Resources Board (CARB) mandate large reductions in emissions for the average *new* vehicle by 2016, the change in gross emissions statewide occurs more slowly because it takes many years for new cars to replace old cars in the vehicle stock. The EMFAC model yields an 18% reduction in CO₂e in Washington by 2020, and 27% by 2030, by which time the fleet will be almost entirely California-certified vehicles. Because the Washington Ecology analysis duplicates a similar effort by CARB, it assumes stock changes identical to those expected for California. If vehicle stock in Washington turns over at a different rate, this will affect the size of the 2020 estimate because either more or less California-certified vehicles will have replaced older, non-certified model years.

The emissions savings produced by standards are reduced by a few percent by interaction with the biofuels measure, see the Appendix to this memo for details.

2. Biofuels

When biofuels standards are set at the most aggressive levels allowed by legislation, approximately 1.3 MMtCO₂e of 2020 GHG emissions will be avoided, or 3.7% of the statewide 2020 target.

Description of the action

Washington state has passed into law several requirements and incentives supporting an in-state biodiesel industry.

- In 2003, the Legislature passed four bills that provide various tax incentives to encourage the development, distribution, and sale of biodiesel and ethanol fuels.⁶

⁵ Washington State, Department of Ecology, *Cost, Benefit, and Least Burdensome Analysis for the Proposed Low Emission Vehicles Chapter 173-423 WAC*, October 2005, pub. no. 05-02-029, available at <http://www.ecy.wa.gov/pubs/0502029.pdf>.

⁶ Chapter 261, Laws of 2003 (HB 1240) available at <http://www.leg.wa.gov/pub/billinfo/2003-04/Pdf/Bills/Session%20Law%202003/1240-S2.SL.pdf>; Chapter 63, Laws of 2003 (HB1241) available at <http://www.leg.wa.gov/pub/billinfo/2003-04/Pdf/Bills/Session%20Law%202003/1241-S2.SL.pdf>; Chapter 17, Laws of 2003 (HB 1242) available at <http://www.leg.wa.gov/pub/billinfo/2003->

- In 2005, Governor Gregoire signed Executive Order 05-01 (superseding Executive Order 04-06), *Establishing Sustainability and Efficiency Goals for the State Operations*. Executive Order 05-01 directs agencies to reduce petroleum use 20% (state agency fuel use is about 36 million gallons per year) in the operation of state vehicles and privately owned vehicles used for state business by September 1, 2009. By that date standard diesel must be replaced with 20% biodiesel blend and as soon as practical, agencies must begin using a minimum 5% bio-blend.
- In 2006, the Legislature adopted the Fuel Quality Standards Act establishing minimum renewable fuel content requirements and fuel quality standards.⁷ Beginning November 30, 2008, fuel suppliers must ensure a minimum of 2% of total annual diesel and 2% of total annual gasoline sold in the state must be biodiesel or ethanol. The law allows those numbers to be increased to 10% mandated ethanol and 5% mandated biodiesel, if in-state production supports higher levels.
- The 2006 Legislature established the Energy Freedom Program⁸ in the Department of Agriculture and appropriated \$17 million for the Energy Freedom Loan Program to develop a viable bioenergy industry, promote research and development in bioenergy sources and markets and to support an agriculture industry to grow bioenergy crops.

GHG reductions due to the first and fourth of these initiatives are not calculated, as the actions do not set quantity targets for production or consumption. The second item, Executive Order 05-01, is quantified in *State fleet efficiency*, below. Hence the methodology described in this section is exclusively for quantifying the Fuel Quality Standards Act.

Methodology

For this memo we assume that rulemaking follows the most aggressive limits allowed by the Fuel Quality Standards Act by January 1, 2020; this means that in 2020 5% of diesel sales will be biodiesel, and 10% of gasoline sales will be ethanol.

It is assumed that in calendar year 2008, 1% of diesel fuel sales are biodiesel, and that the 2% criterion for diesel is met in calendar year 2009. After calendar year 2009, the fraction of diesel climbs linearly up to 5% in 2020. For each gallon of diesel replaced with biodiesel, emissions are reduced by 54%.⁹

04/Pdf/Bills/Session%20Law%202003/1242-S.SL.pdf; Chapter 64, Laws of 2003 (HB 1243) available at <http://www.leg.wa.gov/pub/billinfo/2003-04/Pdf/Bills/Session%20Law%202003/1243-S.SL.pdf>.

⁷ Chapter 338, Laws of 2006 (ESSB 6508) available at <http://www.leg.wa.gov/pub/billinfo/2005-06/Pdf/Bills/Session%20Law%202006/6508-S.SL.pdf>.

⁸ Chapter 171, Laws of 2006 (E3SHB 2939) available at <http://www.leg.wa.gov/pub/billinfo/2005-06/Pdf/Bills/Session%20Law%202006/2939-S3.SL.pdf>. The Energy Freedom Program was subsequently amended by Chapter 348, Laws of 2007 (see note 11 on p. 6)

⁹ Though biodiesel is manufactured from biological feedstocks that consume as much CO₂ during growth as they emit at combustion, upstream processes for growing the feedstocks and refining the biodiesel produce GHG emissions. Fossil diesel refining also produces upstream emissions, but fewer. Hence

The state currently uses about 0.93% ethanol. Under the 2005 federal Energy Policy Act (EPACT) by 2012, an average of 5% ethanol is required nationally. It is assumed that the current ethanol mix is already ramping up in response to EPACT, moving linearly from 0.93% in 2007 to 5% in 2012. This satisfies the state mandate of 2% by 2009 automatically. From 2012 to 2020, the mix increases linearly from 5% to 10%, following the strongest target permitted by the Fuel Quality Standards Act. Only the portion over 0.93% is counted as a reduction. For each gallon of gasoline replaced with ethanol, emissions are reduced by a variable percentage based on the relative quantities of corn and cellulosic ethanol. In 2008, all ethanol is assumed to be corn ethanol, with a GHG reduction of 25% per gallon. This increases linearly to a GHG reduction of 38% per gallon in 2020, assuming that by then 25% of ethanol is cellulosic.¹⁰

The emission reductions are also slowed by interaction with the automobile emissions standards measure, see the Appendix to this memo for additional details.

3. State fleet efficiency

Meeting the E.O. goal for gasoline reduction in the state vehicle fleet would avoid approximately 0.05 MMtCO₂e, or 0.1% of the statewide 2020 target.

Description of the action

In 2005, Governor Gregoire signed Executive Order 05-01 (superseding Executive Order 04-06), *Establishing Sustainability and Efficiency Goals for State Operations*. Executive Order 05-01 is incorporated by reference into E.O. 07-02, as one of the enumerated goals in Section 2.

Executive Order 05-01 directs agencies to reduce petroleum use 20% in the operation of state vehicles and privately-owned vehicles used for state business by September 1, 2009, in part through managed replacement of the state vehicle fleet with high-efficiency vehicles, and in part through replacing standard diesel with biodiesel blends. In particular, the state fleet must be using a 20% biodiesel blend by September 1, 2009.

biodiesel reduces *direct* fossil emissions by 100%, but increases *indirect* emissions, such that Btu-for-Btu the net emissions reduction is only 58%. This result was calculated with Argonne National Laboratory's Greenhouse gases, Regulated Emissions, and Energy use in Transportation (GREET) model. See TIAX LLC, *Full Fuel Cycle Assessment: Well-to-Wheels Energy Inputs, Emissions, and Water Impacts*, California Energy Commission 2007, report no. CEC-600-2007-004-F, available at <http://www.energy.ca.gov/2007publications/CEC-600-2007-004/CEC-600-2007-004-F.PDF>.

¹⁰ Cellulosic ethanol makes use of most the feedstock's plant structure; corn ethanol is manufactured from the kernels only and hence is energetically less efficient than cellulosic ethanol. As described in footnote 9, the upstream emissions were estimated using GREET.

Methodology

In this section we estimate the effect of reaching a 20% reduction in state fleet *gasoline* demand by the target date. Reductions associated with the biodiesel blend are calculated separately in the Section 4 below, since the E.O. requirements were enacted into law as part of the Cleaner Energy Act.

We modeled the 20% target as being approached linearly beginning in 2006 such that it is met as of January 1, 2010. From 2010 through 2020 the gasoline reduction remains at 20%, but the associated reduction grows slightly as the state fleet size grows in proportion to state population. The estimate is based on state agency gasoline use of 24 million gallons in 2006.

4. Cleaner Energy Act (not in E.O.)

Three different provisions in the Cleaner Energy Act together have the potential, if implemented to the most aggressive extent suggested by the law, to reduce emissions by approximately 0.2 MMTCO₂e, or 0.6% of the statewide 2020 target.

Description of the action

In 2007 the Legislature passed a Cleaner Energy Act that includes several provisions having an impact on GHG emissions.¹¹

- A school bus replacement incentive program encourages replacement of 1994 or older school buses with new models (§ 101(1));
- Diesel vehicles in the state fleet are required to consume 20% biodiesel by June 1, 2009, echoing the requirement of Executive Order 05-01 (§ 201(2)); and
- A target is set for meeting 100% of the state fleet's fuel needs with electricity and biofuels by June 1, 2015. (§§ 202(1) & 204).

Methodology

K-12 schools in Washington state host a fleet of slightly under 10,000 buses. Of these, over 3,000 date from 1994 or earlier. The Cleaner Energy Act was assumed to increase the rate of 1994 or earlier bus replacement by 100 buses per year. Each new bus will

¹¹ Chapter 348, Laws of 2007 (E2SHB 1303), available at <http://www.leg.wa.gov/pub/billinfo/2007-08/Pdf/Bills/Session%20Law%202007/1303-S2.SL.pdf>. The Act includes several other provisions whose GHG reductions cannot be quantified at this point in time:

- school bus retrofits or alternative fuels (§ 102(2)(a));
- pollution control at ports (§ 103);
- vehicle electrification/PHEV measures (§§ 206, 401, 408); and
- amendments to the Energy Freedom Program (§ 301).

have better fuel economy than the retired bus, and emit about 2.4 fewer metric tons of CO₂ each year. Hence, each year the quantity of avoided emissions increases by approximately 240 metric tons.

Both diesel and gasoline use are stipulated to decrease to zero by 2016, following the goal established in Sections 202(1) and 204 of the Act.

The estimate for reductions in state diesel consumption was limited to the ferry fleet, which consumed 17 million gallons of diesel in 2005. Ferry diesel demand is projected to increase according to population growth, reaching 22 million gallons by 2020. Replacement of diesel with biodiesel was modeled to increase linearly beginning in 2006, reaching 100% by January 1, 2016. Each gallon of biodiesel was estimated to reduce emissions by 54%, according to the lifecycle emissions ratio described in footnote 9.

Projected gasoline use in the state fleet was adjusted to account for the impacts of the state biofuels standard (measure number 2) and the state fleet efficiency requirement (measure number 3). Replacement of the remaining gasoline use was modeled to grow linearly beginning in 2008, reaching 100% by January 1, 2016. It is assumed that the gasoline will be replaced entirely with mixtures of corn and cellulosic ethanol as described for measure number 2 above, with corresponding upstream emissions factors. Significant amounts of displacement by electric energy are not likely for several years, and furthermore once it is possible it is likely to produce an emission reduction similar to cellulosic ethanol. Since cellulosic ethanol is also modeled to enter the mix only in later years, including electricity in the modeling would not change the result significantly.

RCI - related actions

Residential, commercial and industrial emissions contribute 19 MMtCO₂e to Washington’s 2005 GHG inventory, and originate principally from combusting natural gas and oil, as shown in Figure 4. RCI emissions are expected to grow to 24 MMtCO₂e by 2020.

Existing measures affecting residential, commercial and industrial buildings and facilities together contribute about 4.8 MMtCO₂e of emissions reductions by 2020, reducing the projected RCI emissions by 20% and achieving about 13% of the statewide 2020 target.

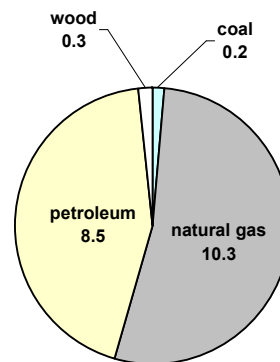


Figure 4 – 2005 RCI emissions in Washington State, MMtCO₂e .

All of the RCI measures also result in reductions in electricity consumption. The emissions reduction associated with each unit of electricity use reduced is calculated using a provisional marginal emissions rate for electricity of 0.5 MMtCO₂e/MWh. This emissions rate is a rough approximation reflecting past detailed analysis by the U.S. EPA in the late 1990s that suggested a marginal emissions rate closer 0.7 MMtCO₂e/MWh and the recent trend towards natural gas combined cycle generation with a lower emissions rate (about 0.4 MMtCO₂e/MWh), and the current BAU projections that suggest most new generation in Washington state will be gas-fired. Furthermore, the emission performance standard recently enacted by SB 6001 appears to set a maximum emissions rate of about 0.5 MMtCO₂e/MWh for new long-term utility purchases as well for new in-state power projects. Further analysis is underway to improve the BAU projections, based on modeling analysis by the Northwest Power Planning Council, which is expected to yield more detailed estimates.

5. State green building standard

Replacements and upgrades of state facilities to green building standards can avoid approximately 0.21 MMtCO₂e, or 0.6% of the statewide 2020 target.

Description of the action

Executive Order 05-01 directs state agencies to adopt green building practices in the construction of all new buildings and in the renovation of existing buildings for which the cost of the project amounts to at least 60% of the building’s appraised value.

Building projects of over 25,000 square feet entering the pre-design phase from 2005 to 2007 must either meet the Leadership in Energy and Environmental Design (LEED) “Silver” Standard, or be certified by the Department of General Administration (GA).

Effective July 24, 2005, the High-Performance Public Buildings Act (codified in Chapter 39.35D RCW), signed into law by Governor Gregoire on April 8, 2005, requires all new state-funded facilities over 5,000 square feet to meet green building criteria.¹² Major office and higher education facility projects will be required to achieve the US Green Building Council Leadership in Energy and Environmental Design rating standards, referred to as LEED™ Silver certification; new K-12 schools will be required to meet the Washington Sustainable Schools Protocol (WSSP) or LEED certification. The Department of General Administration's Sustainable Design and Construction program oversees the construction or reconstruction of state and state funded facilities built to LEED standards.

These requirements do not apply to affordable housing projects that receive state funding, although the bill does require the Department of Community, Trade, and Economic Development to adopt sustainable building standards by July 1, 2008. In addition in the sustainable building requirements, the legislature prioritizes the use of locally extracted and manufactured products in all state building projects.

Executive Order 05-01 also requires that state agencies must use all practicable and cost effective means available, including energy efficiency and renewable energy measures, to reduce energy purchases by 10% from fiscal year 2003 levels by September 1, 2009. Procedures for monitoring, documentation, and reporting of the progress of these efforts are outlined in the order.

Methodology

A rough estimate of emissions reductions due to Executive Order 05-01 was made by assuming that each new or renovated green building reduces electric and gas use by 30% each, that 5% of the state's total stock of buildings are replaced or renovated each year, and that 50% of the state's electric and gas bills are accrued to qualifying facilities (state-owned buildings greater than 5,000 square feet). Reductions in electric consumption yield reductions in GHG emissions at the marginal emissions rate for electricity consumption in Washington.¹³

The state constructs new or replacement school buildings at the rate of approximately 2.6 million square feet per year. The same assumption regarding 30% reductions in electric and gas use was applied to the average electric and gas used per square foot in school buildings.

¹² Chapter 12, Laws of 2005 (ESSB 5509) available at <http://www.leg.wa.gov/pub/billinfo/2005-06/Pdf/Bills/Session%20Law%202005/5509-S.SL.pdf>.

¹³ Executive Order 05-01, Section 7, also sets a goal for a 10% reduction in electric use by state agencies beginning September 1, 2009. This goal was not included in the quantitative modeling due to the complex interaction with the green buildings requirement.

6. Building codes

Recent adjustments to state building codes are expected to yield 0.56 MMtCO₂e of GHG emissions reductions, or 1.6% of the statewide 2020 target.

Description of the action

Three packages of building code changes have been approved to take effect on July 1 of 2002, 2005 and 2007, respectively. The building code changes include a number of provisions that increase both residential and commercial building energy efficiency.

Methodology

CTED provided estimates of first-year electricity and gas savings associated with each package of changes. Each package of changes penetrates the housing stock at a constant rate through 2020, so that each year the first-year savings are added to the cumulative savings from prior years. The result is a linear increase in savings associated with each package such that in the second year savings are twice those in the first year, in the third year savings are three times those in the first year, and so forth. These trajectories for the three building code packages were summed to estimate total electric and gas savings from 2002 to 2020. To arrive at GHG reductions, electric savings were multiplied by the marginal emission factor of electricity and gas savings were multiplied by the emission factor of natural gas.

7. Appliance standards

State and federal appliance standards passed since 2005 will produce about 0.08 MMtCO₂e of the statewide 2020 target.

Description of the action

Washington is one of only 10 states with standards for minimum energy efficiency of specific products not covered by federal standards. The 2005 Legislature adopted minimum efficiency standards for 12 products (RCW 19.260.040). Some were overridden by the 2005 federal standards. CTED is authorized by statute to update and recommend standards not covered by federal standards if: the products are being produced, they are cost effective, their utility is equal to or exceeds the existing product, and the standards exist in at least two other states.

The National Energy Policy Act of 2005 set new standards on 16 products, such as exit signs, torchiere lights, compact fluorescent light bulbs and other products. The federal standards override the state's standards. Other energy efficiency resource standards and equipment efficiency standards are under discussion for inclusion in possible new federal energy legislation.

Methodology

CTED supplied estimates of first-year electricity and gas savings for each appliance, and 2020 electricity and gas savings for each appliance. After the first year, savings due to each appliance increases linearly until the appliance's average life expectancy is reached, after which point the savings remain constant. The trajectories for the various appliances are summed to estimate total electric and gas savings from 2002 to 2020. To arrive at GHG reductions, electric savings are multiplied by the marginal emission factor of electricity, and gas savings are multiplied by the emission factor of natural gas.

8(a). Energy Independence Act efficiency measures

Energy efficiency measures called for by Initiative 937, the Energy Independence Act, are expected to achieve approximately 3.9 MMtCO_{2e} of GHG reductions, or 11% of the statewide 2020 target.

Description of the action

The goal is to make more efficient use of energy by reducing energy consumption through policies that spur efficiency, including appliances and equipment standards, building codes and consumer education. The potential for “saved” energy from residential and commercial use is quite high.

The Energy Independence Act requires the use of “methodologies consistent with those used by the Pacific Northwest electric power and conservation planning council in its most recently published regional power plan...” also known as the NPCC 5th Plan. The 5th Plan calls for reduction of 2,800 aMW (average megawatts) in energy consumption through conservation in the next 20 years (2025) in the Northwest. Washington state consumes about 50% of the energy in the Northwest (based on Washington's population as compared to the rest of the region).

Methodology

CTED estimated the first year Washington state energy savings due to the NPCC 5th Plan efficiency measures to be 60 MW. The I-937 energy efficiency measures are modeled as penetrating the market linearly beginning in 2006, so that total efficiency is 120 aMW in 2007, 180 aMW in 2008, and continuing to increase at 60 aMW per year until 2020, when total savings reaches 900 aMW. Each year's GHG emissions reduction is the savings due to efficiency multiplied by the marginal electricity emission factor.

Energy Supply – related actions

GHG emissions resulting from electric generation in Washington state originate principally from natural gas and coal combustion, as shown in Figure 5. 2005 emissions from this sector constitute 20% of the inventory at 19 MMtCO₂e, and are expected to grow to 23 MMtCO₂e by 2020.

Prior actions in the Energy Supply sector are expected to reduce emissions by 8.9 MMtCO₂e, some 39% of the sector emissions and 25% of the statewide 2020 target.

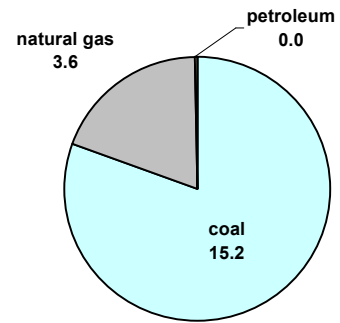


Figure 5 – 2005 Energy Supply emissions in Washington State, MMtCO₂e .

8(b). Energy Independence Act renewable portfolio standards

The renewable portfolio standard (RPS) implemented under the Energy Independence Act is expected to result in approximately 7.1 MMtCO₂e of emissions reductions, or 20% of the statewide 2020 target.

Description of the action

Washington has significant solar, wind, wave, tidal and bio-mass resources. Shifting from fossil fuel-based energy to bio-energy and bio-products will reduce GHG emissions. 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 2012, 9% in 2016 and 15% in 2020) and undertake cost-effective energy conservation. The renewable portfolio standards affect 95% of the electric generation in the state.

Renewable resources include: water; wind; solar; geothermal; landfill gas; wave, ocean and tidal energy; and gas from sewage treatment facilities.

Methodology

The portion of load supplied by renewables is interpolated linearly between the target years. Prior to 2012, the portion is interpolated linearly between the existing fraction supplied by qualifying renewables, 0.8% as of 2007, and the 3% target set for 2012. The amount of conventional generation displaced by the RPS in each year is the interpolated target minus the baseline fraction (0.8%). The percentage targets are applied to the load calculated *after* reductions due to the RCI electric efficiency measures. The RPS resources are assumed to displace electric generation having the marginal GHG emission rate.

9. GHG emission performance standard

The GHG emission performance standard implemented by recent legislation will result in reductions of approximately 1.8 MMtCO₂e, or 5.1% of the statewide 2020 target.

Description of the action

In 2007 the Legislature passed a Climate Change – Mitigating Impacts Act that includes a GHG performance standard for all new electric generating resources (including long term power purchase contracts, defined in the legislation as 5 years or longer).¹⁴ The performance standard requires new resources to emit no more than the emissions rate of an average new, natural gas, combined-cycle combustion turbine, or 1,100 lb CO₂e/MWh, whichever is less. A resource is considered new when it becomes a “subject of long-term financial commitments.”

Methodology

The policy will result in the inability of utilities to renew existing, long-term contracts with providers of coal-fired electricity generation. The effect is estimated by freezing growth of coal-fired resources in the consumed electric mix, and gradually replacing 25% of the coal-fired resources with gas-fired resources by 2020.

Baseload resources on long-term contracts typically do not decrease with reductions in electric demand. Hence, to the extent that the coal-fired resources are baseload resources, this policy does not interact with the other reduction measures covered in this memo. However, some of the coal-fired resources are spot market purchases, which may increase with economic growth. But spot market purchases do interact with the other measures, so the coal-related, spot-market emissions will experience an opposing tendency to decrease as electric demand decreases. The effect on emission reductions of this complex interaction is not estimated in this memo.

¹⁴ Chapter 307, 2007 Laws (ESSB 6001), available at <http://www.leg.wa.gov/pub/billinfo/2007-08/Pdf/Bills/Session%20Law%202007/6001-S.SL.pdf>, § 5.

Appendix – interaction terms

The biofuel standard, if enacted alone, would reduce existing automotive emissions E_0 by a factor $r(1-u)$, where r is the fractional substitution of ethanol for gasoline, and u is the lifecycle emissions ratio of ethanol vs. gasoline, so that once the program was in place the adjusted gross emissions would be:

$$E_{\text{biofuel standard only}} = (1 - r(1 - u))E_0$$

and the corresponding, gross reduction would be

$$R_{\text{biofuel standard only}} = E_0 - E_{\text{biofuel standard only}} = r(1 - u)E_0.$$

The automobile emissions standard, if enacted alone, would reduce existing automotive emissions E_0 by a factor $\frac{e_0 - e}{e_0}$, where e_0 and e are the emissions per mile before and after the standard, respectively, so that once the program was in place the adjusted gross emissions would be:

$$E_{\text{automotive emissions standard only}} = \left(1 - \frac{e_0 - e}{e_0}\right)E_0$$

and the corresponding, gross reduction would be

$$R_{\text{automotive emissions standard only}} = E_0 - E_{\text{automotive emissions standard only}} = \frac{e_0 - e}{e_0}E_0.$$

If both programs are implemented, the adjusted gross emissions would be

$$E = (1 - r(1 - u))\left(1 - \frac{e_0 - e}{e_0}\right)E_0$$

and the corresponding, gross reduction would be

$$\begin{aligned}
R &= E_0 - E \\
&= E_0 - (1 - r(1 - u)) \left(1 - \frac{e_0 - e}{e_0} \right) E_0 \\
&= E_0 - \left[E_0 - r(1 - u)E_0 - \frac{e_0 - e}{e_0} E_0 + r(1 - u) \frac{e_0 - e}{e_0} E_0 \right] \\
&= r(1 - u)E_0 + \frac{e_0 - e}{e_0} E_0 - r(1 - u) \frac{e_0 - e}{e_0} E_0 \\
&= R_{\text{biofuels standard only}} + R_{\text{automotive emissions standard only}} - r(1 - u) \frac{e_0 - e}{e_0} E_0.
\end{aligned}$$

So when both programs are implemented together, their combined reductions, once summed, must be decremented by the term $r(1 - u) \frac{e_0 - e}{e_0} E_0$.