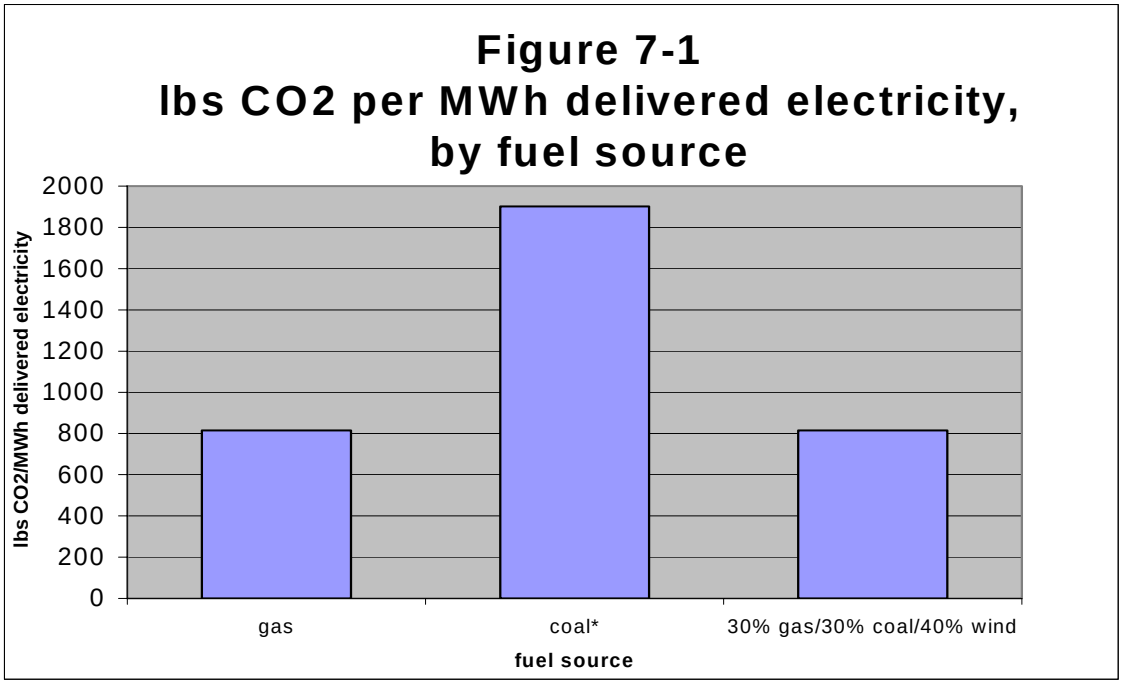
DRAFT DOCUMENT 7
Electric Generation Options for Reducing Carbon Dioxide
April 29, 2004

Measures are generally ranked from easiest to hardest to implement.

1. **BASE CASE ASSUMPTION: The base-case mix forecast assumes Oregon will implement the final versions of the Oregon renewable resource plan and the West Coast Working Group renewable plan (WG 3), both currently in draft form.** This could be easy or medium depending on costs. The draft Oregon plan calls for the following new renewable energy projects by the end of 2006:
   - 300 megawatts of wind energy resources (enough electricity to power a city one and a half times the size of McMinnville);
   - 50 megawatts of biomass-fueled electric generation;
   - 10 megawatts of environmentally sustainable hydro electric generation (primarily irrigation piping channels);
   - 5 megawatts of biogas from waste water treatment, dairies and landfills;
   - 100 million gallons of annual ethanol production;
   - 15 million gallons of annual biodiesel production from Oregon crops; and
   - one geothermal electric generation project underway.

   The mix is based roughly on the NWPCC draft mix that includes reduced load growth from energy efficiency (EE) measures and the monetary impacts of the Energy Facility Siting Council's (EFSC) CO2 standard being applied gradually throughout the West.



Achieve the NWPCC New Generation Mix

CRITERIA	STAFF COMMENTS	ADVISORY GROUP MEMBER RANKING [HIGH/MEDIUM/LOW] . . . AND COMMENTS
1. Reduce/avoid/sequester significant amounts of Greenhouse Gases?	Base case mix of new generation (30% coal, 30% gas and 40 wind aMW) assumes NWPCC EE and renewable goals are met.	
2. Cost Effects?	Base mix minimizes costs, including monetary impact of EFSC of CO2 standard.	
3. Technically Feasible?	All power plants are commercial available.	
4. If legislation or regulation needed, how difficult?	Assumes implementation of actions similar to draft renewable resource plans.	
5. Early or delayed reductions; permanent or temporary?	New power plants may last 50 years or more.	
6. Equitable distribution of costs/impacts?	Depends on the level and distribution of costs of renewable action plans	

2. **Recommend the Oregon Public Utility Commission (PUC) continue its review of rules and tariffs to ensure they accurately reflect the costs and benefits to the utility grid from combined heat and power systems (CHP, also called cogeneration), especially within the distribution system. Also, recommend that consumer-owned utilities (COUs) conduct similar reviews.** This should increase the amount of CHP, especially efficient gas-fired CHP, which has lower CO2 emissions than stand-alone gas generation and much lower emissions than coal plants. This requires action by an independent board or commission, but could be ranked as easy because the PUC, which covers 72 percent of Oregon load, has begun this process. The emission reduction in 2025 could range from 0.10 to 0.54 million metric tonnes of carbon dioxide (MMT CO2) per year depending on the mix of new generation displaced (0.10 at the base mix of 30%, 30% & 40%: gas, coal and wind and 0.54 if the mix displaced is a 50/50 mix of new coal and natural gas-fired power). See Figure 7-1 for the pounds of CO2 per MWh for gas, coal and the base case mix

PUC and COU CHP Measures

CRITERIA	STAFF COMMENTS	ADVISORY GROUP MEMBER RANKING [HIGH/MEDIUM/LOW] . . . AND COMMENTS
1. Reduce/avoid/sequester significant amounts of Greenhouse Gases?	Reductions are modest unless the displaced mix is mostly coal and gas-fired power.	
2. Cost Effects?	Negative costs, as programs are cost-effective.	
3. Technically Feasible?	Mostly commercially available equipment. Some new technologies.	
4. If legislation or regulation needed, how difficult?	PUC is reviewing regulatory changes in two proceedings now.	
5. Early or delayed reductions; permanent or temporary?	Equipment with 20 to 30 year lifetimes.	
6. Equitable distribution of costs/impacts?	Likely only minor cost shifts among electric customer classes in the allocation of distribution costs. Could help keep rates low if gas prices stay high.	

3. **Recommend the Governor establish a budget for renewable purchases by state agencies.** This could be either through a "one percent for renewables" requirement for new state and university buildings (similar to the "one percent for art" program) or through state purchase of renewable power or renewable energy certificates (green tags). Spending the funds on visible technologies in new buildings (such as solar photo-voltaic, daylighting or ground-source heat systems) might increase public awareness and advance distributed renewable technologies more than purchases of renewable power as renewable energy certificates. Either option would require legislative approval of funding, but might not be controversial.

   If the state buys only the green tags, it would raise the costs to state government. If renewables with costs above the expected price of purchased fuel or electricity are built into new or retrofitted buildings, it could help insulate future state budgets from electric and natural gas prices spikes. If actual prices are higher than expected, these measure could reduce the cost of state operations over the lifetime of the buildings.

   During the last 15 years the state spent about a billion dollars on new state buildings. One percent of this would be about $670,000 per year. This analysis assumes these funds are applied only to the above-market portion of the cost of the renewable resources.

   For comparison, spending this same amount on the above-market cost of electric renewables purchases would make about one-third of the state government's power renewable (assuming renewable power costs $5/MWh more than wholesale market power). This would add 2 to 3 percent to the state's electric bill. This would save between 0.05 and 0.08 MMT CO2 per year depending on the new generating mix displaced (the same two mixes as in #1 above).

State Purchase of Renewables (Above Market Costs)

CRITERIA	STAFF COMMENTS	ADVISORY GROUP MEMBER RANKING [HIGH/MEDIUM/LOW] . . . AND COMMENTS
1. Reduce/avoid/sequester significant amounts of Greenhouse Gases?	Small reductions.	
2. Cost Effects?	State budgetary costs in the short run. Long run costs depend on future fuel prices, CO2 regulation and on impacts on technology changes.	
3. Technically Feasible?	Some measures not currently commercial	
4. If legislation or regulation needed, how difficult?	Budgetary increase likely needed to fund this scale of program.	
5. Early or delayed reductions; permanent or temporary?	Changes to equipment with 20-30 year lives.	
6. Equitable distribution of costs/impacts?	Budgetary increases would be difficult in the current fiscal situation.	

4. **Recommend the PUC consider a minimum mandatory CO2 cost-adder or maximum expected lifetime for fossil-fueled power plants for utility least-cost plans during the planned UM 1056 rulemaking on least-cost planning .**

   Since 1990 utilities have submitted least-cost plans to the Oregon PUC for acknowledgement. PUC acknowledgement of a resource decision does not guarantee recovery of costs in rates, but does indicate to future PUCs that the action seemed reasonable at the time. Lack of PUC acknowledgement would discourage a utility from taking an action, but would not prevent it.

   To date the PUC has not used the $10 per short ton of CO2 (1990$) minimum cost-adder it adopted in Order 93-695 to guide acknowledgement of utility decisions. This value could guide the utility procurement choices among coal, natural gas and renewables for new generation.

   Alternatively, the PUC could adopt maximum lifetimes for specific resources for resource planning purposes. For example, utility planning calculations for gas-fired power plants typically assume 30 year lives. Calculations for coal plants assume 50 year lives. If the studies assumed that coal plants would be obsolete in 20 years because of future federal CO2 regulation, then coal-fired power would be less competitive compared to gas-fired power or renewable resources. It would reduce coal's relative ranking even if all new generation plants had the same assumed 20-year lifetime.

   Oregon-specific resources mix requirements, cost-adders or equipment lifetime assumptions may affect the allocation of PacifiCorp costs among the six states it serves. If requirements are adopted through statute, with clear guidance on the allocations of costs among the states PacifiCorp serves, it might assure that PacifiCorp can recover all its costs from rates in the six states. This action requires independent regulatory action and will likely be controversial. This measure could have the effect of banning new coal-fired plants. If so, the savings could be 2.4 MMT CO2 of carbon dioxide in 2025, relative to the assumed base case mix of new generation. This is 6 percent of the base case 2025 forecast.

Revise PUC Least-Cost Planning To Account For CO2 Risks

CRITERIA	STAFF COMMENTS	ADVISORY GROUP MEMBER RANKING [HIGH/MEDIUM/LOW] . . . AND COMMENTS
1. Reduce/avoid/sequester significant amounts of Greenhouse Gases?	Potentially large reductions.	
2. Cost Effects?	Would likely increase electric rates in the short run. Long run costs depend on future fuel prices and CO2 regulations.	
3. Technically Feasible?	Potential savings assume only existing generation technologies.	
4. If legislation or regulation needed, how difficult?	Can be accomplished with changes in PUC regulation. Even if the PUC refuses to acknowledge a new coal plant the utility can build it, but with greater risks to equity shareholders.	
5. Early or delayed reductions; permanent or temporary?	Coal plants can operate for more than 50 years with replacement maintenance.	
6. Equitable distribution of costs/impacts?	Short run rate impacts will likely make this controversial.	

5. **Through legislation, ban PacifiCorp and PGE from acquiring the output of new (constructed post-2004) coal plants.** The legislation would have to address cost recovery issues for PacifiCorp's multi-state service territory. It would be highly controversial, as it is difficult to accurately predict the net cost of this measure. The only new low-cost generating resources with significant potential are coal, natural gas and wind projects. Any ban on coal should likely include a sunset date or might exclude coal resources that sequester CO2 or are "sequestration-ready." This would be a difficult measure to get passed in the legislature. Carbon dioxide savings would be the same as the potential PUC Option #4 above (2.4 million metric tonnes in 2025), but would be more certain if the legislation were passed. Legislation might resolve cost-allocation issues among PacifiCorp's six states.

Pass Legislation To Ban New Coal Plants In Rates

CRITERIA	STAFF COMMENTS	ADVISORY GROUP MEMBER RANKING [HIGH/MEDIUM/LOW] . . . AND COMMENTS
1. Reduce/avoid/sequester significant amounts of Greenhouse Gases?	Large reductions.	
2. Cost Effects?	Would likely increase electric rates in the short run. Long run costs depend on future fuel prices and CO2 regulations.	
3. Technically Feasible?	Potential savings assume only existing generation technologies.	
4. If legislation or regulation needed, how difficult?	Controversial legislation required.	
5. Early or delayed reductions; permanent or temporary?	Coal plants can operate for more than 50 years with replacement maintenance.	
6. Equitable distribution of costs/impacts?	Short run rate impacts will likely make this controversial.	

6. **Through legislation, substantially expand the amount of new renewable power projects.** This could be done by adopting a renewable portfolio standard (RPS) for Oregon electric utilities and other retail electric suppliers or by expanding the 0.5 percent renewable charge on PGE and PacifiCorp retail electric bills from SB1149 (1999 session). In either case, the 0.5 percent renewable public purpose charge should not be repealed as it funds renewables, such as solar photovoltaics, that are expensive now, but have good long-term potential.

   There are several states with an RPS that could serve as a model. A poorly devised RPS could imply action but be ineffective. Any RPS legislation would have to address a long list of issues. These issues include:

   - Resource eligibility (perhaps including separate targets for resources or sub-resource technologies within each category. Inclusion of hydro and definitions of biomass tend to be controversial)
   - Vintage (only projects built after a specific year)
   - Size of targets (absolute capacity or energy, percent of load or percent of load growth)
   - Timing of targets (deferred until when loads have grown or fixed targets for specific years)
   - Compliance paths (whether to require bundled power purchases or whether to allow renewable energy certificates, a.k.a. "green tags")
   - Price or cost caps (absolute or pegged to shifting market values)
   - Covered entities (all utilities or investor-owned only, inclusion of retail access suppliers)
   - Geographic eligibility (in- and out-of-state plants or in-state only)
   - Banking (carryover from over-compliance years to future years and true-up provisions)

   This legislation would be highly complex and controversial. It may be perceived violating the legislative intent of SB1149.

   6a. 15 Percent of Load Served by New Renewable Power in 2025
   Carbon dioxide savings from an RPS or similar measure could be very large. The effects several levels of RPS are show on Table 7-1. A 15 percent RPS by 2025 (as percent of 2025 load) would reduce annual carbon dioxide emissions between 2.8 and 3.6 million metric tonnes. A 15 percent RPS would meet 75 percent of forecast load growth with renewable generation (aMW), mostly through wind projects. The uncertainty in the above estimates relates to whether a 15 percent RPS would effectively ban new coal or not.

   In the lower savings estimate, the percent of load growth met by new coal goes from 30 percent in the base case to 12 percent. The higher savings estimate assumes no new coal is built and the remaining 25 percent of load growth that is not met by renewables is met by new natural gas plants. Further studies using utility planning models would be needed to remove this uncertainty.

Pass Legislation To Require 15% New Renewable Power By 2025

CRITERIA	STAFF COMMENTS	ADVISORY GROUP MEMBER RANKING [HIGH/MEDIUM/LOW] . . . AND COMMENTS
1. Reduce/avoid/sequester significant amounts of Greenhouse Gases?	Large reductions. Larger if it has the effect of banning new coal plants.	
2. Cost Effects?	Would likely increase electric rates in the short run. Long run costs depend on future fuel prices, CO2 regulations and cost caps if any.	
3. Technically Feasible?	Net costs depend on the rate of technological progress for renewable generation.	
4. If legislation or regulation needed, how difficult?	Controversial legislation required.	
5. Early or delayed reductions; permanent or temporary?	Early impact depends on targets for 2010 and 2015. Power plants can last 50 years or more.	
6. Equitable distribution of costs/impacts?	Short run rate impacts will likely make this controversial.	

6b. 25 Percent of Load Served by New Renewable Power in 2025

Under an RPS that requires 25 percent of 2025 load be met by new renewables, existing coal and gas-fired resources would be operated less than in the base case. In this case, it is implausible to assume new coal-fired resources would be built. Some new gas-fired resources would be need to integrate wind resources and meet peak system loads.

PASS LEGISLATION TO REQUIRE 25% NEW RENEWABLE POWER BY 2025

CRITERIA	STAFF COMMENTS	ADVISORY GROUP MEMBER RANKING [HIGH/MEDIUM/LOW] . . . AND COMMENTS
1. Reduce/avoid/sequester significant amounts of Greenhouse Gases?	Absolute reductions from 2000 stationary source emissions if combined with maximum programs. Likely would effectively ban new coal plants and displace existing coal and gas generation.	
2. Cost Effects?	Would likely increase electric rates more than other options. Long run costs depend on cost caps, if any.	
3. Technically Feasible?	May not be possible with existing technologies.	
4. If legislation or regulation needed, how difficult?	Controversial legislation required.	
5. Early or delayed reductions; permanent or temporary?	Early impact depends on targets for 2010 and 2015. Power plants can last 50 years or more.	
6. Equitable distribution of costs/impacts?	Rate impacts will likely make this the most controversial option.	

Table 7-1
2025 Savings from Renewable Portfolio Standards
(million metric tonnes per year)

RPS as % of 2025 Load	MMT CO2/yr reduction	% of 2025 Base Case Stationary Source CO2
15% RPS some new coal	2.8	7%
15% RPS no new coal	3.5	9%
25% RPS	7.0	17%