

Appendix P: Calculation of Retail Rates and Customer Bills

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In this analysis we present the methodology and the levelized average retail rates and bills for the least risk resource plan under various scenarios. The scenarios are defined in Chapter 9 of the Plan. These rates and bills reflect the impact of conservation investment, CO2 costs and other resource options for each scenario. It should be emphasized that the retail rate calculations presented here are a gross simplification of the detailed calculations and regulatory approval process that rates have to go through. Actual rate setting procedures and calculations will vary across utilities, class of customers and regulatory jurisdictions. The rate calculations presented here are averaged across all customer classes, so relative changes among classes are not reflected. The rates should, however, be valid for comparison across scenarios.

METHODOLOGY FOR ESTIMATING AVERAGE RETAIL RATES

To estimate the retail rates, dollars of revenue requirements are divided by the total retail sales of electricity. To calculate dollars of revenue requirements; the continuing fixed cost of the existing power system was added to the development and operational cost of the future power system. The cost of existing power system is assumed not to change, remaining at 2008 levels, in real terms over the planning horizon. This implicitly assumes that depreciation in cost of existing power system is equal to capital additions to maintain the existing power system. The future system costs consist of the capital cost of the new resources and the non-capital cost of the existing power system. The future system cost is the cost measured in the Resource Portfolio Model (RPM). The consumer’s contribution to conservation measures is netted from the total system cost calculated in the Resource Portfolio Model. It should be noted that the average rates and bills shown below are an average of the rates and bills under 750 possible futures.

Estimating Existing Power System Cost:

The total regional revenue requirement for the power system in 2008 is reported to be \$11.6 billion dollars. It was estimated that about 85 per cent of that requirement was due to fixed costs, which amounts to about \$9.8 billion dollars per year. Figure P-1 illustrates the relative importance of this component; in the \$0 to \$100 per ton CO2 case it accounts for about 60 mills per kilowatt hour of the total retail rate.

Estimating Future Power System Cost:

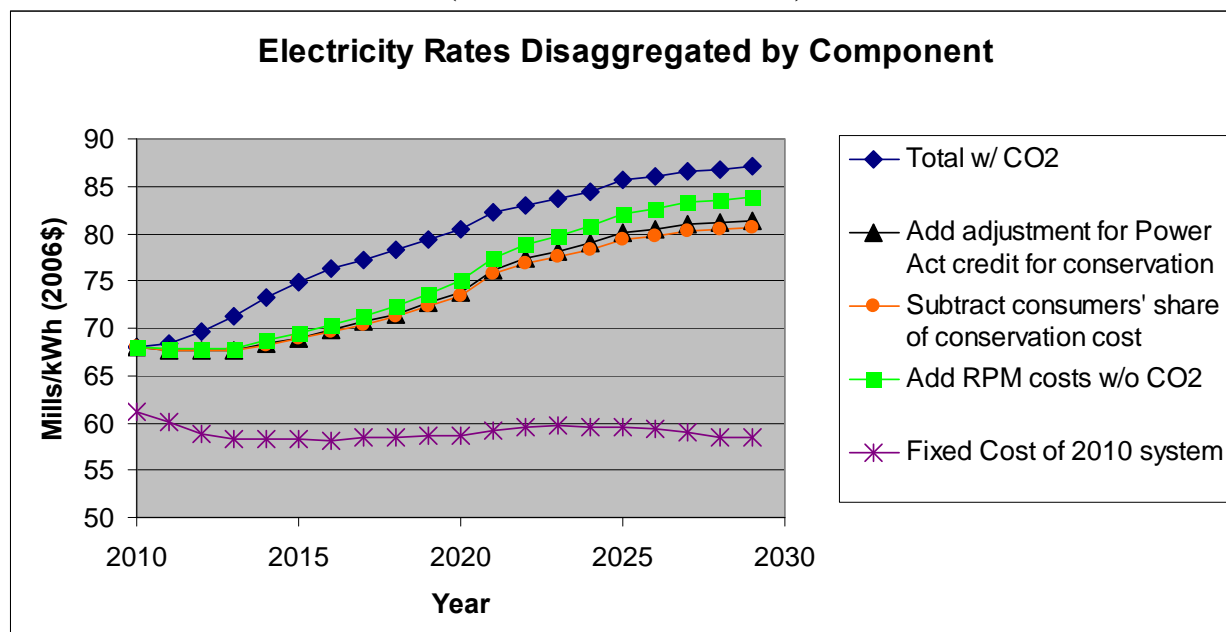
The cost of the future power system consists of levelized costs of conservation resources and capital and non-capital costs of other new resources selected in the Resource Portfolio Model. To translate conservation costs calculated in the RPM model, to conservation costs that should be included in the revenue requirement calculations, the levelized conservation costs¹ are adjusted for the 10 percent Regional Power Act Conservation credit, and reduced by the share of conservation costs paid for by the consumer, assumed to be 35% of the cost. Figure P-1 illustrates that the total costs simulated in the RPM account (excluding CO2 costs) for about 7 mills per kilowatt hour in 2010, rising to about 25 mills per kilowatt hour by 2029. Reducing revenue requirements by the consumers' share of conservation cost into account reduces rates by about 3 mills per kilowatt hour in 2029. Adding to revenue requirements to compensate for the Power Act's Conservation credit raises rates by about one mill per kilowatt hour in 2029.

Cost of CO2 Penalties

The default accounting of the total cost of new system includes cost of CO2 emissions. However, given uncertainty regarding the impact of CO2 costs on power system revenue requirements, the rate impacts are calculated with and without CO2 costs. To the extent that CO2 costs are included in the power system revenue requirement, they are in rates for the consumers served by the generators emitting the CO2, regardless of whether the generators are physically in the region or not. That is, CO2 emissions from power exported from the region are subtracted from CO2 emissions due to regional load and CO2 emissions from power imported to meet regional load are added to CO2 emissions due to regional load. The addition of CO2 costs as though they are paid on every ton of emissions raises rates by about 6 mills per kilowatt hour when added to the components already described above, as shown in Figure P-1.

¹ The conservation premium used to select the level of conservation acquisition does not change the cost of conservation resources and the levelized cost of conservation and the cash-flow of expensed conservation do not vary greatly if conservation acquisition levels are increasing smoothly and do not have significant jumps from one year to next.

**Figure P-1: Average Retail Electricity Rates Disaggregated by Component
(\$0 to \$100/ton CO₂ Case)**



Calculated Retail Rates

The above methodology, averaged across the 750 futures simulated by the Regional Portfolio Model, results in the annual and levelized retail rates for the period 2010 through 2029. The results in Tables P-1 and P-2 represent 13 scenarios defined in Chapter 9. The regional retail rate in 2008 across all sectors was estimated to be about 6.5 cents per kilowatt-hour or \$65 dollars per megawatt hour of sales. As an illustrative example, the “\$0 to \$100 per ton CO₂” case projects the rate to increase to about \$68 per megawatt hour by 2010. By 2030 the case projects rates to be between \$80 and \$86 dollars per megawatt hours depending on whether CO₂ penalties are paid on all emissions (Table P-1) or whether allowances are distributed to utilities free (Table P-2).

Calculated Monthly Bills

Representative residential bills are estimated beginning with the total revenue requirements calculated earlier, allocating the residential share of those annual revenue requirements (about 39 per cent) to the residential sector, dividing by the projected number of households in future years and dividing by 12 to arrive at monthly bills per household. The results of those calculations are shown in Tables P-3 and P-4.

The Excel workbook on which Tables P-1 through P-4 are based is posted on the Council’s web site at: http://www.nwcouncil.org/energy/powerplan/6/Appendix_P_082409.xls

Table P-1: Average Electricity Rates for Least Risk Portfolios by Scenario - CO2 Costs in Rates
 (All rates are expressed in \$2006/MWh (=mills/kWh))

	\$0-\$100 per ton CO2	Current Policy	Low Cons	Dam Removal	High Cons	Suspend Carbon Policy	No RPS	Retire Coal WO/CO2	Retire Coal W/CO2	\$100/ton CO2	\$20/ton CO2	PHEV	\$0-\$50 per ton CO2
Case Identifier	L811	L811J	L811A	L811B	L811C	L811D	L811E	L811I	L811G	L811H	L811K	L811M	L811Q
2010	67.96	67.90	67.86	67.96	68.04	67.91	67.96	67.88	67.91	87.89	73.24	67.95	67.93
2011	68.30	67.54	68.09	68.30	68.49	67.55	68.31	67.93	68.58	85.02	72.90	68.29	67.95
2012	69.63	67.30	69.34	69.63	69.86	67.32	69.66	67.96	70.02	84.88	72.59	69.61	68.57
2013	71.14	67.18	70.77	71.14	71.41	67.19	71.16	68.63	72.00	85.46	72.46	71.11	69.37
2014	73.05	67.82	72.61	73.07	73.41	67.50	72.89	70.27	74.61	86.39	72.99	73.00	70.82
2015	74.66	68.33	74.11	74.70	75.04	67.71	74.49	71.89	76.83	87.17	73.43	74.60	72.04
2016	76.07	68.94	75.39	76.14	76.56	68.00	75.74	73.92	79.17	87.25	74.01	75.98	73.07
2017	77.00	69.34	76.09	77.06	77.76	68.07	76.72	75.57	80.81	87.26	74.25	76.76	73.74
2018	77.85	69.73	76.79	77.98	78.72	68.06	77.17	77.22	82.26	87.42	74.69	77.56	74.40
2019	78.93	70.57	77.84	79.07	79.93	68.60	78.20	79.79	84.27	88.13	75.47	78.56	75.39
2020	79.97	71.58	78.82	83.38	81.03	68.76	78.78	82.42	86.20	88.47	76.23	79.57	76.39
2021	81.77	73.03	80.13	84.90	82.66	69.18	80.16	83.02	87.41	88.84	77.56	81.50	77.99
2022	82.49	73.84	80.57	85.57	83.30	69.75	80.32	83.78	88.01	89.55	78.44	82.16	78.87
2023	83.06	74.35	80.99	86.13	83.80	70.15	80.99	84.33	88.54	89.78	78.94	82.72	79.51
2024	83.74	74.66	81.52	86.89	84.24	70.42	81.53	84.85	89.13	90.53	79.32	83.43	80.02
2025	84.87	75.23	82.58	88.01	85.15	70.95	82.71	85.51	90.45	91.61	79.90	84.58	80.89
2026	85.33	75.37	83.12	88.65	85.48	71.12	83.24	85.90	91.18	92.43	80.09	85.13	81.20
2027	85.77	75.58	83.81	89.06	85.90	71.51	83.71	86.38	92.04	93.29	80.41	85.79	81.58
2028	85.98	75.51	84.06	89.46	86.01	71.75	84.06	87.06	92.99	94.08	80.46	85.82	81.60
2029	86.33	75.52	84.47	89.79	86.37	71.89	84.49	87.35	93.55	94.27	80.51	86.12	81.86
Levelized Rates	\$77.37	\$70.80	\$76.28	\$78.70	\$77.83	\$68.87	\$76.48	\$77.03	\$80.97	\$88.44	\$75.78	\$77.20	\$74.60
Annual Rate of Growth	1.2%	0.5%	1.1%	1.4%	1.2%	0.3%	1.1%	1.3%	1.6%	0.4%	0.5%	1.2%	0.9%
% Δ from \$0-\$100/ton CO₂	-	-8.5%	-1.4%	1.7%	0.6%	-11.0%	-1.2%	-0.4%	4.65%	14.3%	-2.1%	-0.2%	-3.6%

Table P-2: Average Electricity Rates for Least Risk Plans by Scenario - CO₂ Costs Not in Rates
 (All rates are expressed in \$2006/MWh (=mills/kWh))

	\$0-\$100 per ton CO ₂	Current Policy	Low Cons	Dam Removal	High Cons	Suspend Carbon Policy	No RPS	Retire Coal WO/CO ₂	Retire Coal W/CO ₂	\$100/ton CO ₂	\$20/ton CO ₂	PHEV	\$0-\$50 per ton CO ₂
Case Identifier	L811	L811J	L811A	L811B	L811C	L811D	L811E	L811I	L811G	L811H	L811K	L811M	L811Q
2010	67.93	67.90	67.83	67.93	68.01	67.91	67.93	67.88	67.88	74.57	68.75	67.92	67.92
2011	67.64	67.54	67.42	67.64	67.83	67.55	67.65	67.93	67.92	72.28	68.23	67.63	67.61
2012	67.50	67.30	67.19	67.50	67.76	67.32	67.53	67.96	67.88	71.47	67.82	67.48	67.47
2013	67.47	67.18	67.03	67.47	67.81	67.19	67.49	68.63	68.46	71.77	67.71	67.43	67.44
2014	68.06	67.82	67.45	68.07	68.53	67.50	67.79	70.27	70.09	72.76	68.30	67.99	68.13
2015	68.67	68.33	67.83	68.71	69.24	67.71	68.29	71.89	71.76	74.55	68.90	68.59	68.74
2016	69.42	68.94	68.35	69.49	70.16	68.00	68.78	73.92	73.99	75.26	69.55	69.28	69.38
2017	70.22	69.34	68.74	70.29	71.32	68.07	69.58	75.57	76.07	75.91	70.00	69.88	69.91
2018	70.99	69.73	69.16	71.10	72.37	68.06	70.04	77.22	78.02	76.70	70.58	70.50	70.47
2019	72.12	70.57	70.11	72.27	73.69	68.60	71.11	79.79	80.71	77.71	71.47	71.54	71.43
2020	73.26	71.58	71.20	75.17	75.00	68.76	71.65	82.42	83.34	78.50	72.48	72.67	72.51
2021	75.51	73.03	72.79	77.09	76.92	69.18	73.29	83.02	85.07	79.43	74.15	75.07	74.28
2022	76.77	73.84	73.56	78.26	77.88	69.75	74.06	83.78	86.19	80.48	75.16	76.16	75.32
2023	77.46	74.35	73.92	78.87	78.40	70.15	74.89	84.33	86.71	81.27	75.81	76.85	76.06
2024	78.23	74.66	74.50	79.74	78.78	70.42	75.43	84.85	87.37	82.34	76.21	77.60	76.60
2025	79.24	75.23	75.53	80.81	79.60	70.95	76.49	85.51	88.73	84.25	76.86	78.65	77.41
2026	79.68	75.37	76.07	81.49	79.88	71.12	76.94	85.90	89.58	85.55	77.08	79.19	77.72
2027	80.14	75.58	76.89	81.91	80.29	71.51	77.42	86.38	90.49	86.48	77.34	79.99	78.12
2028	80.25	75.51	77.23	82.20	80.30	71.75	77.67	87.06	91.52	86.71	77.32	79.99	78.10
2029	80.39	75.52	77.44	82.29	80.43	71.89	77.87	87.35	91.92	86.91	77.38	79.96	78.24
Levelized Rates	\$72.51	\$70.80	\$70.75	\$73.21	\$73.17	\$68.87	\$71.30	\$77.03	\$78.28	\$77.68	\$71.79	\$72.22	\$71.78
Annual Rate of Growth	0.8%	0.5%	0.7%	1.0%	0.8%	0.3%	0.7%	1.3%	1.5%	0.8%	0.6%	0.8%	0.7%
% Δ from \$0-\$100/ton CO₂	-	-2.4%	-2.4%	1.0%	0.9%	-5.0%	-1.7%	6.2%	8.0%	7.1%	-1.0%	-0.4%	-1.0%

Table P-3: Average Residential Bills for Least Risk Portfolios by Scenario - CO2 Cost in Rates
(Bills are expressed in 2006\$/month/household)

	\$0-\$100 per ton CO2	Current Policy	Low Cons	Dam Removal	High Cons	Suspend Carbon Policy	No RPS	Retire Coal WO/CO2	Retire Coal W/CO2	\$100/ton CO2	\$20/ton CO2	PHEV	\$0-\$50 per ton CO2
Case Identifier	L811	L811J	L811A	L811B	L811C	L811D	L811E	L811I	L811G	L811H	L811K	L811M	L811Q
2010	72.18	72.15	72.21	72.18	72.15	72.15	72.19	72.10	72.13	93.39	77.81	72.18	72.16
2011	71.51	70.76	71.63	71.51	71.39	70.76	71.52	71.11	71.80	89.06	76.36	71.51	71.15
2012	71.79	69.49	72.10	71.79	71.54	69.48	71.81	70.07	72.19	87.57	74.92	71.81	70.71
2013	72.57	68.69	73.10	72.57	72.17	68.66	72.60	70.02	73.45	87.22	74.03	72.60	70.79
2014	73.85	68.80	74.67	73.87	73.34	68.41	73.69	71.05	75.44	87.39	73.94	73.91	71.64
2015	74.46	68.45	75.54	74.50	73.77	67.75	74.29	71.71	76.63	86.97	73.41	74.56	71.89
2016	75.22	68.54	76.58	75.29	74.43	67.50	74.90	73.14	78.31	86.32	73.39	75.35	72.32
2017	74.93	67.91	76.52	75.00	74.19	66.56	74.67	73.59	78.67	84.95	72.49	75.00	71.84
2018	74.95	67.62	76.84	75.07	74.10	65.87	74.30	74.39	79.22	84.16	72.16	75.06	71.71
2019	75.09	67.72	77.44	75.22	74.15	65.68	74.41	76.01	80.22	83.86	72.10	75.21	71.83
2020	75.48	68.22	78.25	78.69	74.48	65.37	74.37	77.93	81.43	83.50	72.30	75.68	72.23
2021	75.98	68.58	78.80	78.89	74.95	64.81	74.52	77.21	81.25	82.53	72.43	76.39	72.60
2022	75.69	68.57	78.65	78.50	74.94	64.59	73.71	76.96	80.77	82.15	72.39	76.15	72.51
2023	75.63	68.58	78.76	78.42	75.26	64.50	73.77	76.87	80.65	81.70	72.32	76.18	72.56
2024	75.99	68.84	79.17	78.78	75.78	64.65	73.96	77.12	80.80	82.02	72.59	76.66	72.84
2025	76.55	69.13	79.75	79.24	76.38	64.87	74.51	77.33	81.27	82.31	72.86	77.34	73.29
2026	76.91	69.38	80.09	79.67	76.77	65.11	74.87	77.72	81.62	82.85	73.14	77.87	73.61
2027	77.29	69.67	80.51	79.98	77.23	65.51	75.23	78.15	82.15	83.54	73.51	78.52	74.00
2028	77.87	70.03	80.87	80.73	77.78	66.10	75.91	79.17	83.30	84.65	73.98	79.00	74.43
2029	77.92	69.90	80.68	80.72	77.86	66.04	75.99	79.13	83.38	84.50	73.85	79.05	74.44
Levelized Rates	\$74.72	\$69.14	\$76.49	\$75.89	\$74.25	\$67.17	\$73.87	\$74.42	\$77.97	\$85.60	\$73.73	\$75.05	\$72.25
Annual Rate of Growth	0.4%	-0.2%	0.6%	0.6%	0.4%	-0.4%	0.3%	0.5%	0.7%	-0.5%	-0.3%	0.5%	0.2%
% Δ from \$0-\$100/ton CO₂	-	-7.5%	2.4%	1.6%	-0.6%	-10.1%	-1.1%	-0.4%	4.3%	14.6%	-1.3%	0.4%	-3.3%

Table P-4: Average Residential Bills for Least Risk Portfolios by Case - CO2 Cost Not in Rates
(Bills are expressed in 2006\$/month/household)

	\$0-\$100 per ton CO2	Current Policy	Low Cons	Dam Removal	High Cons	Suspend Carbon Policy	No RPS	Retire Coal WO/CO2	Retire Coal W/CO2	\$100/ton CO2	\$20/ton CO2	PHEV	\$0-\$50 per ton CO2
Case Identifier	L811	L811J	L811A	L811B	L811C	L811D	L811E	L811I	L811G	L811H	L811K	L811M	L811Q
2010	72.15	72.15	72.17	72.15	72.12	72.15	72.15	72.10	72.10	79.22	73.04	72.15	72.14
2011	70.81	70.76	70.93	70.81	70.71	70.76	70.82	71.11	71.11	75.69	71.47	70.82	70.80
2012	69.60	69.49	69.86	69.60	69.39	69.48	69.62	70.07	69.99	73.70	69.99	69.61	69.59
2013	68.83	68.69	69.24	68.83	68.53	68.66	68.85	70.02	69.84	73.24	69.18	68.85	68.83
2014	68.81	68.80	69.36	68.83	68.47	68.41	68.54	71.05	70.87	73.59	69.20	68.84	68.92
2015	68.49	68.45	69.14	68.53	68.07	67.75	68.11	71.71	71.58	74.37	68.88	68.56	68.61
2016	68.66	68.54	69.44	68.73	68.21	67.50	68.03	73.14	73.19	74.42	68.97	68.72	68.67
2017	68.34	67.91	69.12	68.40	68.04	66.56	67.73	73.59	74.05	73.85	68.34	68.28	68.11
2018	68.34	67.62	69.20	68.44	68.11	65.87	67.42	74.39	75.11	73.78	68.19	68.21	67.92
2019	68.61	67.72	69.75	68.75	68.36	65.68	67.67	76.01	76.82	73.87	68.28	68.50	68.06
2020	69.15	68.22	70.69	70.95	68.94	65.37	67.64	77.93	78.70	74.01	68.73	69.12	68.56
2021	70.14	68.58	71.55	71.62	69.74	64.81	68.10	77.21	79.03	73.70	69.23	70.35	69.14
2022	70.42	68.57	71.79	71.79	70.05	64.59	67.95	76.96	79.06	73.72	69.36	70.57	69.25
2023	70.48	68.58	71.84	71.77	70.37	64.50	68.15	76.87	78.90	73.81	69.44	70.72	69.38
2024	70.94	68.84	72.30	72.26	70.84	64.65	68.36	77.12	79.11	74.44	69.73	71.25	69.70
2025	71.39	69.13	72.85	72.70	71.33	64.87	68.82	77.33	79.60	75.48	70.06	71.85	70.10
2026	71.75	69.38	73.22	73.20	71.68	65.11	69.13	77.72	80.05	76.45	70.36	72.36	70.42
2027	72.15	69.67	73.79	73.52	72.13	65.51	69.50	78.15	80.64	77.20	70.67	73.14	70.82
2028	72.60	70.03	74.22	74.13	72.53	66.10	70.05	79.17	81.82	77.74	71.06	73.54	71.19
2029	72.50	69.90	73.91	73.96	72.47	66.04	69.99	79.13	81.78	77.66	70.94	73.35	71.12
Levelized Rates	\$70.08	\$69.14	\$70.98	\$70.68	\$69.86	\$67.17	\$68.93	\$74.42	\$75.32	\$74.95	\$69.81	\$70.25	\$69.56
Annual Rate of Growth	0.0%	-0.2%	0.1%	0.1%	0.0%	-0.4%	-0.2%	0.5%	0.6%	-0.1%	-0.1%	0.1%	-0.1%
% Δ from \$0-\$100/ton CO₂	-	-1.3%	1.3%	0.9%	-0.3%	-4.2%	-1.6%	6.2%	7.5%	7.0%	-0.4%	0.2%	-0.7%

Analysis of Rate and Bill Differences among Cases

The tables can be used to contrast rates and bills among cases in almost infinite combinations, but a few illustrations should make it possible for regional analysts to pursue their interests using the tables. For example, consider the impact of a reduction in conservation potential:

We can compare the “\$0 to \$100 per ton CO₂” case to the “Low Conservation” case, which reduces the availability of conservation by about 22%. Comparison of the “\$0 to \$100 per ton CO₂” and “Low Conservation” columns of Tables P-2 and P-4 shows that rates decrease when conservation is reduced but bills increase. The disparity in impact on rates versus bills is because conservation reduces sales by a larger proportion than it reduces costs. The same results are shown graphically in Figures P-2 and P-3. The data shown in Figure P-2 are from the “\$0 to \$100 per ton CO₂” and “Low Conservation” column in Table P-2 and the data shown in Figure P-3 are from the same columns in Table P-4.

Figure P-2 Average Electricity Rate Comparison - CO₂ Costs Not in Rates

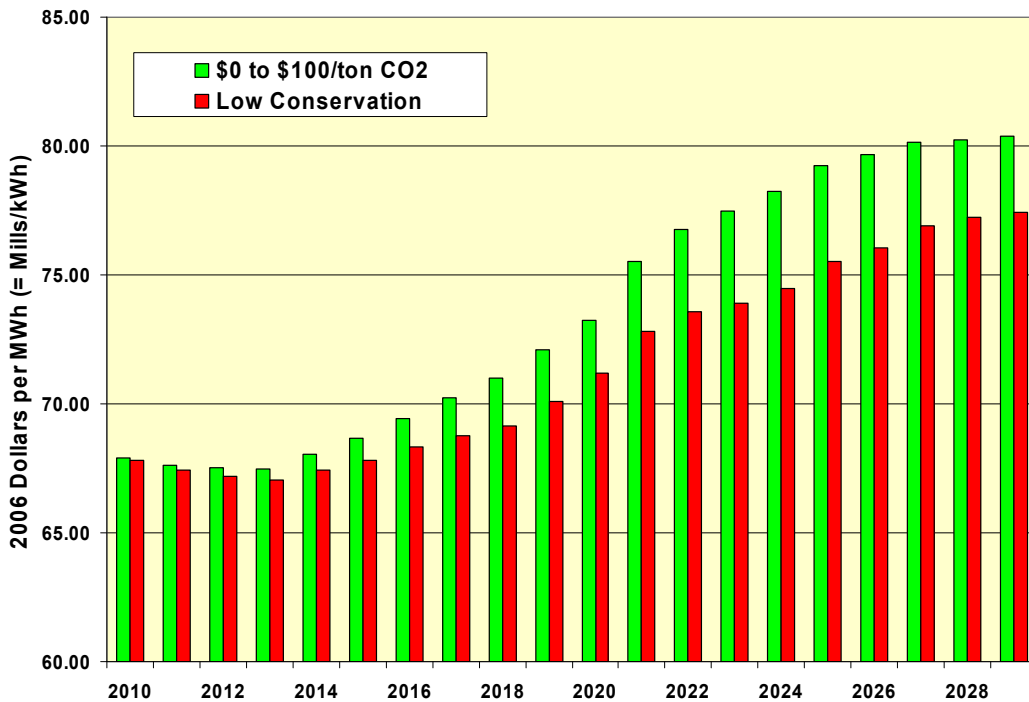
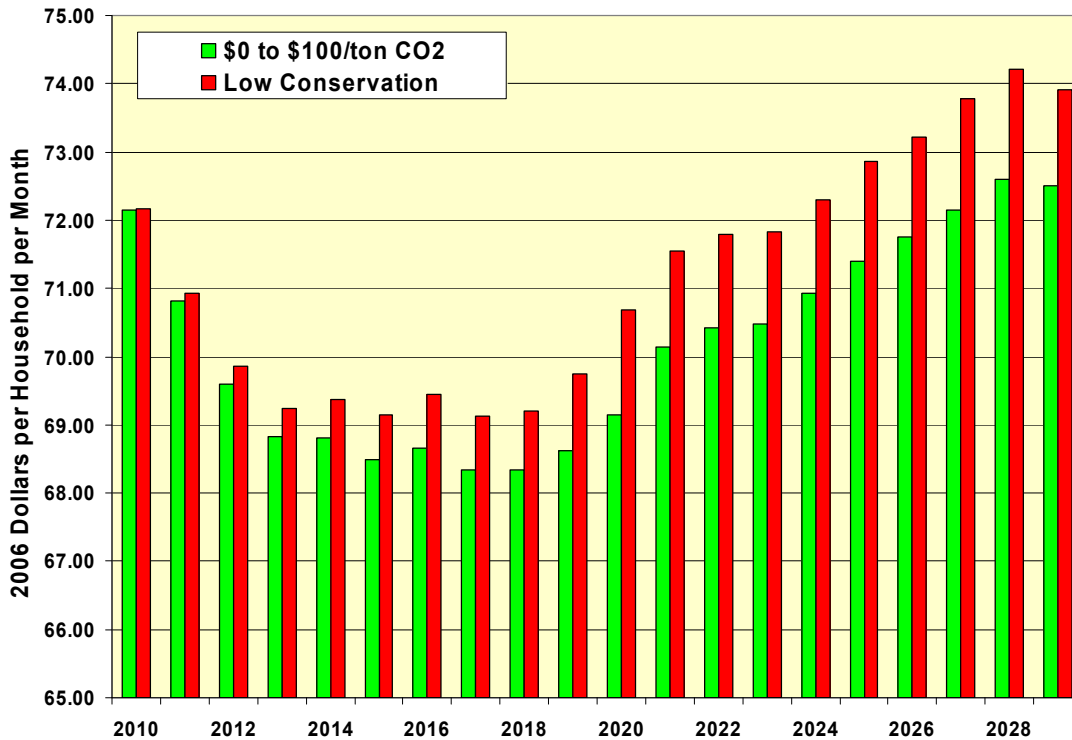


Figure P-3 Typical Residential Electricity Bill Comparison - CO2 Costs Not in Bills



Another illustration of potential analysis using Tables P-1 through P-4 (and the Excel workbook that lies behind them) is a comparison of the levelized rates and bills across the 13 scenarios included in the tables. Figure P-4 compares levelized rates across all scenarios, and Figure P-5 compares levelized bills, both with CO2 costs excluded from both rates and bills. Levelized rates (from Table P-2) range from a low of \$70.75 per megawatt hour for the “Low Conservation” scenario to \$78.28 per megawatt hour for the “Retire Existing Coal W/CO2” scenario. Levelized bills range from \$67.17 for the “Suspend Carbon Policy” scenario to \$75.32 for the “Retire Existing Coal W/CO2” scenario.

Figure P-4: Levelized Electricity Rates by Scenario - CO2 Costs Not in Rates

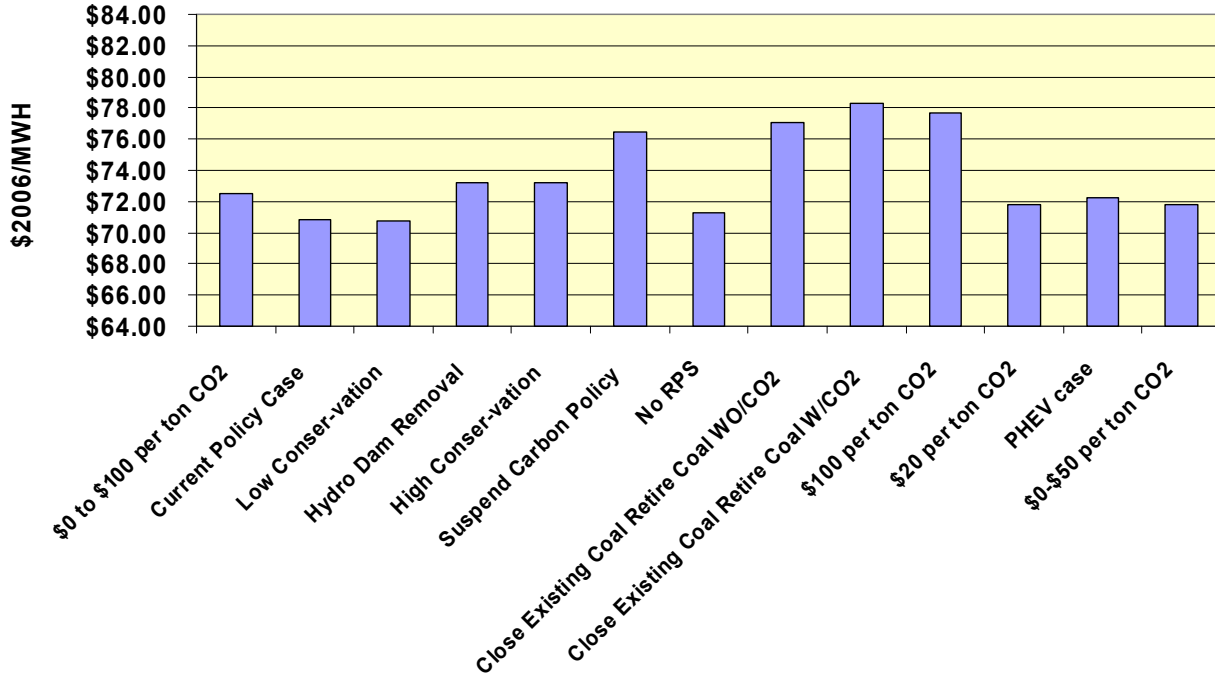


Figure P-5: Levelized Typical Residential Electricity Bills by Scenario - CO2 Costs Not in Bills

