Resource Portfolio Model's Determination of Conservation's Cost-Effectiveness[1]

The regional Resource Portfolio Model (RPM) finds large amounts of conservation cost effective. The cost of some of the conservation is above long-term wholesale power market price ("electricity price", "power price" or "market price"). Many utilities use this price as a measure of cost effectiveness. They apply it not only of conservation but to all resources. They do so because it can be viewed as the utility's avoided cost. This section explains why the cost effectiveness for conservation can be higher than the wholesale power market price.

First, it is helpful to review how the RPM decides to acquire conservation. The RPM uses a decision criterion ("criterion"), as this section explains. There are two parts to the criterion, and they work in different ways. The two parts are the "adjusted market price" and the "market adder." In each period of each future, the RPM buys conservation from a supply curve up to the criterion value. The supply curve is like a stack of conservation programs, sorted by price. Programs can have different sizes (reductions in electricity use) as well as different prices. There are separate supply curves for lost opportunity and non-lost opportunity (i.e. discretionary or schedulable) conservation. The real levelized cost for each program acquired is added to the cost of conservation already acquired.

The *adjusted market price* reflects considerations unique to valuing conservation. The adjusted market price, for example, weights market prices according to the *distribution* (i.e., load shape) of energy reductions. It also averages market prices over recent history. In the RPM the averaged market prices is a proxy for forecasts of long-term market price. Views of the long-term market price tend to follow spot prices and other recent news. They change more slowly, however, just like an average. The decision point also lags the averaging period by a year. Utility budget cycles and decisions give rise to the lag effect. Another difference with market price is the ratchet mechanism used (or "sticky downward") decision criteria used for lost opportunity conservation. The ratchet comes from the nature of codes, laws, and standards, which govern much lost opportunity conservation acquisition. That is, once adopted, laws and codes are rarely reversed. To represent this characteristic, once a "cost-effectiveness limit" is set for lost-opportunity resources, it becomes the lower bound for the remainder of the planning period.

The *market adder* is the second factor controlling how the RPM acquires conservation. As the name suggests, this value is added to the *adjusted market price* to determine how far up the conservation supply curve to go. The market adder is one of the elements of a plan, and the RPM experiments with the value of the adder to reduce cost at each level of risk. The RPM tries a range of adders, from negative values to as high as $100 per megawatt-hour. Of course, the RPM is also trying different combinations of other generation resources as it does so. The market adder for plans on the efficient frontier is therefore the results of the RPM's search process.

One way to understand how factors affect conservation development is to begin with the simple

[1] Excerpted and adapted from 6th Plan, Appendix J, pages J-7 – J-10 (http://www.nwcouncil.org/media/6320/SixthPowerPlan_Appendix_J.pdf)

RPM described in the preceding section. Adding factors one at a time gives us an idea of their relative importance. Because the order of the additions matters, however, some care is necessary in interpreting the results.

The starting point is replacing each uncertainty with a deterministic forecast. Using the Council's adopted medium electricity price forecast leads to about 4,008 average megawatts of conservation[8]. The electricity price forecast used for this initial estimate assumes no carbon cost penalty and there are no "market adders."

The effect of changes to the RPM depends on the order in which the changes are made. This description follows one path. Table J-2 contains the result of studies using the various model input assumptions. It shows how applying the changes in a different order would change the effect. Stochastic variation in electricity price, assuming no carbon penalty, adds 469 average megawatts, bringing the total to 4,477 average megawatts. This variation is the result of uncertainty and variation in natural gas price and the construction costs for power plants. It is also due to hydro generation variability, load growth excursions, and many other factors.

Stochastic variation increases acquisition for several reasons. Discretionary conservation has a single supply curve for the entire study. The supply, once accessed, is not restored. Variation in electricity price drives the decision criterion higher earlier than otherwise. The last high water mark, so to speak, is the level at the end of the study. Lost opportunity conservation has a similar ratchet mechanism in its criterion, as described earlier.

Carbon cost penalty uncertainty moves the wholesale market electricity price up and, consequently, moves up the cost effectiveness threshold for conservation. Introducing the carbon penalty uncertainty increases conservation energy by 470 average megawatts, to 4,947 average megawatts, by the end of the study. The RPM handles the representation carbon penalty directly.

It is therefore possible to cull the contribution from this source of uncertainty from the others. Finally, we have the effect of market price adders. The adders increase acquisition by 1,011 average megawatts, to 5,958 average megawatts. The adders in the least-risk resource portfolio from the Carbon Risk scenario are different for lost opportunity and discretionary conservation. The former gets a $50 per megawatt-hour adder; the latter garners an $80 per megawatt-hour adder.

The results are summarized in Table J-2. It may be useful to see the effect if discretionary conservation got the same $50 per megawatt-hour adder as lost opportunity conservation. This situation is included among the studies presented here.

Some of the entries in Table J-2 require explanation. Each row describes the results of a particular study. The first column indicates whether there is a carbon cost penalty assumed. The RPM uses average carbon cost penalty across future in the deterministic RPMs. If the RPM is stochastic, it uses the full 750 futures of carbon penalty which range between zero dollars per ton and $100 per ton of carbon. The second and third columns have the market adders for lost opportunity (LO) or discretionary (NLO) conservation. The values to the right of these columns

identify the average megawatts (energy) developed and the average cost of conservation acquired by the end of the planning period. The costs are averages across futures for all conservation acquired up to the end of the study.

Table J-2 Sensitivity Analysis of Factors Affecting Conservation Acquisitions in 6th Plan Resource Portfolio Model[2]

Conservation Acquisitions by the End of Study				Lost Opportunity		Non-Lost Opportunity		Total	
	Includes Carbon Cost?	LO Market Adder Value (2006$/MWh)	NLO Market Adder Value (2006$/MWh)	MWa	Average Cost (2006$/MWh)	MWa	Average Cost (2006$/MWh)	MWa	Average Cost (2006$/MWh)
Deterministic Model Results									
Base Case	N	$ -	$ -	1,835	$ 11.40	2,253	$ 23.25	4,008	$ 17.93
Average Carbon Cost	Y	$ -	$ -	2,180	$ 16.65	2,479	$ 26.01	4,660	$ 21.63
Equal LO & NLO "Adders"	N	$ 50	$ 50	2,854	$ 28.22	2,584	$ 28.16	5,438	$ 28.19
Final 6th Plan LO & NLO "Adders"	N	$ 50	$ 80	2,854	$ 28.22	2,727	$ 32.05	5,582	$ 30.09
Average Carbon Cost + Equal LO & NLO "Adders"	Y	$ 50	$ 50	3,037	$ 32.28	2,719	$ 31.78	5,755	$ 32.05
Average Carbon Cost + 6th Plan LO & NLO "Adders"	Y	$ 50	$ 80	3,037	$ 32.28	2,812	$ 35.08	5,849	$ 33.63
Stochastic Model Results									
Base Case	N	$ -	$ -	2,072	$ 15.30	2,405	$ 25.40	4,477	$ 20.90
Average Carbon Cost	Y	$ -	$ -	2,395	$ 21.30	2,552	$ 28.10	4,947	$ 24.90
Equal LO & NLO "Adders"	N	$ 50	$ 50	2,963	$ 30.60	2,672	$ 30.70	5,635	$ 30.60
Final 6th Plan LO & NLO "Adders"	N	$ 50	$ 80	2,963	$ 30.60	2,787	$ 34.30	5,750	$ 32.40
Average Carbon Cost + Equal LO & NLO "Adders"	Y	$ 50	$ 50	3,092	$ 33.70	2,787	$ 33.80	5,859	$ 33.80
Average Carbon Cost + 6th Plan LO & NLO "Adders"	Y	$ 50	$ 80	3,092	$ 33.70	2,867	$ 37.69	5,958	$ 35.63

[2] **Source: Table J-2, Appendix J, 6th Power Plan, page J-10.**
http://www.nwcouncil.org/media/6320/SixthPowerPlan_Appendix_J.pdf