A Few Analytical Tools From Puget Sound Energy's Least Cost Planning Process

Jim Lazar RAP Associate

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The Regulatory Assistance Project

50 State Street, Suite 3
Montpelier, Vermont USA 05602
Tel: 802.223.8199
Fax: 802.223.8172

177 Water St.
Gardiner, Maine USA 04345
Tel: 207.582.1135
Fax: 207.582.1176

Website:
http://www.raponline.org

PSE Load-Resource Balance

Pacific Northwest Region

PSE resources:	Regional resources: Less **than** loads	Regional resources: **Equal** loads	Regional resources: **Exceed** loads
Less than loads	BUY $$$	BUY $ We are here	BUY $
Equal loads	BALANCED (Short market)	PERFECT WORLD	BALANCED (Long market)
Exceed loads	SELL $$$	SELL $$	SELL $

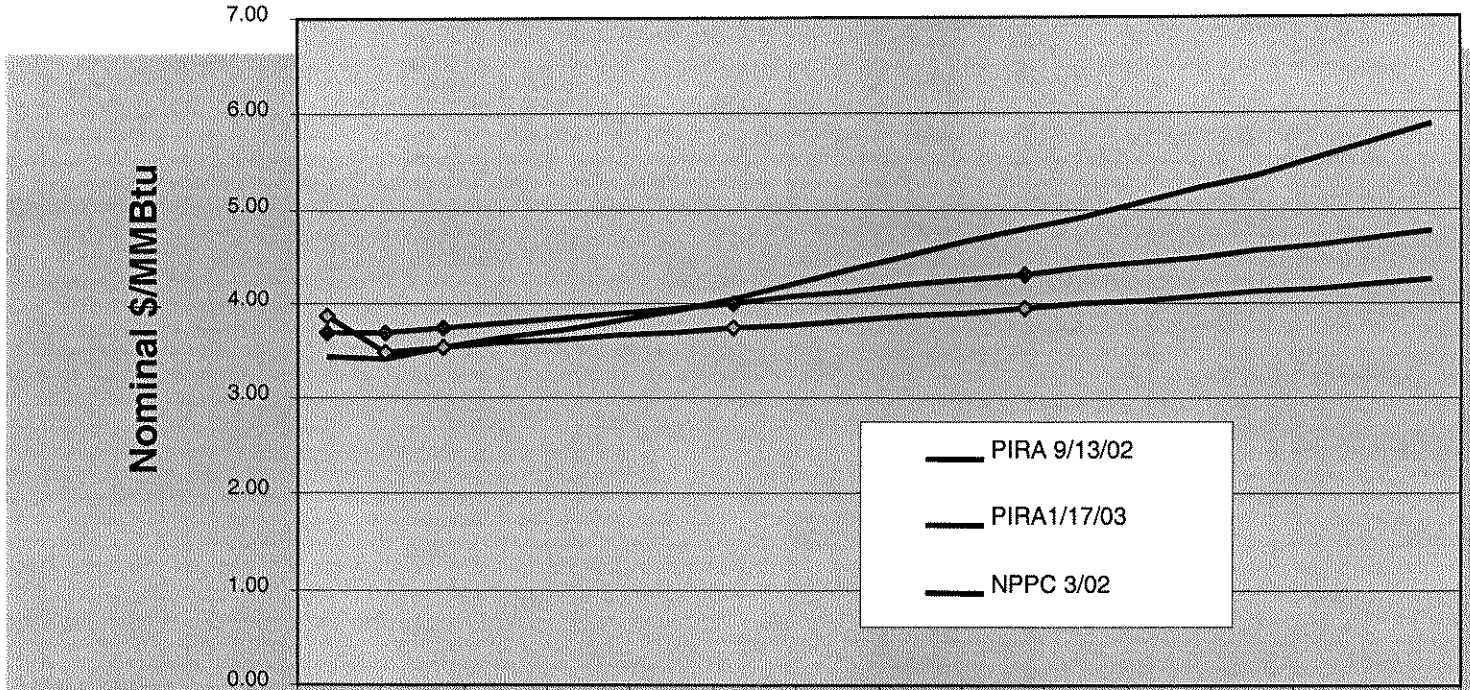
Lots of Uncertainty

- Fuel prices
- Hydro conditions
- Load Growth
- Production Tax Credit
- CO2 Taxes
- Interest Rates
- Codes and Standards
- Conservation achievement
- Technology innovation

- Old Approach
  - **Make <u>one</u> assumption for each area of uncertainty. Calculate a least-cost mix.**
- New Approach
  - **Estimate range and probability for each area of uncertainty. Calculate probability-weighted portfolio cost, volatility, and standard deviations; Use judgment with final results.**

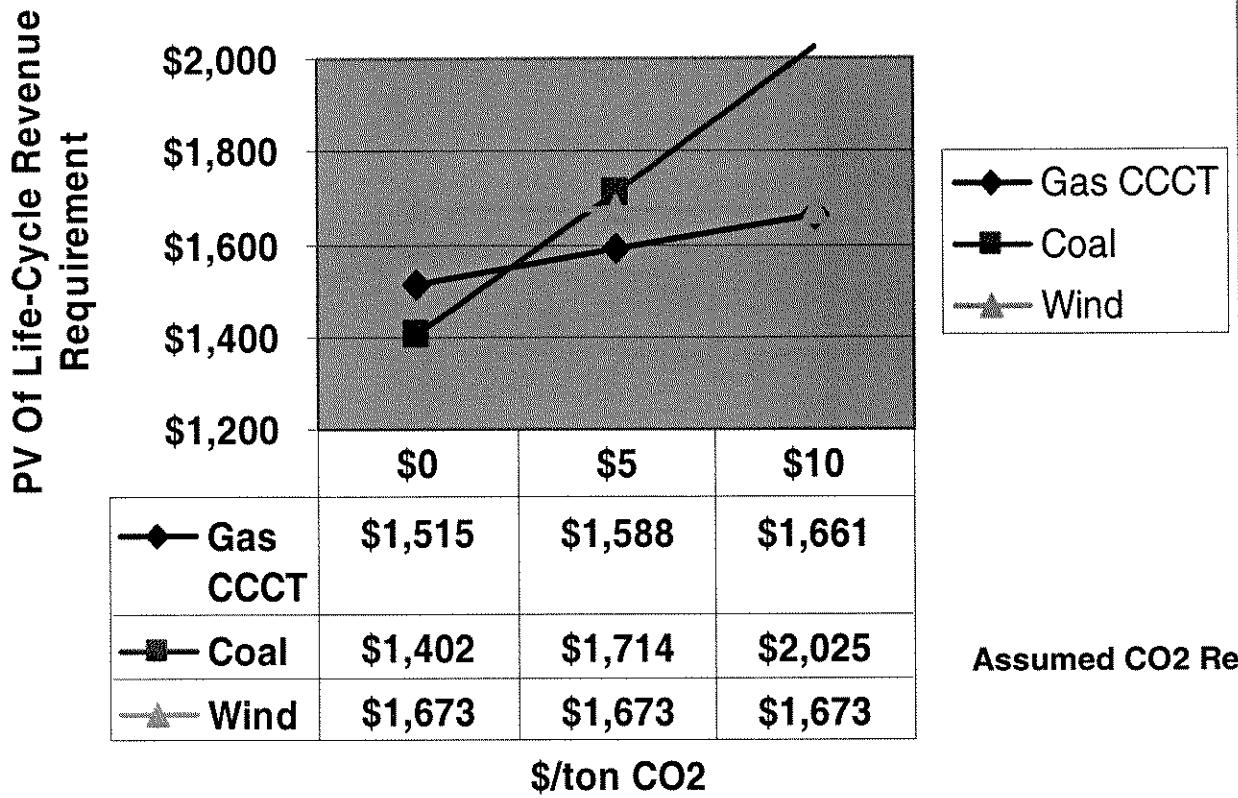
Fuel Prices Are Uncertain

9/13/02 - 1/17/03



	2004	2005	2007	2008	2010	2011	2013	2014	2015	2017	2018	2020	2021	2023
PIRA 9/13/02	3.7	3.7	3.798	3.848	3.95	4.008	4.127	4.188	4.25	4.369	4.43	4.555	4.619	4.748
PIRA1/17/03	3.858	3.5	3.579	3.619	3.7	3.739	3.819	3.859	3.9	3.985	4.029	4.117	4.162	4.253
NPPC 3/02	3.443	3.413	3.632	3.724	3.914	4.052	4.343	4.496	4.655	4.924	5.064	5.356	5.525	5.879

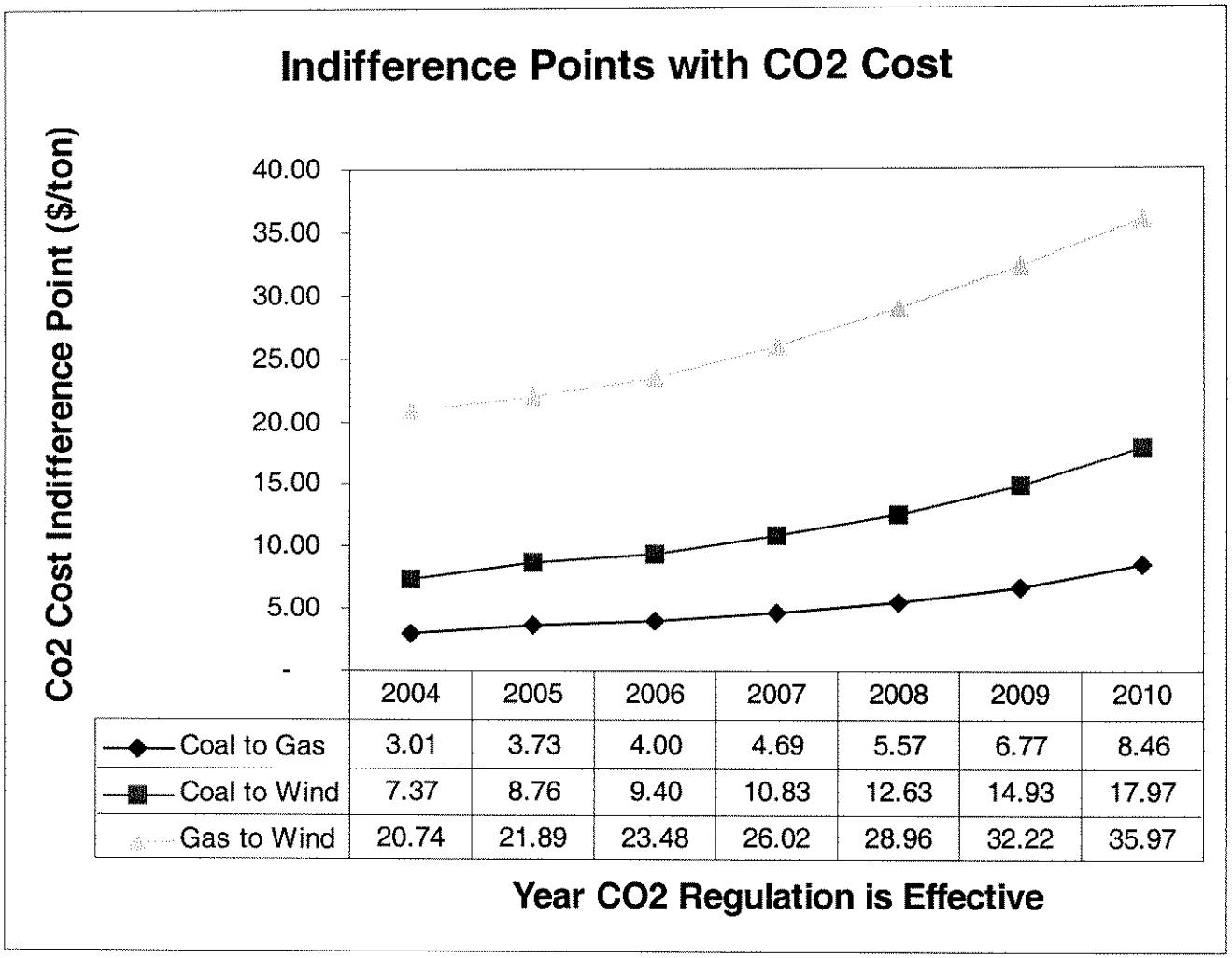
Impact of CO2 Costs On Generation Economics



	$0	$5	$10
Gas CCCT	$1,515	$1,588	$1,661
Coal	$1,402	$1,714	$2,025
Wind	$1,673	$1,673	$1,673

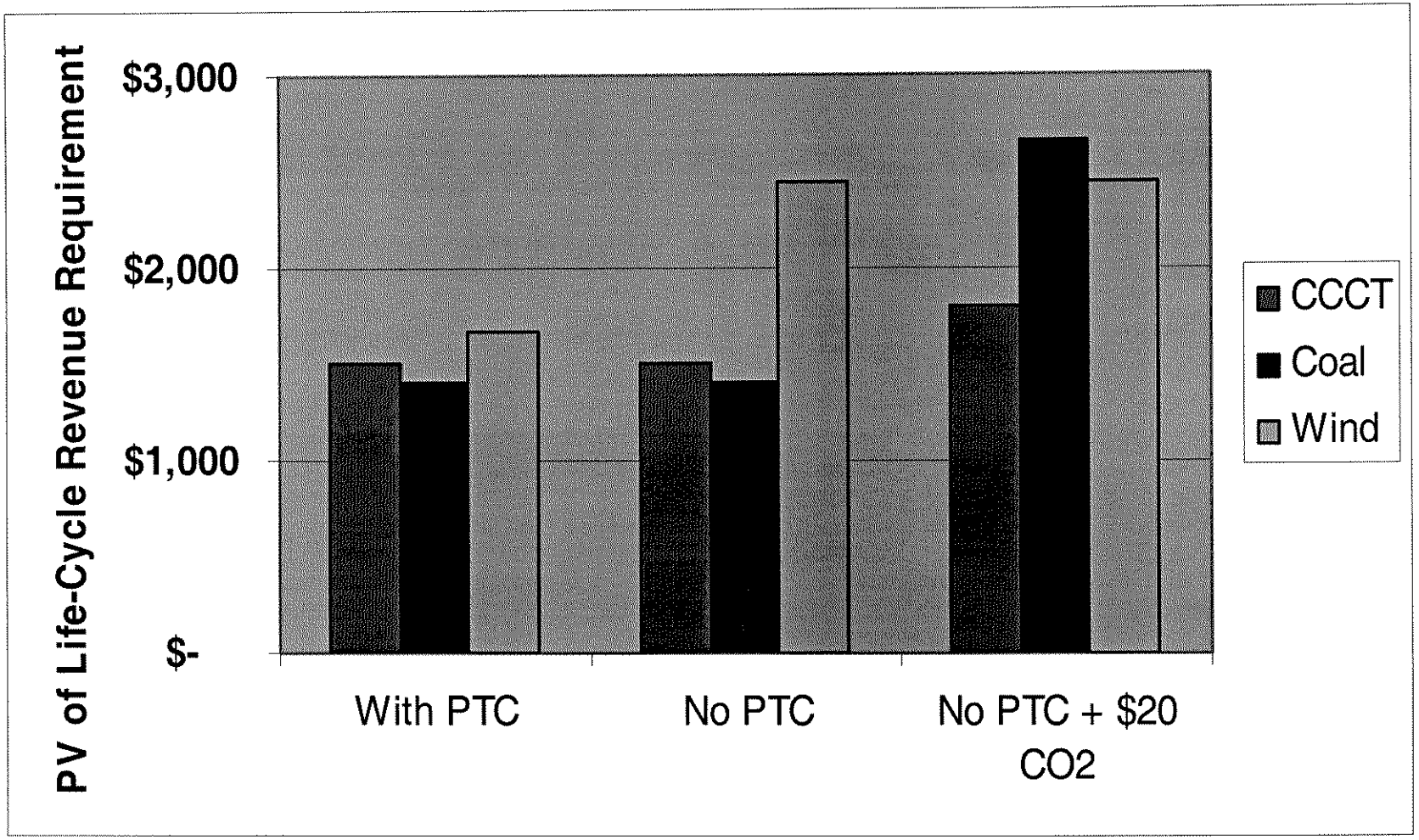
Assumed CO2 Regulation in 2008

Puget Sound Energy Least Cost Plan March 2003 Comment Draft, P. X-30



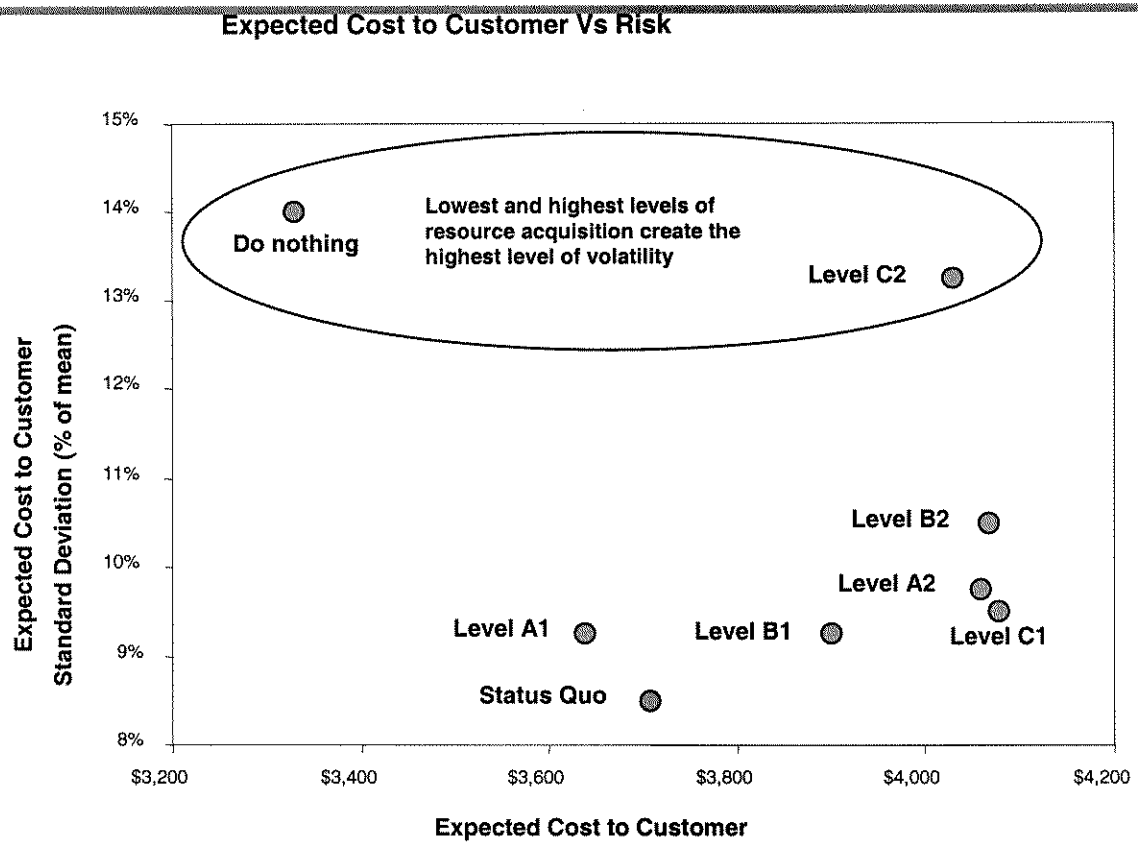
	2004	2005	2006	2007	2008	2009	2010
Coal to Gas	3.01	3.73	4.00	4.69	5.57	6.77	8.46
Coal to Wind	7.37	8.76	9.40	10.83	12.63	14.93	17.97
Gas to Wind	20.74	21.89	23.48	26.02	28.96	32.22	35.97

Effect of Production Tax Credit and/or Carbon Tax



Expected Cost to Customer and Risk

(Low Cost of Capital Case)



Risk vs. Cost
Putting It All Together

- **<u>Overbuilding</u> means you're a seller in a buyer's market.**
- **<u>Underbuilding</u> means you're a buyer in a seller's market**
- **Betting on coal exposes you to uncertain environmental risk**
- **Betting on oil exposes you to massive fuel cost risk**
- **Betting on wind exposes you to hourly resource risk**
- **Customers value stability, reliability, and the environment.**
- **Examine the risk and expected cost of alternative portfolios**
- **Apply judgment.**