

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

Jim Lazar

Consulting Economist

Associate, Regulatory Assistance Project

April, 2003

# PSE Load-Resource Balance

## *Pacific Northwest Region*

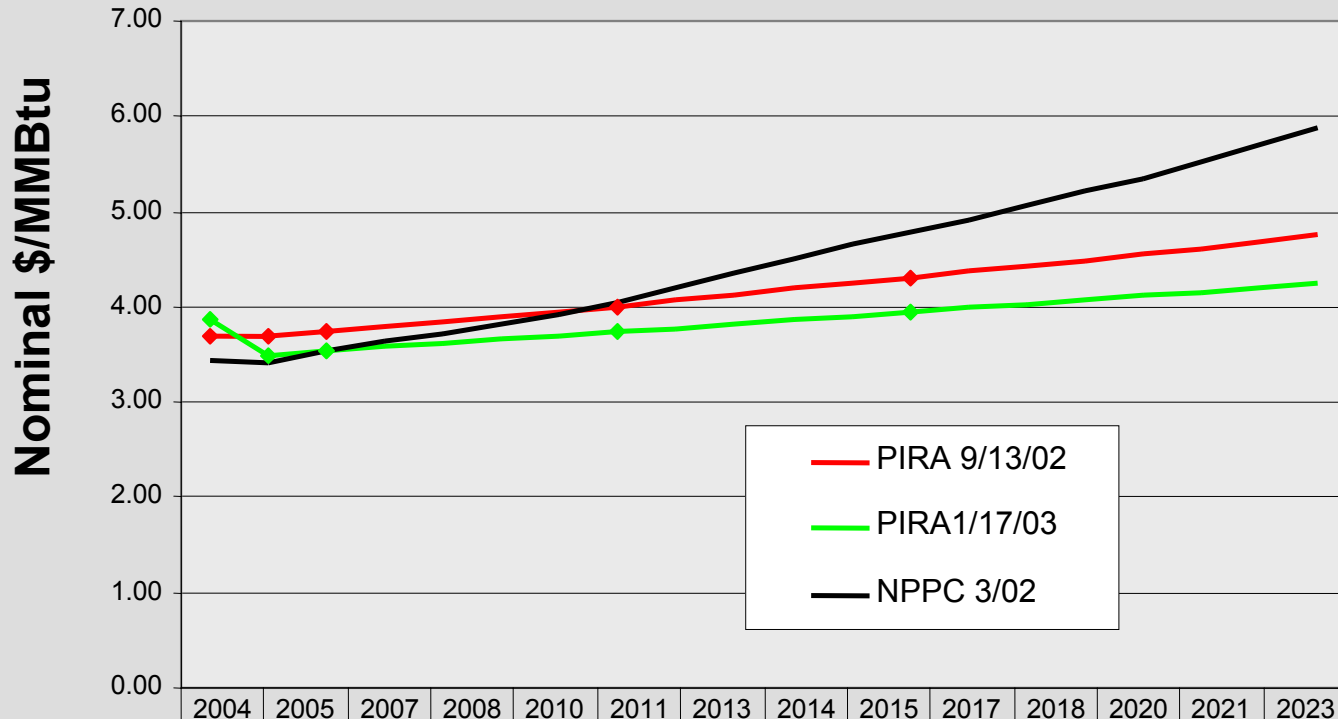
		<b>Regional resources:</b>		
		Less than loads	Equal loads	Exceed loads
<b>PSE resources:</b>	Less than loads	<b>BUY</b> \$\$\$	<b>BUY</b> \$ 	<b>BUY</b> \$
	Equal loads	<b>BALANCED</b> (Short market)	<b>PERFECT WORLD</b>	<b>BALANCED</b> (Long market)
	Exceed loads	<b>SELL</b> \$\$\$	<b>SELL</b> \$\$	<b>SELL</b> \$

# Lots of Uncertainty

- Gas prices
- Hydro conditions
- Load Growth
- Production Tax Credit
- CO2 Taxes
- Interest Rates
- Codes and Standards
- Conservation potential
- Old Approach
  - Make one 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.

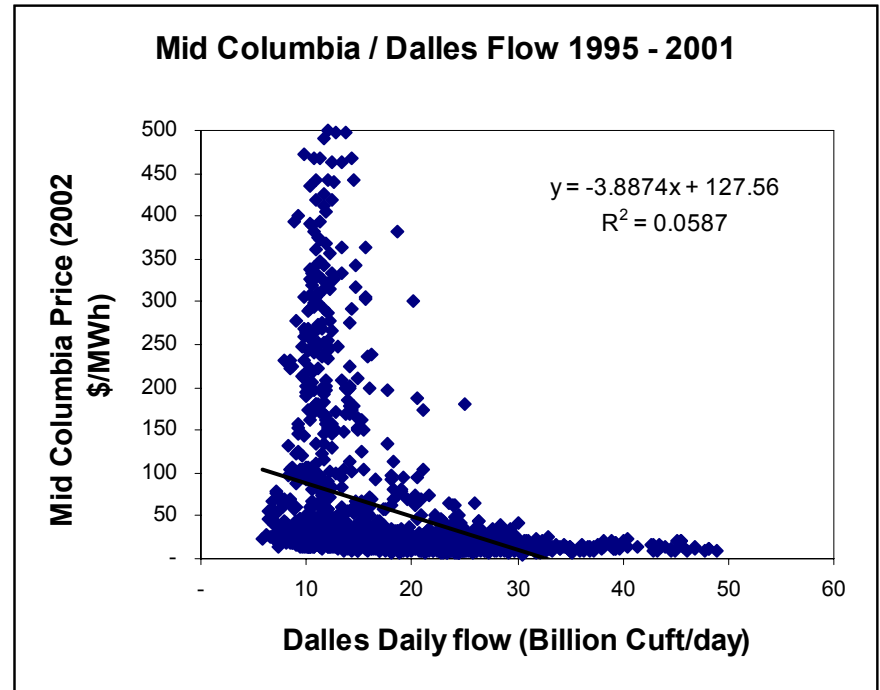
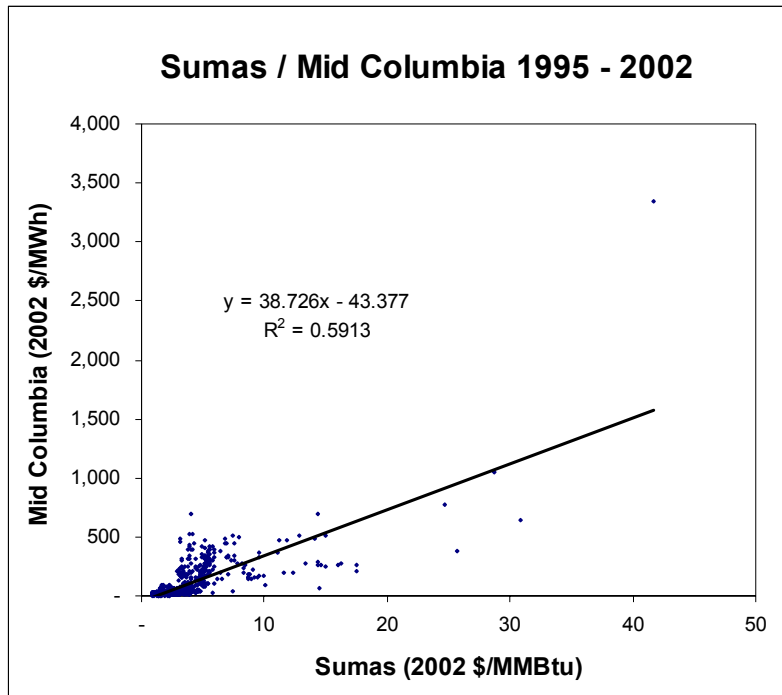
# Gas Prices Are Uncertain

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

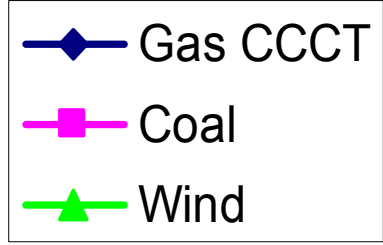
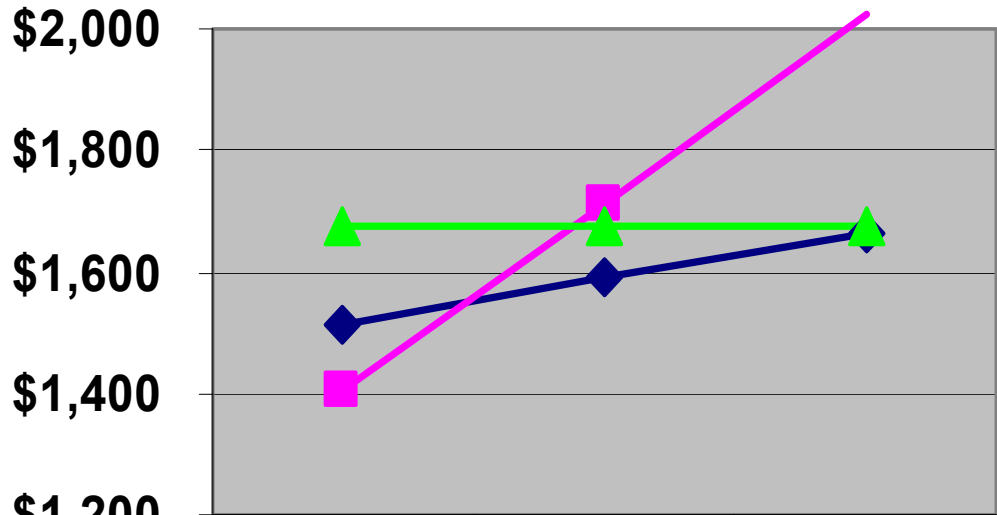
# Power Price, Gas Price, Hydro Correlations



# Impact of CO2 Costs On Generation Economics

Assumed CO2 Regulation in 2008

PV Of Life-Cycle Revenue Requirement

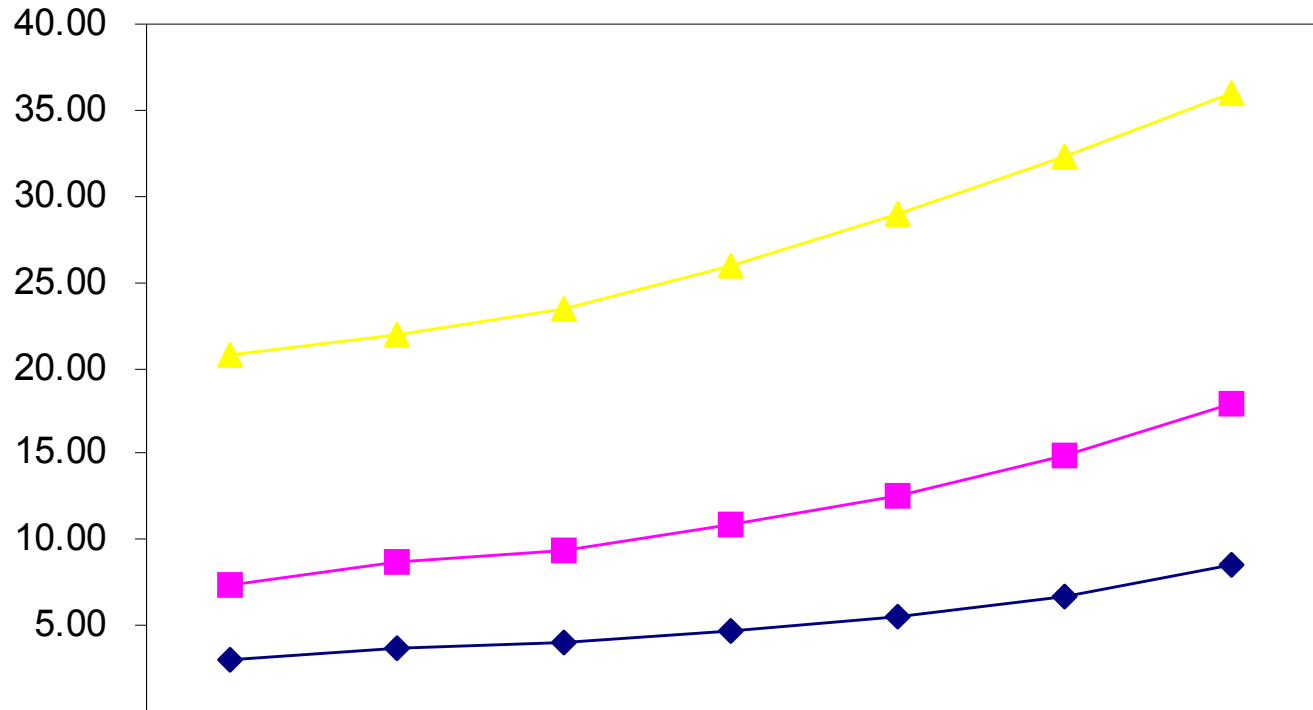


	\$0	\$5	\$10
◆ Gas CCCT	\$1,515	\$1,588	\$1,661
■ Coal	\$1,402	\$1,714	\$2,025
▲ Wind	\$1,673	\$1,673	\$1,673

\$/ton CO2

## Indifference Points with CO2 Cost

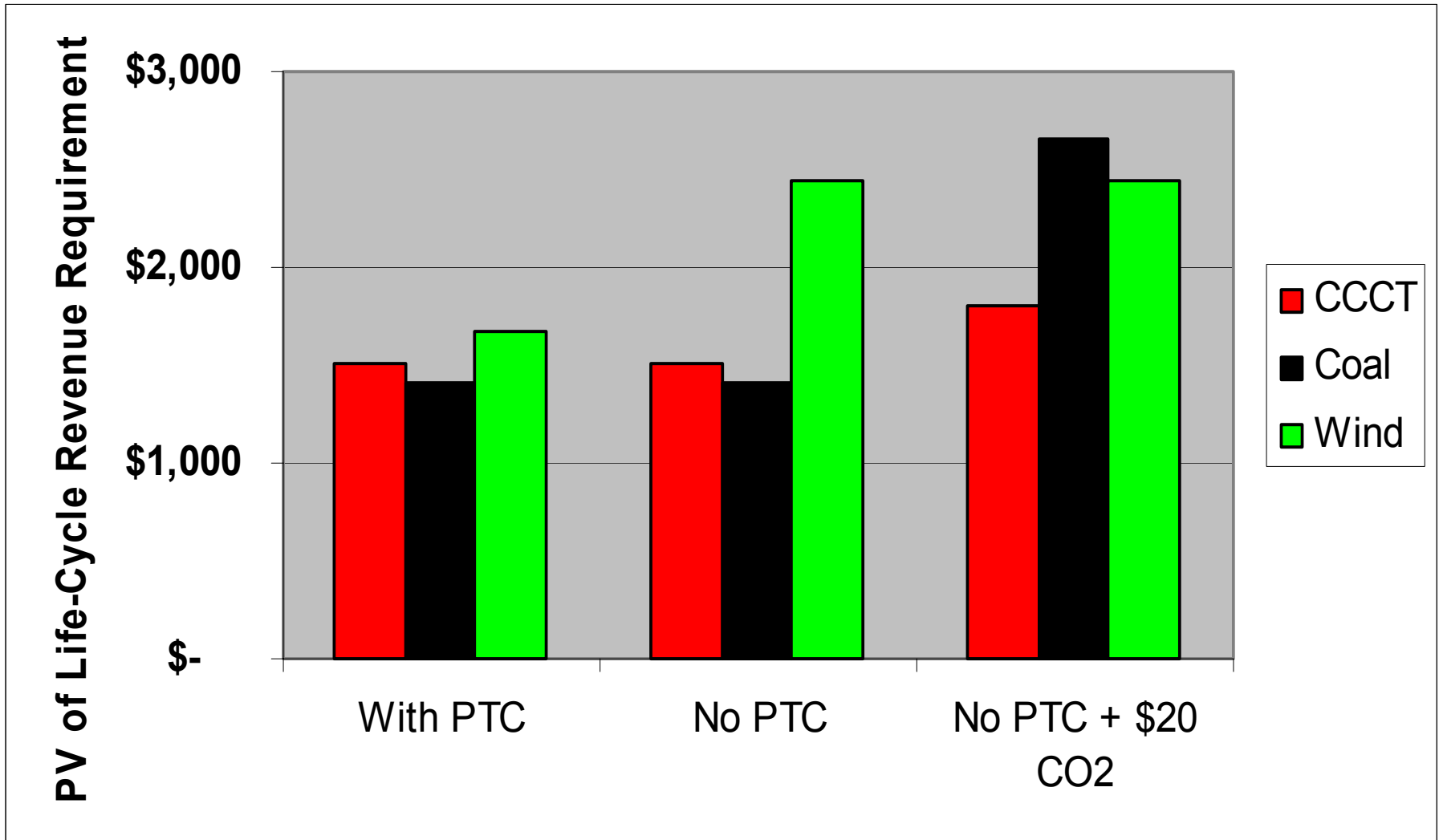
**Co2 Cost Indifference Point (\$/ton)**



	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

**Year CO2 Regulation is Effective**

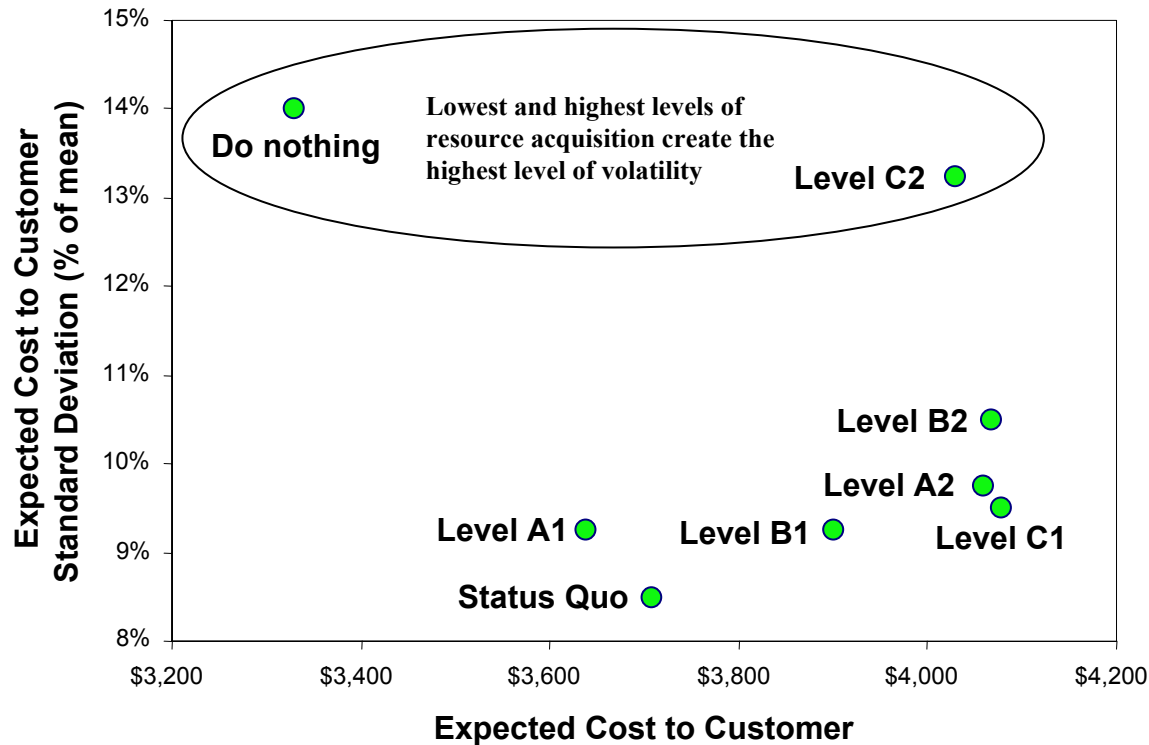
# Effect of Production Tax Credit and/or Carbon Tax





# Expected Cost to Customer and Risk (Low Cost of Capital Case)

## Expected Cost to Customer Vs Risk



# Risk vs. Cost

## Putting It All Together

- **Overbuilding** means you're a seller in a buyer's market.
- **Underbuilding** means you're a buyer in a seller's market
- **Betting on coal exposes you to uncertain environmental risk**
- **Betting on wind exposes you to uncertain hourly price risk**
- **Examine the risk and expected cost of alternative portfolios**
- **Apply judgment.**
  
- **Puget has Julia Ryan, Vice President of Energy Portfolio Risk Management**