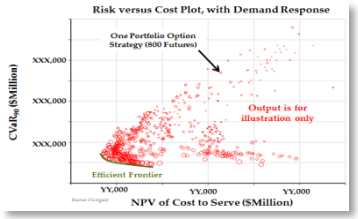
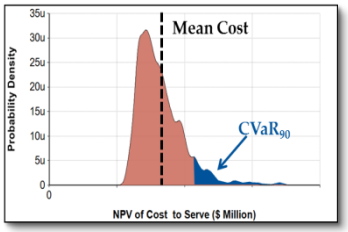
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Northwest Power and Conservation Council

Integrating Demand Response into the Northwest's 7th Power Plan





Business Planning in an Uncertain World

May 28, 2015

Cory Welch, Greg Wikler (Navigant)

John Ollis (Northwest Power and Conservation Council)



DISPUTES & INVESTIGATIONS • ECONOMICS • FINANCIAL ADVISORY • MANAGEMENT CONSULTING

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Caveat: The 7th Power Plan is currently under development. As such, all values in this presentation are illustrative only.

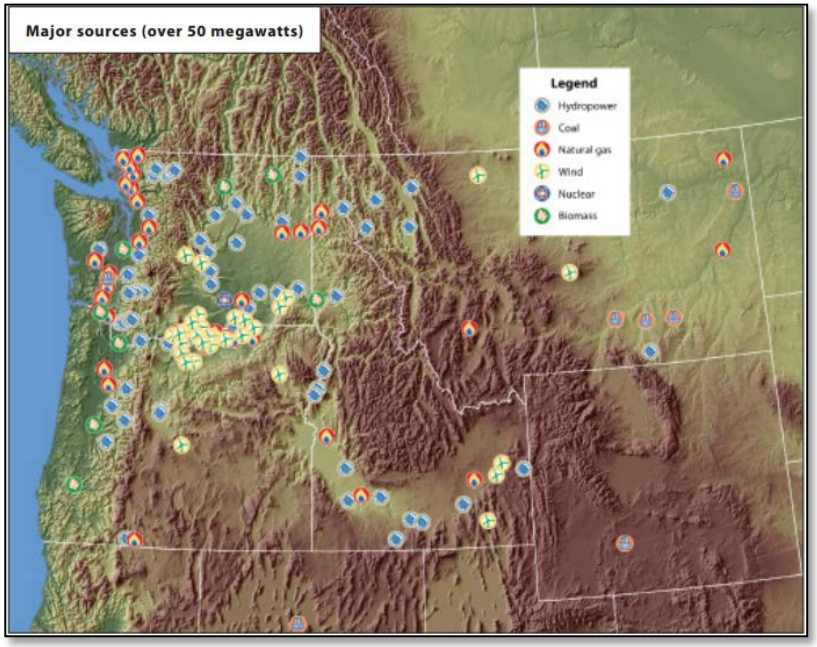
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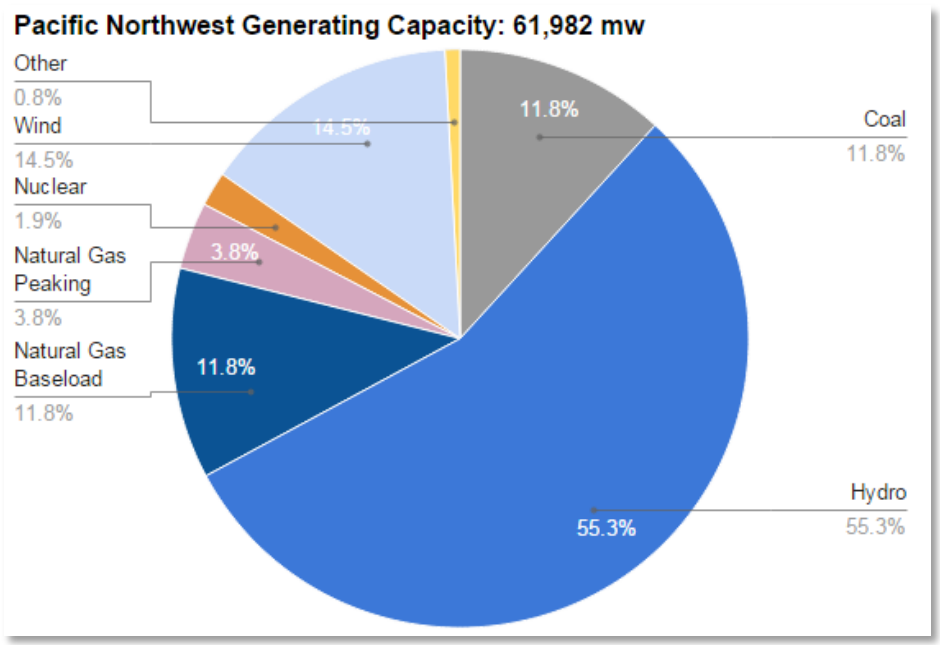
Resource Planning in the Pacific Northwest

Northwest Power and Conservation Council (NPCC)

"… develops a plan, updated every five years, to ensure the region's power supply and acquire cost-effective energy efficiency. The process relies on ***broad public participation to inform the plan and build consensus*** *on its recommendations."*[1]



Source: see link in footnote 1



Source: see link in footnote 1

1. https://www.nwcouncil.org/energy/powerplan/ [emphasis added]

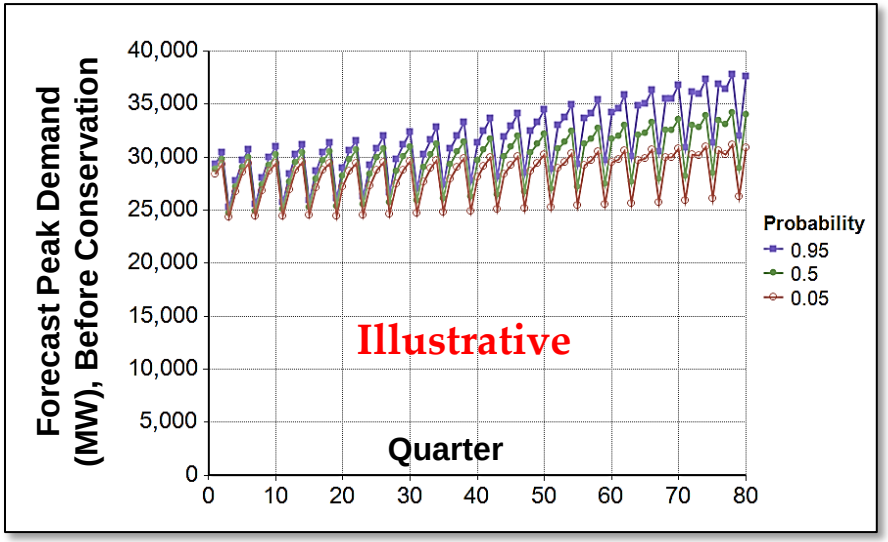
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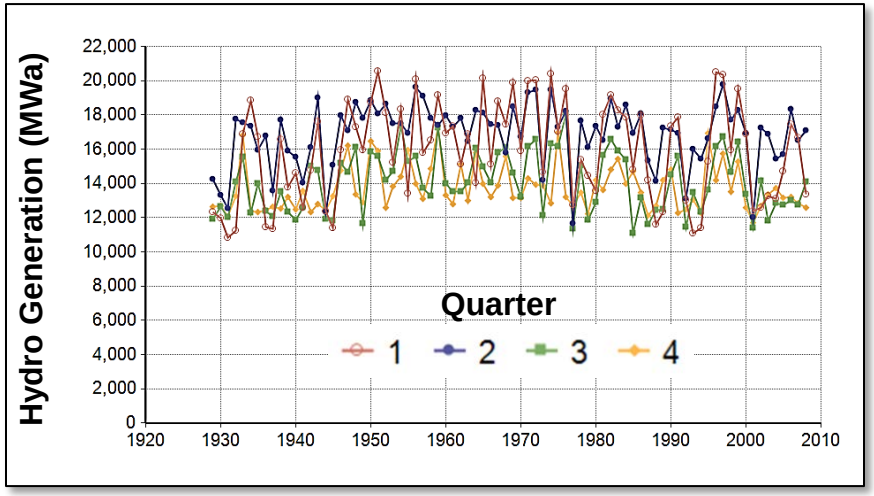
Resource Planning in the Pacific Northwest

» Historically, the NPCC's Power Plans have only addressed *energy* adequacy (limited peak demand capability).

» Business planning is necessitating explicit evaluation of peak resource adequacy (under uncertainty) due to factors including:
- growing peak demand,
- planned resource retirements,
- increasing intermittent distributed renewable resources, and
- continued heavy reliance on variable hydro generation.



Source: Navigant



Source: NPCC Data Provided to Navigant

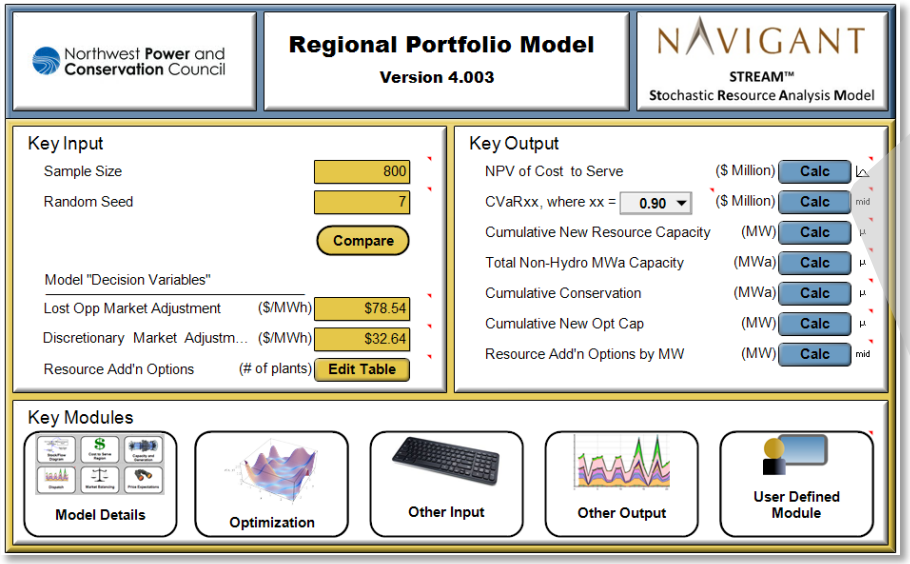
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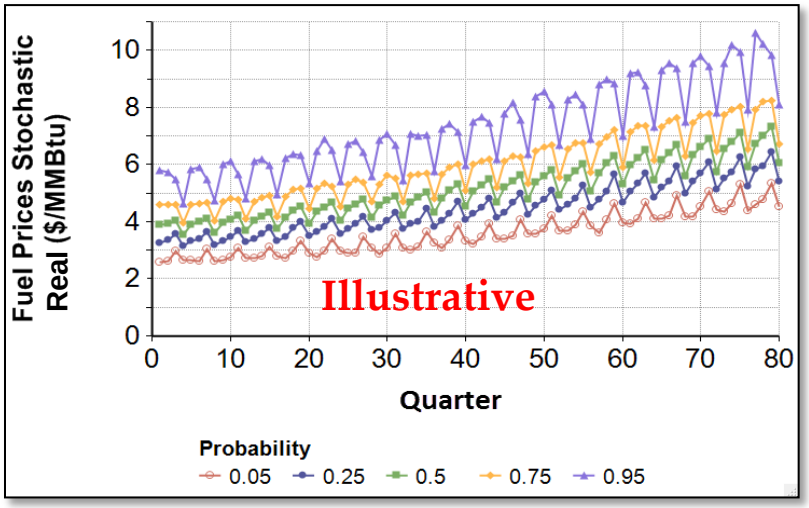
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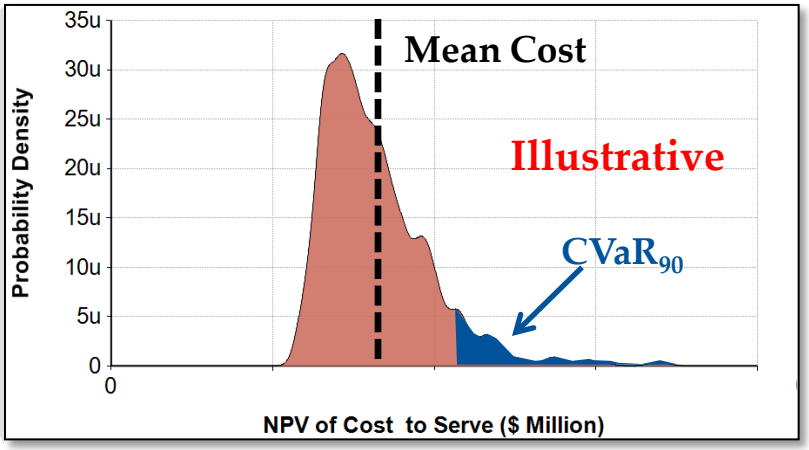
Business Planning Considering Uncertainty and Risk

» Navigant re-developed for NPCC a transparent planning model that tracks peak demand, competes distributed resources, and identifies optimal strategies considering uncertainty and risk.

» Key uncertainties considered include:
- Energy Consumption, Peak Demand
- Commodity Prices, CO_2 Prices
- Intermittent Renewable Generation
- Imported Electricity Prices







Source: Navigant

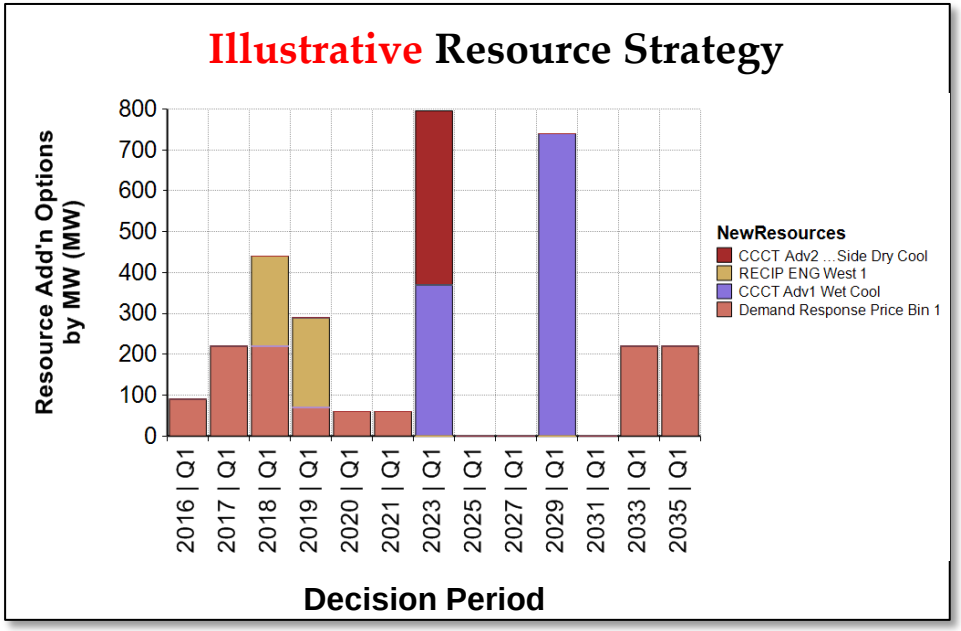
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Optimal Resource Strategies – Solution and Approach

» A *resource strategy* consists of the *option* to acquire a specified quantity of resources.

» Strategies are assessed using nonlinear optimization.
- Minimize either mean cost or risk ($CVaR_{xx}$)
- Calculate the efficient frontier of risk versus cost



Source: Navigant

» Whether an option is exercised in a particular uncertain future (in a random sample of 800) is determined by:
- A linear program that minimizes cost to meet resource adequacy;
- A calculation of expected profitability using trended prices and statistical calculations of unit dispatch.

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Treatment of Demand Response: Market Potential

- Navigant conducted a study of DR potential in the Northwest.
  - Peak load potential
  - Cost of potential
- Residential & C&I resources were assessed.
- Data sources included:
  - NW-specific utility DR programs & assessments;
  - DR data developed by Navigant for Bonneville Power Administration;
  - Relevant non-NW sources, including DR program data & assessments compiled by other entities.
- Resources totaling ~8.5% of summer peak and ~8.2% of winter peak were identified.

Resources Assessed

Residential DR
Space Cooling Space Heating Water Heating

C&I DR
Space Cooling Lighting Controls Agriculture Irrigation Curtailable/Interruptible Aggregator DR Refrigerated Warehouses

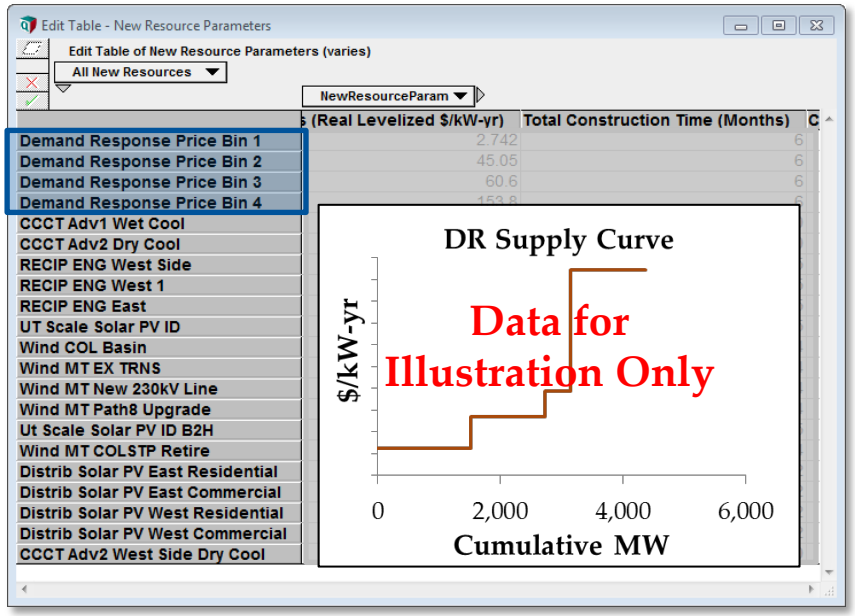
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Treatment of Demand Response: Modeling as a Resource

» NPCC aggregated/supplemented data from the DR potential study.

» Key DR inputs to model include:
  - **Resource lead time**
  - Price/quantity supply curve/bins
  - Maximum acquisition rate
  - **Minimum unit size**
  - Seasonal capacity values
  - **Resource option cost**



Source: Navigant (illustrative data only)

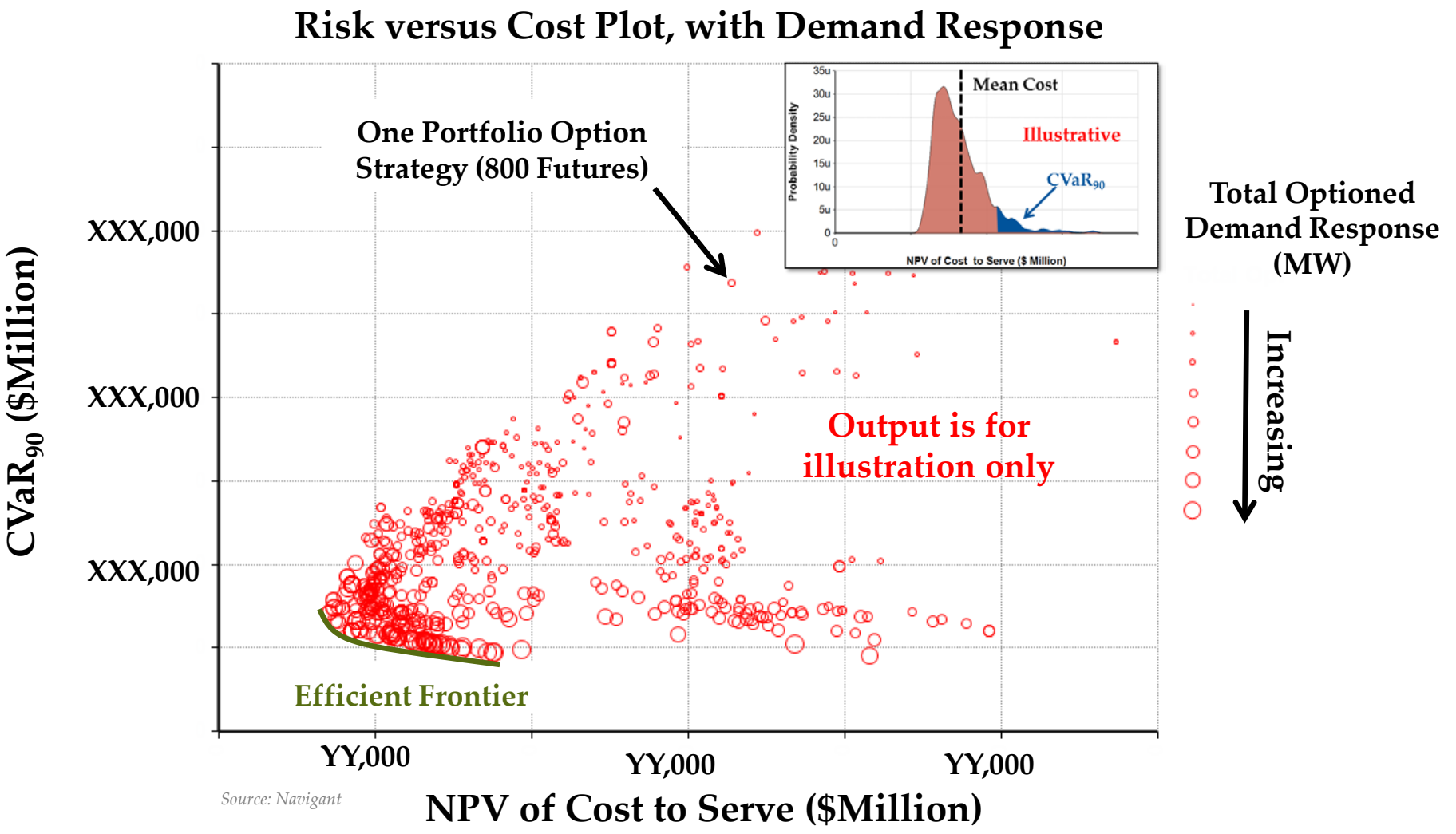
» DR resources compete directly with thermal resources and other distributed resources.

» DR also competes with conservation.
  - Quantity of conservation acquired varies with each uncertain future and by calculating the long-run added value of conservation as a cost or risk reduction mechanism.

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Risk versus Cost: The Efficient Frontier



Portfolios with more DR tend to be lower cost and lower risk.

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Summary and Take-Aways

» *"If there's one thing that's certain in business, it's uncertainty."*

-- Stephen Covey

» In an uncertain world, demand response affords many advantages:
- Short lead times
- Low option cost
- Flexible capacity sizing

» Trends in the utility industry are such that uncertainty is *increasing*, not decreasing (intermittent renewables, distributed resources, etc.).

» Good business planning will require *embracing that uncertainty* and appropriately *managing risk*.

» For more detail regarding the ongoing development of the 7th Power Plan, refer to: https://www.nwcouncil.org/energy/powerplan/7/home (a fully transparent model will be accessible online once the draft 7th Power Plan is finalized).

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Thank you for your attention.

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Key CONTACTS



Cory Welch, Navigant
Director, Energy Modeling
Boulder, CO
303.728.2528
cory.welch@navigant.com

Greg Wikler, Navigant
Director, Energy
San Francisco, CA
415.399.2109
greg.wikler@navigant.com

John Ollis, Northwest Power and Conservation Council
Power Systems Analyst
Portland, OR
503.22.5161
jollis@nwcouncil.org

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