Incorporating Non-generation Assets in Planning

Energy and Generation Planning Summit

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Non-generation assets

- Alternatives to traditional central station power plants
- Demand-side management
- Distributed generation
- Transmission

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Introduction to Summit Blue

Summit Blue Consulting provides professional consulting services to energy companies and the utility industry. Summit Blue is a team of experienced energy industry professionals with a wide range of backgrounds and skills, including economics, engineering, and market research. Summit Blue's primary practice areas include:

- Renewable energy strategy and program development.
- Generation asset valuation and appraisal
- Energy efficiency and load management program performance measurement and evaluation, program development and implementation.
- Energy systems technology assessment and technical potential studies.
- Quantitative and qualitative market research and market assessments.
- Utility business management consulting.

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Overview

- Types of non-generation assets
- Incorporating non-generation assets in planning process

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Types of Non-generation Assets

- Demand-side management
  - Energy efficiency
  - Demand Response
- Distributed generation
- Transmission

Demand-side management

- Demand-side management (DSM) refers to actions taken by a utility to help manage the level and timing of demand for electricity on its system.
- Although there is a wide spectrum of such actions, they fall into two large categories:
  - **Energy efficiency:** those that help consumers decrease the amount of electricity needed to meet a given level of end-use service, such as light, heat, or motor drive; and
  - **Demand response:** those that are focused on encouraging consumers to move some of their consumption from peak load periods to off-peak periods. By shifting use from peak periods to off-peak periods, utilities and consumers can avoid some of the high costs associated with meeting peak-period loads.

Today's DSM Enviroment

- EE and DR are now being considered in regions that have not previously aggressively pursued these options.
  - Concern over a new regime of rising fuel costs (gas, oil and coal) and commodity costs that increase plant construction costs.
  - Environmental compliance costs are likely to increase.
  - Concerns over getting supply-side power plants and related infrastructure built in a timely manner.
  - A desire to provide customers with ways to manage energy costs.
- More states and utilities actively supporting new DR:
  - System-reliability based DR – interruptible customers tied to notification.
  - Price-based DR - customers in response to price signals.

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Demand Response has been evolving

- Many utilities still regard demand response as a form of DSM program to be administered by the utility and treated in much the same way as energy efficiency initiatives.
- Demand response field has evolved to the point where direct load control and other initiatives to enable load curtailment are no longer the clear responsibility of the DSM staff.
- Utilities are beginning to view load control as a resource that is handled differently internally and that may receive special regulatory treatment as compared to traditional DSM programs.

Early Years	Past Decade	Latest Trend
Residential water heater and A/C switches		Curtailable "resource" (MW) purchased from aggregators
Large C&I interruptible rates	Thermostats and more diverse loads	No "program" for utility to run
Utilities administered programs internally	Vendors playing a bigger role	MW reductions guaranteed through DR portfolio
Predictable MW reductions	MW reductions less predictable	

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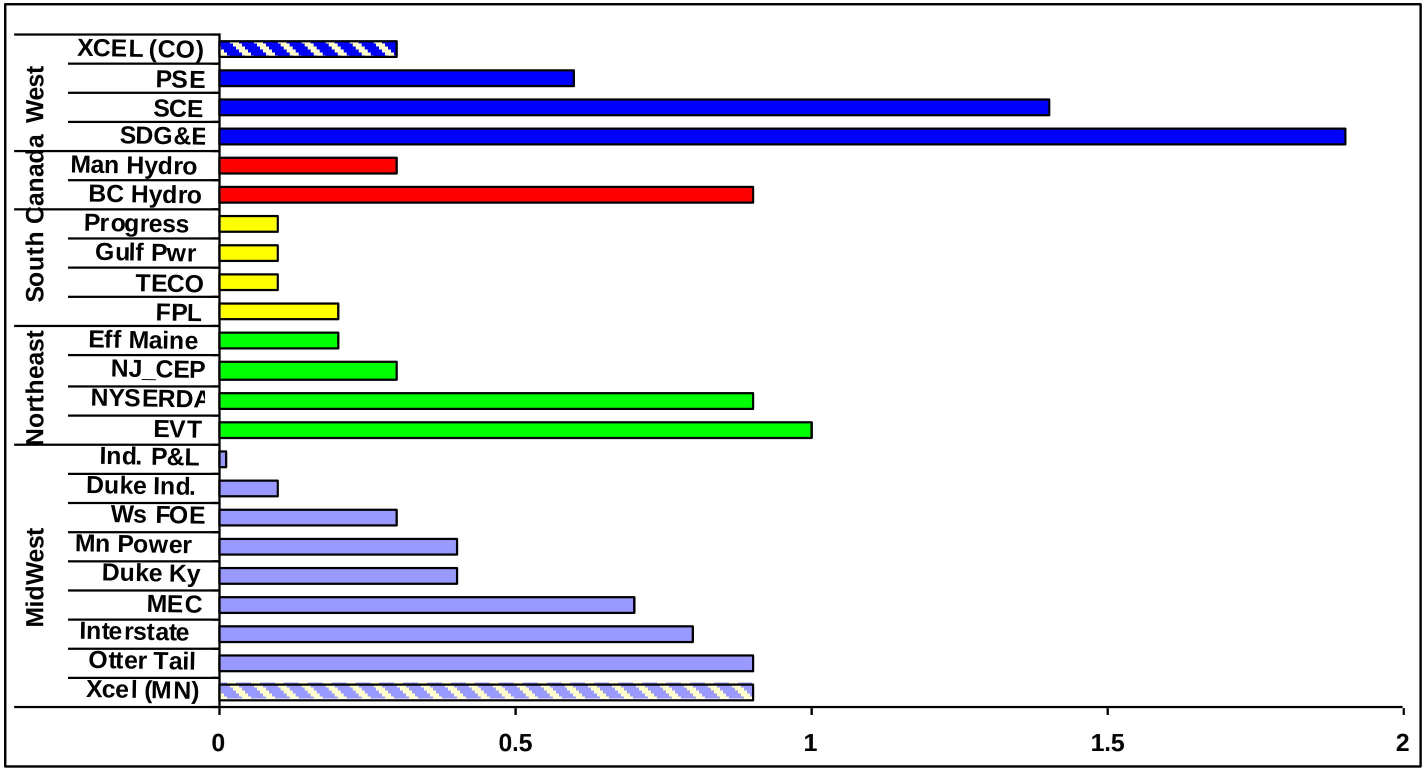
DSM Annual Energy Savings Above 1% of Sales is Uncommon

- Energy savings range from a low of 0.1% for the Florida utilities and others to close to 2% for SDG&E. Florida used the RIM test as the main benefit-cost analysis test.
- Median energy savings are about 0.4% of sales. Most organizations achieved DSM savings of 1% of sales or less.
  - NOTE: Energy savings in this chart and those following are first year only.



Source: EIA 861 2005 data and Summit Blue analysis

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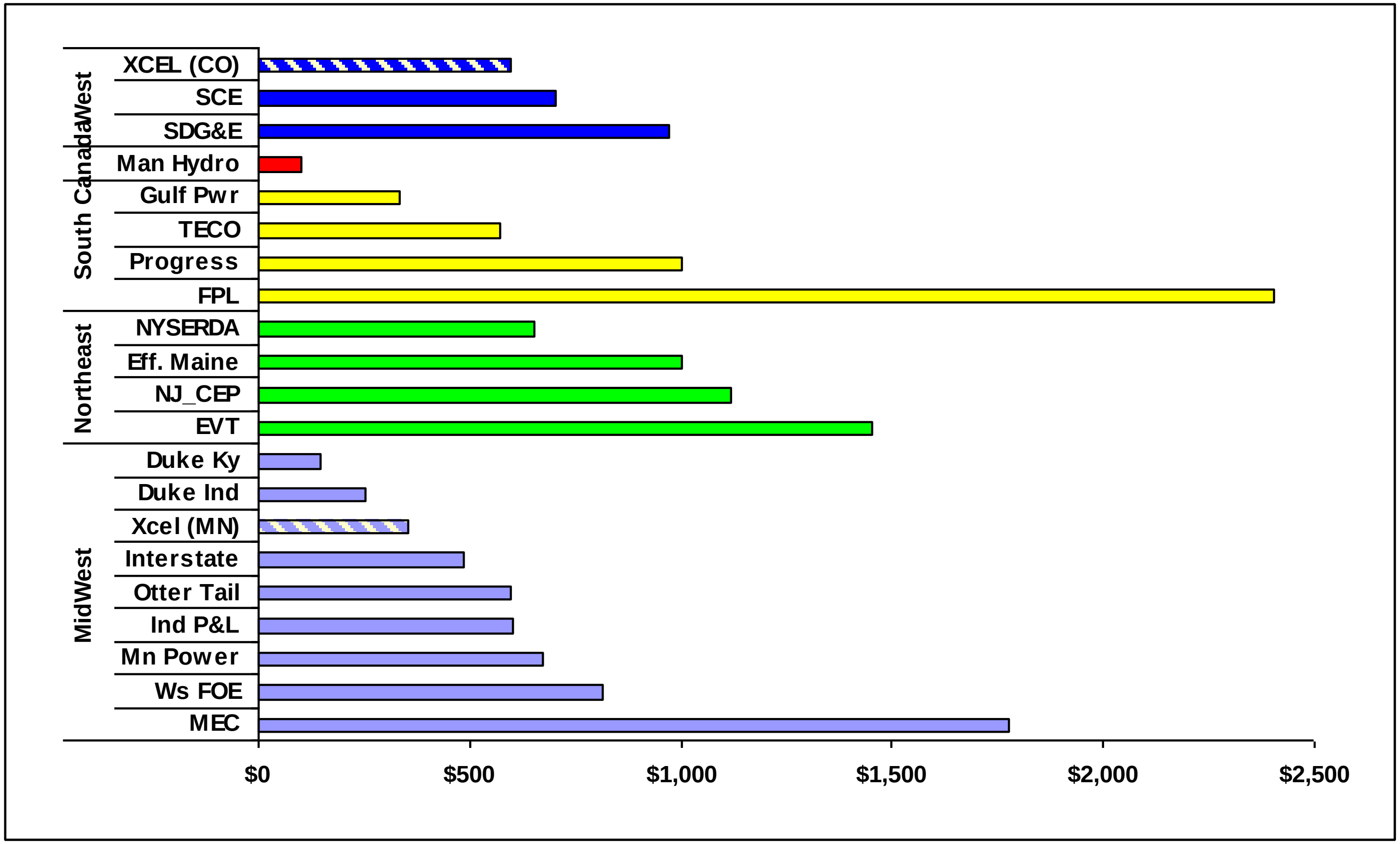
Median Cost for Peak Demand Savings was $655/kW

- Costs of peak demand savings range from under $146/kW at Duke Energy Kentucky up to about $2,500/kW.
- Lower costs of conserved demand for utilities with significant DR programs.



Source: EIA 861 2005 data and Summit Blue analysis

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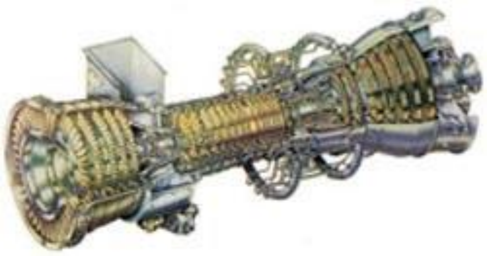
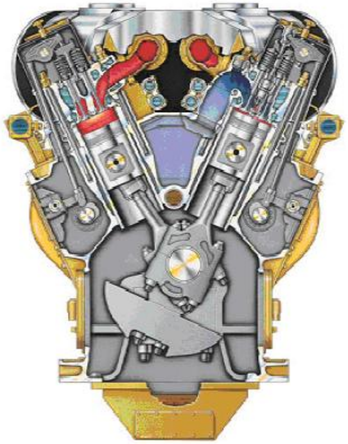
Distributed generation





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Distributed Generation value varies by region

Source: California Public Utilities Commission 2003.

Transmission

- Neptune projects—arbitrage between lower priced and higher priced markets.
  - Neptune line: 660 MW, 500 kV DC line between NJ and NY (LIPA). Energized in June 2007. Cost $600 million, entirely financed by private investors.
  - Hudson project. Selected by NYPA to bring 500+ MW from PJM to NYC under the Hudson River.
  - Green Line. Proposed underwater project to bring renewable energy from Maine to greater Boston area.
- Nevada task force recommended that governor take three steps to improve transmission accessibility for renewable energy.
  - construct a transmission line linking the electrical grids of Sierra Pacific Power in northern Nevada and Nevada Power in southern Nevada.
  - build transmission lines in 12 wind, four solar, six geothermal and four biomass zones.
  - direct the committee to continue work and identify methods of
  - financing transmission lines

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Transmission (cont.)

- Transmission in California is essential to meeting renewables targets.
  - PG&E is proposing a 1,000-mile transmission project, which could deliver up to 3,000 MW of renewable power from British Columbia and the Pacific Northwest to California. The project could result in a 500 kV line or greater and $3 billion to $6 billion.
  - Sunrise Powerlink is composed of a 500 kV line and several 230 kV lines that would run about 150 miles from Imperial Valley to San Diego Valley. The lines aim to import 1,000 MW of electricity. SDG&E pegs Sunrise's cost at nearly $1.7 billion, including mitigation expenses. Hearing have dealt with cultural sites, easement rights, bighorn sheep populations and the costs of photovoltaics.

Methods of Resource Planning

1. Benefit Cost Test Approach – Typically uses tests like the Total Resource Cost (TRC) test and the Ratepayers Impact Measure (RIM) test.
    - Tends to be a static assessment process with one set of avoided cost values used throughout the planning horizon.
    - Assessment of DR during low-probability/high-consequence events are hard to address (These could be supply-side uncertainties)
    - B/C tests still the most widely used form of incorporating DR in planning – most utilities still use the process with which they are most familiar.
2. Incorporation in resource planning models.
    - Differential revenue requirements now specify the benefits of different resource plans just as they do for supply-side investments.
    - The planning horizon allows for variation in DR benefits and costs (adaptations to B/C tests could address these issues)

Benefit-cost screening models

- A simple benefit-cost screening tool can give a good idea of the cost-effectiveness of a non-generation assets program
- Avoided costs for the program are calculated as:

  Program MW Capacity * (avoided capacity costs + avoided T&D costs) + Program MWh * avoided energy costs
- Program costs include: administration, payments for customer shifted/avoided/generated energy, advertising, rebates, etc.
- Comparing avoided costs and program costs gives an estimate of cost-effectiveness

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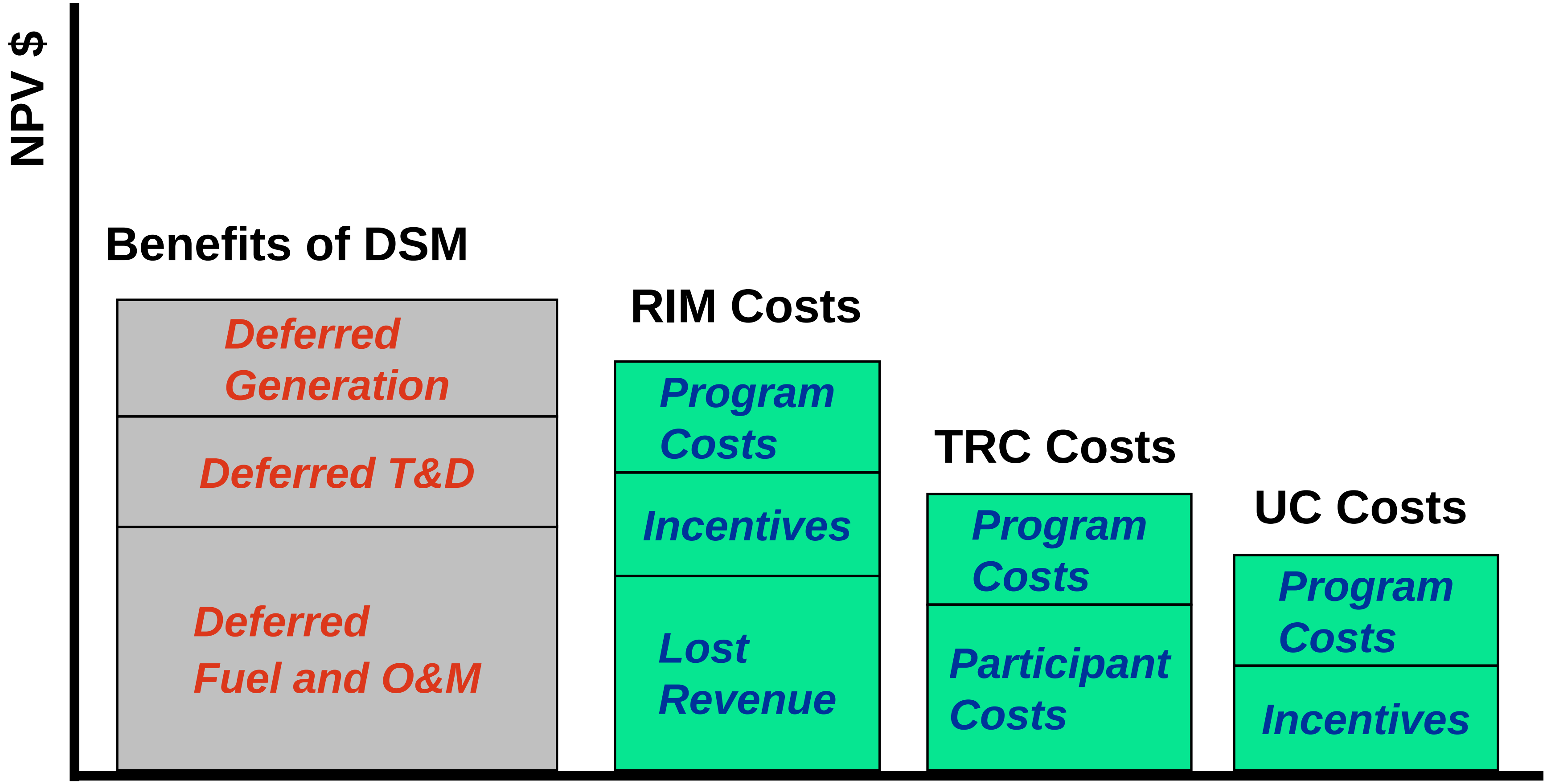
Avoided Costs

- Avoided (or marginal) costs are needed when evaluating or planning EE/DR/DG programs. They are the costs a utility/ISO can avoid by saving energy or shifting/reducing demand through non-generation assets
- Marginal costs are the incremental investment required by an incremental increase in a utility's system energy requirements ($/kWh), peak load demand ($/kW-year), or number of accounts ($/Customer)
- There are three broad categories of avoided costs:
  - **Capacity:** Peak Load Capacity ($/kW-yr)
  - **T&D:** Transmission ($/kW-yr), Sub-transmission ($/kW-yr), Distribution ($/kW-yr)
  - **Generation:** Energy ($/MWh)
- *For there to be avoided costs, it must be possible to avoid something. This is not known at the start of the process.*

Test Comparison



Use of planning models

- Utilities buying bundled renewable energy typically use complex planning models such as Strategist.
- These models simulate system costs over a planning horizon (e.g., 20 years) for many combinations of existing and possible new resources.
- These portfolios are typically evaluated under alternative scenarios (e.g., high fuel and/or various carbon costs).
- Utilities consider overall net present value cost in base and alternative cases, in addition to non-price factors such as bidder qualification, economic development considerations, and fuel diversity.

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Valuing non-generation assets with planning models

- Models can be used to estimate both capital and marginal avoided costs due to non-generation assets
- Can use specific modules for EE and DR that implement restrictions on callable hours and add payments for load reductions e.g., Strategist® (from New Energy Associates)
- Alternatively, non-generation assets can be added to the model in the same way that generating plants are
- Callable DR and RTP can be most easily compared to peaker plants, as they reduce peak load only
- Energy efficiency programs can be compared to a base load plant as they reduce load at all times

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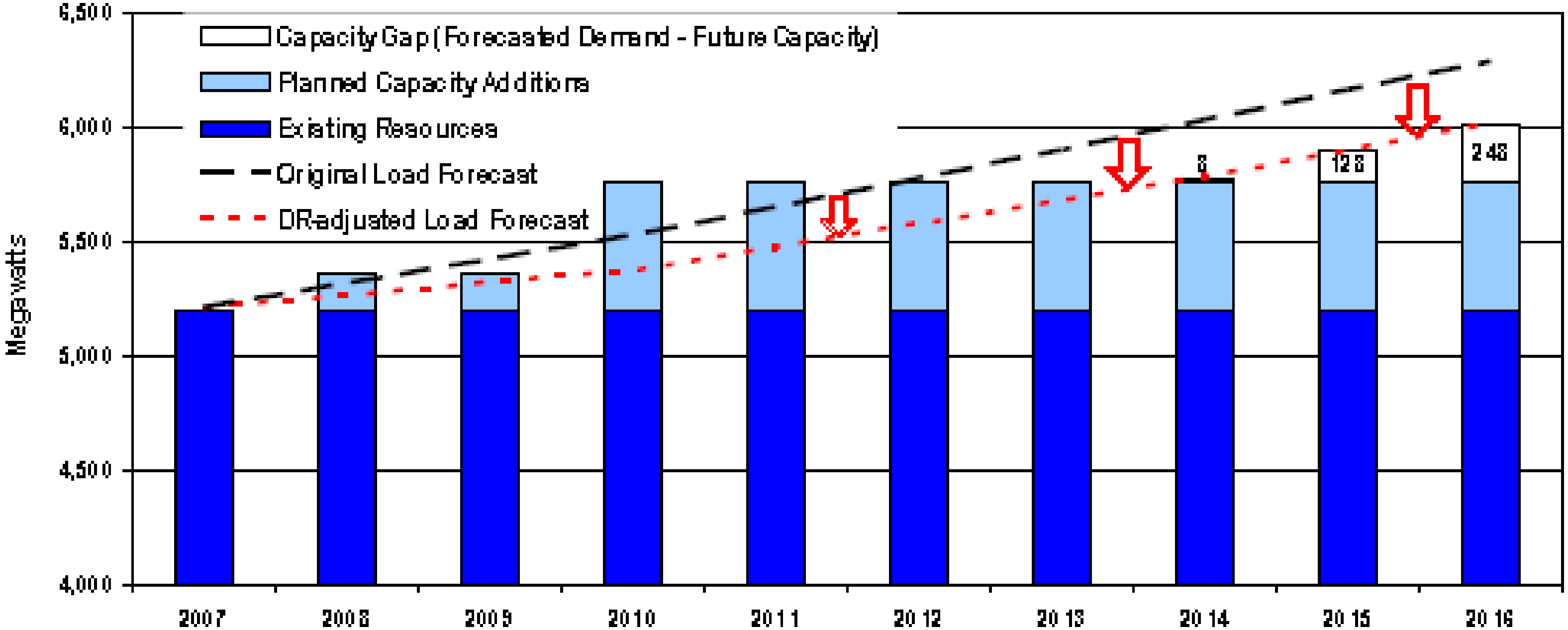
To Increment or Decrement?

Non-generation assets benefits can be estimated by comparing a base case with a "with non-generation assets" case in various ways. For example:

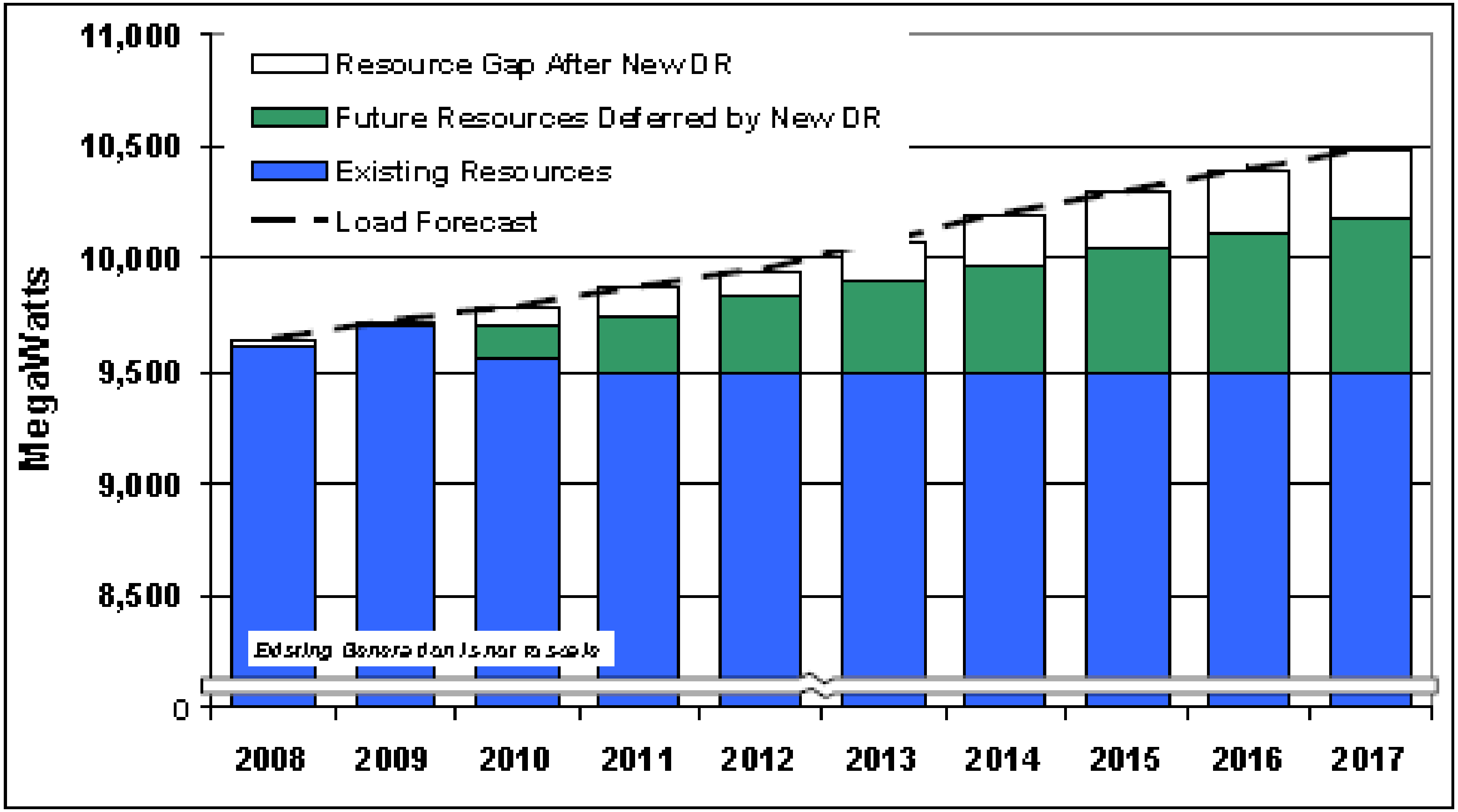
- Decremental Load – estimate the savings due to non-generation assets by decreasing load forecasts
- Incremental Resource – specify resources that are on the margin to serve incremental (or decremental) load and analyze their cost for different types of non-generation assets that can offset the need for those resources

DSM as a reduction to utility load forecast



Source: Summit Blue and utility resource planning initiatives

Demand Response as a Resource to Defer New Generation



Source: Summit Blue and utility resource planning initiatives

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Case Study: Resource Planning Approach

- As an example, 100 cases were created as data inputs to a resource planning model (Strategist™) using a simplified Monte Carlo methods to capture an appropriate range of possible futures.
- A number of pivot factors were identified and the uncertainty around these factors was dimensioned:
  - Fuel prices – natural gas, residual oil, distillate oil, and coal
  - Peak demand
  - Energy demand
  - Unit outages -- "what if" stress cases (four specified) were introduced with ranges of capacity being off line -- up to 12%.
  - Tie line capacities

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Demand-Side Resource Programs

- Five DR programs were modeled in simulated market using PJM -- mid-Atlantic data:
  - 1) large customer interruptible,
  - 2) mass market direct load control,
  - 3) dispatchable purchase transaction (day-ahead bid program),
  - 4) time of use with event-based Critical Peak Pricing (CPP) and
  - 5) Real-time pricing variants (the only non-event based program).
- The MW capacities of the programs were calculated to start at a low value and grow at a quick rate in the first ten years to a level of about 4% of peak demand, and thereafter grow at a slightly higher rate than the peak demand.
- DR costs, economics, availability and capacity data were developed as inputs to the resource planning model based on specific product designs.`

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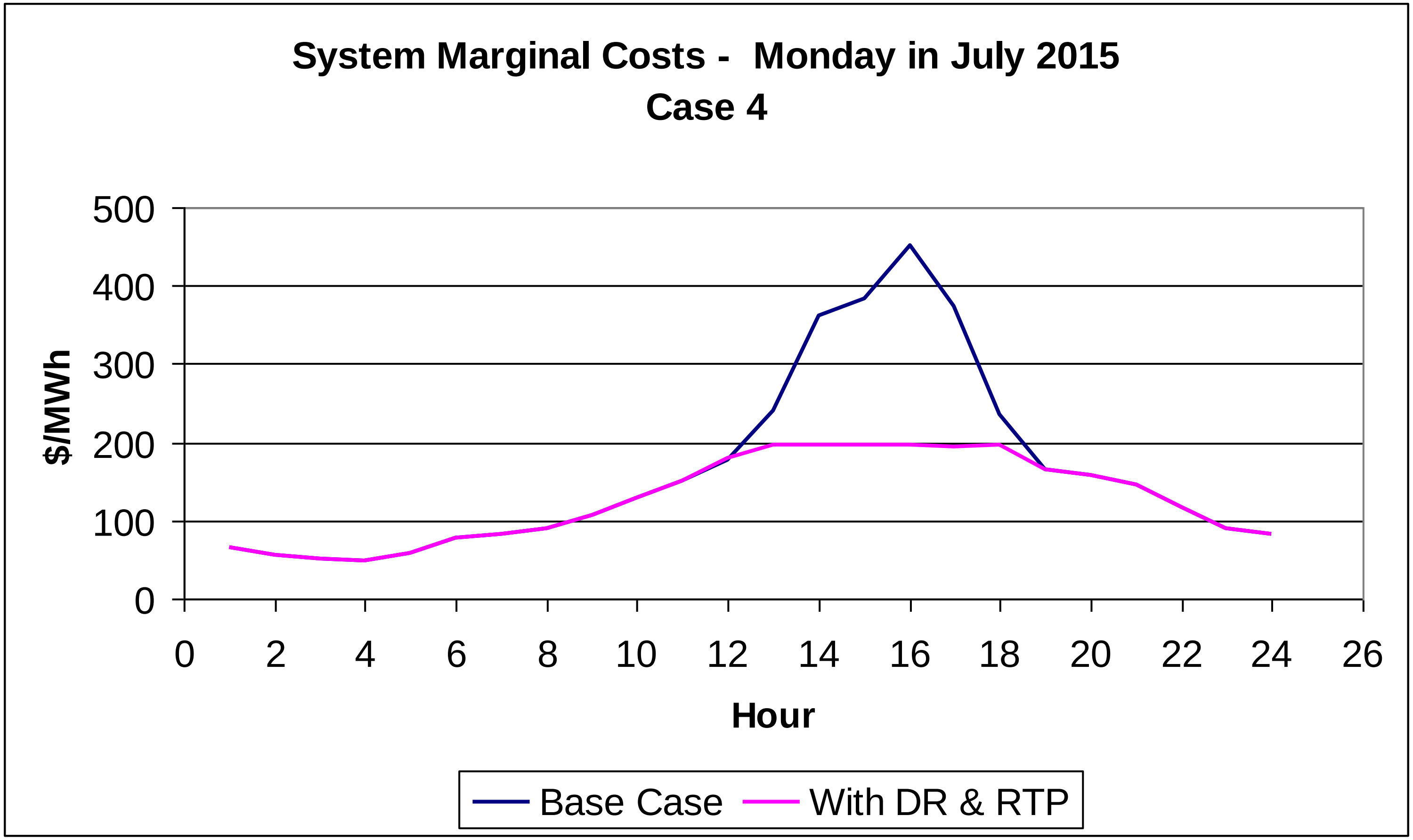
System Marginal Cost – Stress Case



- $24.5 Million saved on this one day and $45.2 million saved in this week.

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Results - Overall Risk Profile

- There was a change in the risk profile associated with the planning scenarios with the addition of the various portfolios of DR
- There were significant savings when looking at value at risk (VAR), at the 90th percentile (VAR90), and at the 95th percentile (VAR95). Results for the three scenarios are shown below.

Risk Metrics – Reduction in System Costs at Risk ($M)		
	VAR 90	VAR 95
Callable DRR	238	213
Callable DRR with Critical Peak Pricing	924	966
Callable DRR with Real Time Pricing	2,673	2,766

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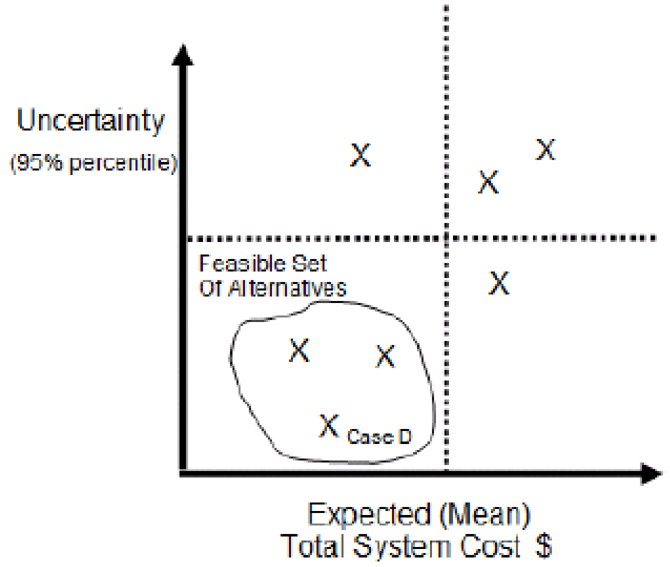
Monte Carlo Analysis examines robustness

- A Monte Carlo analysis has three steps:

1. Define the range and probability distribution of potential input conditions
2. Generate series of input conditions randomly from the defined input condition and calculate the portfolio's performance for each randomly generated input
3. Aggregate the results of the individual results to see how the proposed portfolio performs within the range of input.



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Example of portfolios

	Approved EE	Base EE	Adv EE	Max EE	High Max
(2027)	9.2 MW	39.8 MW	174.2 MW	298.0 MW	344.0 MW
(2027)	84 GWh	240.3 GWh	1288.3 GWh	1638.1 GWh	1864.2 GWh
~/yr exp.	$4.6 M (3yr)	$ 2.2 M	$ 11.1 M	$16.4 M	$29.2 M
2008	Photovoltaic DG	Photovoltaic DG	Photovoltaic DG	Photovoltaic DG	Photovoltaic DG
2009	Luna/ Lordsburg	Luna/ Lordsburg	Luna/ Lordsburg	Luna/ Lordsburg	Luna/ Lordsburg
2010					
2011					
2012	LMS 100	LMS 100	LMS 100		
2013				LMS 100	LMS 100
2014	7FA	7FA	Wind/ Geotherm		
2015			7FA	LMS 100	
2016	Wind	Wind			LMS 100
2017	7FA	7FA			
2018	PV Renewal	PV Renewal	PV Renewal/LMS	PV Renewal/7FA	PV Renewal/Geo
2019	7FA	Geothermal		Wind	7FA
2020		7FA	7FA		
2021					
2022	LMS 100	LMS 100		7FA	
2023	LMS 100/ Geo		7FA		7FA
2024	Geothermal	Nuclear - 200			Wind
2025	Nuclear - 200			Geothermal	
2026			LMS 100	LMS 100	
2027		LMS 100			LMS 100
NPV- 20	Base	$ (41,548)	$ (290,734)	$ (384,501)	$ (358,788)

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Planning considerations

- Require quality in demand-side resource acquisition – it can be difficult; but, building an IGCC coal plant with supporting infrastructure on time and on budget is also difficult.
- Building demand-side infrastructure is important – this involves practices (building and specification), availability of efficient equipment, skilled practitioners, as well as verification and evaluation.
- Price signals (or proxies) provide an incentive to manage what is scarce AND enables customer respond to those signals.
- Non-generation assets provide flexibility and can balance out supply-side risks.

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Closing

- Utilities are increasingly considering non-generation assets as alternatives for environmental, cost, regulatory, or political reasons.
- Non-generation assets can be considered through static screening models or utility planning models.
- Utility planning models provide a more robust view, but screening models have their place.
- Many current analyses are still based on single-point "most-likely" estimates with sensitivity analyses used to assess uncertainty -- often without considering the correlations across key factors.
- Planning should address uncertainty in a manner that dimensions risk and allows for the assessment of risk management options.

Questions?