



Defining Wind Integration in the 2009 Integrated Resource Plan

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Agenda

10:00 Introductions

10:15 Wind Integration and the 2009 IRP

11:15 Questions/Suggestions for Further Work

12:00 Adjourn



Defining Wind Integration and Its Costs

2009 Integrated Resource Plan

Outline of Presentation

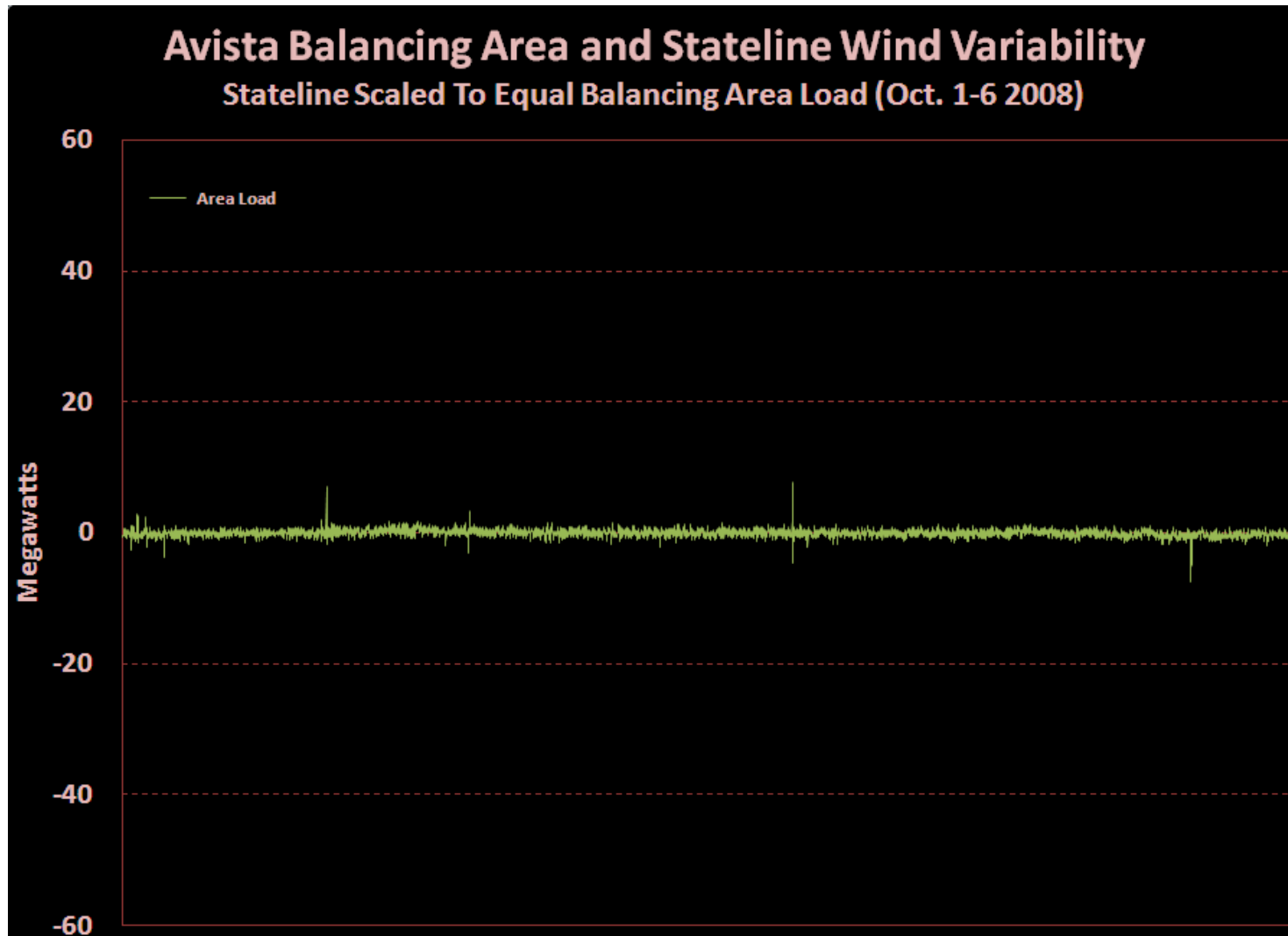
- **Defining Wind Integration**
- **Wind Integration Cost Components**
- **Preferred Resource Strategy Model (PRiSM)**
 - What is PRiSM?
 - The Efficient Frontier
 - covers timeframe from end of regulation up to next ramp (1 hour in WECC)
 - Wind modeling in 2009 IRP
 - Recent enhancements to PRiSM
- **Questions**

Defining Wind Integration

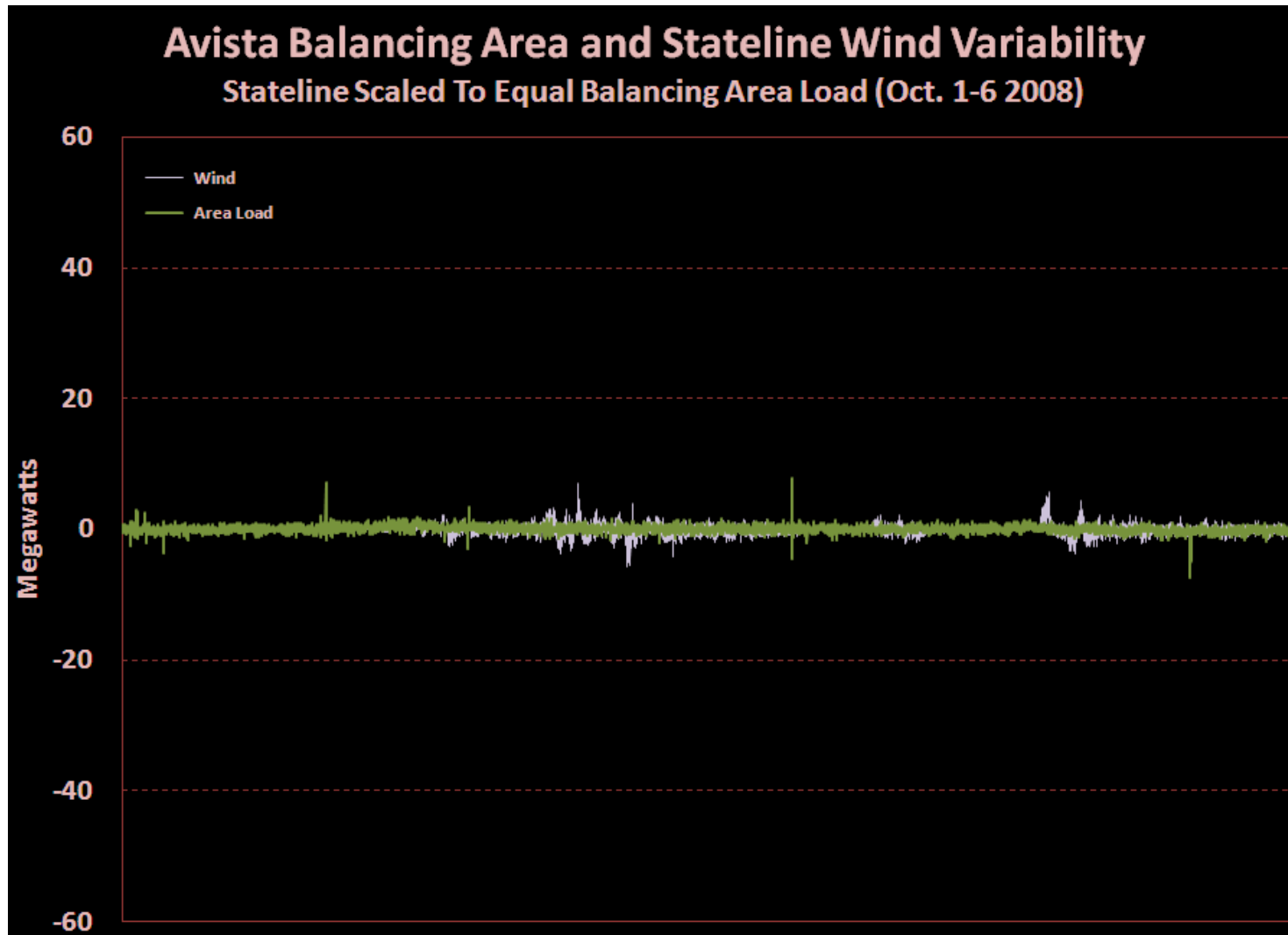
- **Incremental Reserves (Avista Study Method)**
 - Regulation (<1 minute)
 - Load following
 - covers timeframe from end of regulation up to next ramp (1 hour in WECC)
 - Forecast error
 - difference between forecast and actual generation
- **Other Things Sometimes Called Wind Integration**
 - Shape of delivered energy
 - Fuel savings from wind operations
 - Capital costs
 - Environmental attributes

Bottom Line: Be Careful When Assuming 2 Studies are “Apples-to-Apples”

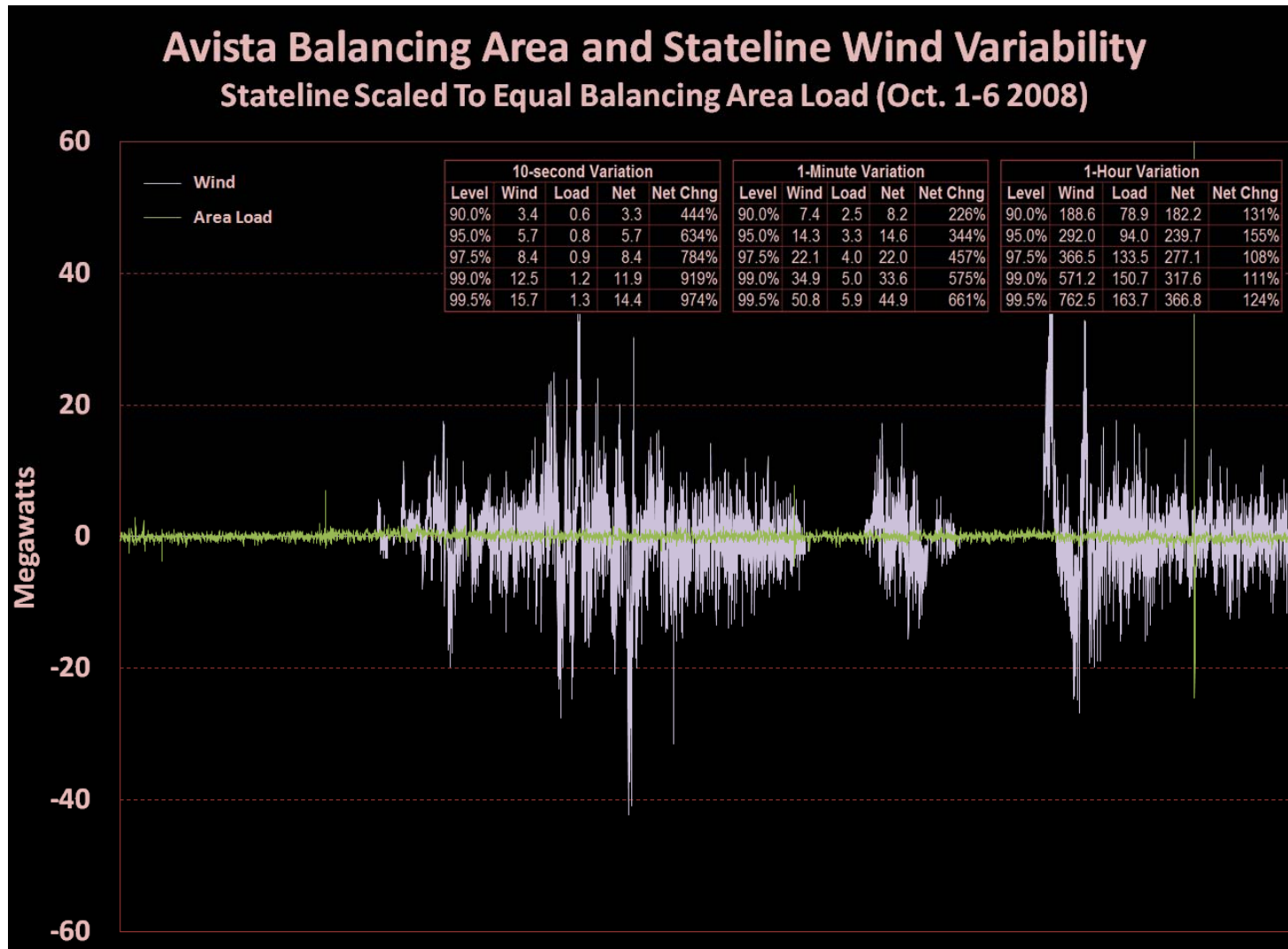
Defining Wind Integration — A Graphical View



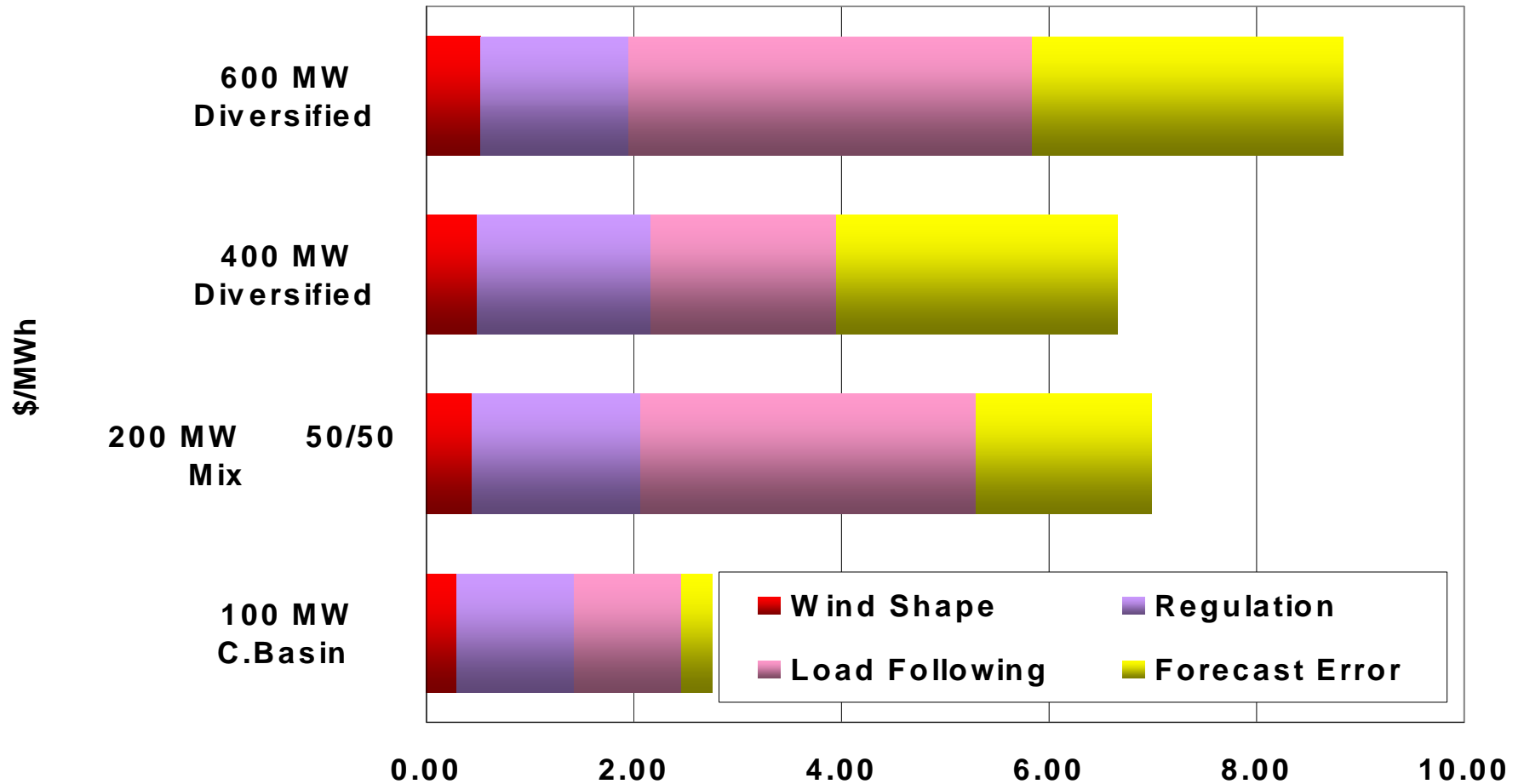
Defining Wind Integration — A Graphical View



Defining Wind Integration — A Graphical View



Wind Integration Cost Components





PRiSM

(Preferred Resource Strategy Model)

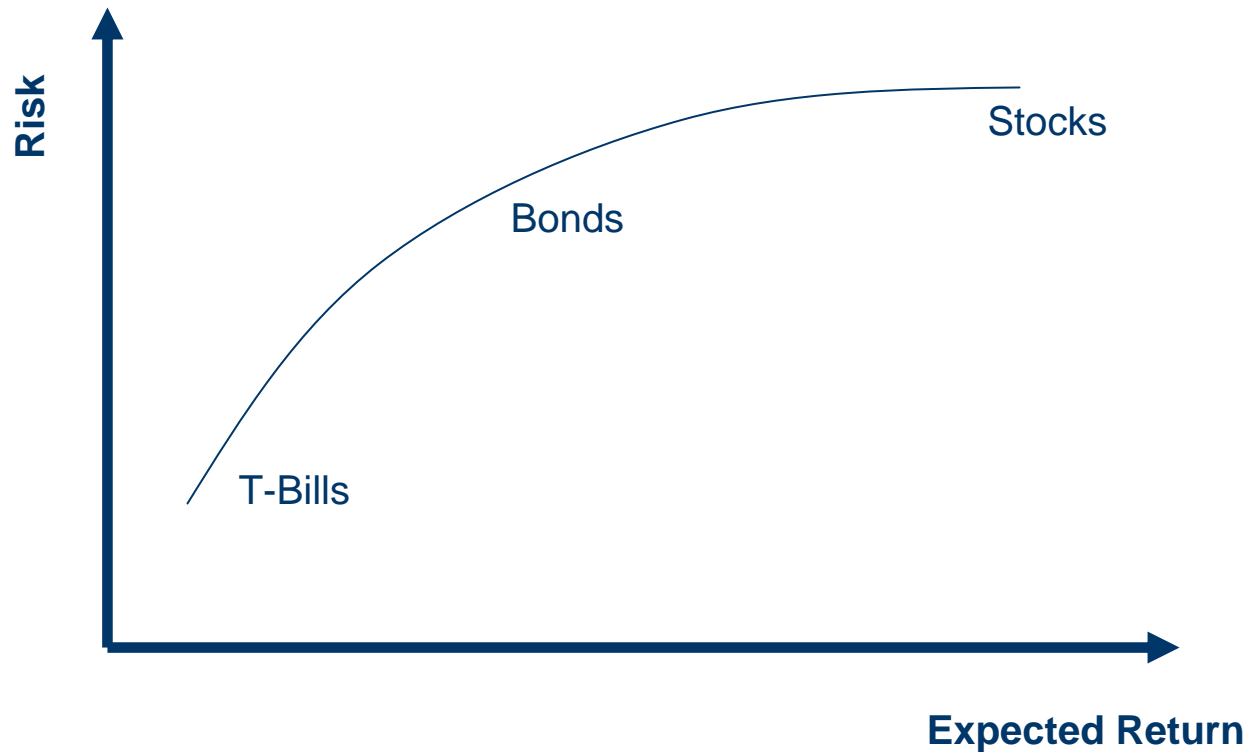
2009 Integrated Resource Plan



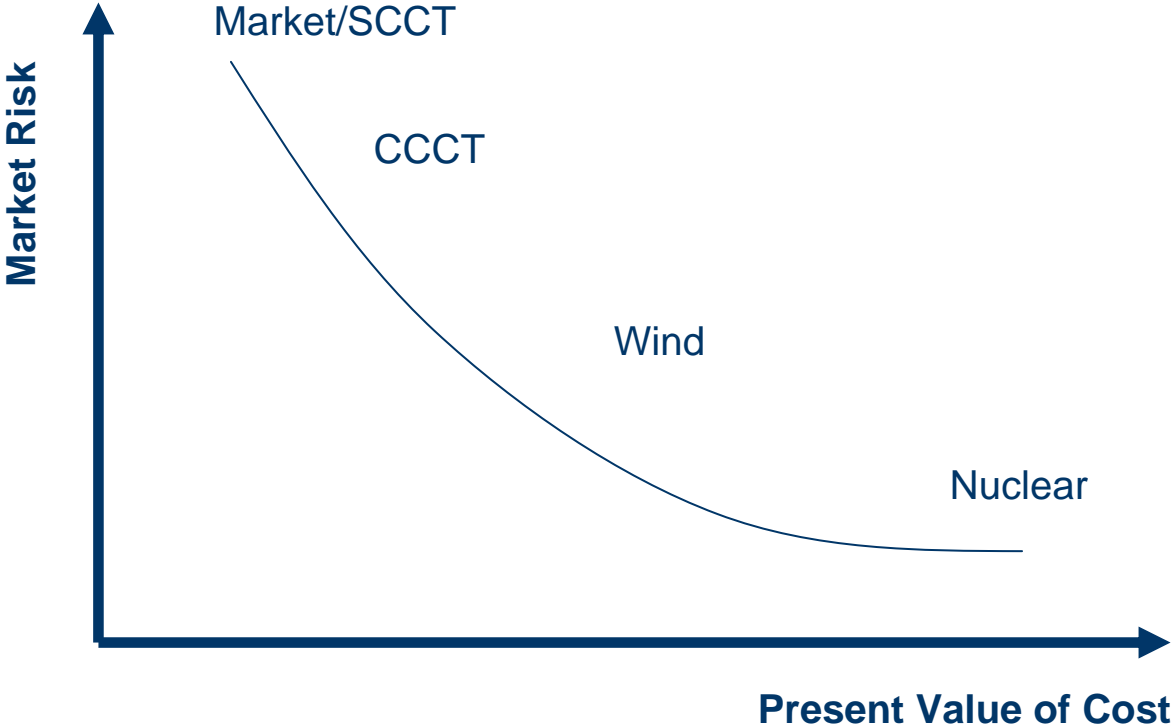
What is PRiSM?

- Preferred Resource Strategy Model
 - *Selects resource & conservation opportunities on an optimal cost and risk basis using a linear program (What's Best!)*
- Objective function is to either select resource strategies to meet our energy/capacity/market/RPS/CO₂ requirements on a least cost and/or least risk basis
- Cost is measured by the present value of incremental fuel & O&M expenses and new capital investment
- Risk is measured by the variation in fuel, emissions, load, wind, forced outages, and variable O&M expenses in years 2019/29

Efficient Frontier- An Introduction 1 (stock portfolios)



Efficient Frontier- An Introduction (Avista IRP)



Wind Modeling in 2009 IRP

- Various Wind Resource Options
 - *Small wind (DG)*
 - *Northwest Wind (Tier 1 and Tier 2)*
 - *Montana Wind*
 - *Reardan Wind Project*

| Location | Capital 2009\$ (includes AFUDC) | Fixed O&M (\$ per kW/Yr) | Capacity Factor |
|-------------------------|-------------------------------------------|----------------------------------------|------------------------|
| Reardan | 2,183 | 45 | 30.0% |
| Columbia Basin (tier 1) | 2,262 | 50 | 33.0% |
| Columbia Basin (tier 2) | 2,262 | 50 | 26.4% |
| Montana | 2,262 | 50 | 37.0% |
| Small Scale | 3,343 | 50 | 20.0% |
| Off Shore | 5,573 | 95 | 45.0% |

- Wind Integration Cost of \$3.50 per MWh (2009\$)
 - *Reflective of low penetration rate presently on system*
 - *Rates will rise as penetration increases*

New Enhancements

- Conservation measures are selected in model rather than an input (only measures that are between \$xx/MWh & \$xxx/MWh)
- Resources are now added in increments rather than any amount
- Use more precise method to estimate frontier curve
- Meets both summer & winter capacity requirements
- Ability to retire resources
- Ability to account for greenhouse gas caps
- More accurate ability to take into account post IRP time period

Questions/Open Discussion