IRP-RELATED TRANSMISSION AND DISTRIBUTION PLANNING

DAVID NIGHTINGALE, UTILITIES AND TRANSPORTATION COMMISSION
REGULATORY SERVICES DIVISION STAFF

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IRP RULES STATIC SINCE 2001

- Current requirements provide a very high-level framework and nothing regarding public involvement
- Recent trends change the range of possible utility and customer options which can impact distribution and transmission
- More transparency and public process surrounding modeling and analysis of T&D options, benefits and costs would be beneficial
- It's complicated now… much more than ever before

"VERSION 1.0" FROM 2001 T&D IN IRP RULE FOR **GAS** COMPANIES

WAC 480-90-238(3)

- Assessment of pipeline transmission capacity and reliability…
- Assessment of current and new policies and programs for conservation…
- Use consistent cost-effectiveness methodology to compare costs of purchasing strategies, storage options, delivery resources, and conservation

"VERSION 1.0" FROM 2001 T&D IN IRP RULE FOR **ELECTRIC** COMPANIES

WAC 480-100-238(3)

- Assessment of transmission system capacity and reliability…
- Assessment of conventional and non-conventional generation…
- Compare energy supply resource (including transmission and distribution) using lowest reasonable cost criteria…

TECHNOLOGY AND CUSTOMER EXPECTATIONS HAVE EVOLVED SINCE 2001

- Smart Grid Initiatives and ARRA funding nationally propelled market changes
- Transactive Signal and other NW pilot projects from ARRA provide examples
- Advanced Metering Infrastructure (AMI) technology has matured
- Cell phone and Wi-Fi communications are now ubiquitous
- Distributed Energy Resources cost reductions and integration policy developing
- Data collection and analytical capabilities continue to expand
- Customers are increasingly concerned with privacy and energy management

THINGS WE KNOW POST-ARRA

- Excerpts from presentation to NW Power Council's Demand Response Advisory Committee on 3/8/2017 by Lee Hall, BPA using Navigant and PNNL analysis
- 2015 baseline of information, Technology and Costs continue to change (*generally getting better every year*)!!
- PNW Smart Grid Demonstration, 2010 – 2015, US DOE funded, 11 NW utilities, BPA, PNNL, 5 product vendors, and consultants

SMART GRID ASSET SYSTEMS

	CVR	Building & Comm. DR	In-home displays	Program.T'stats	Dist Generation	Storage	Photovoltaics	Wind	Residential DR	PHEV	Power Factor	DA	Static VAR	Smart Transformer
Avista	■	■	■	■	■									■
Benton PUD						X								
City of Ellensburg							■	X						
Flathead Electric			■						■					
Idaho Falls Power	■	■	■	■		X	■		■	■	■	■		
Lower Valley Energy	■		■			■	■	■	■				■	
Milton Freewater	■								■					
Northwestern Energy	■	■	■						■					
Peninsula Light	■								■			■		
PGE		■			■	■			■			■		
UW/ Seattle City Light		■	■		■		■							

X – Benton PUD and Idaho Falls Storage assets eliminated due to bankruptcy of vendor.

X – City of Ellensburg small wind farm dismantled due to safety issues.

Asset System Investments:

- Subprojects: ~$77M
- Electricity Infrastructure Operations Center (Battelle): ~$11M

Response Ranges:

- Total Load Reduction: -50 MW
- Total Load Increase: +7MW
- Efficiency Impact: -10MW

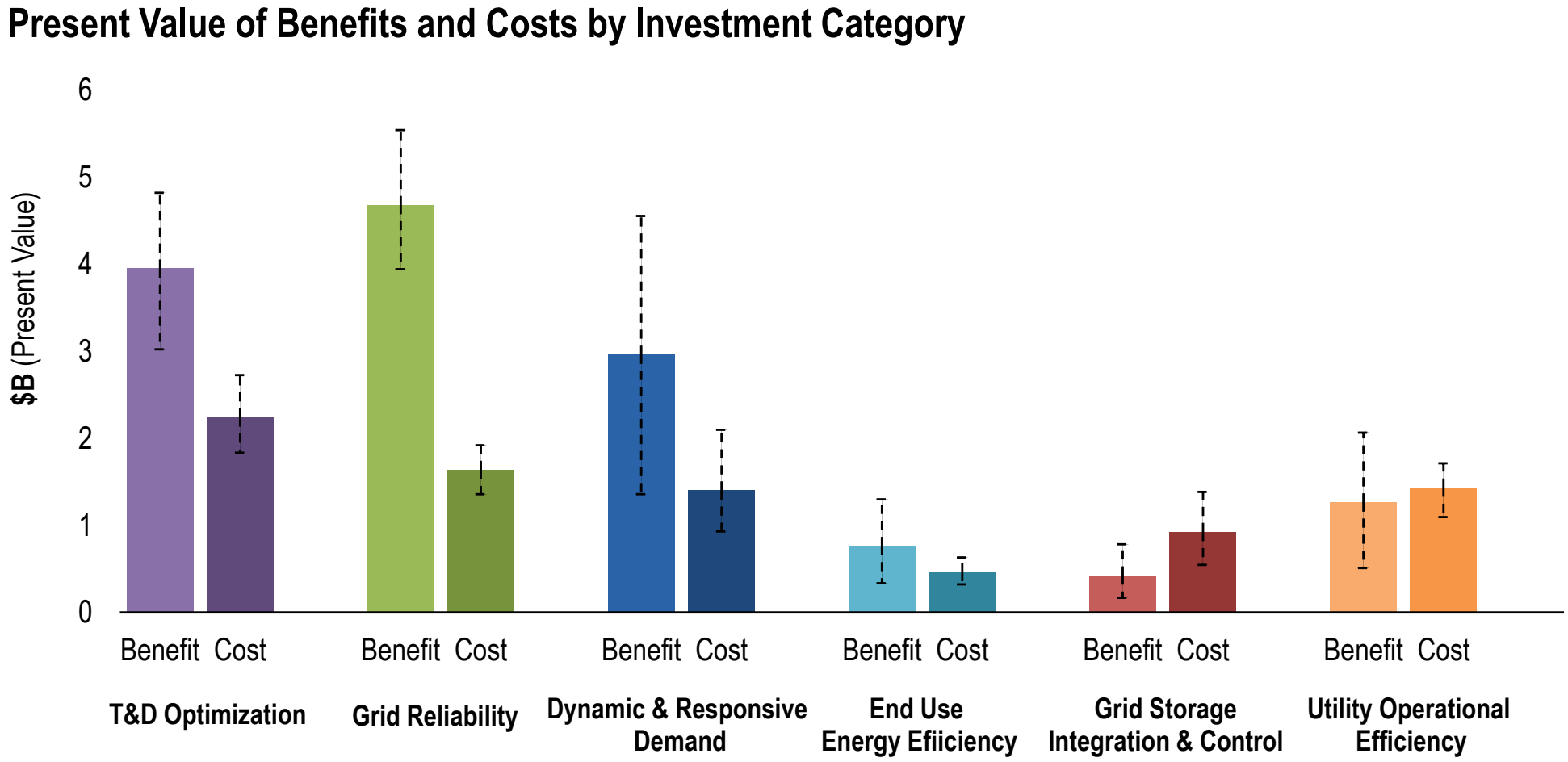
SMART GRID - SIX AREAS OF IDENTIFIED BENEFITS

- T&D Optimization
- Grid Reliability
- Utility Operational Efficiency
- Dynamic and Responsive Demand
- Grid Storage, Integration and Control
- End Use Energy Efficiency

Investment Categories

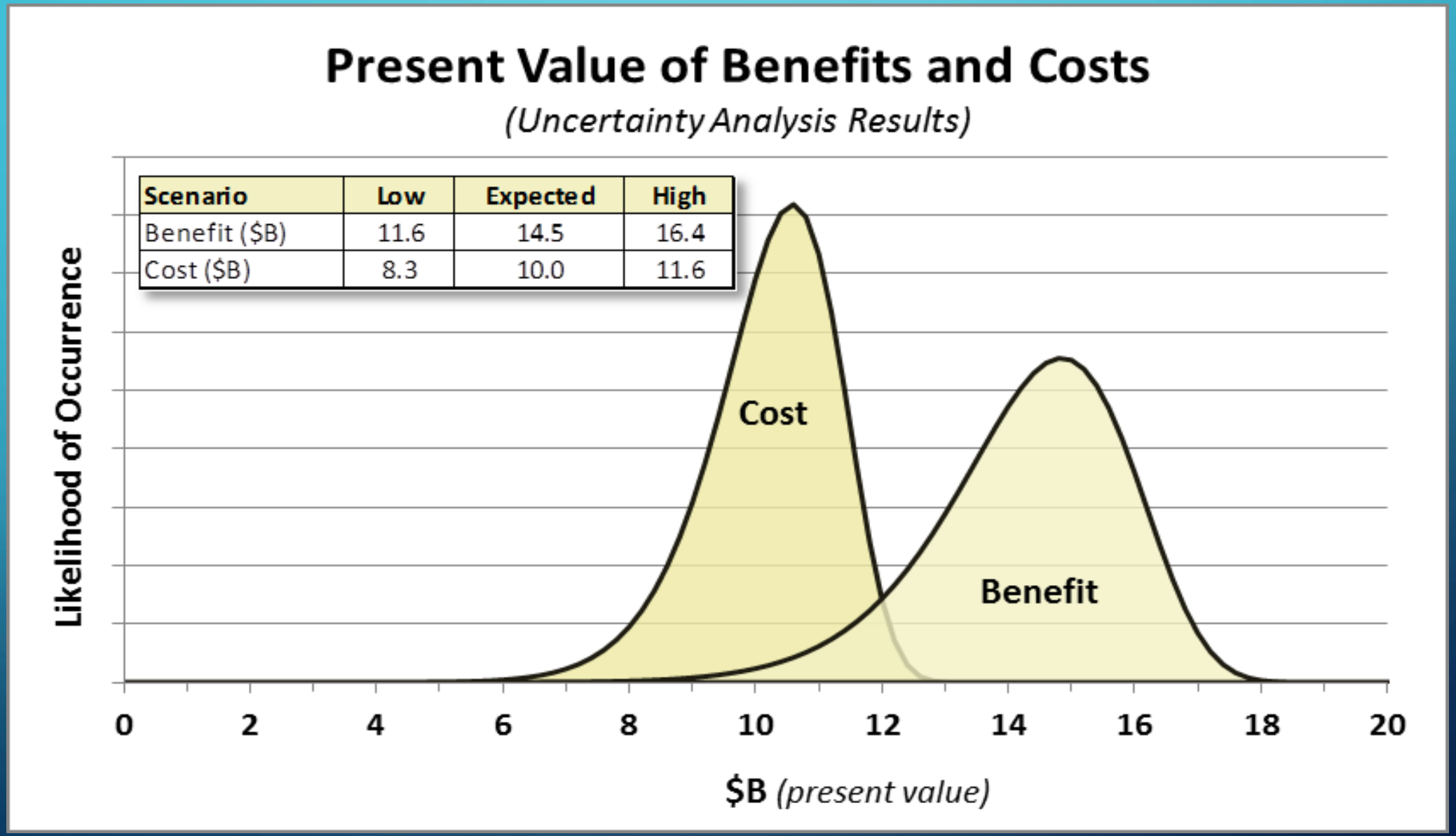
Category	Capability Area (Function)
T&D Optimization	Automated VAR Control
	Conservation Voltage Reduction (CVR)
	Dynamic Capacity Rating
	Automated Power Flow Control for Transmission
	Automated Real Time Load Transfer for Distribution
	Notification of Distribution Equipment Condition
	Notification of Transmission Equipment Condition
	Fault Current Limiting for Distribution
	Fault Current Limiting for Transmission
	Distributed Energy Resource Monitoring & Control
	PMU-Based Centralized Renewable Resource Monitoring & Control
Grid Reliability	PMU-Based Wide Area Monitoring
	Automated Islanding & Reconnection (Microgrid Capability)
	Enhanced Fault Prevention for Distribution
	Enhanced Fault Prevention for Transmission
	Fault Location, Isolation & Service Restoration (FLISR)
Dynamic & Responsive Demand	Demand Response - Air Conditioning/Space Cooling
	Demand Response - Appliances & Plug Loads
	Demand Response - Lighting
	Demand Response - Refrigeration, Motors & Process Equipment
	Demand Response - Space Heating
	Demand Response - Water Heating
End Use Energy Efficiency	End Use Conservation
	End Use Equipment Efficiency Upgrade
	Notification of End Use Equipment Condition - HVAC
	Notification of End Use Equipment Condition - Refrigeration
Grid Storage Integration & Control	Transmission-Sited Grid Storage Integration & Control
	Distribution-Sited Grid Storage Integration & Control
	Electric Vehicle Battery Integration & Control
Utility Operational Efficiency	Automated AMI Meter Reading & Billing
	Improved DSM Program Execution (Marketing, Implementation, M&V)
	Improved Regional Planning & Forecasting
	Transactive Control

Six Investment Categories Showed Different Returns and Uncertainties (2015) for Smart Grid Technology



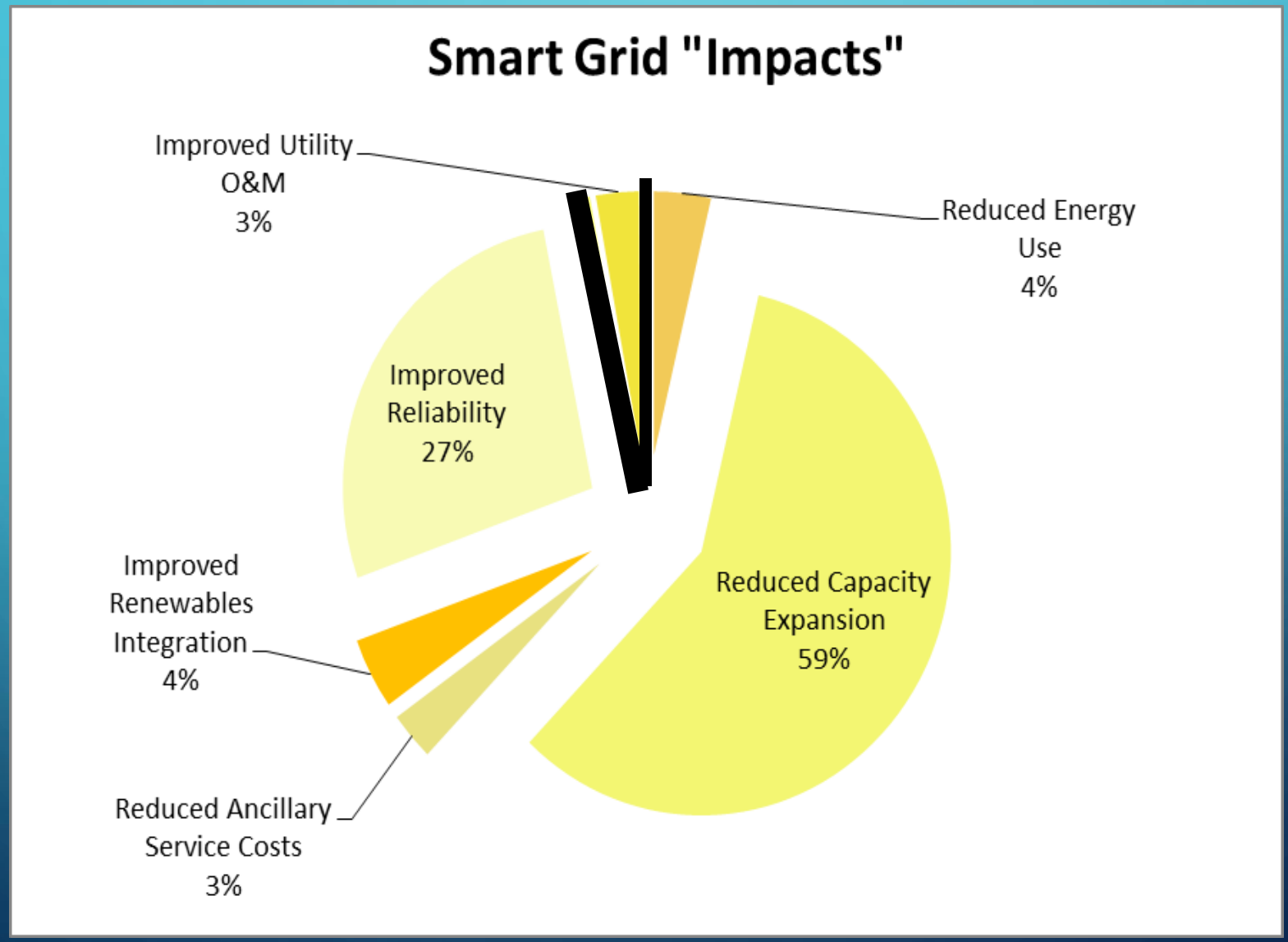
The RBC analysis focuses on the benefits and costs that can be attributed to smart grid investments, and attempts to draw a clear line between smart grid capabilities and traditional capabilities. The benefits and costs of traditional capabilities **are not included** as smart grid benefits and costs in the RBC. Thus, the RBC is not indicative of the benefits, costs, and B/C ratios of traditional capabilities and investments.

Overall Regional Benefits Very Likely to Outweigh Costs



See Figure 2 on page 24 of White Paper

Breakout of Overall Smart Grid Impacts by Dollar (smart grid benefits)



PNW Smart Grid Demonstration
Summary Lessons Learned

1. Transactive Control – still maturing
2. Large scale smart grid projects are data intensive
3. Pay attention to customers!
4. Varying commercial readiness and cost/benefit for tested technologies (as of 2015)
5. Many utility specific successes and deployments

- **Regional Findings are especially important for Transmission Considerations**
- **Following presentations look at:**
  - National,
  - State, and
  - Individual utility

  Experiences and perspectives of T&D planning