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Techniques in Analyzing the Economic Benefits of Transmission:

Case Study Using the Paddock-Rockdale Transmission Project

Michigan PSC Planning Consortium
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Agenda

- Case Study: Paddock to Rockdale 345kV Line
  - Analysis Approach
    - Energy Cost Savings
    - Increased Competitiveness
    - Reliability and Insurance Benefits
    - Loss savings
      - Capacity Savings From Reduced Losses
      - Energy Savings From Reduced Losses
  - Strategic Flexibility
    - Scenario Development
  - Results

Analysis Approach
1)Energy Cost Savings

- Energy Cost Savings
  - Stakeholder formula for estimating the ratepayer impact of a proposed project:

Cost of supply at load LMP
– LMP revenues to utility
+ Cost of utility generation
– FTR revenues to utility
= Impact to Ratepayers

  - Built on this formula and refined it

Analysis Approach
1)Energy Cost Savings (con't)

- Modeled initial energy cost savings using PROMOD
  - Calculated four metrics
    - Adjusted Production Cost (APC)
    - Load-weighted Locational Marginal Prices (LLMP)
    - MISO "RECB II" metric (70/30) – 70% APC and 30% LLMP
    - ATC Customer Benefit
  - Analyzed two model years: 2011 and 2016
  - Each Future run with and without Paddock-Rockdale
- Adjusted for costs/savings not captured in PROMOD
- Estimated **total** benefits using PROMOD results, First Contingency Total Transfer Capability (FCTTC) and MISO market information

Analytical Approach
1)Energy Cost Savings (con't)

- PROMOD Adjustment - Change in FTR value
  - Change in Existing Import FTR Value
    - Existing Import FTRs are worth less
  - Additional FTR Value on Imports from Outside ATC
    - Increase in Available FTRs
  - Change in Existing ATC Internal FTR Value
- PROMOD Adjustment - Losses
    - Internal generation for internal load cost of loss savings (MLC) Differentials from PROMOD * 0.5 MISO refund
    - Similar refund calculation associated with imports
- Values vary by scenario and metric

Analysis Approach
2) Increased Competitiveness

- Increased Competitiveness
  - Reviewed changes in structural measurements of market power
    - Residual Supplier Index (RSI)
    - Pivotal supplier hours
  - Estimated economic value of increased competitiveness using three alternative approaches
    - Cal ISO
    - Tabors study
    - "Independent Market Monitor" approach
  - Estimated value under lower and higher levels of market-based generation
    - Used lower level to reflect cost-of-service environment in WUMS

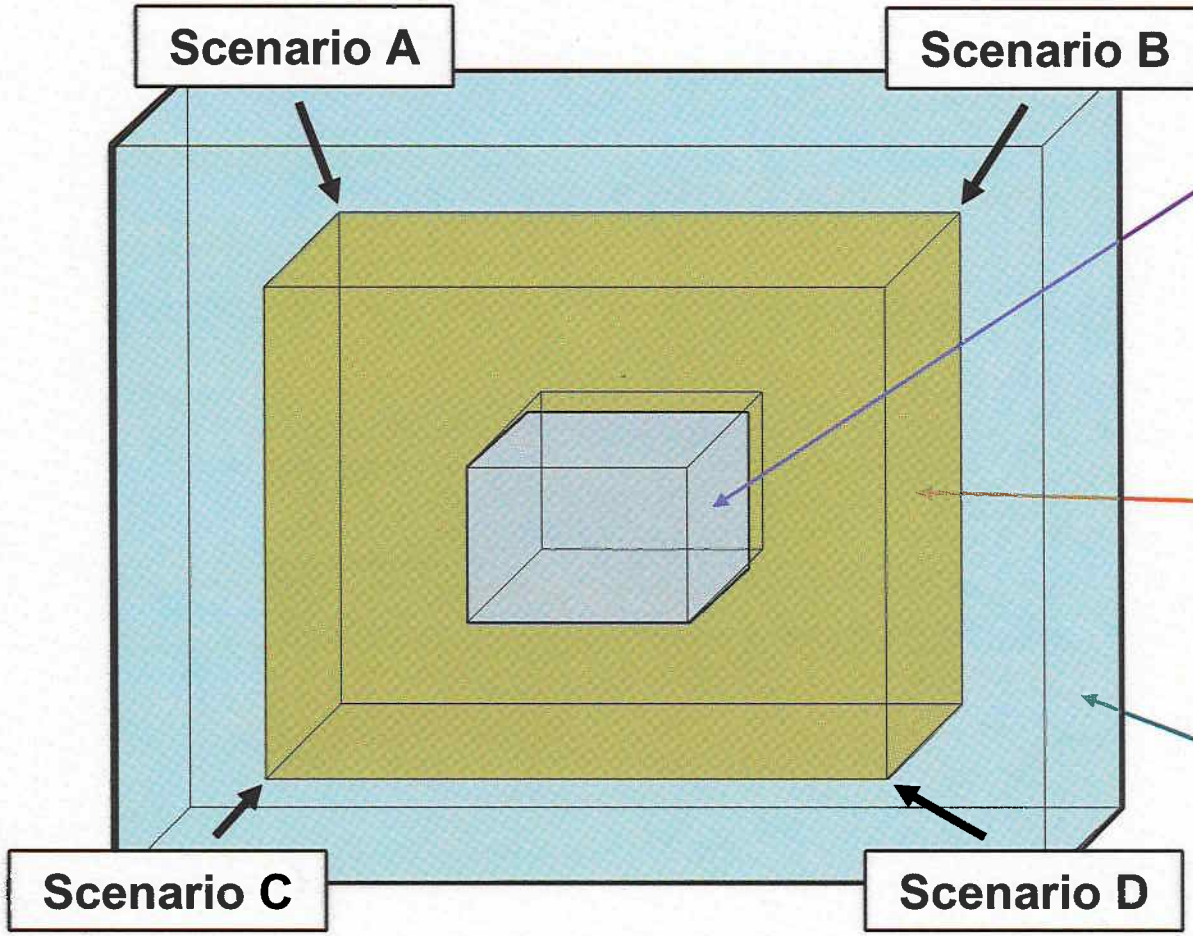
Analysis Approach
3&4) Losses and Reliability

- Losses
  - Capacity
    - Reduction in generating capacity needed at peak due to reduction in losses (MWs) valued at CT price
  - Energy
    - Future Refinement: Adjust the hour-by-hour load forecast to account for reduced losses
- Reliability
    - Future Refinement: Monetize reliability benefits and include in the economic analysis

Analysis Approach
5) Insurance

- Insurance Value
  - Paddock-Rockdale can partially insure against "the worst" occurrence on the system as well as different market-based scenarios/futures
  - Developed "insurance sensitivities" based on prior experience
    - Estimated the "severity" and "frequency" of these events

Process Review
Strategic Flexibility - Scenarios



Traditional strategic planning typically considers a small range of possible futures

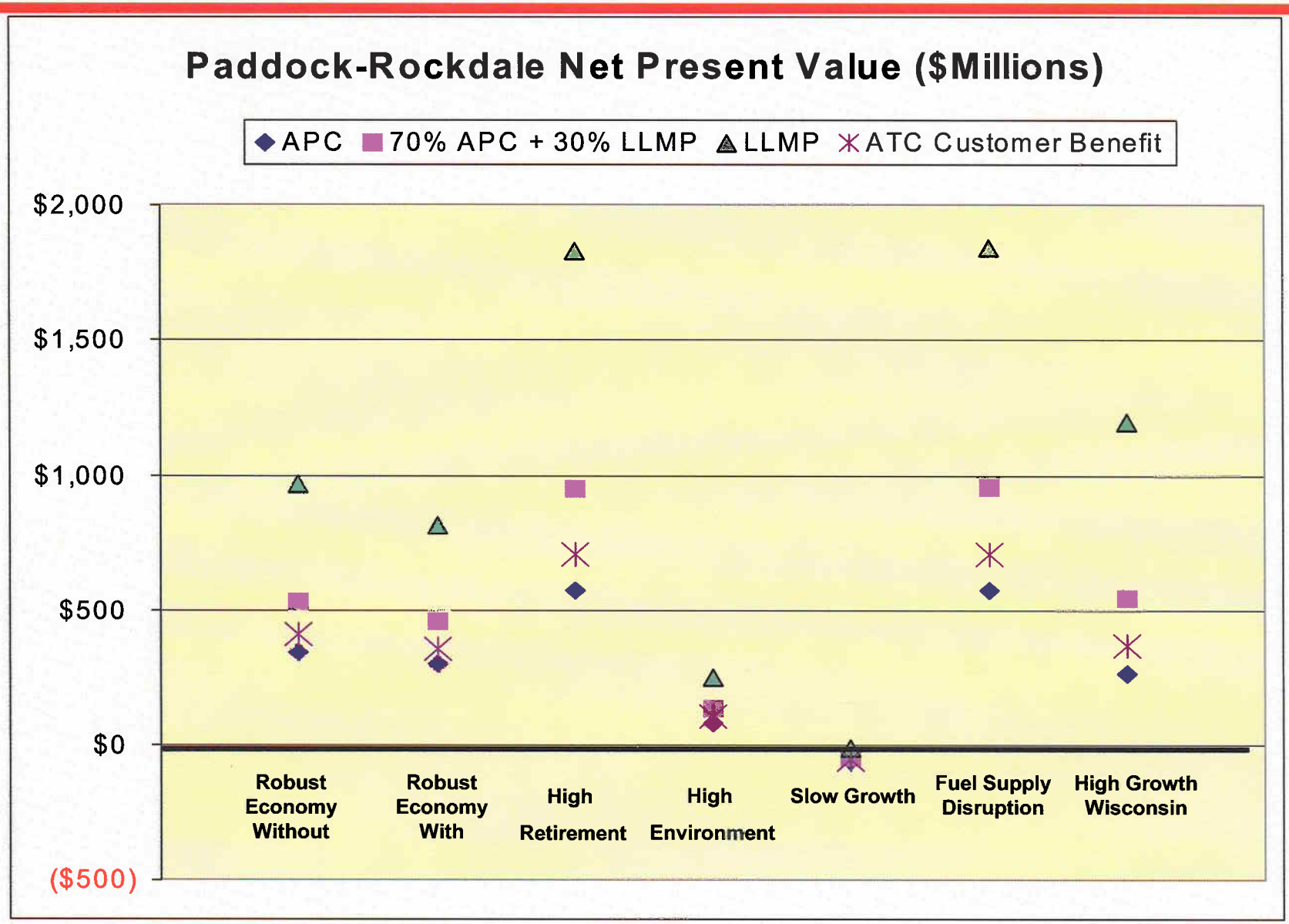
Scenario development provides a process to bound a "plausible" but expanded range of futures that will capture most of the possible futures that could occur. If designed properly, Scenarios A-D should bound that space.

Total range of possible futures

Paddock-Rockdale Process Review

- Designed analysis to comply with PSCW Staff suggestions and serve as a template
- Met with numerous stakeholders to test our analytical approach
- Used Strategic Flexibility approach
- Created and analyzed seven Plausible Futures
  - Robust Economy
    - With North LaCrosse to Columbia (NLAX - COL) line
    - Without North LaCrosse to Columbia line
  - High Generation Retirements
  - High Environmental Regulations (CO_2 tax)
  - Slow Growth
  - Fuel Supply Disruption
  - High Growth Wisconsin
- ATC tried to align its Futures to MISO's

Results - Net Present Value Benefits Less Project Costs



Detailed Results
70/30 Metric Plus Adjustments

	SCENARIOS ($ Millions)						
	Robust Economy No NALX - COL	Robust Economy	High Retirements	High Environmental	Slow Growth	Fuel Supply Disruption	High Growth Wisconsin
ATC Revenue Requirement	($136)	($136)	($136)	($136)	($136)	($136)	($136)
Construction Congestion Costs	($1)	($1)	($1)	($1)	($1)	($1)	($1)
PROMOD 70% Adjusted Production Costs and 30% Load Weighted LMP	$483	$386	$1,335	$159	$27	$1,469	$734
FTR and Congestion Payments	$77	$107	($323)	($1)	$1	($445)	($155)
Losses	$17	$15	$7	$20	$4	($13)	$18
Competitiveness Limited Market-Based Pricing (avg.)	$46	$44	$30	$49	$16	$39	$42
Insurance Benefit During System Failure Events	$28	$28	$28	$28	$28	$28	$28
Capacity Savings From Reduced Losses	$15	$12	$11	$15	$14	$15	$14
Total NPV of Net Benefits	$529	$455	$950	$132	($47)	$956	$544

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Questions?

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Appendix
Summary of Scenarios

- **Robust Economy** – high economic and energy growth, high amount of low-cost generation in Wisconsin, medium environmental, mid-high fuel prices, LaCrosse to Columbia line is built, 4,000-6,000 MW mine-mouth coal campus built in central Illinois
- **High Retirements** – mid-level economy and energy growth, large number of retirements, mid-level environmental, fuel prices vary, mid-level generation built outside Wisconsin
- **High Environmental** – medium economic growth, low-mid energy growth, coal retirements replaced by Nelson Dewey plant, Kyoto environmental, varying fuel prices, generation scenario reflecting $44/ton CO2 tax

Appendix
Summary of Scenarios

- **Slow Growth** – low economic and energy growth, some coal retirements, low environmental, low-mid fuel prices, mid-level generation built outside Wisconsin
- **Fuel Supply Disruption** – natural gas supply disrupted, mid economic and energy growth, high level of new coal generation, additional use of coal generation creates coal availability problems, high fuel prices, mid-high environmental, 3,000-4,000MW mine-mouth coal campus built in central Illinois
- **High Growth Wisconsin** – economic development creates high economic and energy growth in Wisconsin while surrounding areas are mid-low economic and energy growth, some coal retirements and Nelson Dewey is built, mid-level environmental, mid fuel prices, mid-level generation built outside Wisconsin