Transmission Benefits

August 10, 2021

Curtis Westhoff,
System Consulting Engineer

“It is likely that the energy portfolio selected for 100% Zero Carbon scenario would require dozens of new high-voltage transmission lines.”

–Source: E3 Consulting Resources Adequacy in the Pacific Northwest: Serving Load Reliably under a Changing Resource Mix January 2019

“There is no climate plan that is serious if it does not envision a significant interregional transmission upgrade to the grid that we have today.”

— Source: Pat Wood, III
Former FERC Chair

"Transmission is one of those issues that I think there's broad consensus on. We've got to have #transmission in place to ensure that the #grid of the future is there."

– Source: Neil Chatterjee on Twitter

FERC

Transmission Impact

GRID EDGE

MIT Study: Transmission Is Key to a Low-Cost, Decarbonized US Grid

Modeling shows a nationwide transmission network could tap existing solar, wind and battery tech to reach zero-carbon power.

JEFF ST. JOHN | JANUARY 08, 2021

- Transmission "delivers oversize benefits"
  - Enables regional power-sharing
  - Allows wind and solar to be built in optimal areas

SPP 2016 RCAR, 2013 MTF

Quantified

1. **production cost savings***
   - value of reduced emissions
   - reduced ancillary service costs
2. avoided transmission project costs
3. reduced transmission losses*
   - capacity benefit
   - energy cost benefit
4. lower transmission outage costs
5. value of reliability projects
6. value of mtg public policy goals
7. Increased wheeling revenues

Not quantified

8. reduced cost of extreme events
9. reduced reserve margin
10. reduced loss of load probability
11. increased competition/liquidity
12. improved congestion hedging
13. mitigation of uncertainty
14. reduced plant cycling costs
15. societal economic benefits

(SPP Regional Cost Allocation Review Report for RCAR II, July 11, 2016. SPP Metrics Task Force, *Benefits for the 2013 Regional Cost Allocation Review*, July, 5 2012.)

MISO MVP Analysis

Quantified

1. **production cost savings ***
2. reduced operating reserves
3. reduced planning reserves
4. reduced transmission losses*
5. reduced renewable generation investment costs
6. reduced future transmission investment costs

Not quantified

7. enhanced generation policy flexibility
8. increased system robustness
9. decreased natural gas price risk
10. decreased CO_2 emissions output
11. decreased wind generation volatility
12. increased local investment and job creation

(Proposed Multi Value Project Portfolio, Technical Study Task Force and Business Case Workshop August 22, 2011)

CAISO TEAM Analysis

(DPV2 example)

Quantified

1. **production cost savings*** and reduced energy prices from both a societal and customer perspective
2. mitigation of market power
3. insurance value for high-impact low-probability events
4. capacity benefits due to reduced generation investment costs
5. operational benefits (RMR)
6. reduced transmission losses*
7. emissions benefit

Not quantified

8. facilitation of the retirement of aging power plants
9. encouraging fuel diversity
10. improved reserve sharing
11. increased voltage support

(CPUC Decision 07-01-040, January 25, 2007, Opinion Granting a Certificate of Public Convenience and Necessity)

NYISO PPTN Analysis

(AC Upgrades)

Quantified

1. **production cost savings*** (includes savings not captured by normalized simulations)
2. capacity resource cost savings
3. reduced refurbishment costs for aging transmission
4. reduced costs of achieving renewable and climate policy goals

Not quantified

5. protection against extreme market conditions
6. increased competition and liquidity
7. storm hardening and resilience
8. expandability benefits

(Newell, et al., Benefit-Cost Analysis of Proposed New York AC Transmission Upgrades, September 15, 2015)

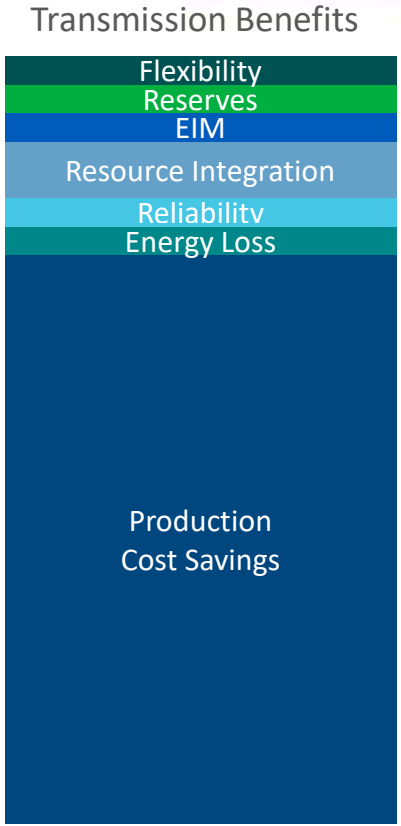
* Fairly consistent across RTOs

Benefit Category	Transmission Benefit
Traditional Production Cost Savings	Production cost savings as currently estimated in most planning processes
1. Additional Production Cost Savings	a. Impact of generation outages and A/S unit designations
	b. Reduced transmission energy losses
	c. Reduced congestion due to transmission outages
	d. Mitigation of extreme events and system contingencies
	e. Mitigation of weather and load uncertainty
	f. Reduced cost due to imperfect foresight of real-time system conditions
	g. Reduced cost of cycling power plants
	h. Reduced amounts and costs of operating reserves and other ancillary services
	i. Mitigation of reliability-must-run (RMR) conditions
	j. More realistic "Day 1" market representation
2. Reliability and Resource Adequacy Benefits	a. Avoided/deferred reliability projects
	b. Reduced loss of load probability or c. reduced planning reserve margin
3. Generation Capacity Cost Savings	a. Capacity cost benefits from reduced peak energy losses
	b. Deferred generation capacity investments
	d. Access to lower-cost generation resources
4. Market Benefits	a. Increased competition
	b. Increased market liquidity
5. Environmental Benefits	a. Reduced emissions of air pollutants
	b. Improved utilization of transmission corridors
6. Public Policy Benefits	Reduced cost of meeting public policy goals
7. Employment and Economic Stimulus Benefits	Increased employment and economic activity; Increased tax revenues
8. Other Project-Specific Benefits	Examples: storm hardening, fuel diversity, flexibility, reducing the cost of future transmission needs, wheeling revenues, HVDC operational benefits

Transmission Planning and Benefit-Cost Analyses, ***www.brattle.com***

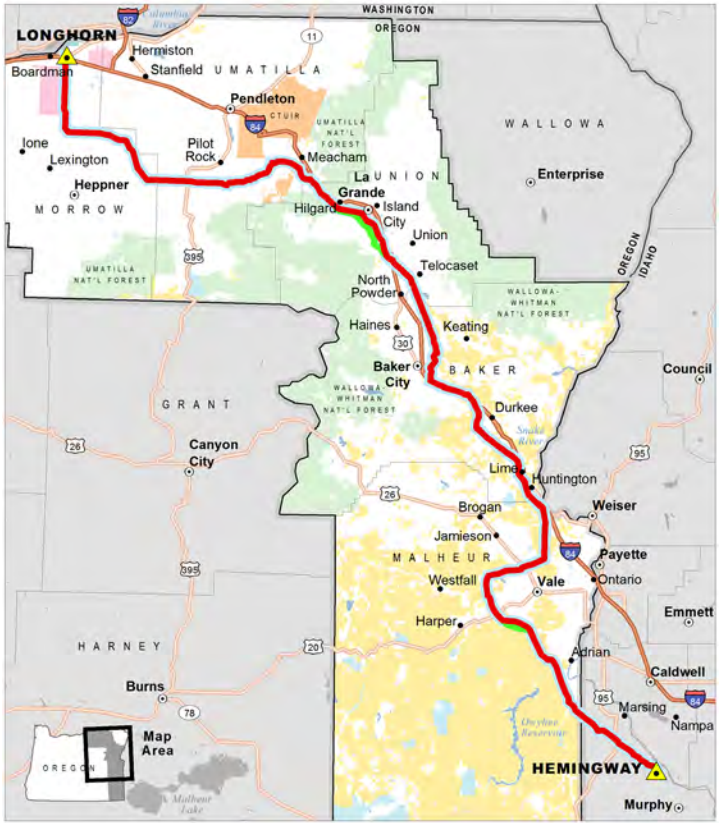
Additional Transmission Benefits

- Reduced energy losses
- Resource reliability
- Resource integration
- Energy Imbalance Market
- Contingency reserves
- Flexibility



Idaho Power Transmission Projects

B2H Project



Gateway West Project

Electrical Losses

Generation Resources

Transmission Grid

Distribution Substation

Resistive Losses (I^2R)

Electrical Losses

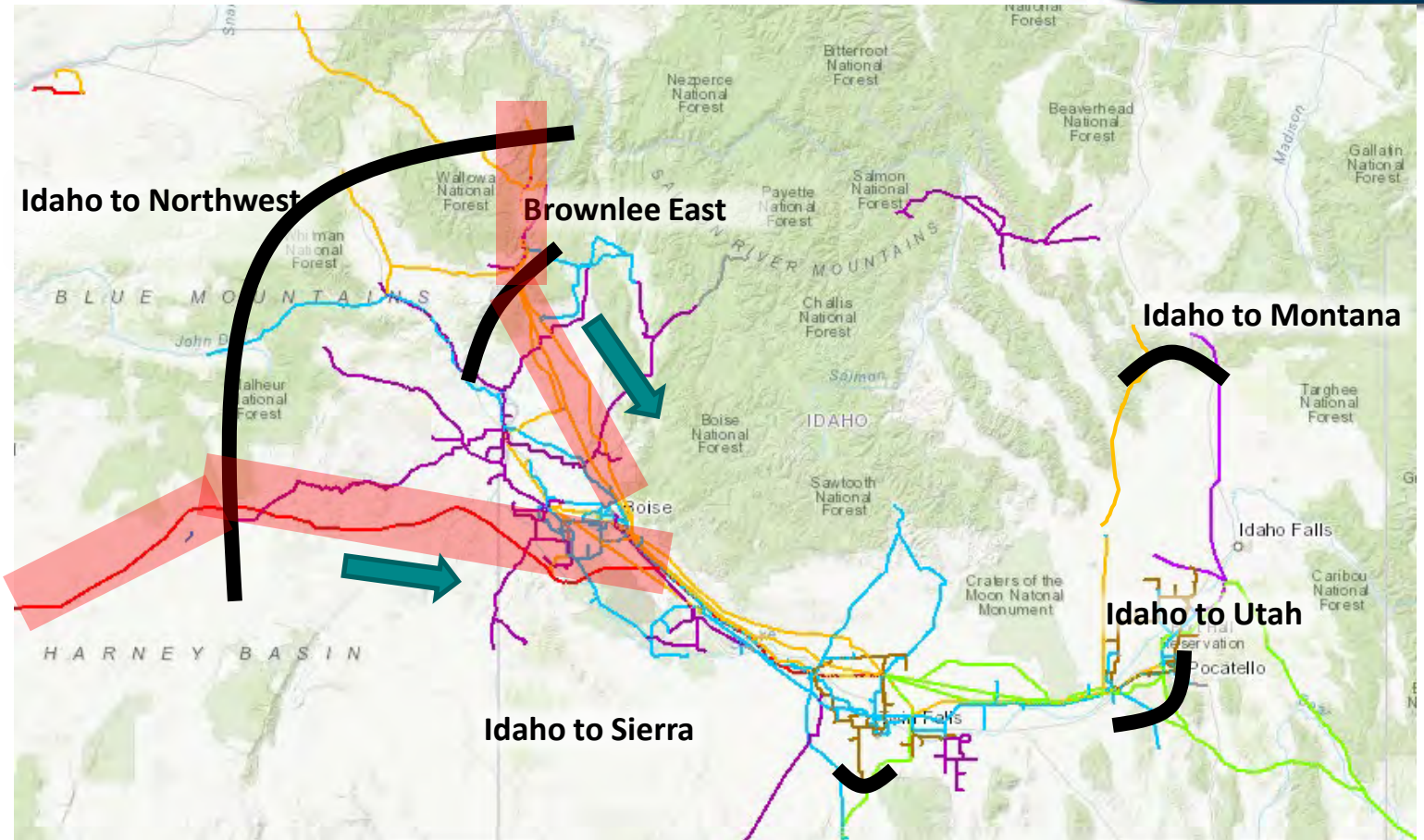
Generation Resources

Transmission Grid

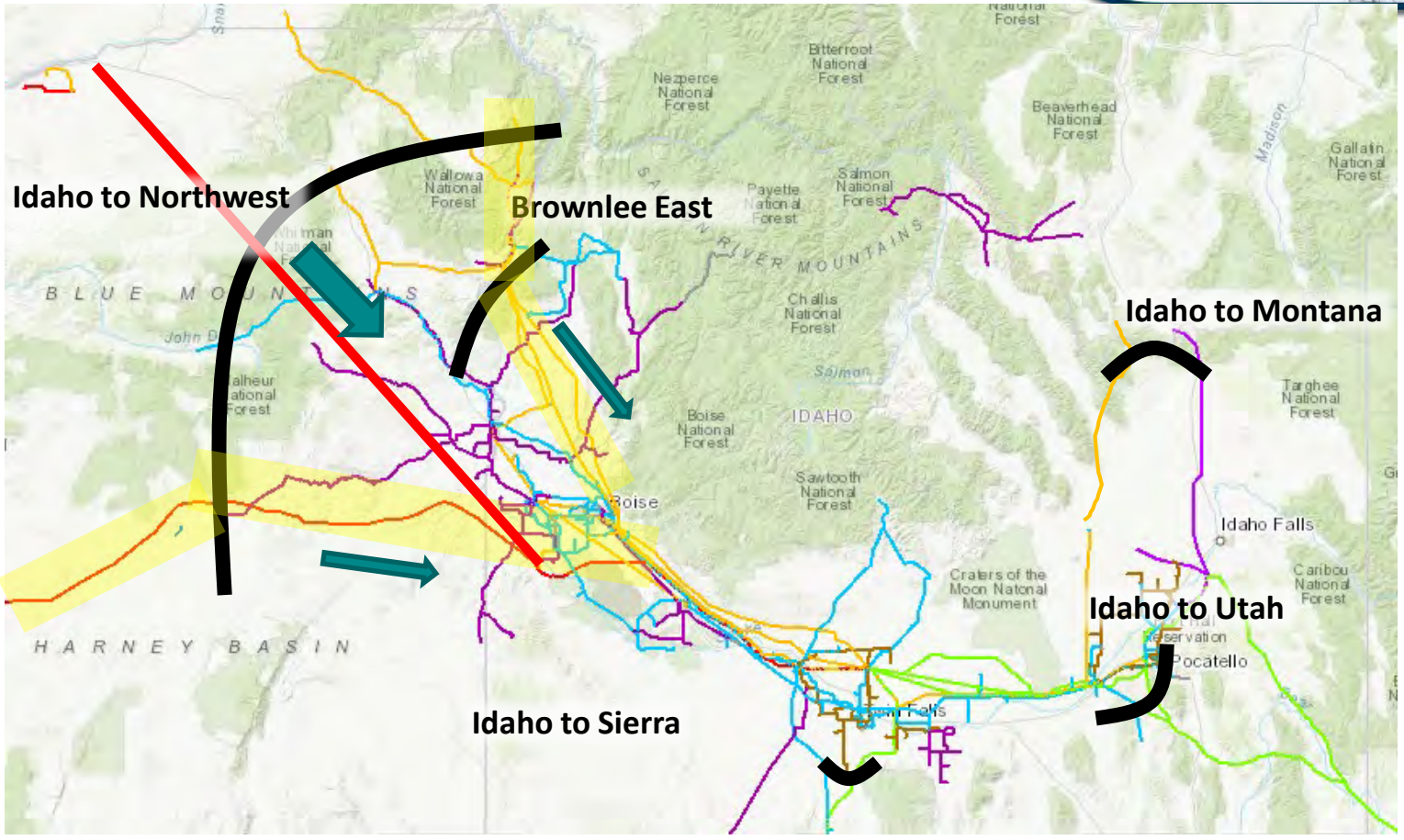
Distribution Substation

Resistive Losses (I^2R) ↓

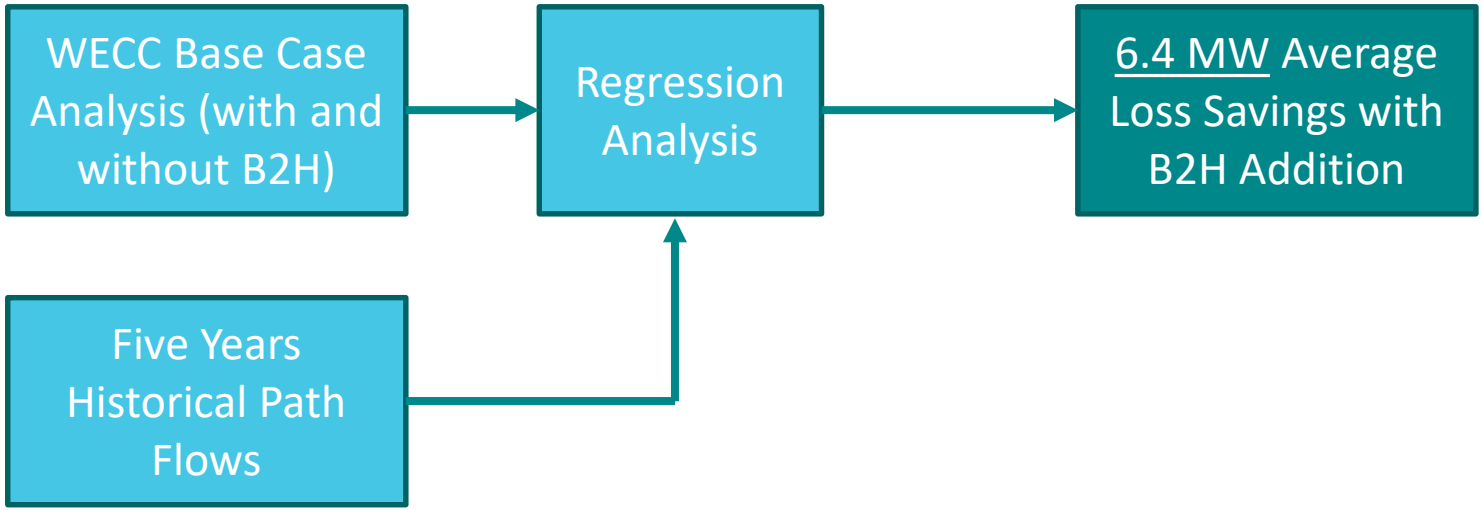
B2H Loss Benefit



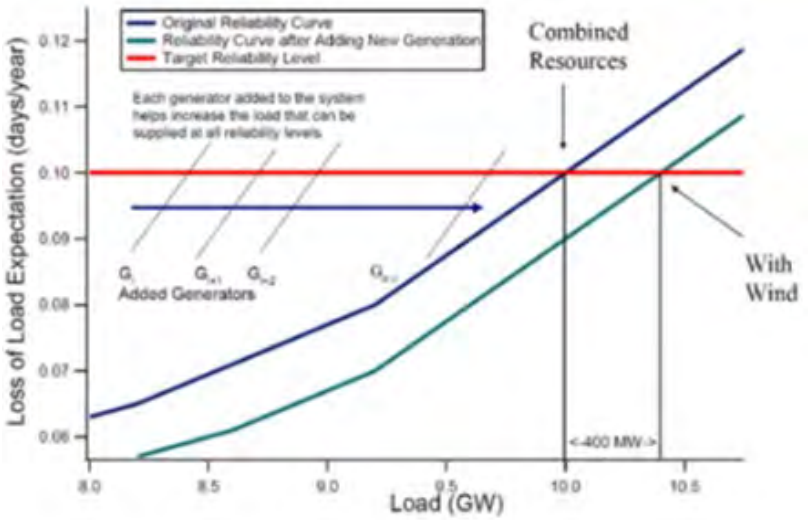
B2H Loss Benefit



B2H Loss Reduction



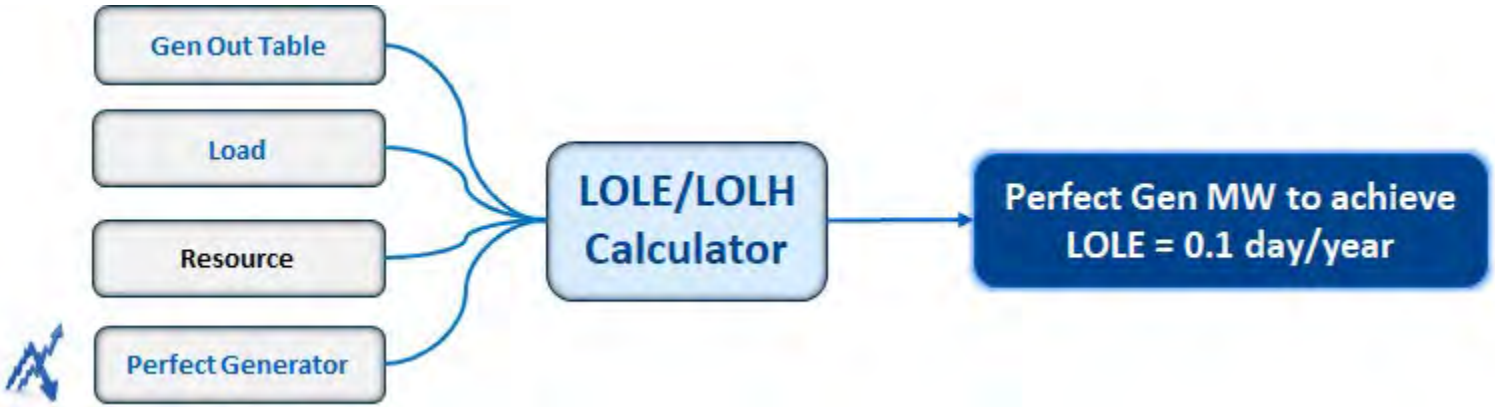
Resource Reliability



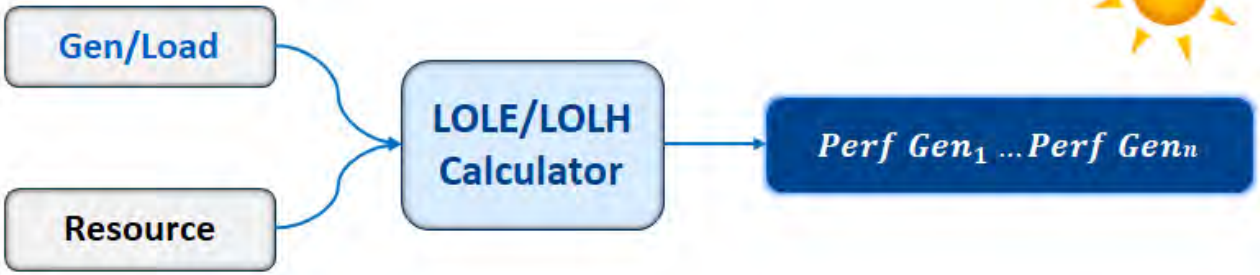
Comparing Resource Adequacy Metrics, E. Ibanez and M. Milligan, National Renewable Energy Laboratory
13th International Workshop on Large-Scale Integration of Wind Power into Power Systems as Well as on Transmission Networks

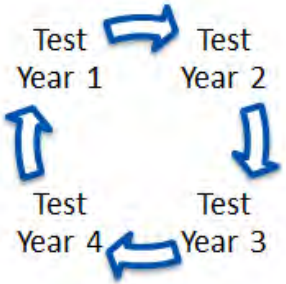
- ELCC provides a way to assess the capacity value of a resource that is tied to the loss of load probability concept.
- ELCC can be defined as the equivalent perfect capacity needed to improve the reliability on the system by the same amount as a particular generator.

Reliability Methodology



Reliability Analysis

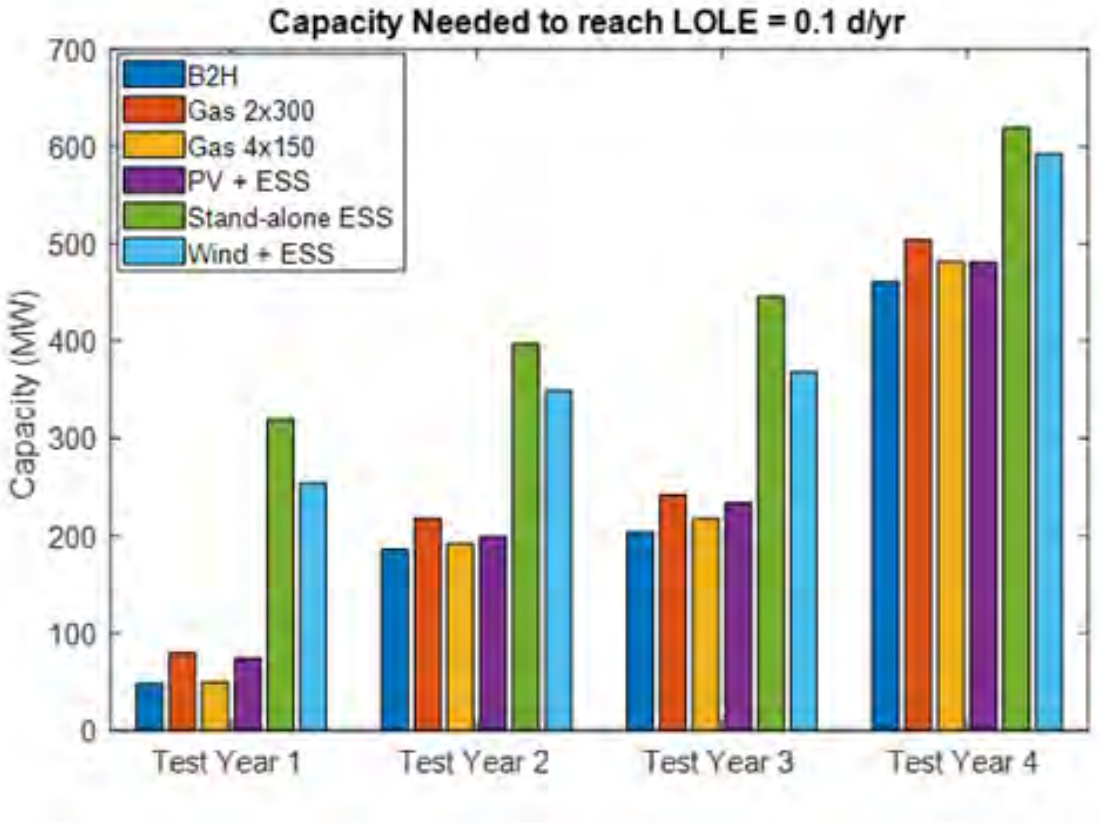




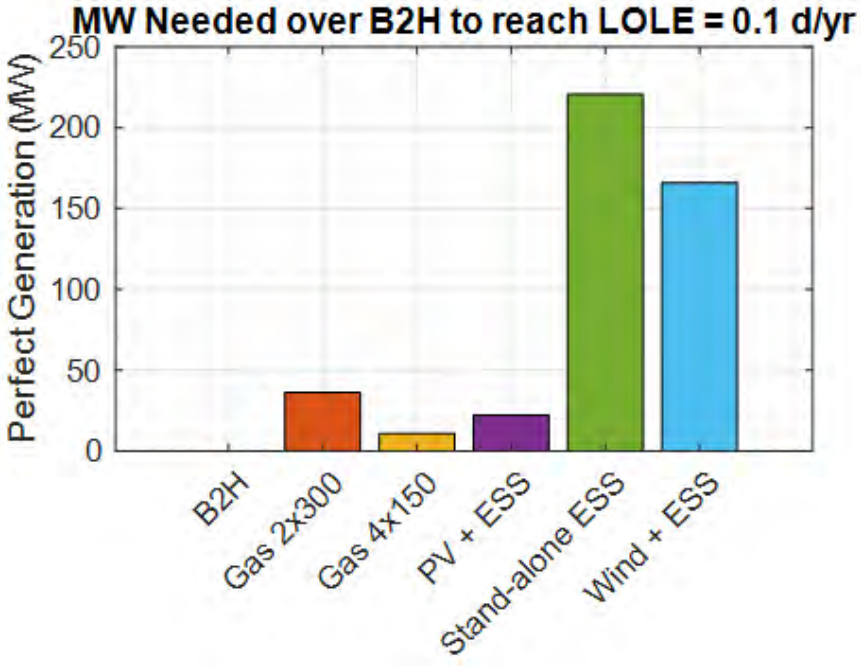
Results

- Test Years = Different Weather Shapes

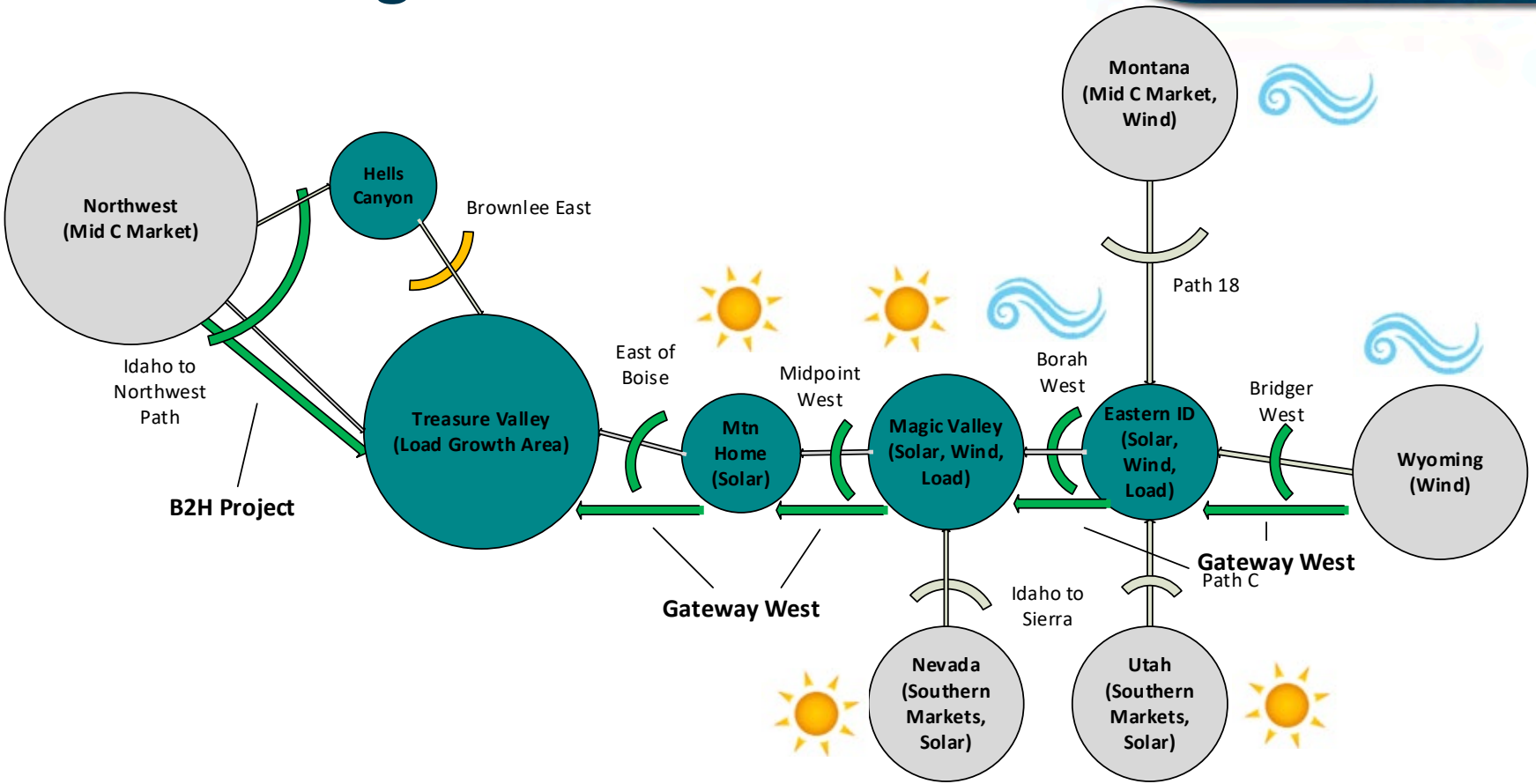
- B2H addition required less MW of perfect capacity to meet 0.1 d/yr LOLE target
  - More reliable



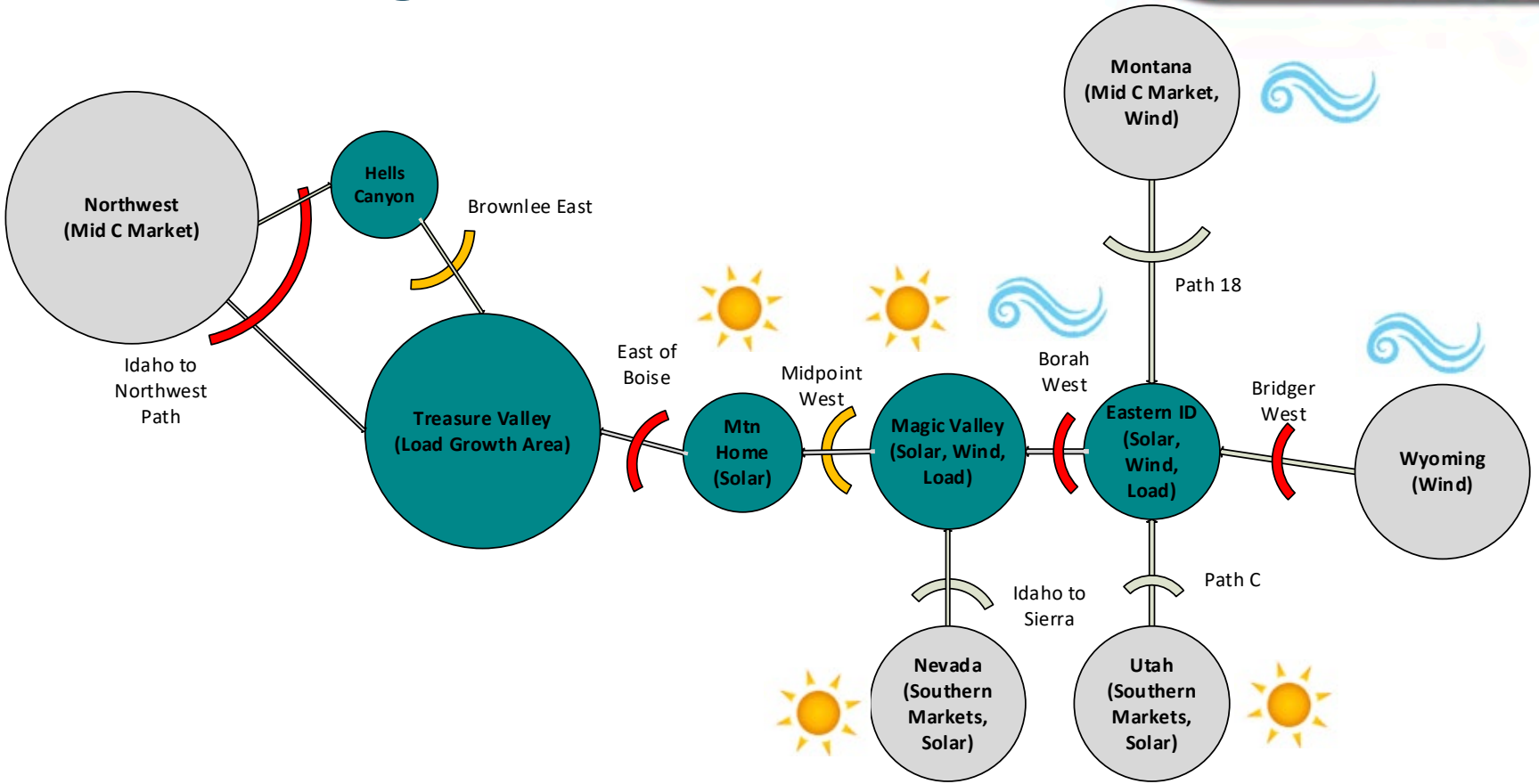
Results


MW Needed over B2H to reach LOLE = 0.1 d/yr
Perfect Generation (MW)
250
200
150
100
50
0
B2H
Gas 2x300
Gas 4x150
PV + ESS
Stand-alone ESS
Wind + ESS

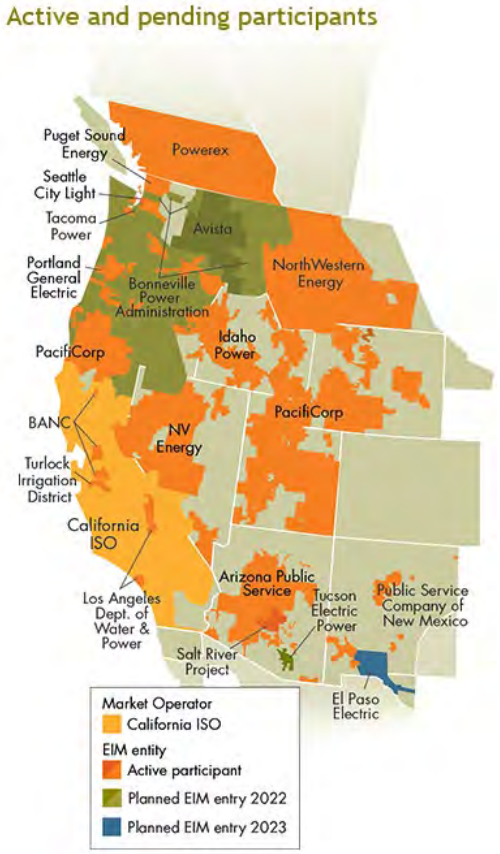
Resource Integration



Resource Integration



Western Energy Imbalance Market



- B2H provides increased transmission capacity between Idaho Power and several EIM participants at Mid-C.
- Transactions to/from the Northwest are frequently limited by available transmission capacity to other EIM participants.

Contingency Reserves

- NERC Standard BAL-002-WECC-3 requires minimum contingency reserves be held equal to
  - 3% integrated load
  - 3% integrated generation
- Firm energy imports via transmission do not add to the integrated generation level
  - Lower contingency reserve requirement compared to new generation resources

Flexibility

- Transmission is not generation specific
- Provides access to economic resources (Mid-C market)
- Can be used when available by others (for purchase) for power transfers
  - Idaho Power customers benefit from third-party transmission revenue
- Reduces congestion, creates additional operational flexibility

Questions? Comments?