



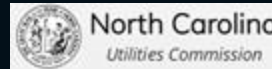
ESIG 2026 Summer Workshops

Workflows for Developing Reliable Least-cost Expansion Plans



Automated capacity expansion
Production costing
LMP forecasting
Resource adequacy

Licensed by 38 utilities/RTOs, 4
states, and several project
developers, consultants and
intervenors



Resource Planning Objectives



Keep Prices Low

- Minimize revenue requirements
- Minimize cost risk



Keep the Lights On

- Resource adequacy
- Weather resiliency



Save the Planet

- Decarbonization
- Sustainability

PROBLEM SIZE

Long-Term Horizon



Environmental
Tightening
requirements



Tax Credits
Expiring in 2030s



New Technologies
LDES and SMR



PROBLEM SIZE

Weather Uncertainty



Renewables

Multi-day
droughts



Reserves

Ancillary services



LOLE Targets

Monte Carlo
analysis

PROBLEM SIZE

Model Wish List



Long-Term View

Capital recovery
and future
changes



Reserves

Ancillary services



Daily Resolution

LDES for
renewable
droughts

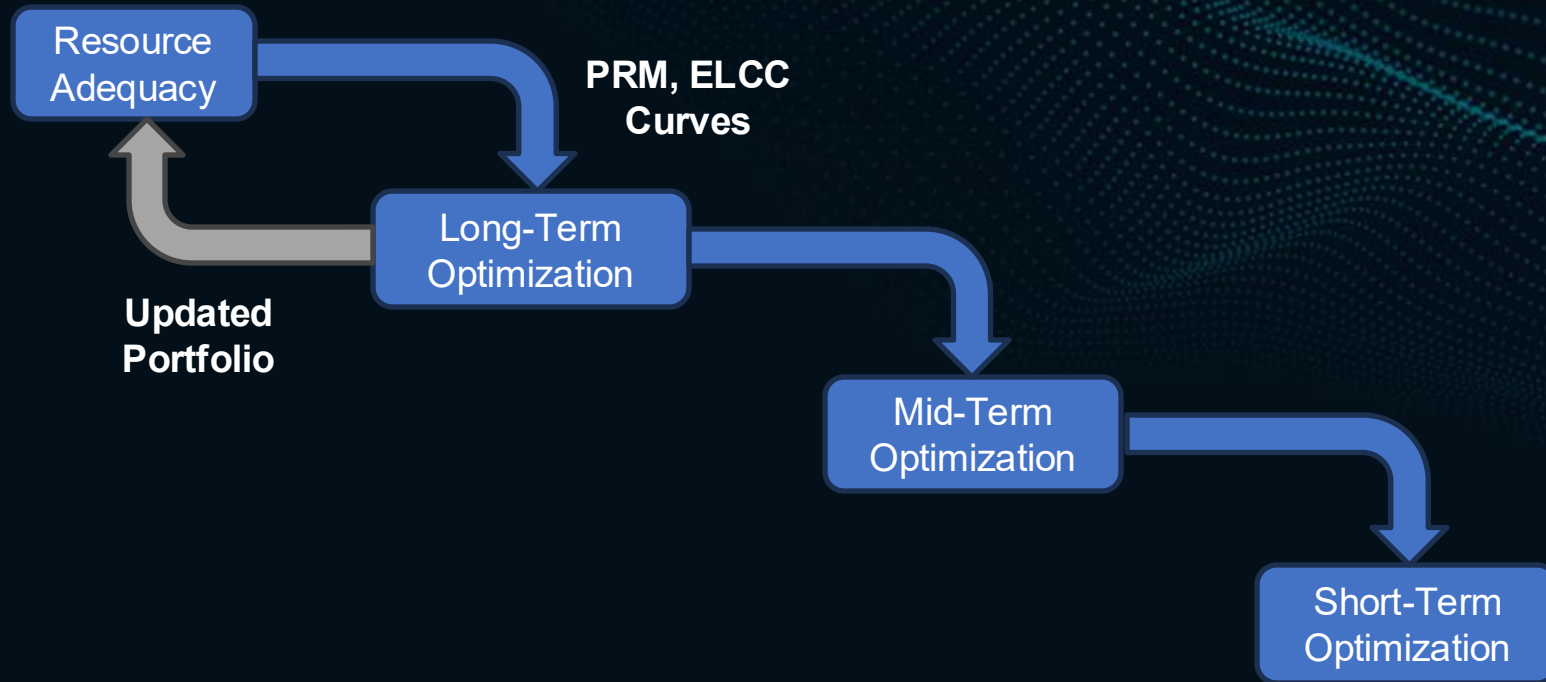


Reliability Metrics

Monte Carlo
analysis

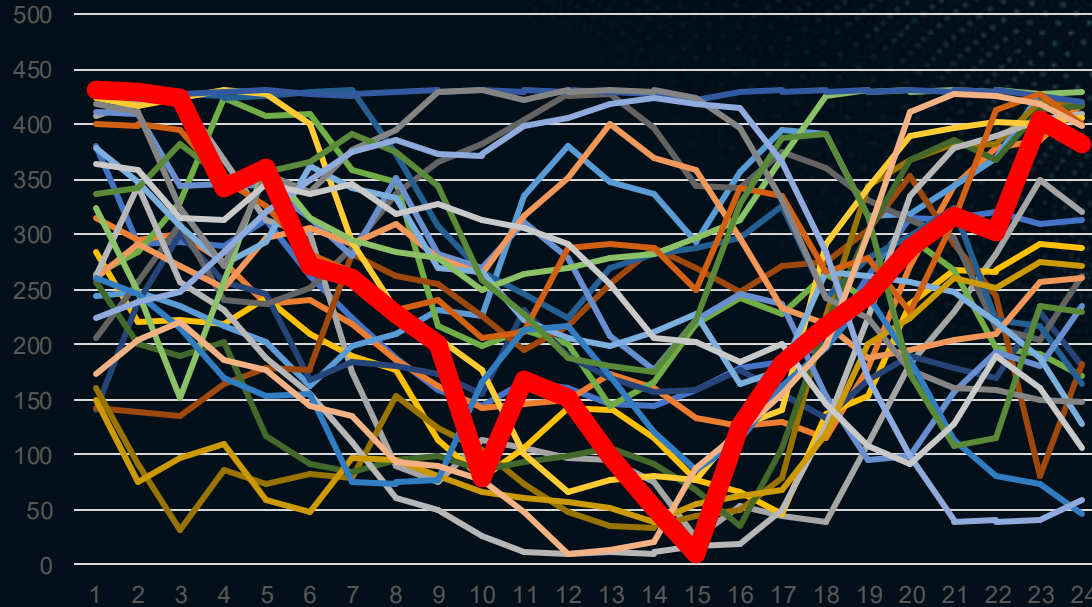
PROBLEM SIZE

Breaking up the problem



BREAKING UP THE PROBLEM

Typical Day Wind Shapes



On/Off Peak Day (2)
Good for storage up to 6 hours



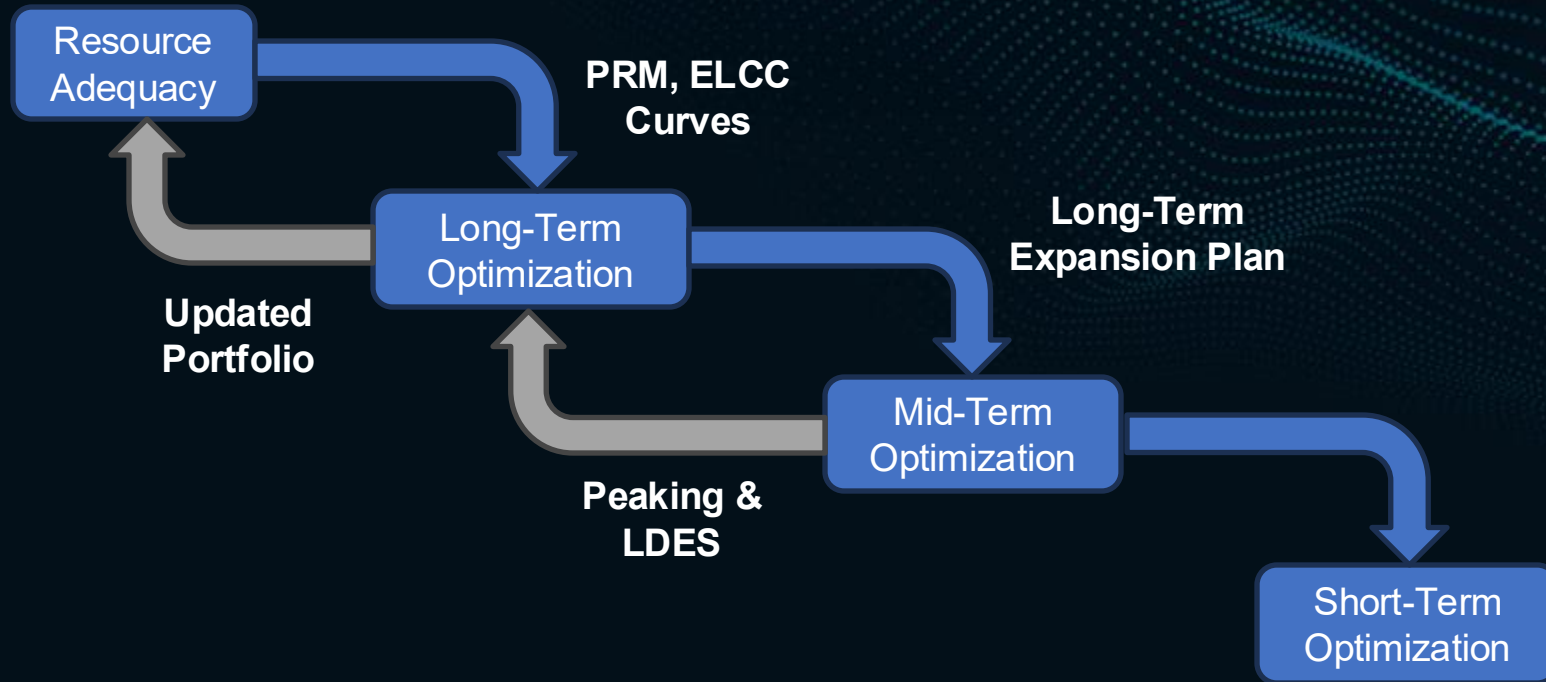
Day of Week (7)
Good for storage up to 48 hours



All days (28-31)
Required for LDES

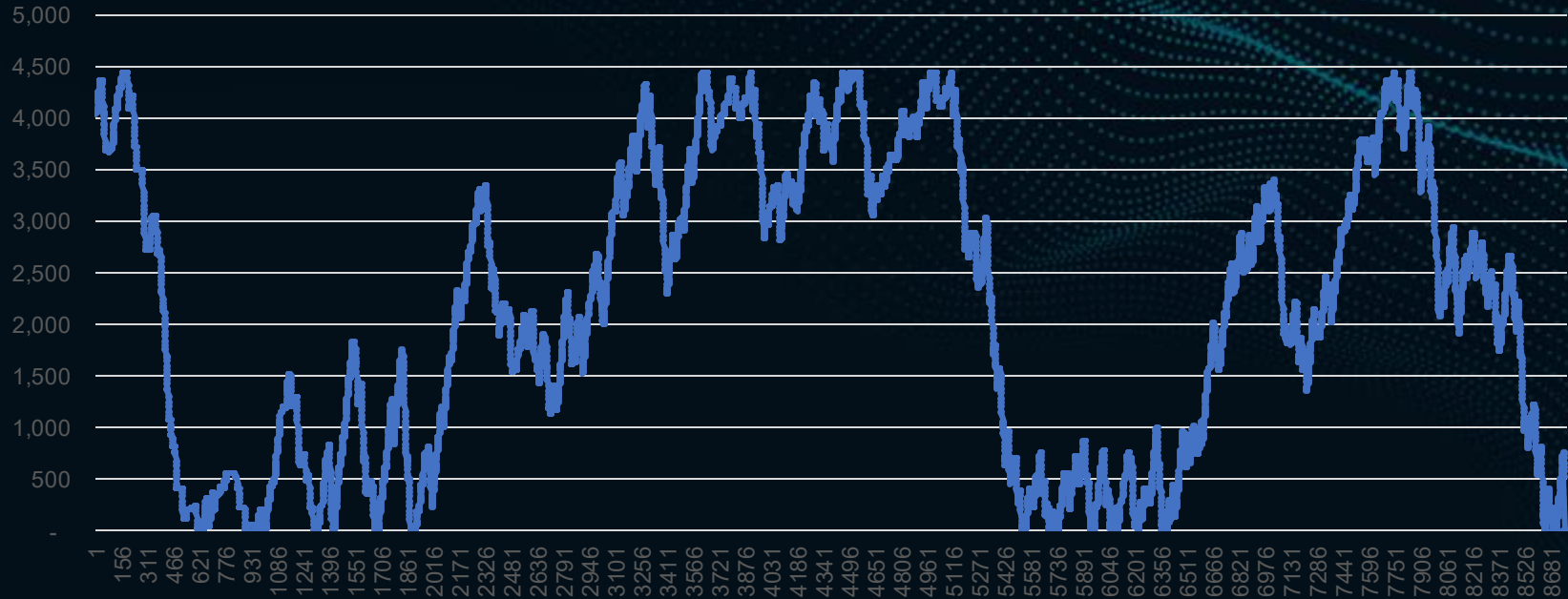
BREAKING UP THE PROBLEM

Mid-Term Optimization



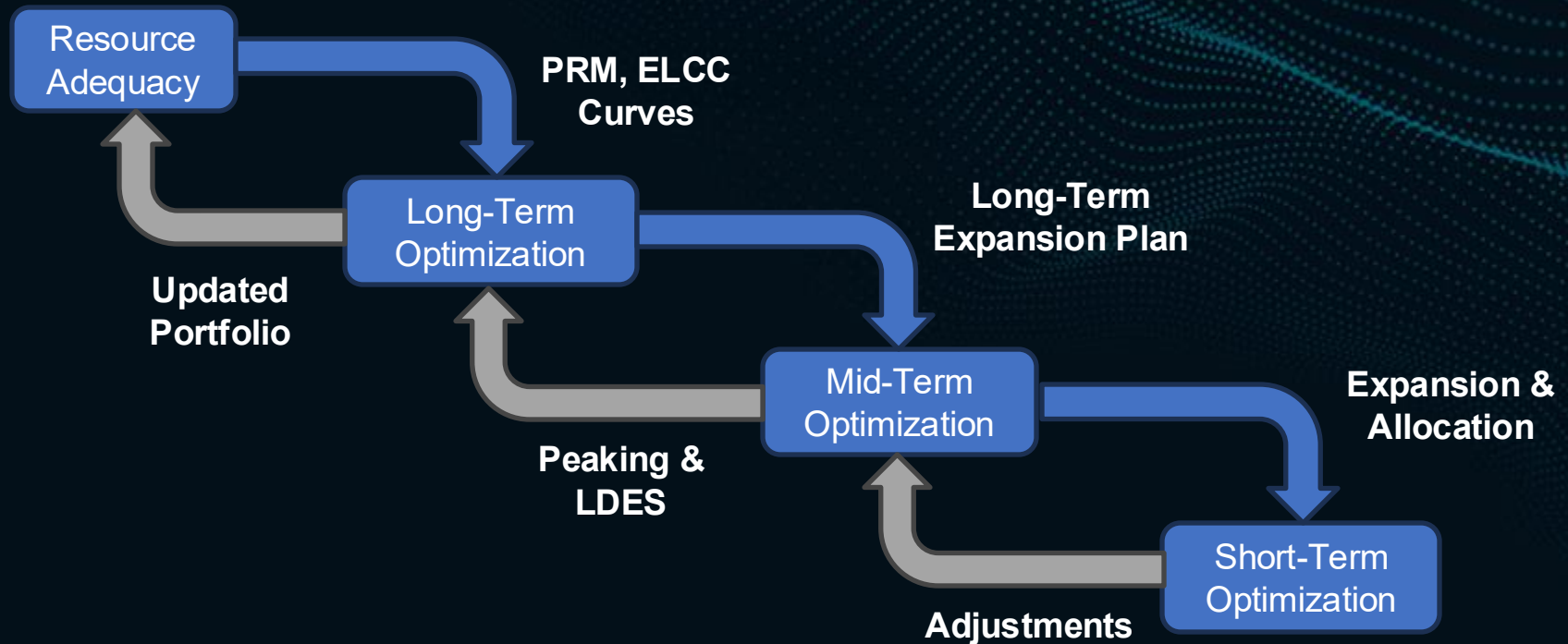
BREAKING UP THE PROBLEM

Long Duration Energy Storage Levels



BREAKING UP THE PROBLEM

Short-Term Optimization



BREAKING UP THE PROBLEM

Optimization Parameters

| | Long-Term | Mid-Term | Short-Term |
|--------------------|---------------|----------------|----------------|
| Horizon | 7-30 years | 1-3 years * | 8-15 days |
| Daily Intervals | 10-24 | 18-24 | 24 |
| Days per Month | 2-7 | 28-31 | 28-31 |
| Commitment | Stack | Partial | Full |
| Carbon Target | 90% of actual | 95% of actual | 100% of actual |
| Expansion | Full | Peaking & LDES | None |
| Forced Outages | Deration | Deration | Monte Carlo |
| Ancillary Services | Full | Full | Full |

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