Performance-based Energy Resource Feedback, Optimization, and Risk Management: PERFORM
If it works...

will it matter?
ARPA-E Program Development and Execution

Program Development Cycle:

- **ESTABLISH**
  - Project Selection
  - Contract Negotiations & Awards

- **ENGAGE**
  - Program Approval
  - Workshop

- **EXECUTE**
  - Proposal Rebuttal
  - Transition Toward Market Adoption

- **ENVISION**
  - Program Conception (Idea/Vision)

- **EVALUATE**
  - Merit Review of Proposals

Key Phases:

- Project Handoff
- Ongoing Technical Review
- Funding Opportunity Announcement
Tentative Program Scope, Timeline, and Beyond

Year 1
- Synthetic Data
- Site Data Collection, Processing, Analytics
- R&D 8-10 Teams
- PERFORM R&D

Year 2
- Data
- R&D Refine
- Validation

Year 3
- Site Data
- R&D Refine
- Validation

Year 4
- Site Data
- R&D&D Finalize
- Down Select: 3 Teams
- Validation and Prediction
- Down Select: 3 Teams

Year 5
- Down Select 3 Pilots: 2 Small + 1 Medium/Large
PERFORM Teams

- Advanced tech
- Asset / system modeling
- Grid software
- Optimization under uncertainty

Targeted pilot locations
- Data / validation

Risk metric
- System risk assessment

Uncertainty quantification and valuation

POWER SYSTEMS

INDUSTRY

FINANCE/ACTUARIAL SCIENCE

OPERATIONS RESEARCH
PERFORM Program Overview

Program Thrust 1

Asset Risk Assessment:
A standardized, transparent risk score to gauge each asset’s relative performance

Program Thrust 2

System Risk Assessment:
Risk-based Energy Management System (REMS) to balance collective risk across the grid

Tech to Market:
Pilot testing with utilities or ISOs willing to collect data and evaluate proposed software solutions to gauge program pursuits
Renewables mainly show up in real-time and do not schedule in advance; operators **guess** at how much backup capacity is needed.

Assumed % of installed renewable capacity guaranteed

Operators procure additional resources to protect against forecast risk exposure

Renewable forecast error hedged with conservative operations, excessive ancillary services requirements, and on-line back-up conventional generators
Industry participation in PERFORM

- **Data**
- Pilot program – who should be involved?
- Team up with proposals
- Program input: what will move industry forward?
Transmission & Distribution

- Where to focus? Start? Most impactful? Most in need?
- Bulk? Distributed energy resources?
- T&D Interface?
- Wholesale? Retail markets?
PERFORM Program Metrics

- System cost reduction
- System reliability improvement
- Reduction in ratio of stand-by thermal generation to scheduled renewable generation
- Reduction in ratio of thermal capacity to emerging resource capacity (long-term planning)
- Reduction in ratio of ancillary services from thermal resources to ancillary services from emerging technologies
- Improvement in quality of service metric: delivered energy to scheduled energy (for every resource)
- Improvement in quality of service metric: delivered ancillary service to scheduled ancillary service (for every resource)
What do you wish to see come from this potential program?

- Mahesh Morjaria, Studio 1, Breakout Session 3:
  - The ability to talk, with ease – similar to how it is handled in the finance sector, on the topic of risk
What can we learn from the past?
What do we see in the future?

Locational Marginal Prices...

and Locational Risk Premiums / Prices?