# Gap Analysis
# Compensation – Incentives

FSSTF

September 20, 2019

# Schedule

- **June Meeting:**
  - Assessed what current mechanisms exist today that contribute toward fuel/energy/resource security and what uncertainties/risks are currently accounted for by these mechanisms

- **July Meeting:**
  - Given the credible risks to fuel/energy/resource security that were identified, determine which uncertainties are not accounted for in the requirements for the current mechanisms that exist today

- **August Meeting:**
  - Given the credible risks to fuel/energy/resource security that were identified, determine if any gaps exist in the compensation in the form of cost-recovery available for the current mechanisms to mitigate those risks

- **Today:**
  - Given the credible risks to fuel/energy/resource security that were identified, determine if any gaps exist in the incentives provided by the compensation available for the current mechanisms to mitigate those risks

- **October Meeting**:
  - Summarize key findings from the gap analysis

# Relevant Risks Identified at June FSSTF Meeting

| Relevant Risks | |
|---|---|
| Long Duration Cold Snap | |
| Short Duration Cold Snap | |
| Natural Gas Pipeline Disruptions | |
| Solar Intermittency | Renewable Intermittency - Related |
| Wind Intermittency | |
| Coal Refueling (Bridge Failure) | Forced Outages - Related |
| Coal Refueling (Lock and Dam Failure) | |
| Coal Refueling (Rail Failure) | |
| Coal Refueling (River Freezing) | |
| Coal Unavailability (Coal Quality) | |
| Natural Gas Unavailability Non-Firm Units | |
| Oil Refueling (Oil Terminal) | |
| Oil Refueling (Truck Restrictions) | |
| Nuclear Regulatory Shutdown (Fuel Related) | |
| Nuclear Regulatory Shutdown (Non-Fuel Related) | |
| Nuclear Unavailability (High Winds) | |
| Hydro Unavailability (Freezing Rivers) | |
| River Freezing (Cooling Water Impacts) | |
| Ice Storm (Transportation Impacts) | |

For ease of exposition, some of the Relevant Risks are grouped in two categories: Renewable Intermittency and Forced Outages.

# Incentives Provided by Current Mechanisms

- Incentives provided by the current mechanisms fall into two categories:

  1) Penalties for Not Performing

  2) Lost Revenue from Not Performing

# Penalties - Capacity Performance

- Resources assessed penalties and bonus credits for performance during a Performance Assessment Interval (PAI)

- Approximate hourly penalty rate for not performing during a PAI for the 2021-2022 delivery year: $3,500/MWh

- Penalty Stop Loss = $157,500/MW-year

# Lost Revenue - Emergency Procedures

- During the Phase I Analysis, to evaluate system performance in each scenario, the following emergency procedures were examined:
  1) Synchronized Reserve Shortage
  2) Voltage Reduction
  3) Demand Response Deployment
  4) Load Shed

- We can use the same triggers to determine the lost revenue (worst case scenario) a unit would be subject to from not performing.
- Question: What is the maximum price during each emergency event?

- Energy price during an RTO-wide Synchronized Reserve Shortage Event:

  - Current Reserve Market Design:  $850/MWh

- Energy price during an RTO-wide Voltage Reduction Event:
  - Current Reserve Market Design:  $1,700/MWh

- Energy price if Demand Response is deployed:
  - $1,850/MWh

- Energy price during an RTO-wide Load Shed Event:
  - Current Reserve Market Design: $1,700/MWh (max. reserve price) + $2,000/MWh (max. energy offer) = $3,700/MWh

# Expectations of Future Costs

- Given that each scenario in Phase I has a probability of occurring, generator incentives to perform can be measured based on expectations of future costs, not on the costs themselves
- Note: Expected costs are only one measure of risk that can be used for decision making.

- A generator may want to minimize expected cost:

$$\text{Expected Cost} = \sum_{for\ all\ Scenarios\ i} \left(Cost_{Scenario\ i} \times Probability_{Scenario\ i}\right)$$

- Question 1: How to determine the cost of each scenario occurring?
- Question 2: How to determine the probability of each scenario occurring?

# Scenario Cost Calculation

- Scenario Cost = Performance Assessment Interval (PAI) penalty cost + Lost Revenue
  - PAI penalty cost for each scenario was determined by multiplying the number of hours with an emergency event by the penalty cost
  - Lost revenue for each scenario was determined by multiplying the maximum price during each emergency event by the number of hours of that event occurring
  - If multiple emergency events were triggered during an hour, then the price of the highest priced emergency event was used for that hour
- Note, the cost estimates for each Phase I scenario represent a worst case scenario as prices during some emergency events may be lower

# Scenario Probability Determination

- Since we cannot calculate the probability of each Phase I scenario occurring, we can calculate the expected costs for a range of scenario probabilities and see the trends in expected cost

# Highest Cost Phase I Scenario Description

- The Phase I scenario with the highest cost had the following emergency procedures triggered:
    - Demand Response Deployment Hours: 192
    - Synchronized Reserve Shortage Hours: 77
    - Voltage Reduction Hours: 108
    - Manual Load Shed Hours: 83

- All other scenarios had lower costs.

- To calculate a Maximum Expected Cost (upper bound), we can assume a probability for the highest cost scenario that is equal to the sum of the probabilities of all the non-zero cost scenarios occurring.

- For example, let:

$$Probability_{Highest\ Cost\ Scenario} = \sum_{for\ all\ Scenarios\ j\ with\ non-zero\ cost} Probability_{Scenario\ j}$$

- Then:

$$\text{Max. Expected Cost} = Cost_{Highest\ Cost\ Scenario} \times Probability_{Highest\ Cost\ Scenario}$$

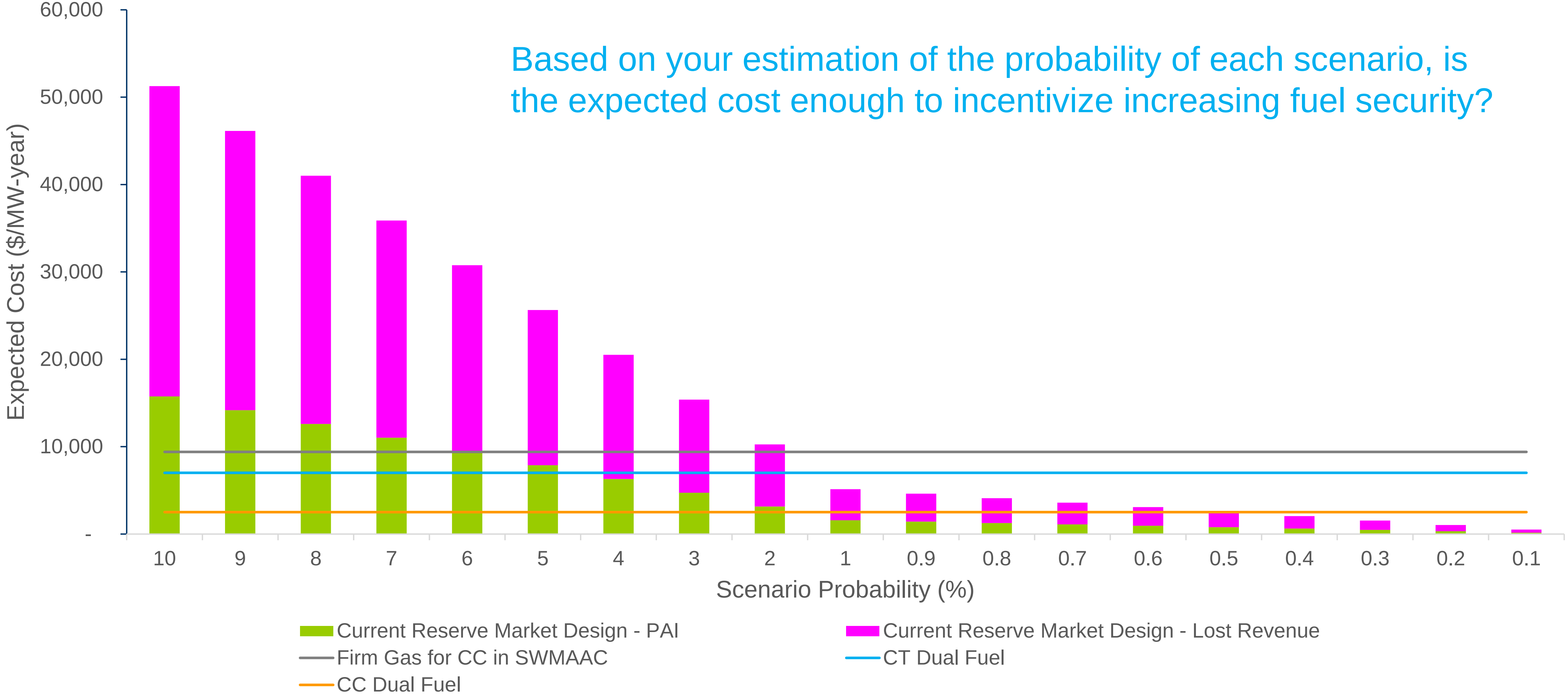
$$\geq Expected\ Cost = \sum_{for\ all\ Scenarios\ i} (Cost_{Scenario\ i} \times Probability_{Scenario\ i})$$

# Example Costs to Increase Fuel Security

- The following are some example costs for generator investments that may allow a resource to increase fuel security (these are provided for illustrative purposes only).
  - Cost for Firm Gas in SWMAAC for a CC = $9,400/MW-year
  - Cost to add dual fuel capability:
    - CT = $7,000/MW-year
    - CC = $2,500/MW-year

*Costs are from the Brattle Report*

# Phase I Highest Cost Scenario Expected Costs



- Current Reserve Market Design:
  - Expected costs drop below $5,100/MW-year when the probability of the scenario drops below 1%
  - Expected costs drop below $510/MW-year when the probability of the scenario drops below 0.1%

# Incentive to Become Fuel Secure

- Based on your estimation of the probability of each scenario, is the expected cost enough to incentivize increasing fuel security?

  – For example, under the current reserve market design, assuming the probability of all scenarios with a non-zero cost is less than 1%, is a maximum expected cost of $5,100/MW-year enough to incentivize a generator to increase fuel security?

# Self-Correcting Problem?

- Is the problem self-correcting?
  - As more emergency events happen more frequently (for example, if the reserve margin is at the IRM), the probability and expected cost of each scenario will also increase providing a greater incentive for units to become fuel secure.
    - At this point, is it already too late (due to lead time to become fuel secure)?
    - At what probability would the expected cost be high enough to incentivize a unit to invest in fuel security measures?
    - Answers will vary based on each participant's investment costs to increase fuel security, estimation of expected costs and risk tolerances.