

Market Renewal Program: Introduction to Enhanced Real-time Unit Commitment (ERUC)

September 20, 2017

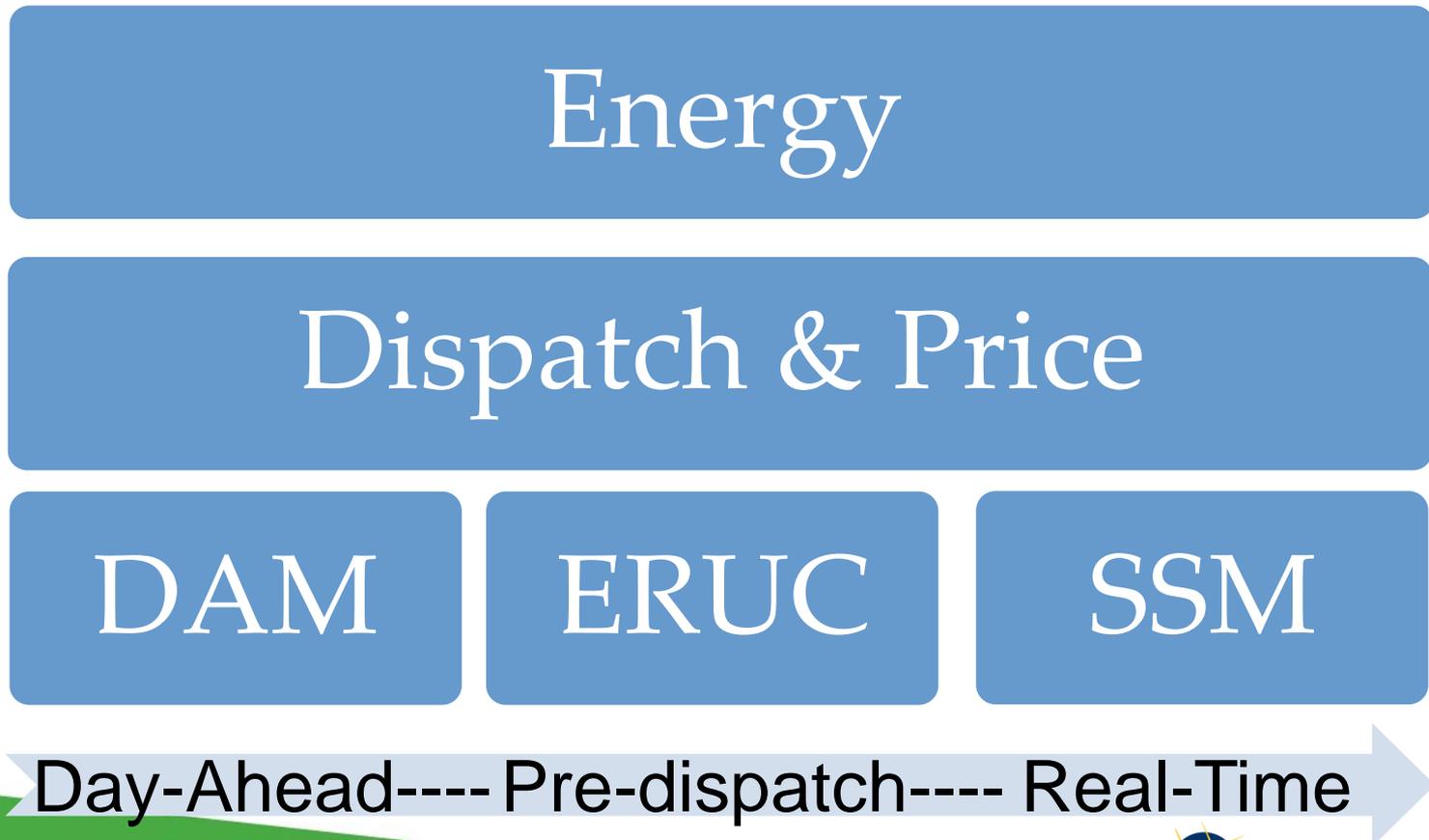
Market Renewal Working Group

Energy Workstream

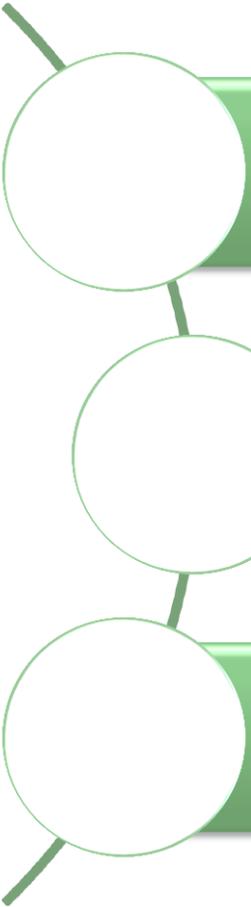
- The Energy workstream consists of three key projects:
 - Single Schedule Market
 - Day-ahead Market
 - Enhanced Real-time Unit Commitment
- Together they will improve the dispatch, commitment and pricing of resources in the energy market

The Big Picture

Enhanced real-time unit commitment will operate in the pre-dispatch timeframe, after day-ahead / before real-time



Current Real-Time Unit Commitment



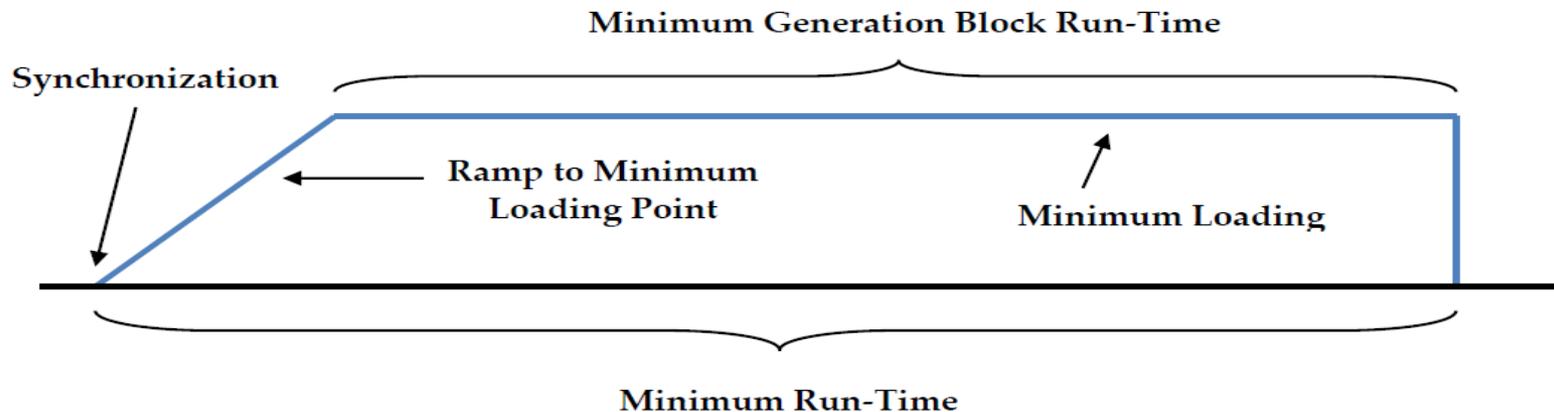
Real-time program is intended to maintain system reliability by providing eligible generators with a commitment and a cost guarantee

Generators with long start-up times must make decisions and prepare to start-up well in advance of real-time

The program ensures that generators will come online even if there is a risk that the real-time price will not cover their costs

Characteristics of Long Start Units

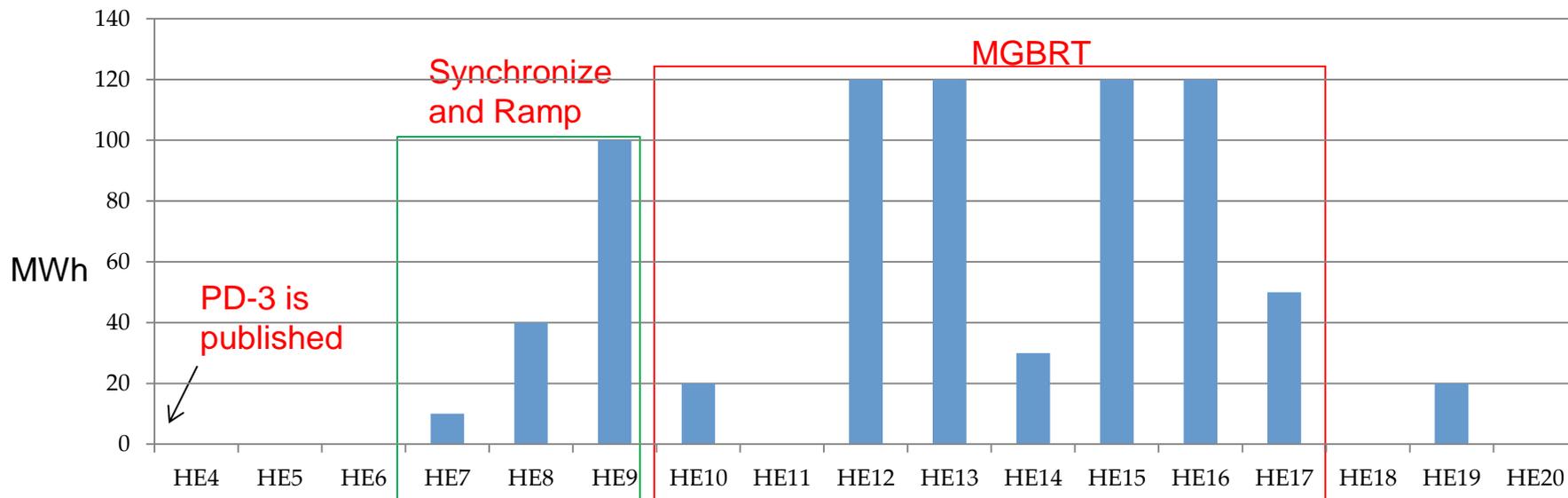
- Generators must operate at their minimum loading point (MLP) for their minimum generation block run-time (MGBRT) for technical reasons



Timing

- Real-time unit commitment happens after the day-ahead commitment process (DACP) runs and before real-time; this is commonly referred to as the “pre-dispatch” timeframe
- However, units are not “committed” by pre-dispatch schedules
- Generators see their hourly pre-dispatch schedules, giving them an indication of which hours they are likely to be economic in real-time
 - If the eligibility criteria are met, the participant will “invoke” a start and begin to bring its unit online

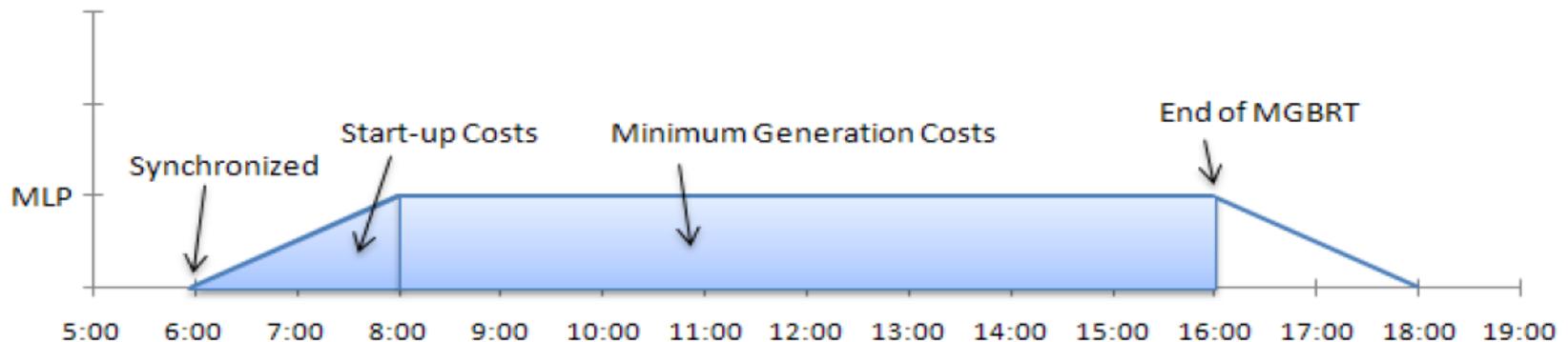
Example: Eligibility for RT-GCG



- In order to be eligible, the generator must be scheduled at their MLP or greater for at least half of their MGBRT in a pre-dispatch schedule
The generator receives a commitment for all MGBRT hours at MLP

RT-GCG Guarantee Payment

- Guaranteed costs are:
 - A. Pre-approved start-up costs; and
 - B. Minimum generation costs based on energy offer
- Guarantee payment will be made if the guaranteed cost is greater than market revenues earned up to MLP during the period from synchronization to end of MGBRT



How has the design evolved?

2003

- Original design created during a time of tight supply: generators were eligible if scheduled for as little as 1 MW, and the guarantee was based on costs submitted after the fact

2009

- Changes made to more efficiently commit: linked guarantee payment to offer prices and tightened the eligibility requirements (MLP for $\frac{1}{2}$ MGBRT)

2017

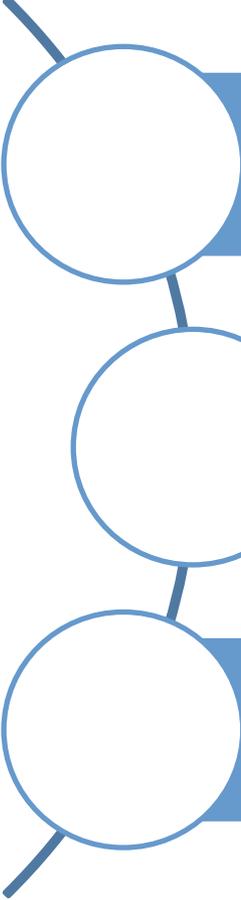
- Replaced after-the-fact start-up cost submission with a pre-approved cost recovery framework

Market Surveillance Panel

In its monitoring reports, the MSP has commented on numerous occasions that there is a need for an optimized program using three-part offers.

Monitoring Report on the
IESO-Administered
Electricity
Markets

Summary of Issues with Current Program



Inefficiency: We may schedule a higher cost resource because we don't consider all costs over the whole run

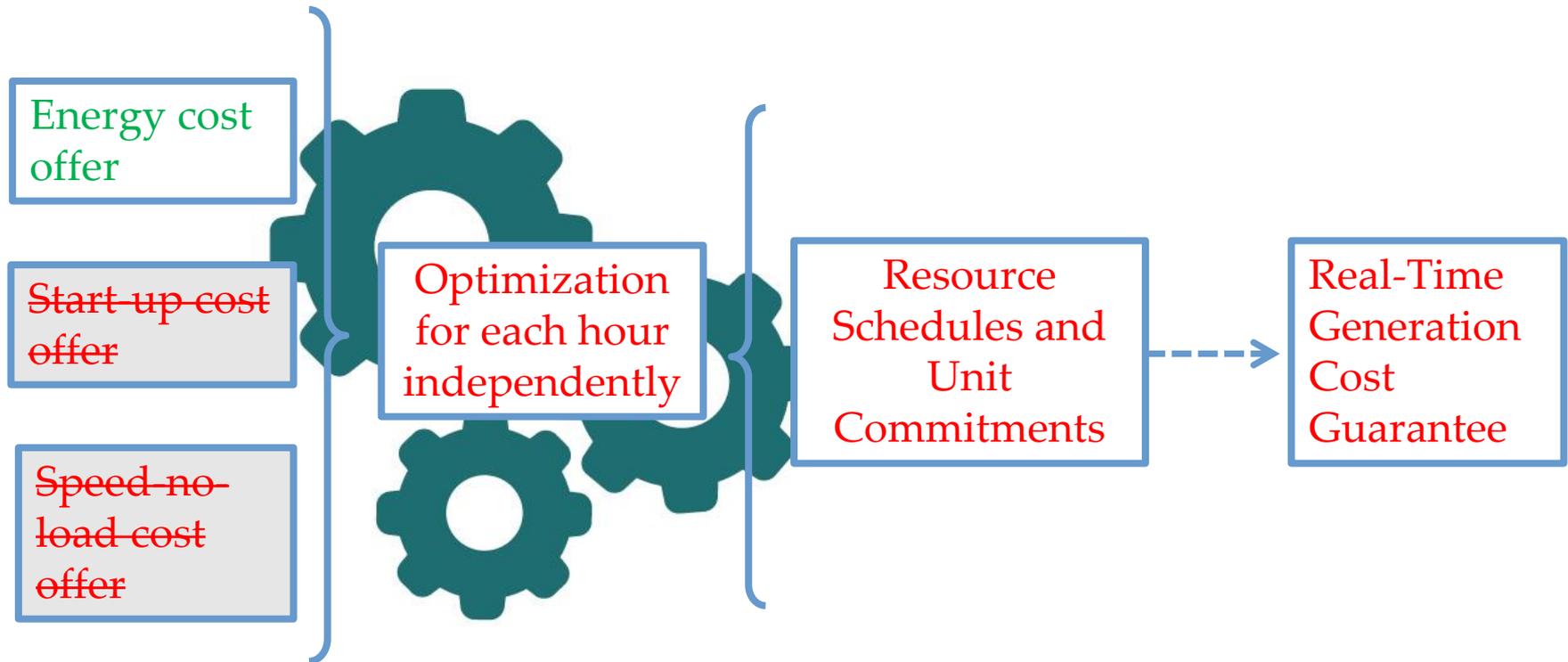
Lack of Competition: Start-up cost submission means no competition between generators on those costs

Misalignment with DA: Due to difference between the DA and RT optimization, we may over-commit resources

Unit Commitment with a DAM

- Even with a DAM, improvement of the current RT unit commitment is required because there are changes in demand and supply between timeframes
 - Energy supply, Ontario demand, exports
 - Operating reserve requirements
 - Ramp requirements
- Often a combination of factors can result in a commitment

Current Real Time Unit Commitment



Misalignment with Day-Ahead

Day-ahead Commitment Process

Three-part offers

24 hour optimization

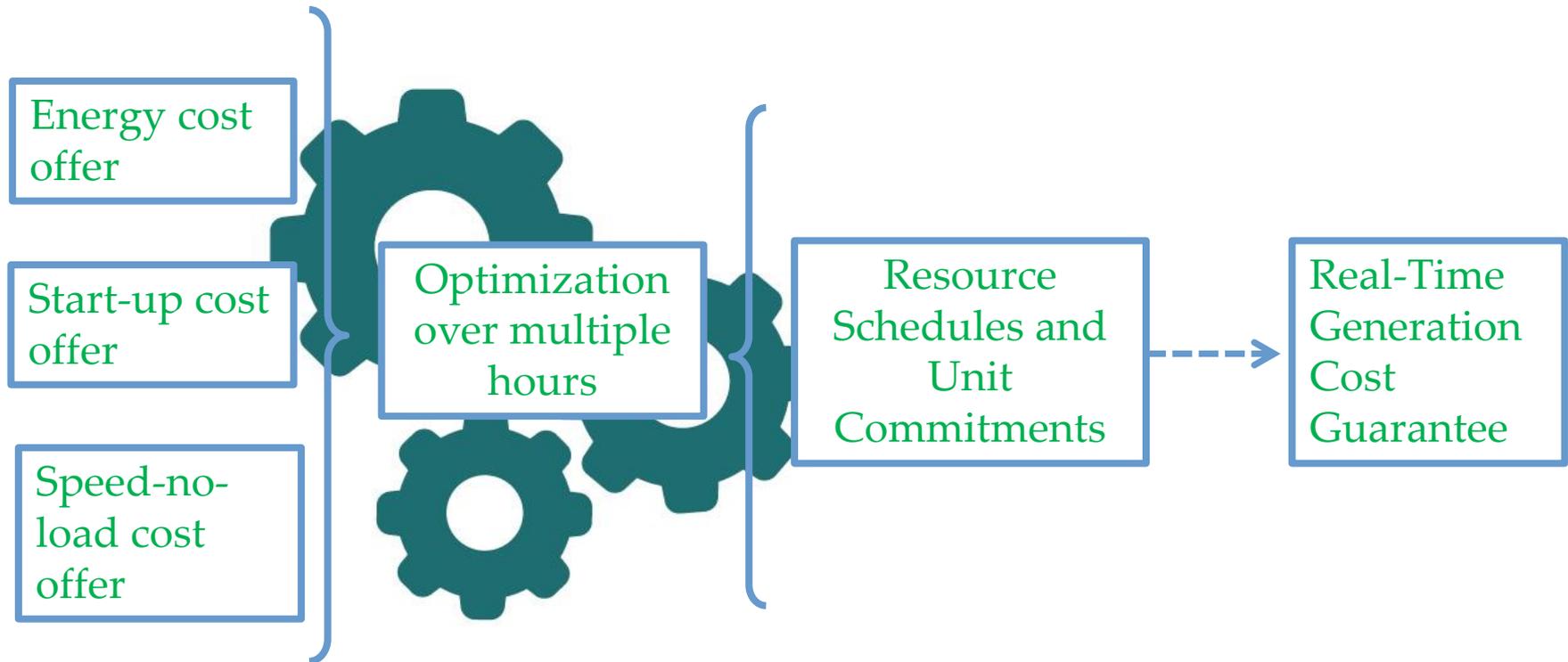
Real-time Commitment Process

Energy only offers

Optimize each hour independently

- Different optimization is utilized in real-time as compared to day-ahead
- Even with identical supply/demand conditions, a different solution may be produced

Enhanced Real Time Unit Commitment



The lowest cost resource will be chosen because:

- all costs will be included in the optimization
- optimization will evaluate the overall efficiency of the commitment across the whole run

Benefits of Enhanced RT Unit Commitment

1

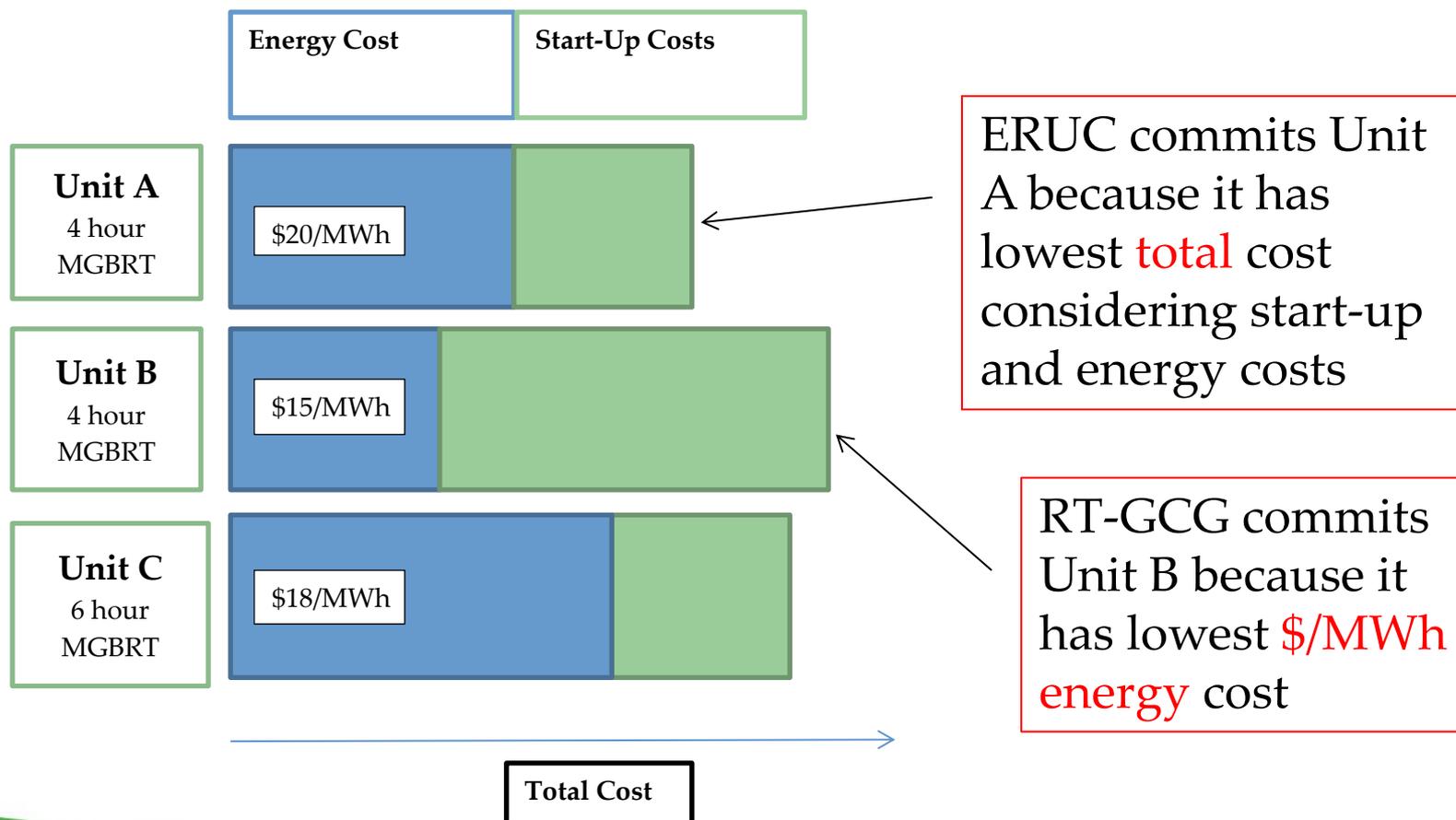
- Resources will be efficiently committed by considering all costs

2

- Optimization over multiple hours will evaluate and select resources based on the overall efficiency of the commitment

ERUC Optimization Example

Scenario: The grid needs to address a 3 hour shortfall.



Introducing Proposed ERUC Design Elements

Module	Module Name	#	Design Element
A	Engine Parameters	1	Functional Passes
		2	Look Ahead Period
		3	Timing and Frequency of Run
		4	Time Step
B	Participation and Input Data	5	Intertie Transactions
		6	Must Offer Requirements
		7	Eligibility Requirements
		8	Non-Quick Start Generator Data
C	Market Power Mitigation	9	Commitment Cost and Non-Price Bids/Offers
		10	Bid/Offer Changes
D	Output of Engine	11	Binding Start-up Instruction and Operational Schedule
E	Settlements	12	Calculation of Make Whole Payment
		13	Failure Charge

Engine Parameters

Module	Module Name	#	Design Element	Description
A	Engine Parameters	1	Passes of Engine	Performs joint optimization of energy and operating reserves, addresses market power mitigation, and generates a solution based on a set of inputs unique to that pass.
		2	Look ahead period	Timeframe over which the engine performs the optimization.
		3	Timing and Frequency of Run	Establishes when and how often the engine will run.
		4	Time Step	Establishes the duration of the schedule increments.

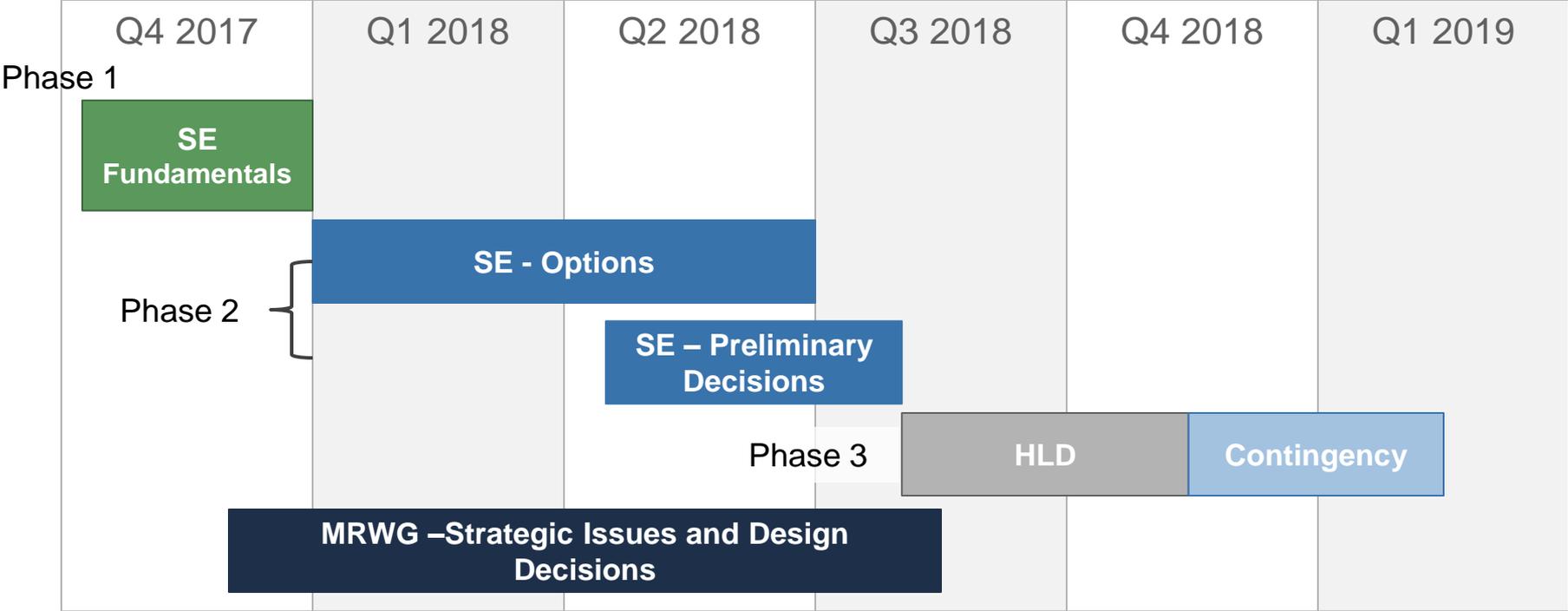
Participation and Input Data

Module	Module Name	#	Design Element	Description
B	Participation and Input Data	5	Intertie Transactions	Addresses whether or not ERUC will consider bids and offers for intertie transactions without a DAM schedule.
		6	Must Offer Requirements	Requirement for resources to offer their capability into the market in the ERUC timeframe.
		7	Eligibility Requirements	Establishes which resources may receive an ERUC binding start-up instruction and real-time make whole payment.
		8	Non-Quick Start Generator Data	Specifies offer data and technical non-price offer parameters of the non-quick start generator.

Market Power Mitigation, Output and Settlement

Module	Module Name	#	Design Element	Description
C	Market Power Mitigation	9	Commitment Cost and Non-Price Bids/Offers	Mitigation will be applied to address the impact of economic or physical withholding of supply. Mitigation of commitment cost and non-price bids/offers will be addressed in ERUC.
		10	Bid/Offer Changes	Restrictions to changes in commitment cost and non-price bids/offers.
D	Output of Engine	11	Binding Start-up Instruction and Operational Schedule	An instruction for NQS generators to come online, as assessed by the engine, and stay online for at least minimum generation (MLP/MGBRT).
E	Settlements	12	Calculation of Make Whole Payment	Ensures generators are kept whole to their as-offered costs for a specific period of time and quantity.
		13	Failure Charge	Charge to incentivize generators to meet their obligations in RT.

ERUC Timelines



ERUC - HLD Schedule

- Three phases of High Level Design to continue through approximately Q4 2018
- Near-term schedule (Phase 1):

Date	Forum	Topic
Wednesday, October 11	ERUC	Introduction
Tuesday, October 31	ERUC	Fundamentals mtg. 1
Tuesday, November 28	ERUC	Fundamentals mtg. 2