ERCOT Look-Ahead SCED
ALSTOM Experiences and Solution

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ERCOT METF Meeting

ALST♥M

Outline

- ALSTOM LA-SCED Customer Implementations

- LA-SCED Implementation Challenges

- ALSTOM Smart Dispatch R&D Development

- ALSTOM's New Developments in Real-Time Markets

- Open Discussion / Q&A

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ALSTOM LA-SCED
# CUSTOMER IMPLEMENTATIONS

ALSTOM LA-SCED Customer Implementations

- PJM LA-SCED went-live on June 9th 2010
  - LA Commitment: 2 hour look-ahead fast-start unit commitment
  - LA Dispatch: coupled multi-interval SCED

- Midwest ISO LA-SCED
  - LAC focuses on fast-start unit commitment in production April 2nd 2012
  - Look-ahead Dispatch (LAD) is next phase

- ISO-NE LA-SCED
  - Commitment advisory passed operator testing Q1 2012
    - Commit fast-start unit, predict emergency conditions, DR activation, and transaction clearing prices
  - Production implementation phase begins Q2 2012

- SPP LA-SCED for Integrated Marketplace (go-live Q1 2014)
  - Pre-RTBM is a interval coupled LA dispatch to look ahead 2 hours for OOME recommendation

- Other LA-SCED projects that went live
  - North China Grid
  - Terna of Italy

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PJM Real-Time Market Evolution

- 2001: 1st RT-UDS for energy only real-time market

- 2002: hourly Sprego market with co-optimization

- 2006: allow DR to participate Spin and Regulation markets

- 2008: perfect dispatch

- 2009: prototype of GCA (LA-SCED)

- 2010: IT-SCED/RT-SCED replaced LA-/RT-UDS
  - Multi-interval RT market and fast start LA commitment

- 2011: PRD prototype

- 2012/13: Shortage Pricing, FERC 745, FERC755, PRD will go live

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PJM LA-SCED

www.pjm.com

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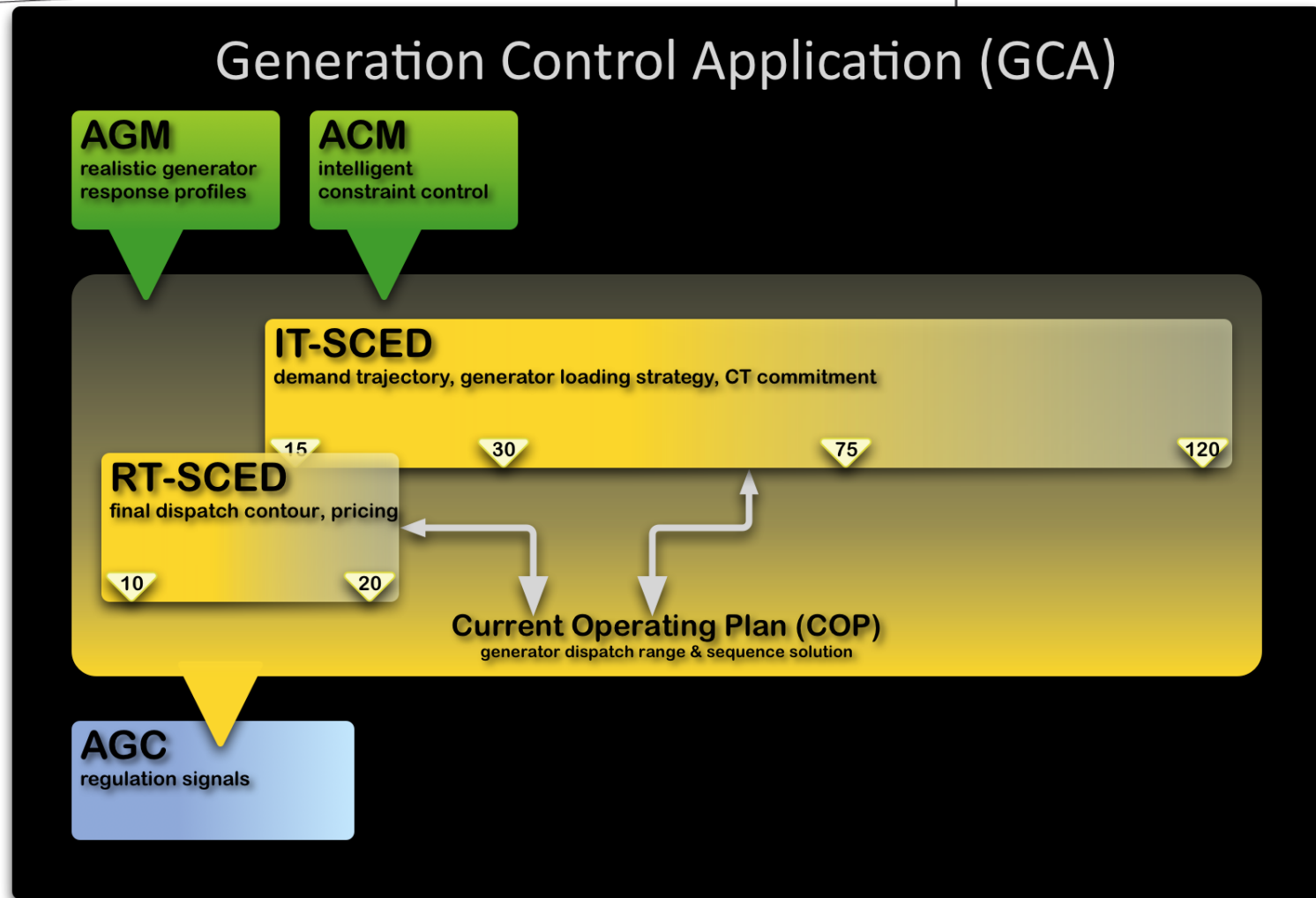
PJM LA-SCED

- Initiated by recommendation from "Perfect Dispatch" Study
  - Reduce fast-start commitment and dispatch cost
- IT-SCED is a MIP Look-ahead Commitment Engine
  - Reduce fast-start unit commitment cost
- RT-SCED is a Multi-interval Look-ahead Dispatch Engine
  - Provide unit dispatch trajectory
  - Pre-ramp units
- Look-Ahead transmission constraint prediction
- Energy and Ancillary Services co-optimization
- Reduce real-time LMP volatility

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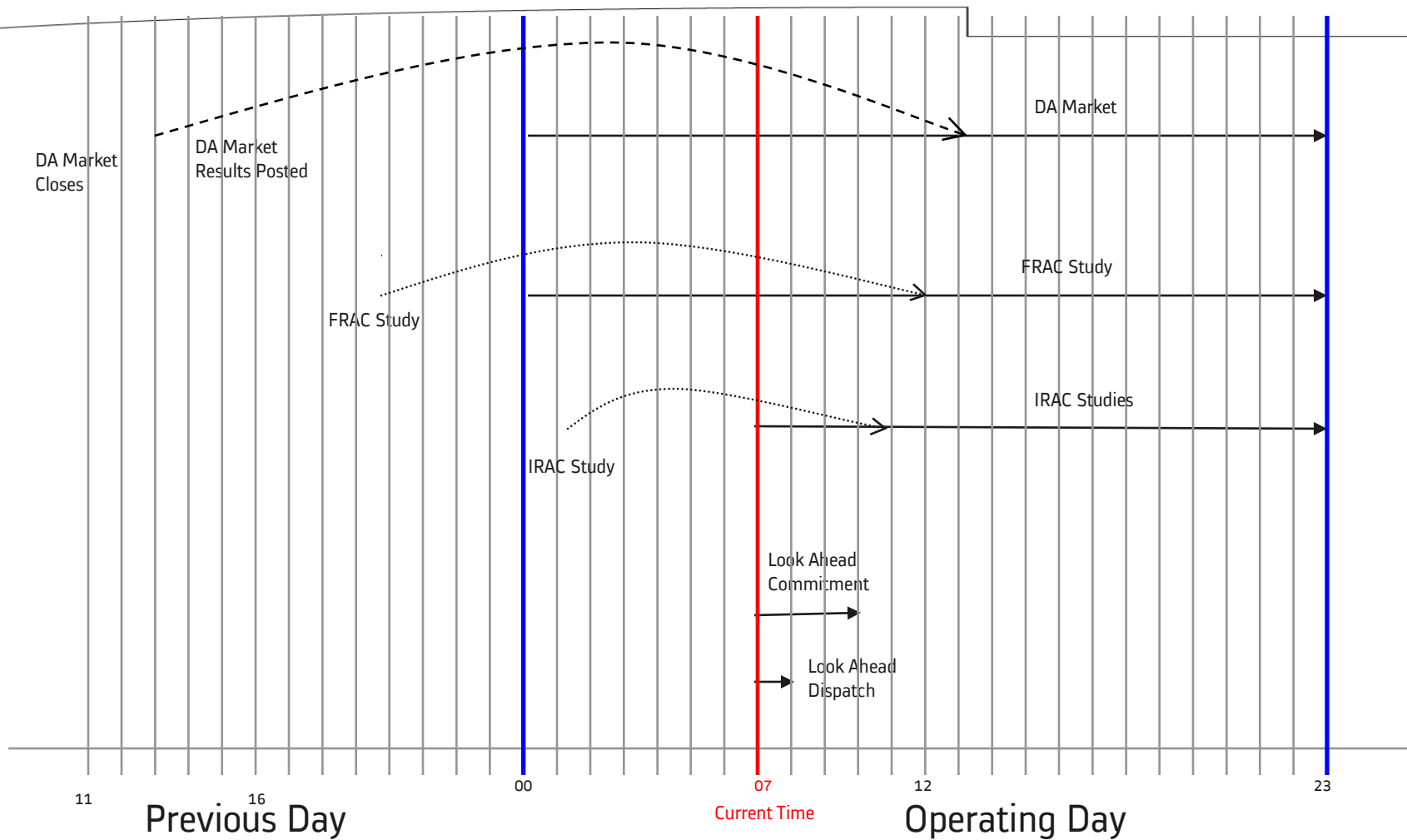# PJM Savings From Perfect Dispatch and GCA

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MISO Real-Time Market Evolution

- 2005: Launched Energy only Market

- 2009: Launched Energy and Ancillary Services Market
  - Energy and AS co-optimization in both DA and RT markets
  - DRR I and II, SER, etc.

- 2011: Look-Ahead Commitment in parallel operation

- 2012: Look-Ahead Commitment went live

- 2012: FERC 755, ELMP

- 2013: Look-Ahead Dispatch in plan

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MISO LA-SCED

Offers
Commitments
Regulation commitments
Operator Overrides
Initial conditions (SE)
Transmission Constraints
Load Forecast
Wind Forecast
NSI

LAC
(~3 hour look ahead commitment)

Commitments & decommitments
Reg commitment changes
Emergency range

LAD
(~1 hour look ahead dispatch)

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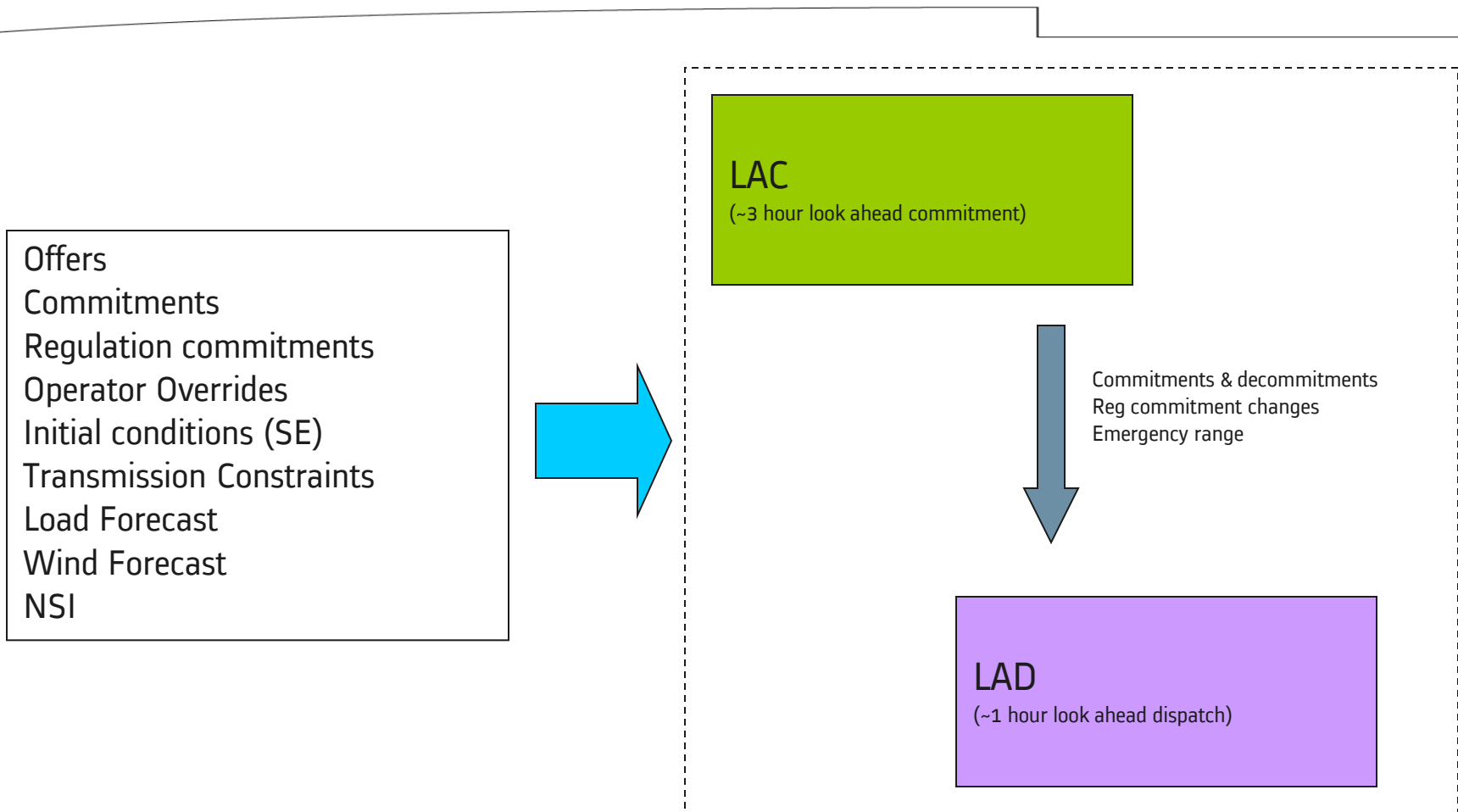
LAC & LAD Relative Timeline at PJM

DA Market
Closes

DA Market
Results Posted

DA Market

FRAC Study

FRAC Study

IRAC Study

IRAC Studies

Look Ahead
Commitment

Look Ahead
Dispatch

11   16   00   07   12   23

Previous Day   Current Time   Operating Day

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MISO LAC Phase 1

- Focus on near short term period (~3 hours)

- Bridge gap between existing IRAC & real-time dispatch

- Application of advanced optimization algorithms to improve ear term commitment process

- 3 scenarios to study input data uncertainties

- Real time telemetry input and wind forecast

- Energy and Ancillary Services Co-optimization

- Sub-hourly granular study to address intra-hour issues

- Operator review and approval of commit suggestions

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MISO Savings from LAC
MISO Press Release Issued April 3, 2012

MISO Make Whole Payment Example

Resource Pre-Ramping in Time-Coupled LA-SCED

Load
Forecast

SE Time

LA-SCED
Case Kickoff

Time
Intervals

T   T+5   T+10   T+15   T+20
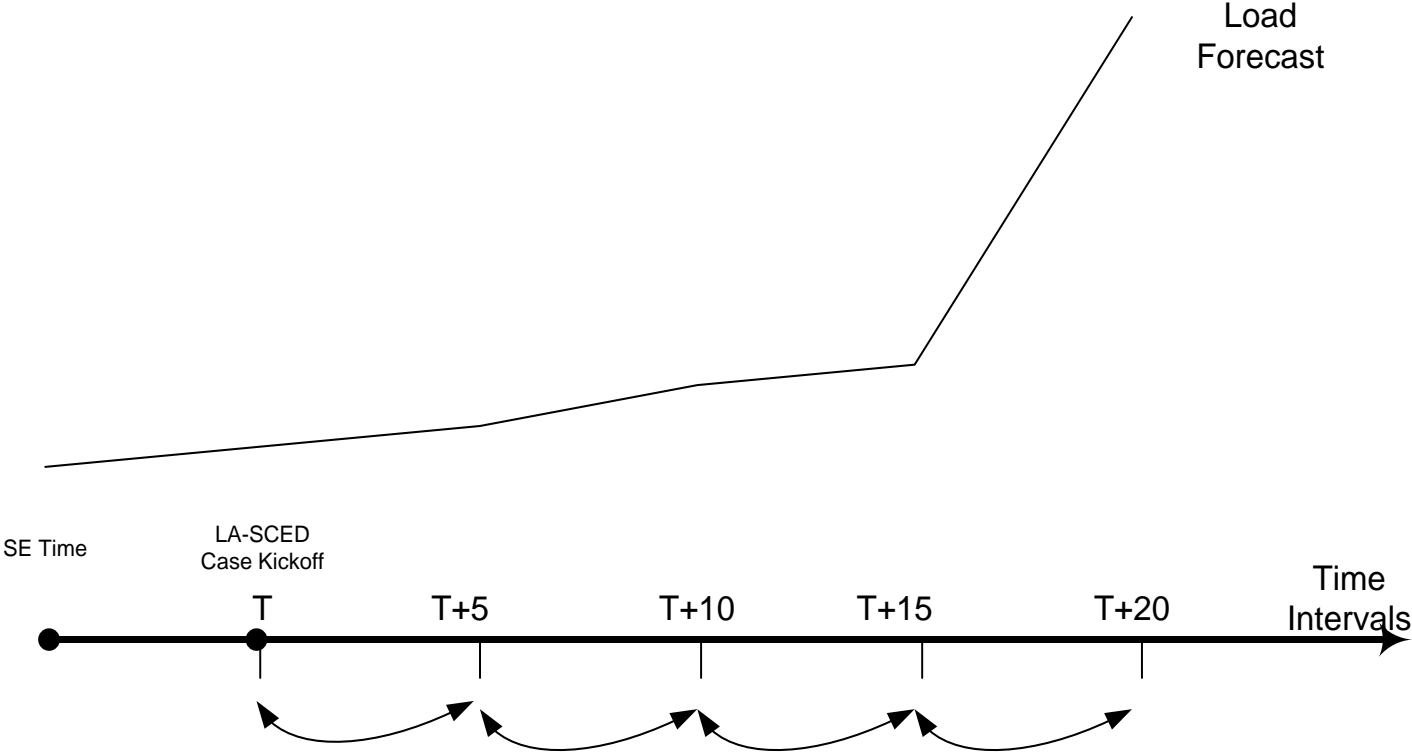
LA-SCED
IMPLEMENTATION CHALLENGES

LA-SCED: Summary of Implementation Challenges

- Uncertainties of future operating conditions
  - Load forecast error
  - NSI uncertainty
  - Wind forecast errors
  - Discrepancy between outage schedules and the actual occurrence

- LA commitment and dispatch justification
  - Operators need to quickly understand the reasons for fast-start commitment and out-of-merit dispatch

- UI design
  - Efficiently presenting information obtained from large amount of data

- Time coupled multi-interval dispatch and pricing

- Cross hourly boundary and day boundary

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ALSTOM SMART DISPATCH
R&D DEVELOPMENT

ALSTOM Smart Dispatch Overview
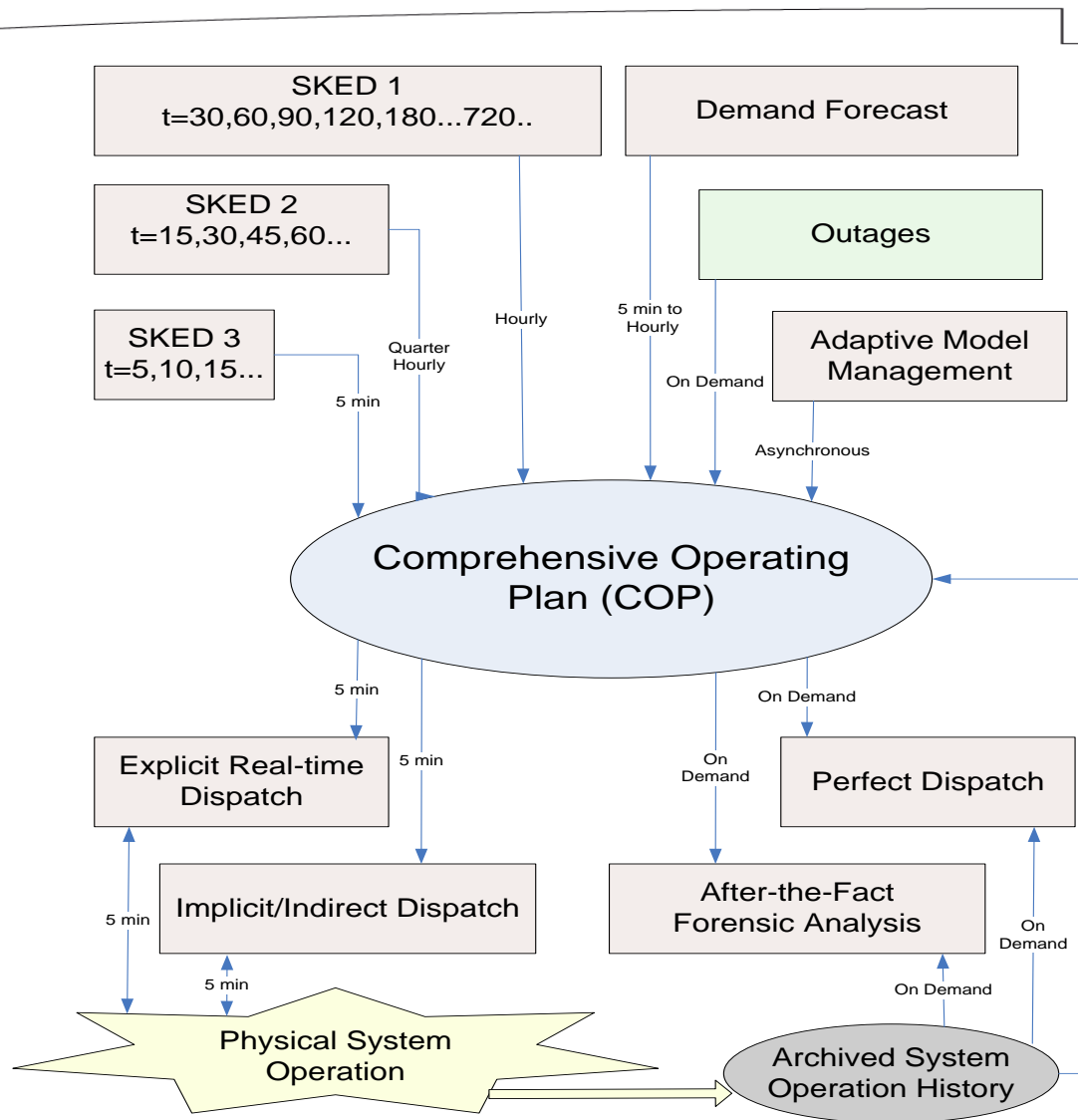
ALSTOM LA-SCED Optimization Engine

- LA-SCED is a Mixed Integer Programming (MIP) / Linear Programming (LP) based optimization application which includes both unit commitment and unit dispatch functions. LA-SCED can be easily configured to perform scheduling processes with different heart beats and different look-ahead time.
  - Far Look-Ahead Unit Commitment
    - Incremental commitment for next 6-12 hours with hourly intervals
  - Short-Term Look-Ahead Scheduling
    - Look ahead 2-4 hours with 15-minute intervals
    - Both commitment and dispatch
  - Real-time Dispatch and Pricing
    - Dispatch and pricing for next hour with 5-minute intervals

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ALSTOM RT/LA Product Features

- Fully support Energy and AS co-optimization
  - Scarcity pricing

- Support various resource types, including storage, DRs, wind, Combined Cycle, etc.

- Look-Ahead network topology processing and constraint prediction

- Information driven Operator UI

- Configurability
  - Commitment/Dispatch/Pricing
  - Single Interval/Multi-interval time coupled /multi-interval non-time coupled
  - Study period and interval duration

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ALSTOM'S NEW DEVELOPMENTS IN REAL-TIME MARKETS

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Alstom's New Developments In Real-Time Markets

- Model Demand Responses and Distributed Energy Resources
  - MISO DRR Type 1 and Type2
  - PJM Price Responsive Demand
  - Pilot Projects with Duke, NiceGrid, etc.

- Wind & Renewables Integration
  - Dispatchable Intermittent Resources

- Model Storage Resources
  - MISO Stored Energy Resource (SER)

- FERC Order 755 – Regulation Payment for Performance
  - Working with PJM and MISO, target production Q4 2012

- MISO Extended LMP

- ISO-NE Adaptive Transmission Rating

- Load following product / ramp product

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Q&A

THANK YOU!

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