Technology Challenges and Future Direction

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Topics Covered

- ✓ Overview of NYISO
- ✓ SMD Overview, Benefits & Features
- ✓ Current Challenges
  - ▪ SMD
  - ▪ NYISO
- ✓ ITC Initiatives
- ✓ Future Direction of NYISO

Overview

✓ **NYISO's Primary Purpose**

  ▪ **Responsible for the reliable operation of the New York electric system.**

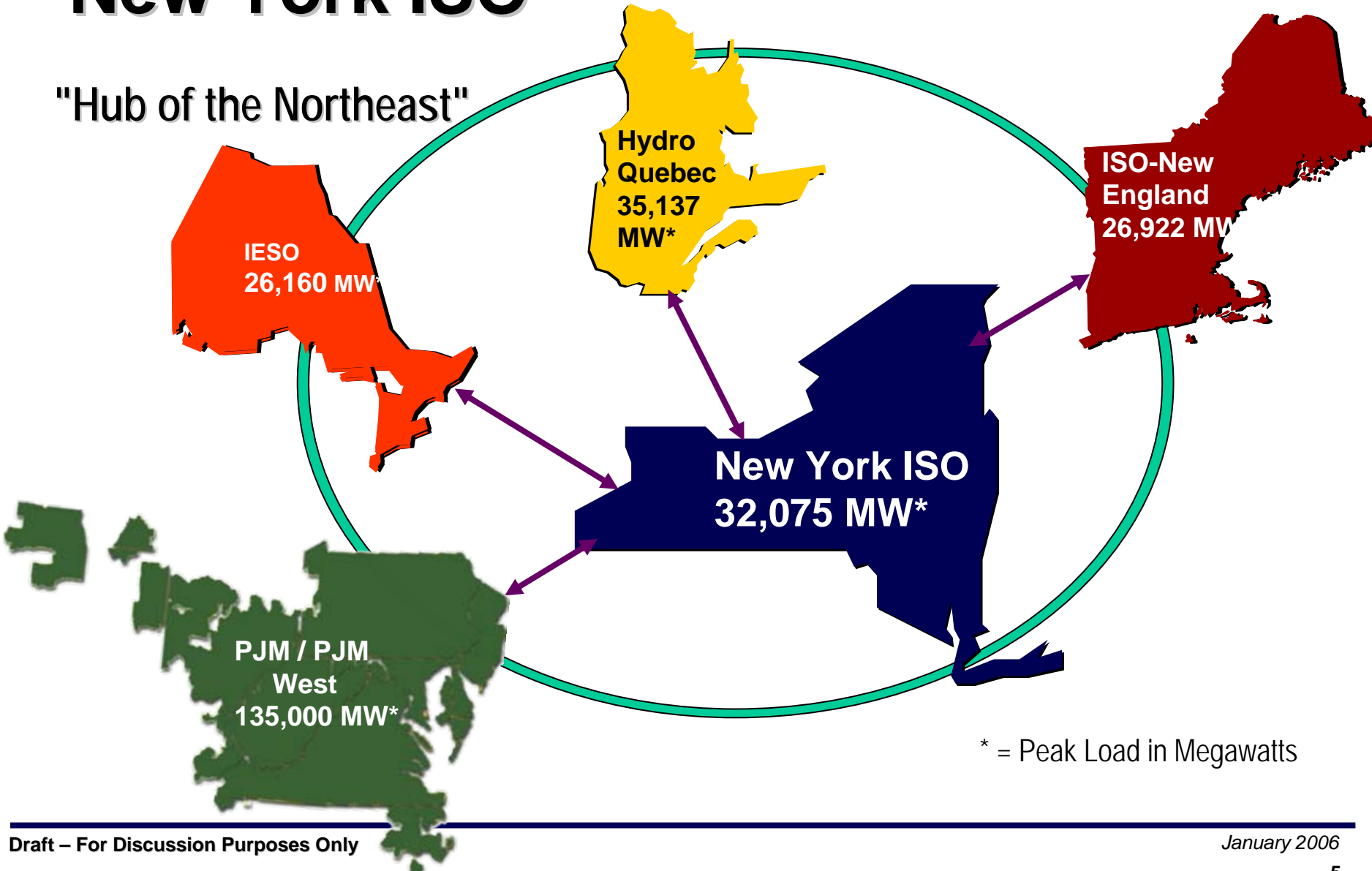 ▪ **Administering and running the competitive wholesale markets for electricity.**

Overview

✓ **NYISO Background**

- ▪ **NYISO formed December 1, 1999.**

- ▪ **Highly divested and complex marketplace featuring co-optimized market clearing systems.**

- ▪ **NYISO market volume was over $10 billion last year and over $33 billion since inception. Highest market volume in the East.**

- ▪ **Unique challenge: New York City is world's biggest and most complex load pocket. World capitals of finance and communications located within.**

- ▪ **Unique geography makes it the "Hub of the Northeast."**
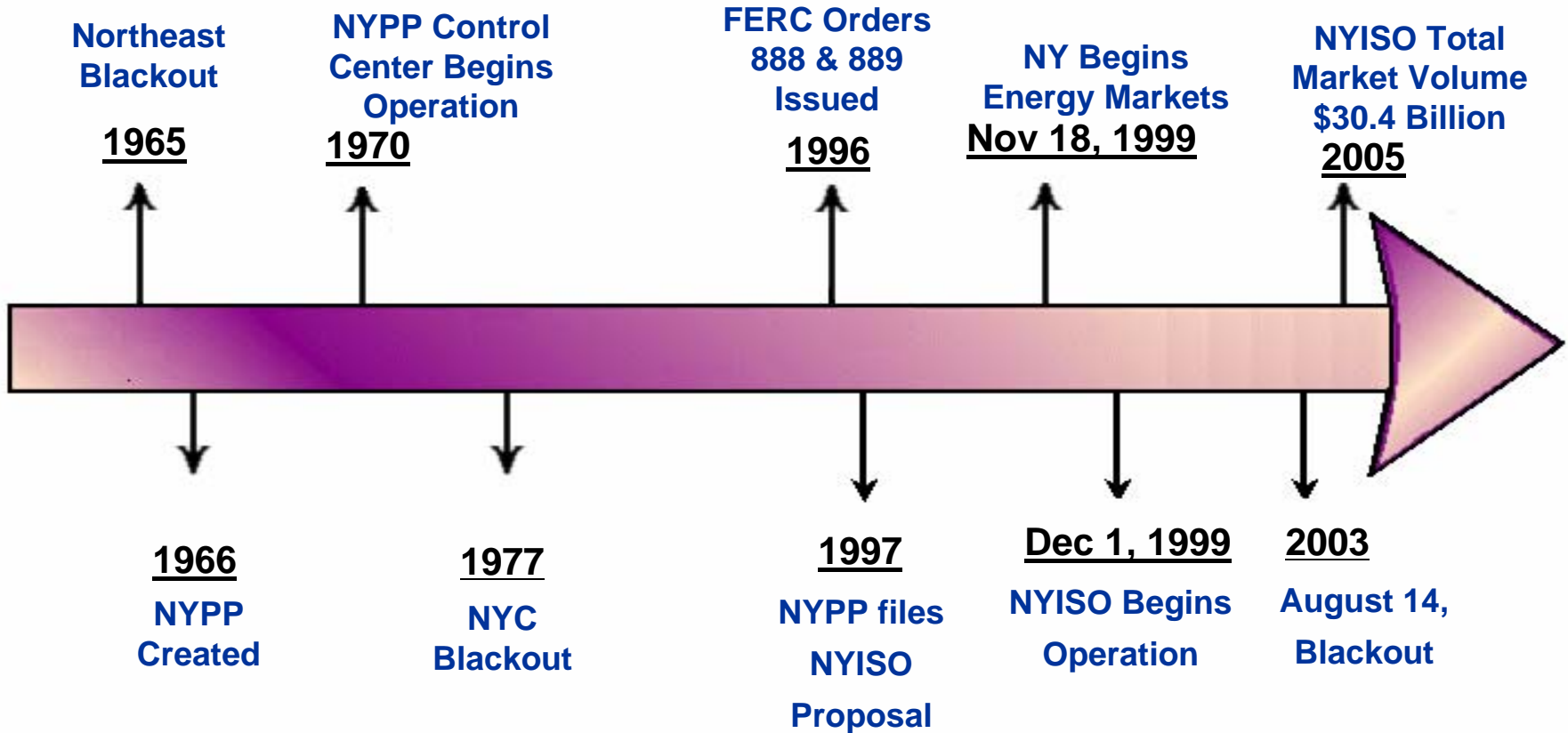
New York ISO

"Hub of the Northeast"

Hydro Quebec 35,137 MW*

ISO-New England 26,922 MW*

IESO 26,160 MW*

New York ISO 32,075 MW*

PJM / PJM West 135,000 MW*

* = Peak Load in Megawatts

Overview

Evolution of the NYISO

Northeast Blackout

1965

NYPP Control Center Begins Operation

1970

FERC Orders 888 & 889 Issued

1996

NY Begins Energy Markets Nov 18, 1999

NYISO Total Market Volume $30.4 Billion

2005

1966

NYPP Created

1977

NYC Blackout

1997

NYPP files NYISO Proposal

Dec 1, 1999

NYISO Begins Operation

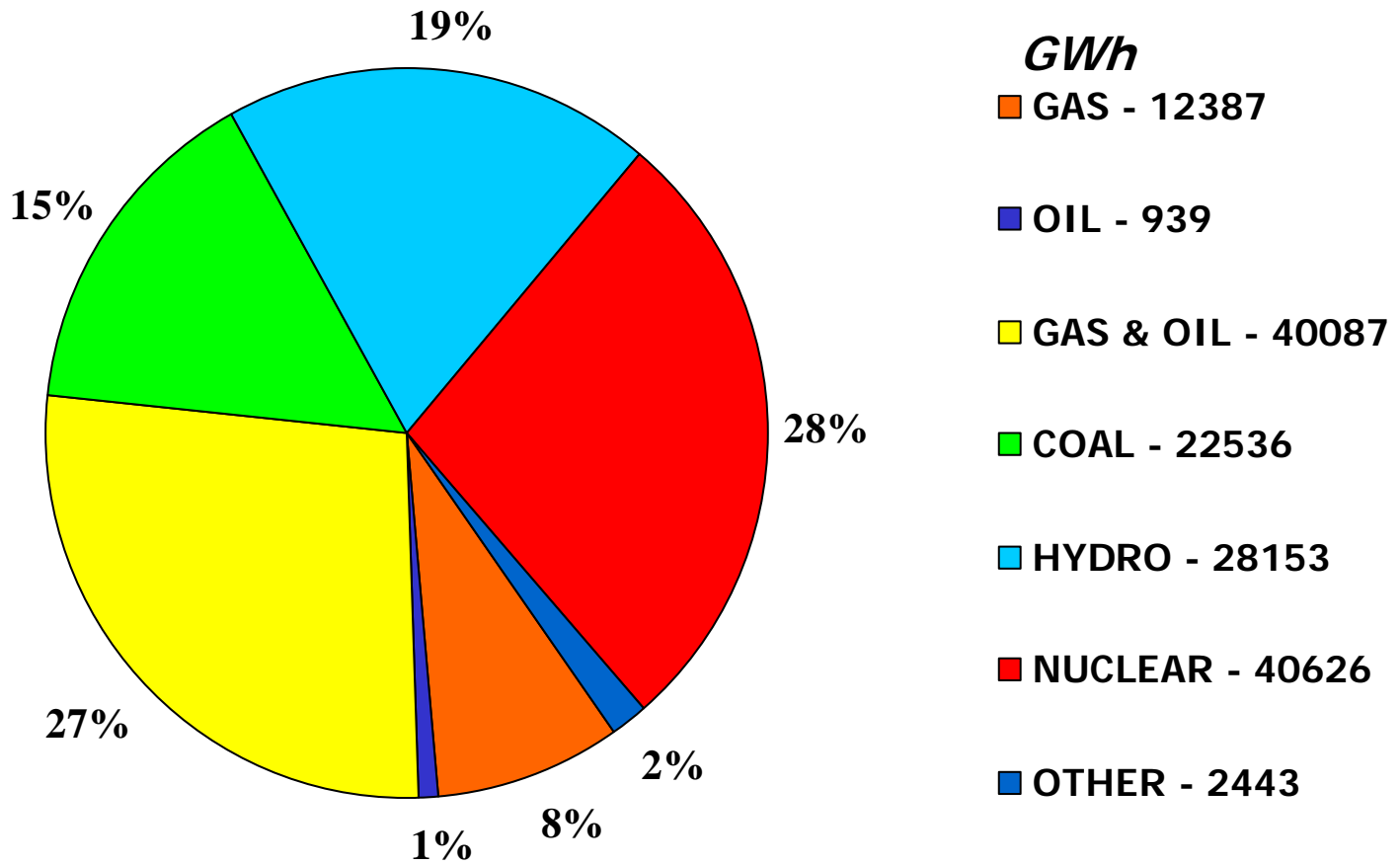**2003**

August 14, Blackout

The NYISO Control Area

> ➢ *New York State:*
>
> *19.2 million people*
>
> ➢*Serving New York City*
>
> ➢*2004 Energy of 160,211 GWh*
>
> ➢*Record peak of 32,075 MW (7/26/05)*
>
> ➢ *10,800 miles of High Voltage Transmission*
>
> ➢*Over 335 generating units modeled*
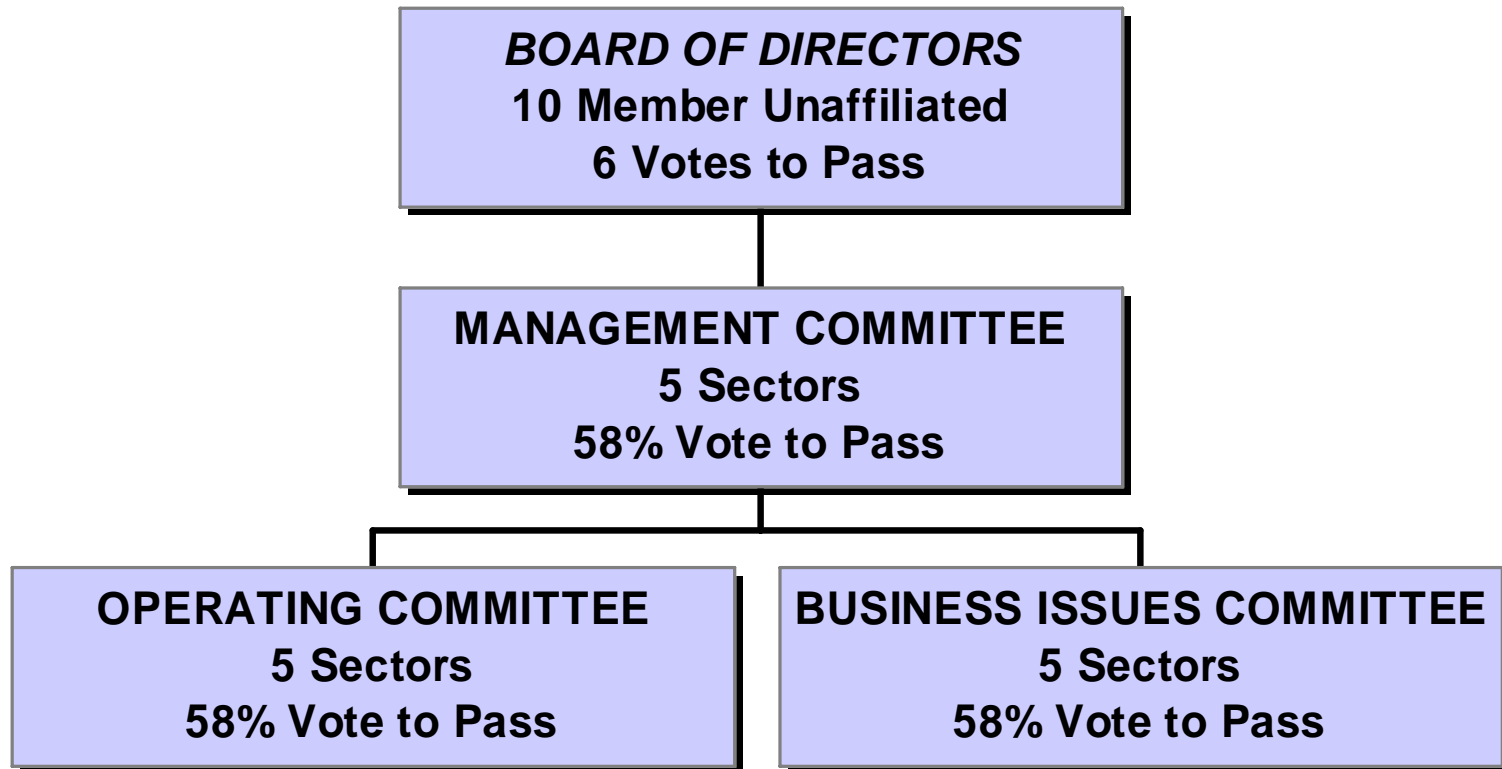>
> ✓ *Required Installed Capacity 37,715 MW (2005)*
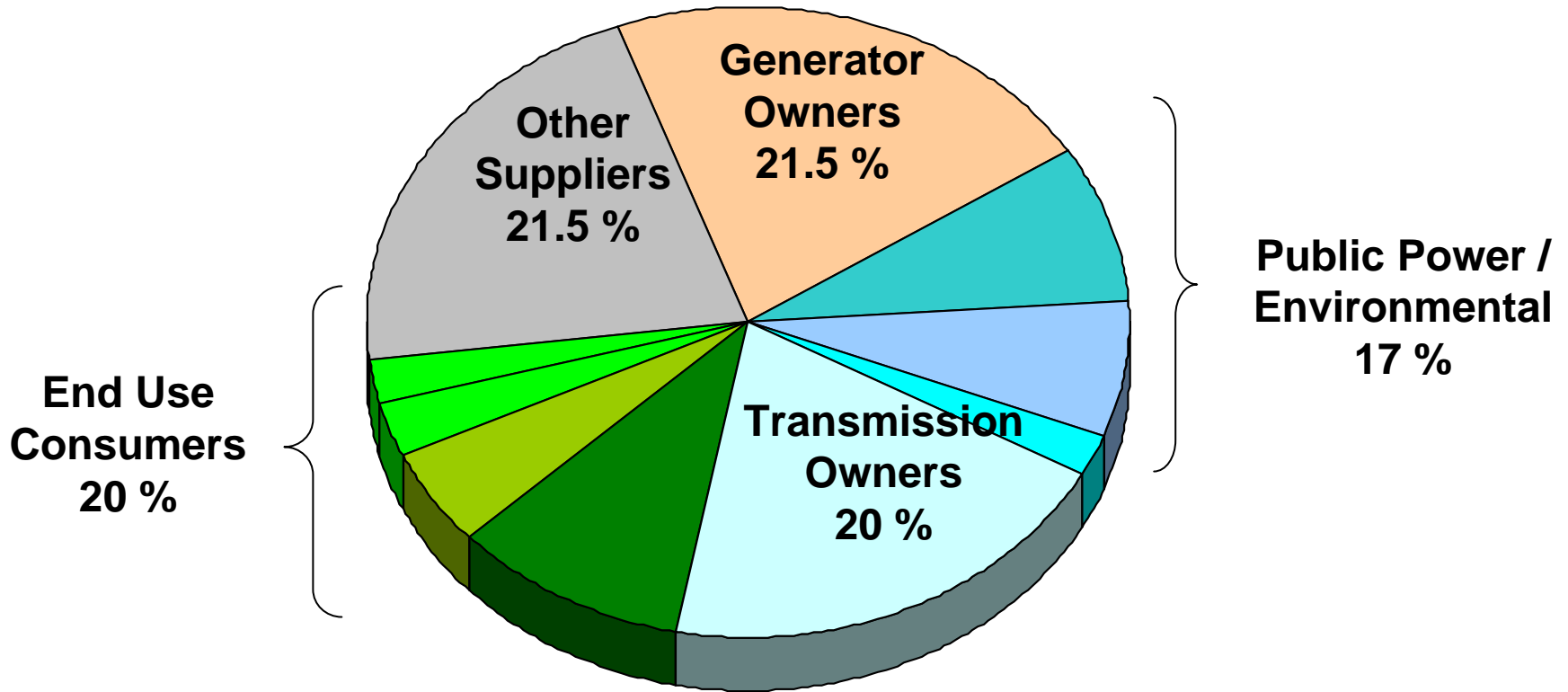
Overview – Energy by Fuel type 2004

GWh

- GAS - 12387
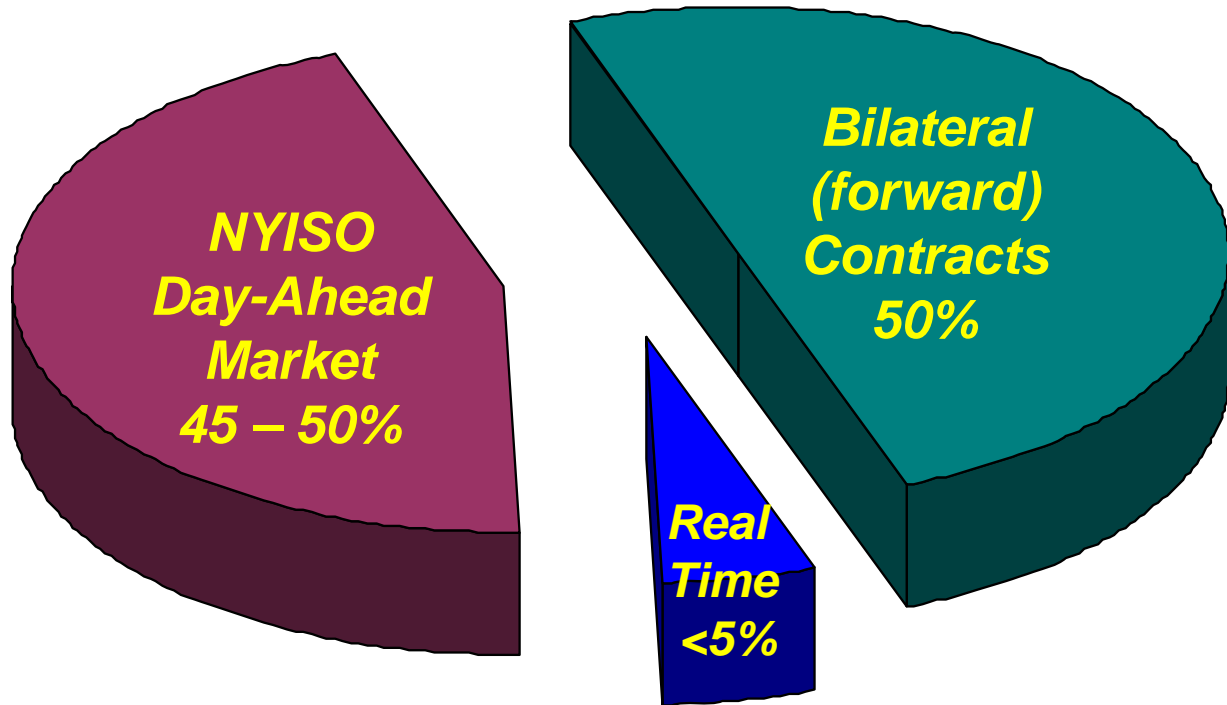- OIL - 939
- GAS & OIL - 40087
- COAL - 22536
- HYDRO - 28153
- NUCLEAR - 40626
- OTHER - 2443

Overview - The NYISO Governance

BOARD OF DIRECTORS
10 Member Unaffiliated
6 Votes to Pass

MANAGEMENT COMMITTEE
5 Sectors
58% Vote to Pass

OPERATING COMMITTEE
5 Sectors
58% Vote to Pass

BUSINESS ISSUES COMMITTEE
5 Sectors
58% Vote to Pass

NYISO <u>Management</u>, <u>Operating</u> and <u>Business Issues</u> Committees Voting Sectors (58% of votes to pass)

Generator Owners 21.5 %

Other Suppliers 21.5 %

Public Power / Environmental 17 %

End Use Consumers 20 %

Transmission Owners 20 %

Overview -Buying Power in New York

Bilateral Contracts outside the NYISO Markets	*50%*
NYISO Day-Ahead Market	*45 - 50%*
NYISO Real-Time Market	*<u><5%</u>*
	100%

The NYISO - the Complete Market

✓ Majority of the State's Generation is Independently Owned

- Two Energy Markets
  - ↘ Day Ahead
  - ↘ Real – Time
- Additional Markets Administered by the NYISO
  - ↘ Installed Capacity (ICAP)
  - ↘ Transmission Congestion Contracts (TCC's)
  - ↘ Reserves
  - ↘ Regulation

Overview - RTS Architecture

✓ Real-Time Scheduling (RTS)

- Real-Time Commitment (RTC)
  - ↘ Scheduling/commitment/de-commitment evaluation every 15 minutes.

- Real-Time Dispatch (RTD)
  - ↘ Co-optimization of energy, reserve & regulation every 5 minutes in real-time

- Corrective Action Mode (RTD-CAM)

Overview - RTC and RTD Time Lines

✓ Real-Time Commitment (RTC)

- Executes every 15 minutes, schedules in 15 minute increments
- Optimizes over 10 hr 15 min periods – total 2 hr 15 min hours
- Schedules Transactions
- Initially hourly, supportive of 15 minute schedules
- Commits 10 and 30 min start resources
- Recognizes unit startup times and costs

✓ Real-Time Dispatch (RTD)

- Executes every 5 minutes, optimizes over a 50, 55 or 60 minute period
- Incorporate transaction schedules and self-schedules
- Dispatches resources committed by RTC
- Determines reserve and regulation schedules

Overview – RTD-CAM

✓ Corrective Action Mode

- Run on-demand by the system operators
- RTD pricing suspended - generate power in an emergency type of event

✓ RTD-CAM execution options include

- Reserve pickup
- Max Gen pickup
- Base points ASAP, no commitments
- Base points ASAP, commit as needed
- Re-sequencing

Market Benefits of RTS

Market Features Incorporated	Market Efficiencies
▪Robust Ancillary Service Markets ▪Increased Control Area Interchange ▪Greater Security and Flexibility ▪Increased Capabilities for Demand Response	▪Ancillary Service market pricing and settlement ▪Improved in-day scheduling and dispatch ▪Long-term incentives for generation expansion and load responsiveness
Market Leadership	Solution Quality
▪Build upon strength of SCUC ▪Establish NYISO markets as a design in an SMD leadership role	▪Improvements in billing, metering and auditability ▪Delivers software modification and enhancement flexibility

Benefits to NY of SMD/RTS

Operational Improvements	Reliability Enhancements
▪15 minute unit and transaction scheduling (where possible) ▪Forward looking unit ramping ▪Reduced Out-of-Merit ▪Improved GT management	▪15 minute reliability assessments ▪Consistent security analysis routines ▪Minimize seams issues ▪Reduce need for reserve pickups
Architecture	Tools
▪Improved system reliability ▪Integrated fail over and redundancy ▪Simulator / Training Environment	▪State Estimator ▪Load Forecast ▪Market power analysis study mode

Market Efficiency & Uplift Benefits

✓ Two settlement system for Ancillary Services

- Loads purchase full ancillary service requirement in the day-ahead market.

- Real-time balancing obligation lies with suppliers with a day-ahead schedule.

- Eliminated additional costs due to re-optimization or procurement of replacement services in real-time.

✓ Load forecast at 15 minute increments – more robust real-time tool – provides greater refinement

✓ 15 minute commitment/de-commitment and scheduling of supply

- 10 & 30 minute start resources are brought online closer to when they are actually needed.

- Minimizes delay in shutting down uneconomic resources that have run out their min-run times

Market Efficiency & Uplift Benefits

✓ Units dispatched and responding consistent with pricing

- ▪ RTD ability to re-optimize dispatch of energy, reserves and regulation every 5 minutes.

✓ 3-part bidding in real-time

- ▪ Start-Up, Min Gen Cost & Incremental Cost are part of RTC and RTD-CAM evaluation to commit fast-start resources.

✓ Real-Time Demand Response for Reserves

- ▪ Loads capable of responding and exposed to real-time prices would receive the reserve clearing price for the option to call on them and avoid high energy prices when actually dispatched.

Generator Bidding Features

✓ General Bidding Features

- 3-part bidding (startup cost, minimum generation cost and incremental energy cost) permitted for all units in real-time.

✓ Startup Cost Bid

- Startup cost as a function of the number of hours since shutdown (increasing or decreasing) or a unique startup cost for each hour of the day.

✓ Minimum Run Time

- The minimum amount of time for which an energy resource can be committed. The values allowed in RTC can be as little as 15 minutes to a maximum of 1 hour.

Generator Bidding Features

✓ Startup Time

- ▪ The time needed start and synchronize the resource and load the resource to its minimum generation level. RTC can commit resources with a startup time of 30 minutes or less.
  - ↘ This provides an improvement over current capabilities by allowing for scheduling closer to real time conditions.

✓ Self-Schedule MWs

- ▪ A self-scheduled unit will provide a single self-scheduled MW value for a given hour in the day-ahead market.

- ▪ In RTS, self-scheduled units may provide a different MW value for 15 minute period in a given hour.

- ▪ The unit will be pre-ramped such that it arrives at it's self-schedule level for the specified 15 minute period.

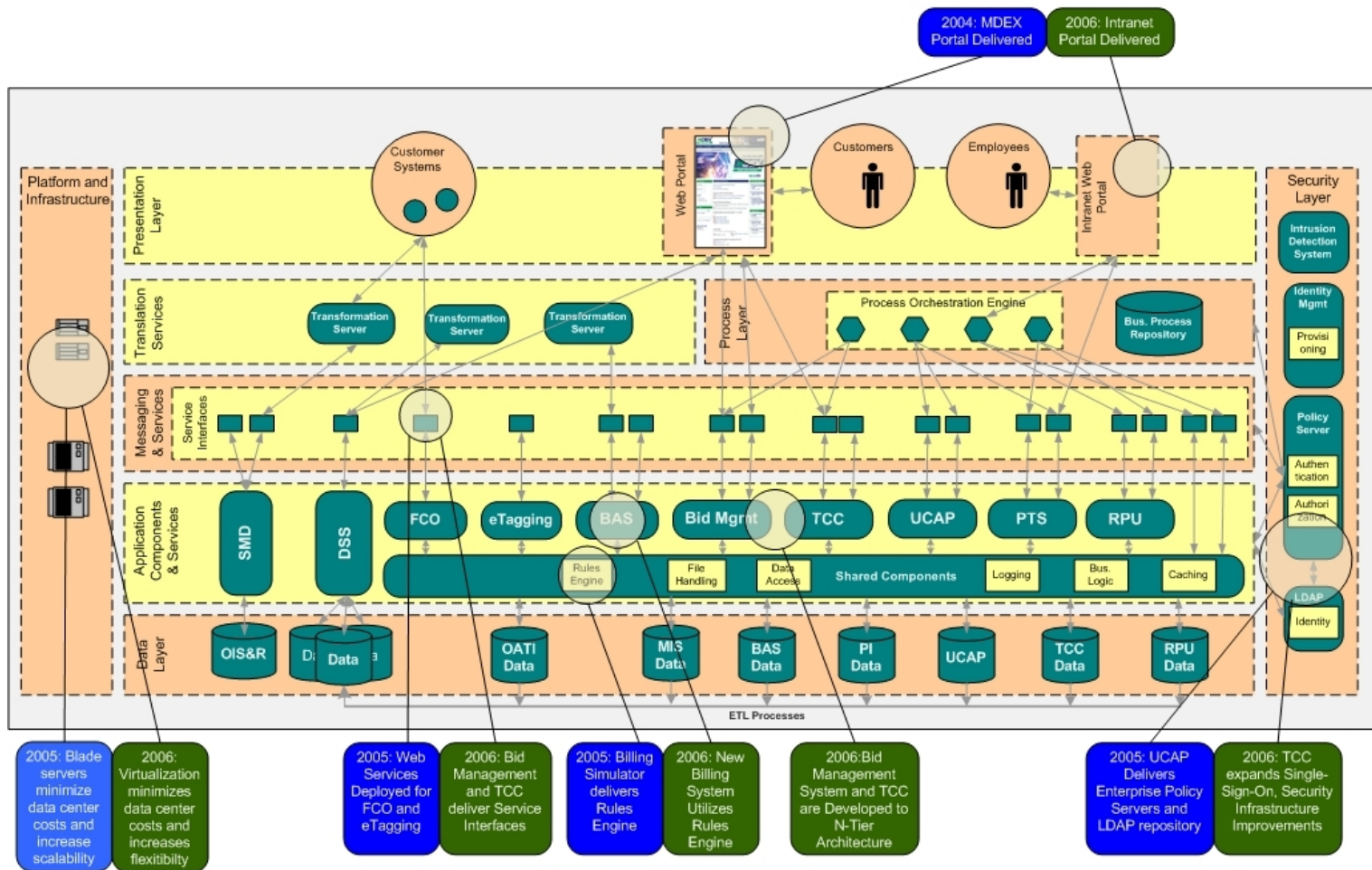- ▪ Self-schedule levels will be financially binding.

SMD System Flow
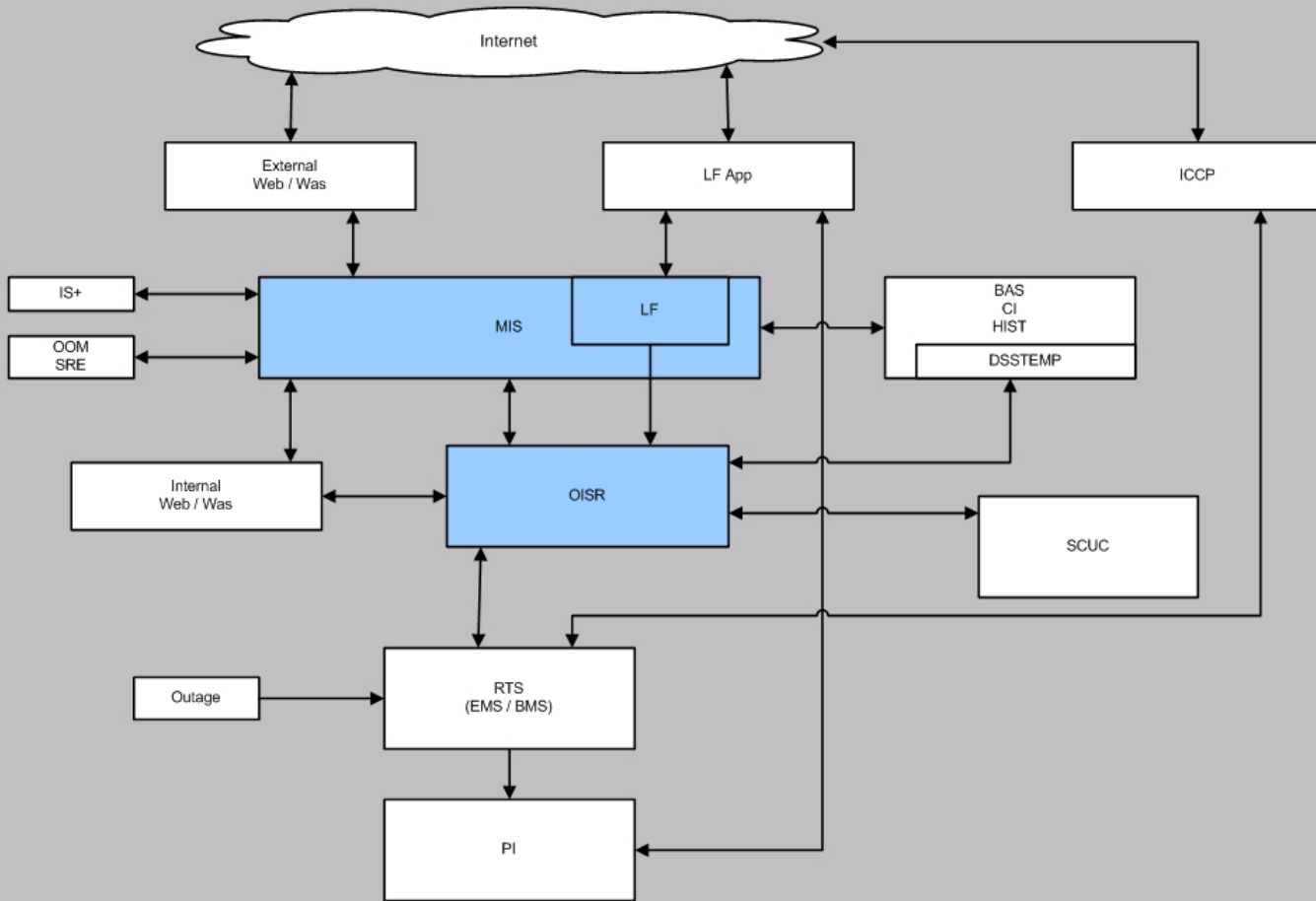
NYISO 2006 Architecture

ISO / RTO Challenges

- ✓ Vendor Constraints
  - ▪ FORTRAN based code
  - ▪ Tru64 primary Operating System
  - ▪ Closed Architecture

- ✓ Scalability of Software/Technical Architectures
  - ▪ Lack of rules based computing
  - ▪ Client-server
    - ↘ Embedded business logic
    - ↘ Oracle SQL

- ✓ Lack of standards across control areas
  - ▪ Web Services, EAI, BPM

- ✓ No consistent architecture across vendors and control areas

Other NYISO Challenges

- ✓ Regulatory and Audit
  - ▪ Must meet increasing scrutiny
  - ▪ FERC, NERC, SOX, SAS70
  - ▪ Board of Director driven Internal Audit Function

- ✓ Data Management
  - ▪ Ongoing need to convert data to accessible timely information

- ✓ Non Optimized Processes
  - ▪ Lack of Automation – manual intervention in a complex evolving market

ITC Initiatives

✓ ITC's two primary working groups (Architecture Working Group and Security Working Group) collaborated to promote standards and guiding principles

   ▪ AWG - Increase ability of members to share information in a common architectural model.

   ▪ SWG – Provide clear direction and guidance with respect to growing cyber security requirements.

✓ Data Initiative

   ▪ Provide a common documented model for the primary inputs, outputs, artifacts, dependencies and interface points of key systems that operate within all ISO/RTO's.

   ▪ Future facilitation of the de-coupling of systems that have often and been provided in a single vendor vertical with little opportunity for diversification.

ITC Initiatives

✓ Web Services

- ■ The exploding arena of web services called for an address of standards and best practices by ITC members.

- ■ Identify areas where standards could be agreed upon - determine areas that need further clarification, collaboration (beyond ITC).
  - ↘ Competing bodies and standards continue to be discussed

✓ Visualization

- ■ Enable the sharing of data across ISO/RTO's providing an architectural model, documentation and working POC.

- ■ This effort is done in partnership with vendor SGI.

- ■ The project completes with the delivery of the POC and all associated architectural models and documentation.

- ■ The ITC will analyze the initiative's outcomes and make decisions as to next steps including possible extension of POC into production.
  - ↘ Executed via a multi generational plan

ITC Initiatives

✓ Redbook

- A comprehensive body of documentation was compiled from the working of archives of all ISO/RTOs in order to provide a single-source binder or library.

- The source documentation for the binder was obtained from dynamic electronic (web-based) sources – living documents.

- A hardcopy binder was presented near year-end 2005 and considered completed.

✓ CIP 02-09 / NERC 1300

- Extension of current NERC 1200 standards.

- Resource estimates and / or requirement are expected to be completed in '06.

- Implementation expected in '07

Future Direction of NYISO

✓ Move to an open agile model across platforms and systems

- Continuing transition to N-tier
- Host based virtualization

✓ Rules based architecture / engines to address ongoing needs and complexity through initiatives

- Re-design BAS (Billing and Accounting System) leveraging Billing Simulator implemented technology

✓ Vendor Relationship Management

- Seek strategic, non-exclusive partnerships
- BEA Web Logic, TIBCO

Future Direction of NYISO

✓ Continue to focus on Quality

- ▪ Ongoing internal documentation, research and implementation of "Best Practices"

- ▪ Refine Standards and governance
  - ↘ Quality initiatives – Lean Six Sigma
  - ↘ Continual refinement of SDLC

✓ Address Lack of Automation

- ▪ Major initiatives to automate manual processes
  - ↘ (i.e., UCAP, TCC)

✓ Questions?