

# PUB Technical Conference

Business Operations Capital

&

Asset Management

July 20, 2017

# Purpose & Disclaimer

- Introduction to MH business & capital practices
- Common basis of understanding & language
- Informal and interactive
- Work in process - journey

# Outline

- Manitoba Hydro Operations & Assets
- Asset Management
- Business Operations Capital planning process
- Forecasting Asset Replacement

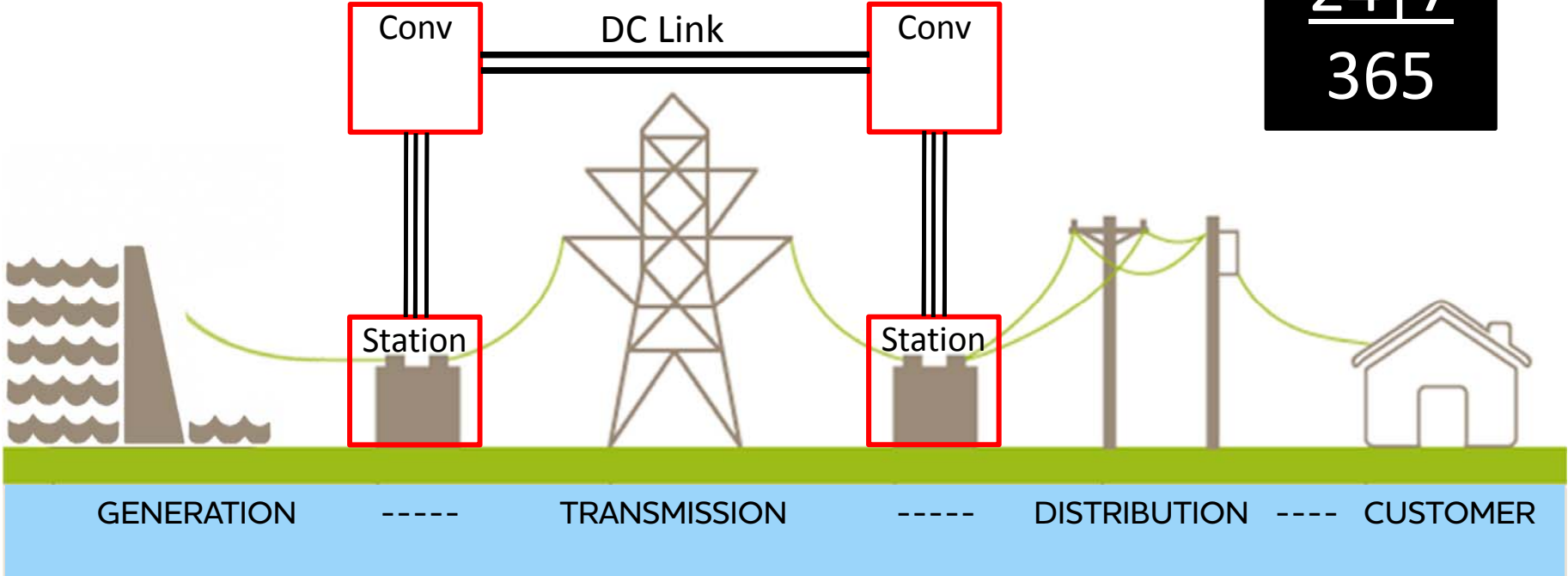
# Glossary

- Black start
- System Stability
- Capacity
- Sustainment
- Reliability
- Effective age
- Economic end of life
- PAS 55
- ISO 55000
- Asset Investment Planning (AIP)
- Corporate Value Framework (CVF)
- Portfolio

# Operations & Assets

# Supply Chain

24 | 7  
365



Small Number of High Cost Assets

Complex Assets & Assets Spanning MB

High Number of Low Cost Assets



# Operational Objectives

## Distribution System

- Existing customer delivery
- New customer connection

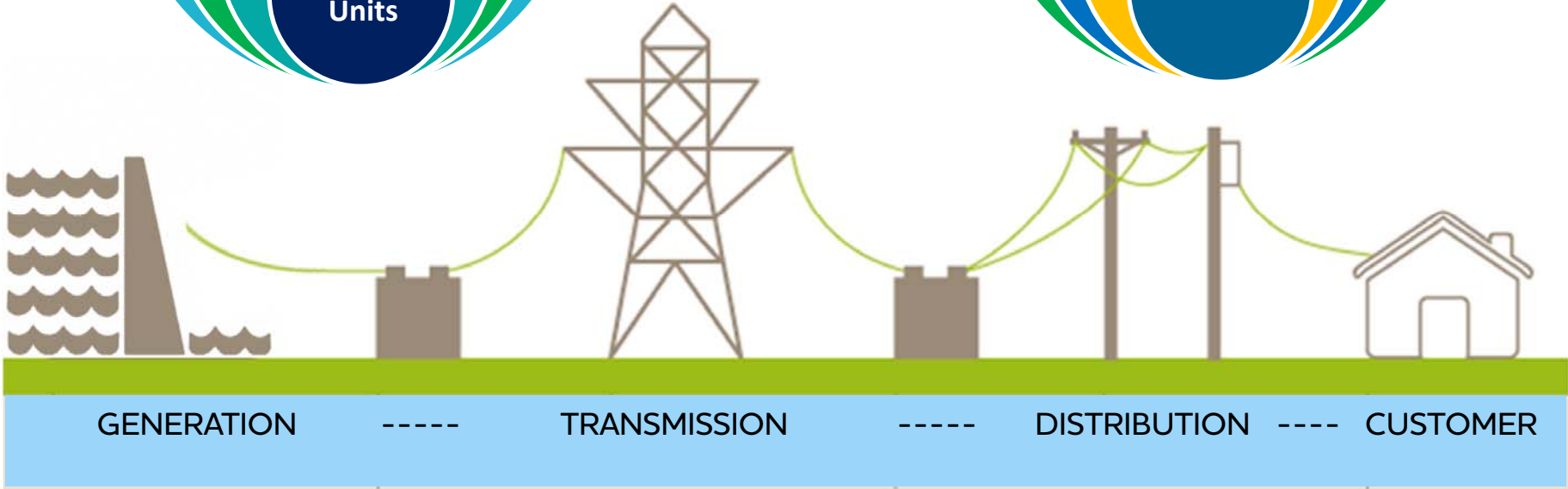
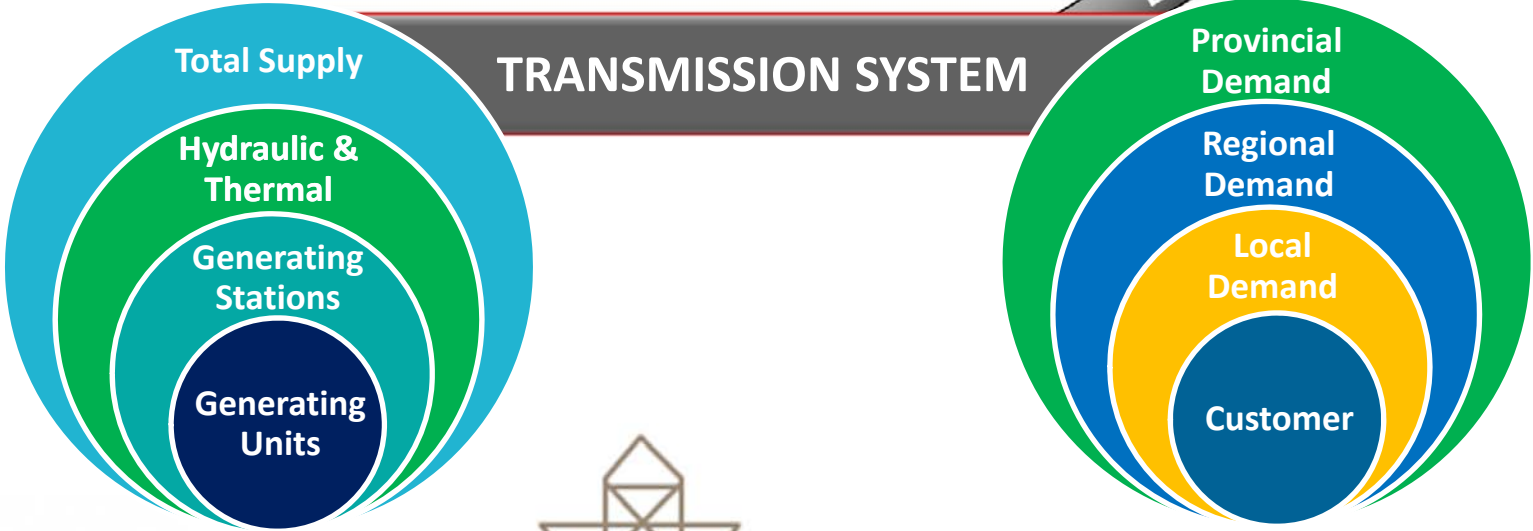
## Transmission System

- Regional energy delivery
- Electric system reliability

## Generating System

- Supply Manitoba load
- Generate revenue from surplus energy

# Supply Chain





# Generating Unit Duty



SUPPLY LOAD &  
REVENUE



STABILITY  
e.g. LOAD BALANCING



OPERATIONS  
e.g. SYSTEM FLOW

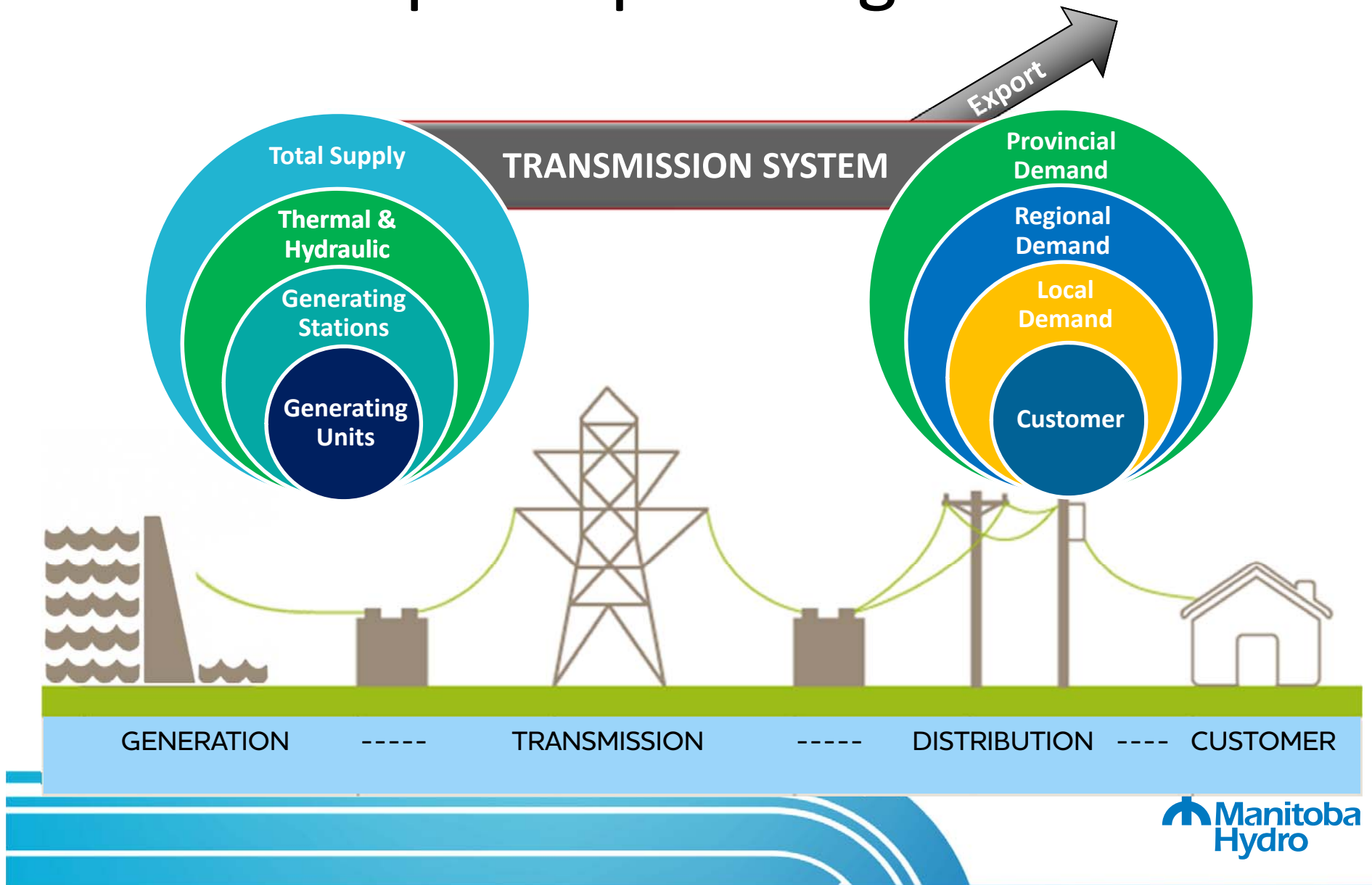


RELIABILITY  
e.g. FUEL VARIATION

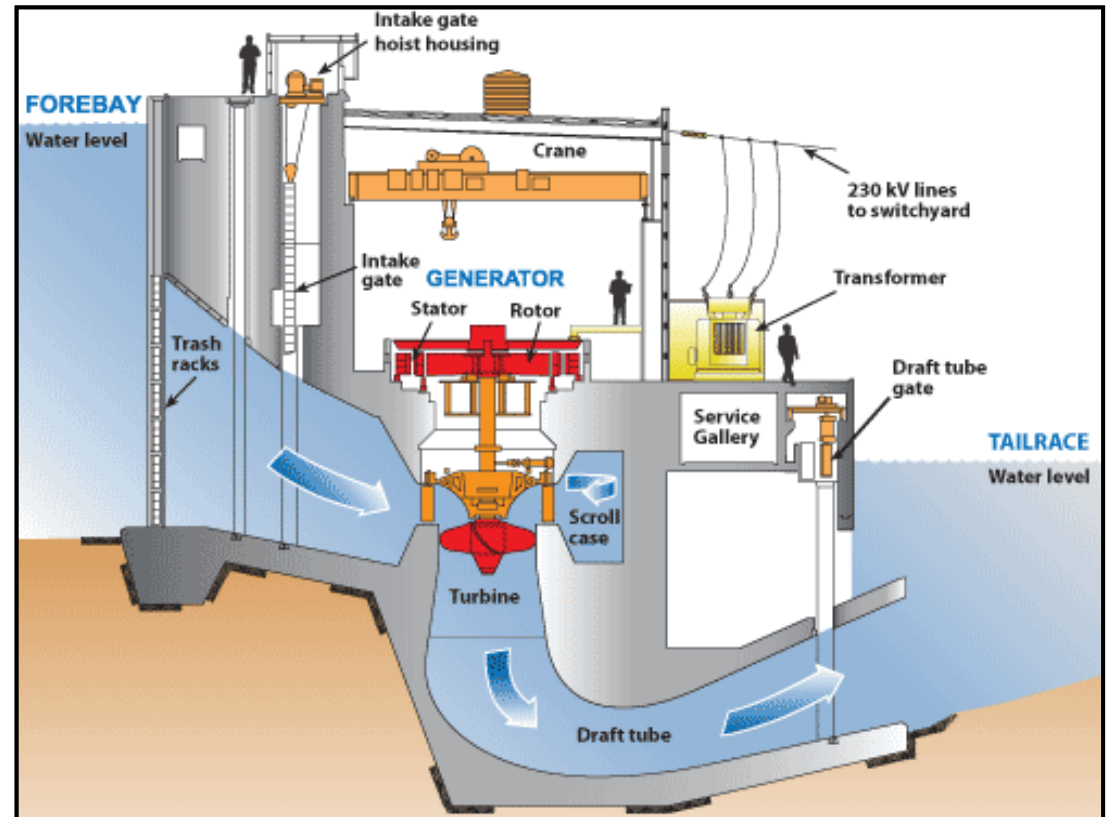
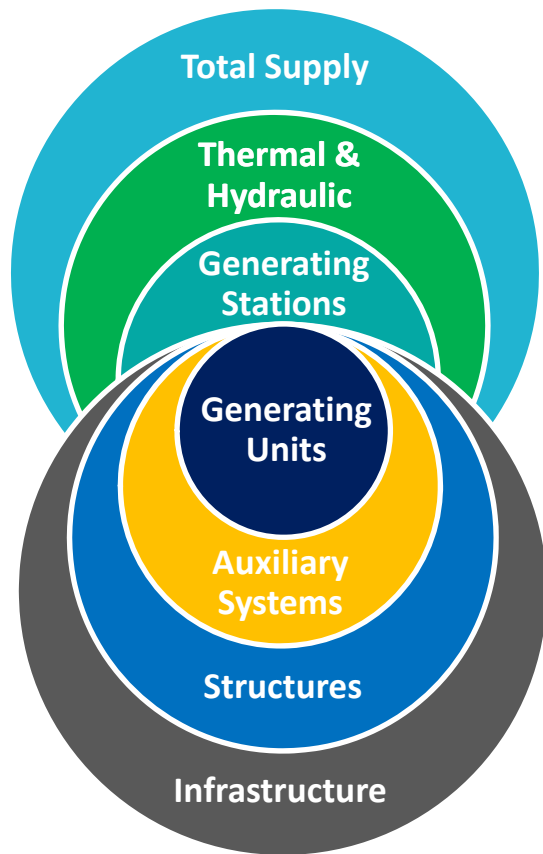


BLACKSTART

# Example: Operating Context



# Example: Operating Context



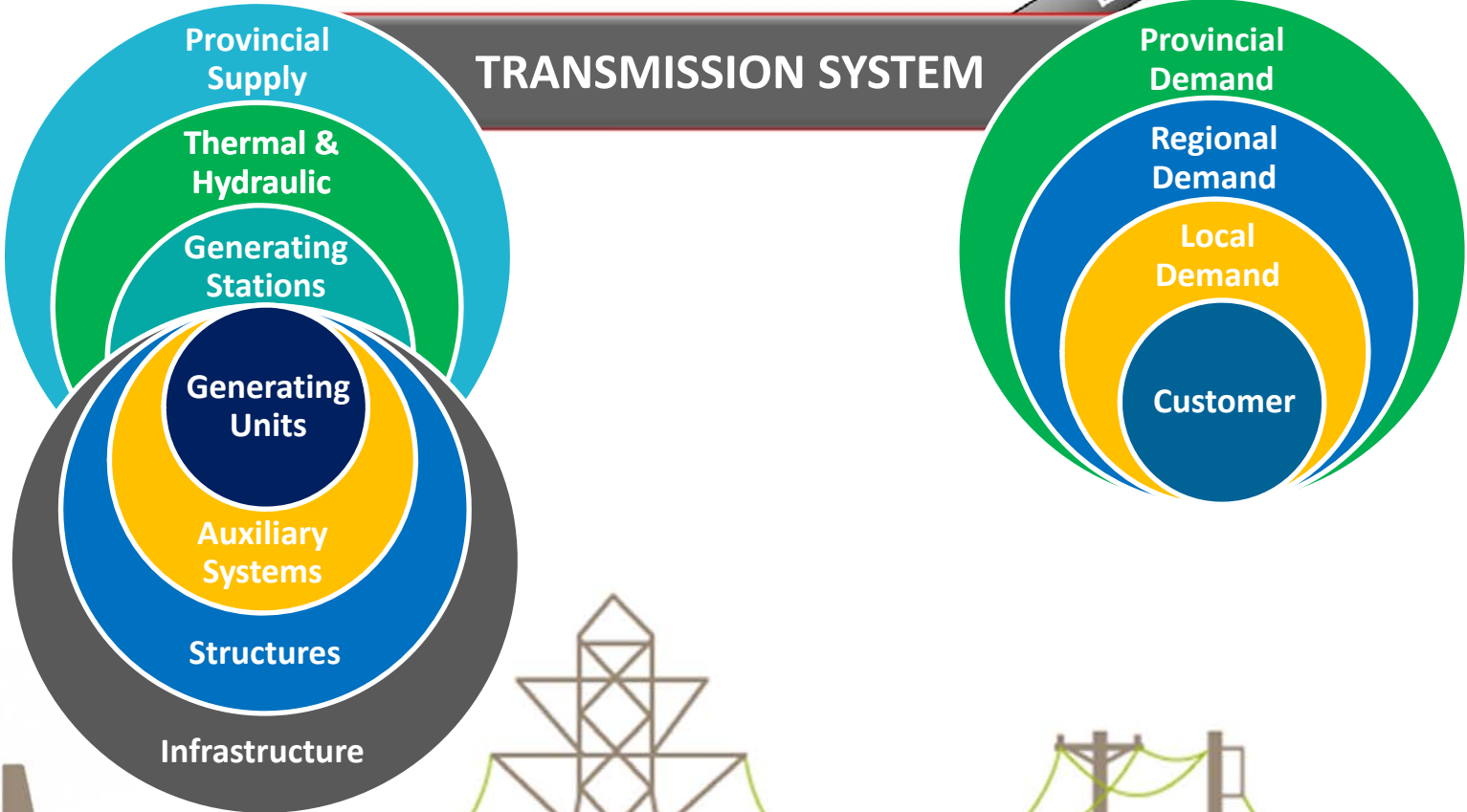
# GS Structures & Infrastructure



## Kelsey Generating Station

- Water control: spillway, dams, dykes
- Electrical: switchyard, transmission, local distribution
- Buildings: Staffhouse, camp, shops, storage
- Municipal: drainage, water treatment, wastewater, solid waste management
- Communications: tower, fibre
- Transportation: roads, airport

# Supply Chain



TRANSMISSION SYSTEM



GENERATION

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TRANSMISSION

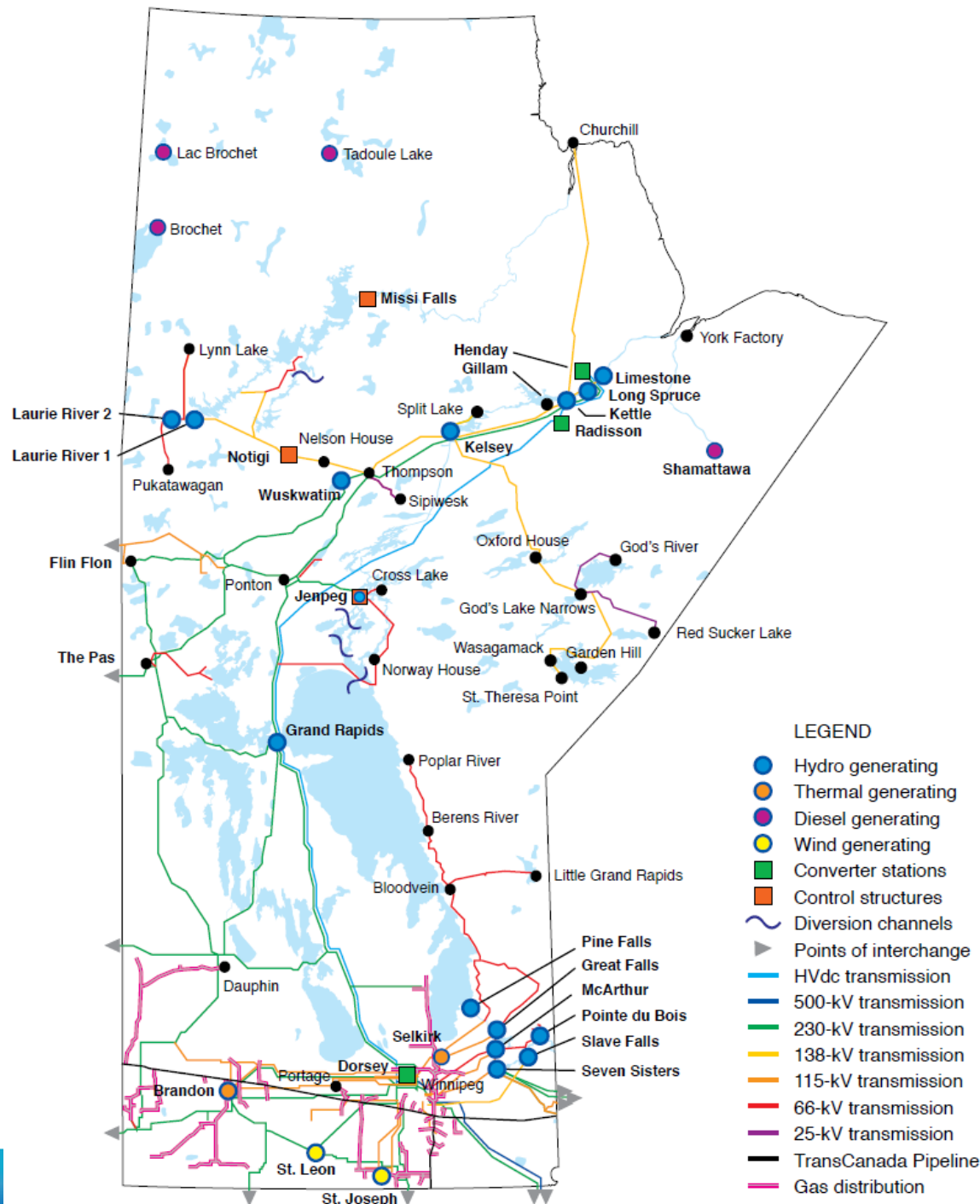
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DISTRIBUTION

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CUSTOMER

# Generation & Transmission Systems

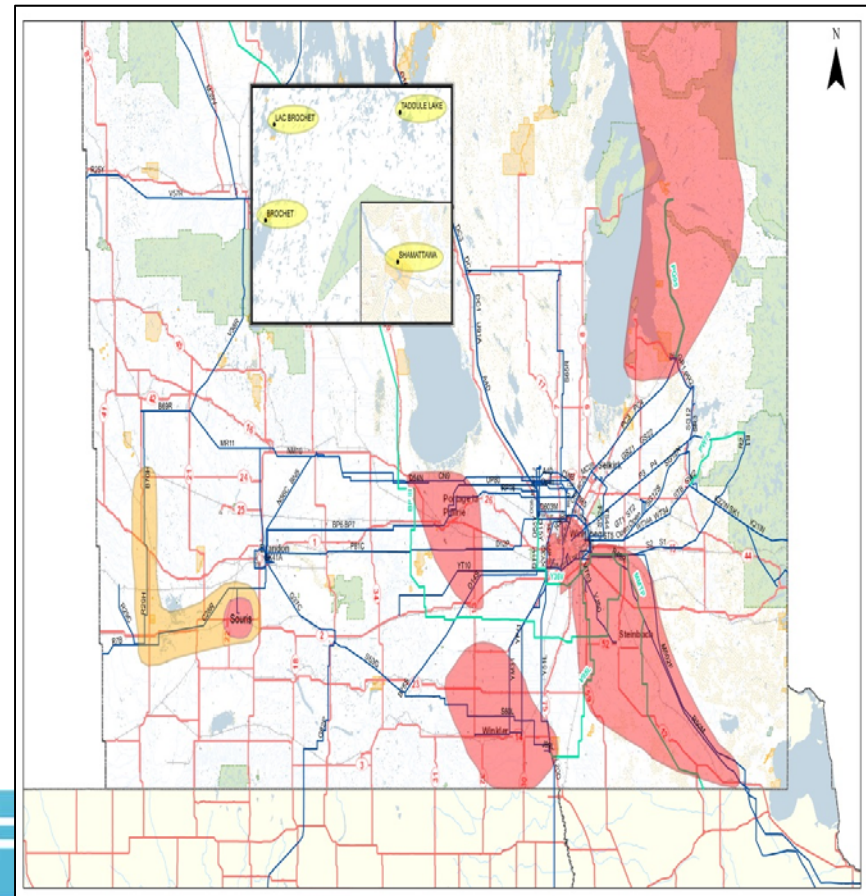


## Regional

- Northern supply
- Southern load
- Province wide delivery
- Varying density
- Remote assets

# Adequate Supply Insufficient Regional Capacity

- Hotspots of growth across Province
- Transmission & distribution system expansion required to serve growth



# System Investment

## Distribution

- Capacity expansion & deteriorating assets
- Highest need for renewal investment

## Transmission

- Capacity expansion for regional load growth
- Acceptable performance at current investment levels

**Large assets entering middle-age**

## Generation

- Sufficient capacity to serve load growth
- Acceptable performance at current investment levels



# Asset Management

# Asset Management Strategies?

## Proactive

- Replace before failure
- Significant in-service failure consequence
- Monitor degradation
- May defer or advance to smooth demand
- Example: Furnace, roof

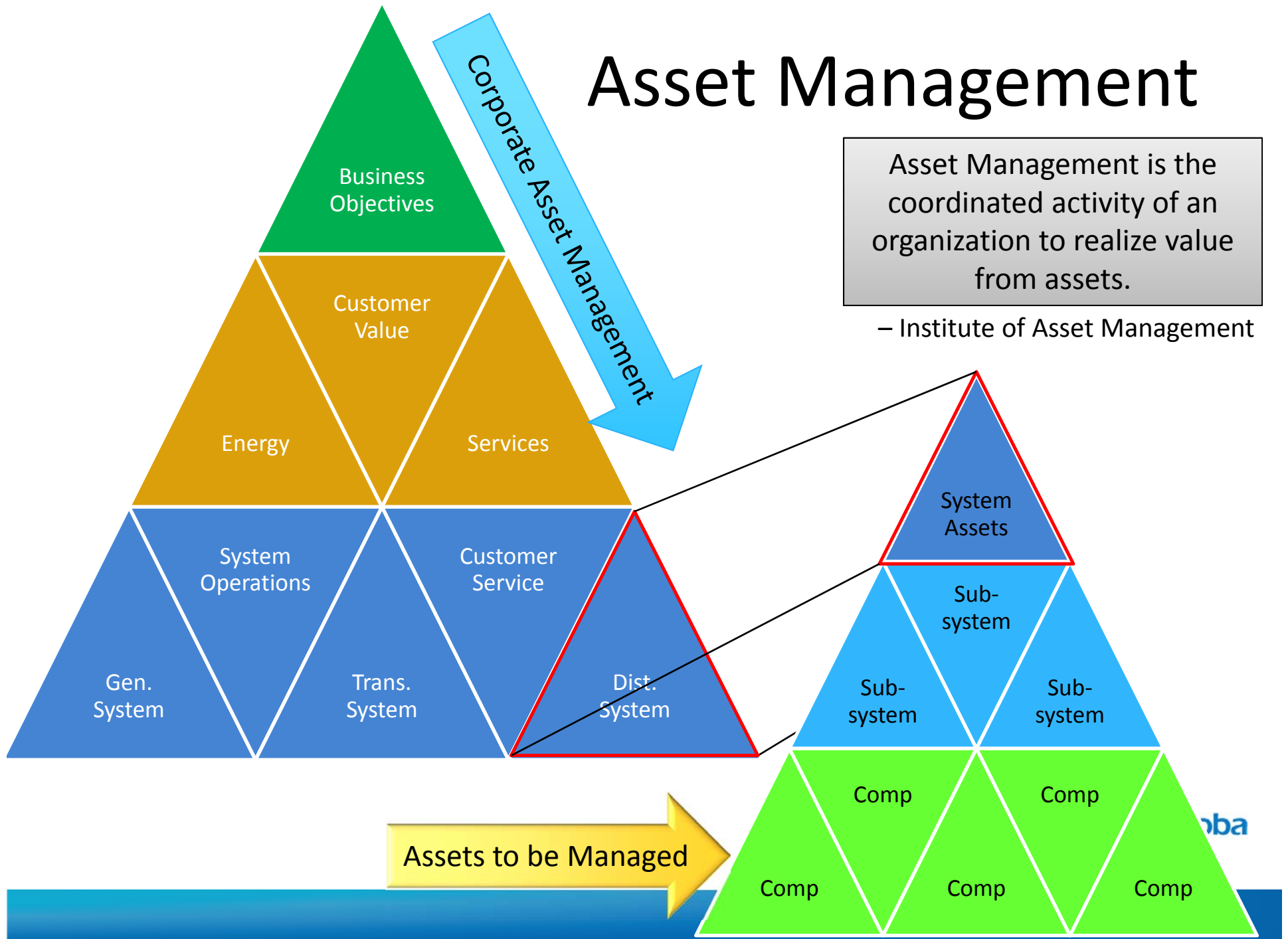
## Reactive

- Run to failure
- Manageable in-service failure consequence
- Life expectancy
- May advance to smooth demand
- Example: Hot water tank, windows

# Asset Management

Asset Management is the coordinated activity of an organization to realize value from assets.

– Institute of Asset Management



# Asset Management Journey

- Corporate Asset Management (CAM)
  - Centralization
  - Framework for business alignment
- Improvement to capital tools & processes
  - Asset investment planning
  - Capital portfolio management
  - Asset condition assessment

# Corporate Asset Management (CAM) Governance Structure

## CAM Executive Council

- Vice President level committee
- Chaired by Chief Finance & Strategy Officer
- Provides centralized vision and strategic direction
- Asset Owner

## CAM Steering Committee

- Director level Committee
- Chaired by the **Director of Strategic Business Integration**
- Executes MH's asset management development strategy
- Business owner for processes & tools

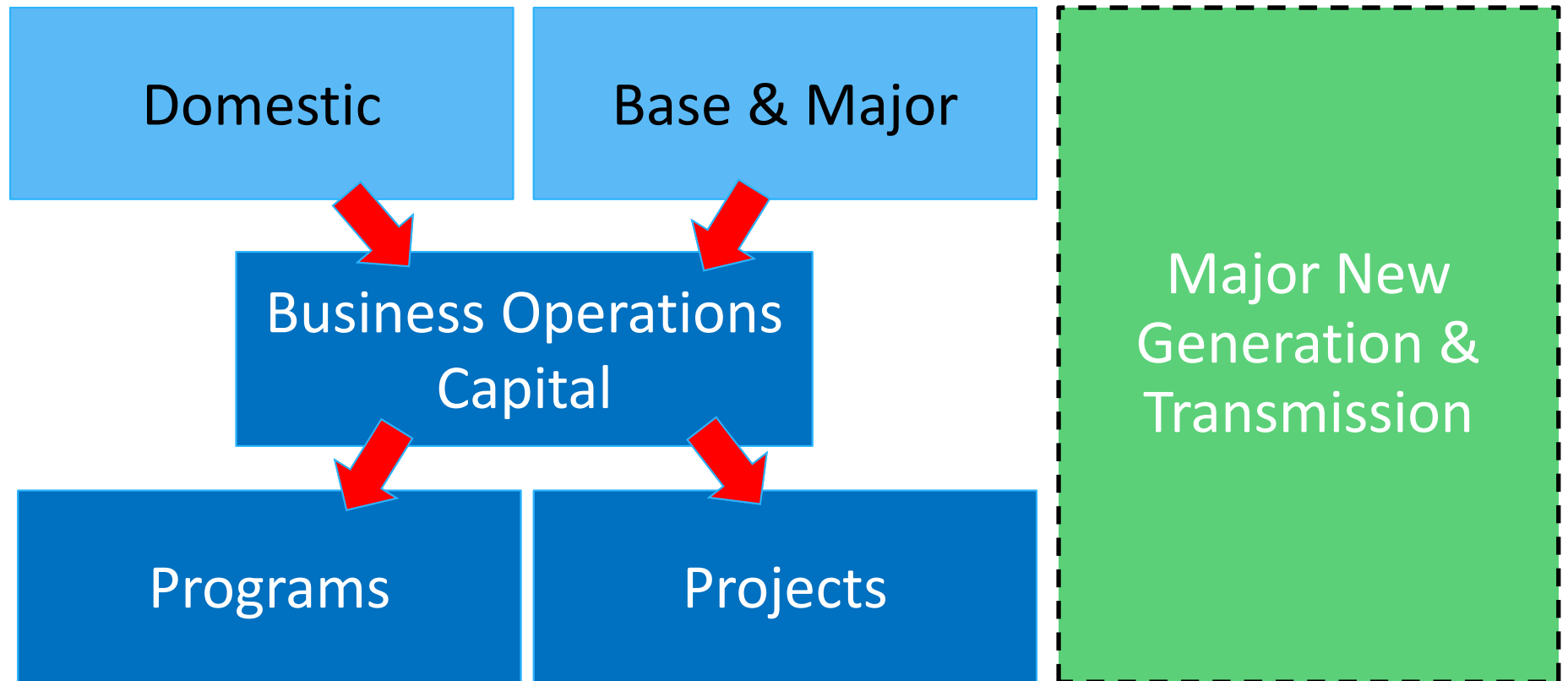
# Corporate Asset Management (CAM) Framework

- Phase 1
  - Review Asset Management practices at Manitoba Hydro
  - Gap assessment against industry best practices, PAS 55, and ISO 55000
  - Complete – Appendix 5.1 in GRA
- Phase 2
  - Development of AM strategy and policies
  - In-progress
- Phase 3
  - Development of Asset Management implementation road map
  - To be completed following Phase 2

# Business Operations Capital Planning Process

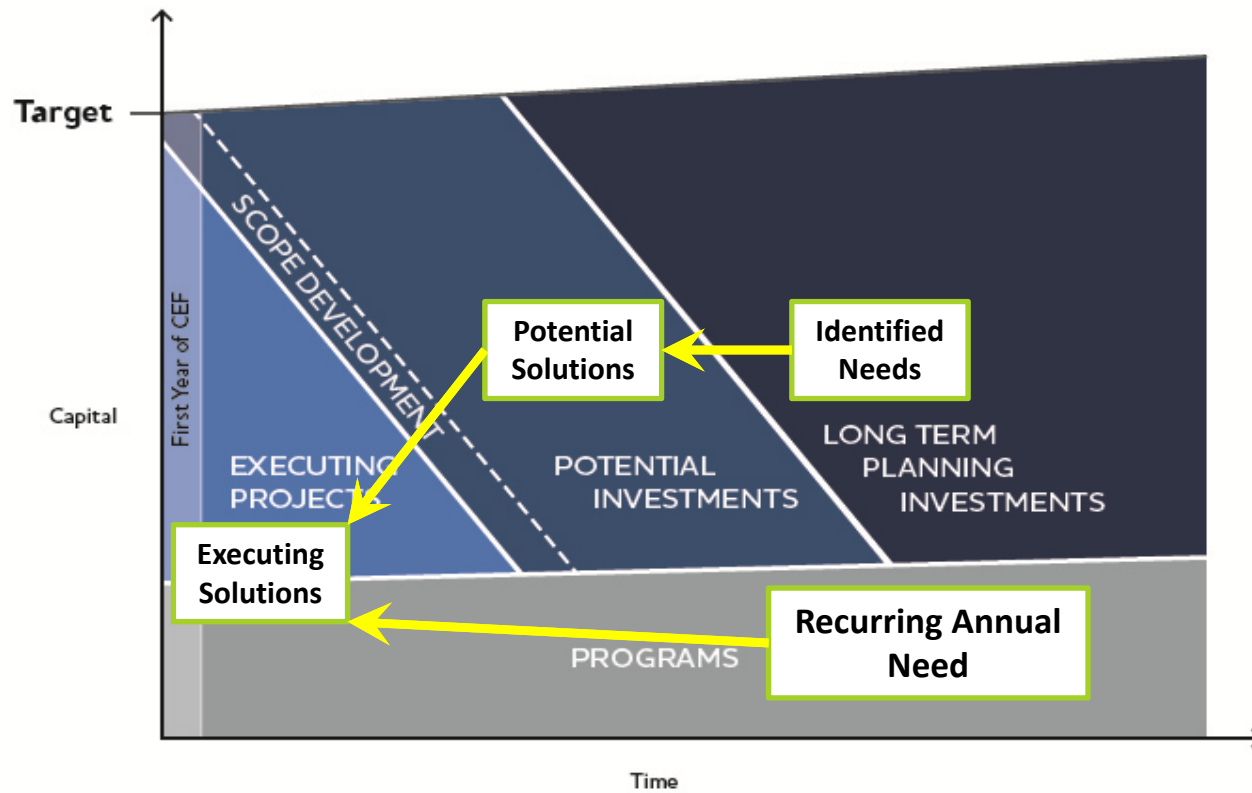
(excludes Major New Generation & Transmission)

# Changes to Capital Expenditure Categories





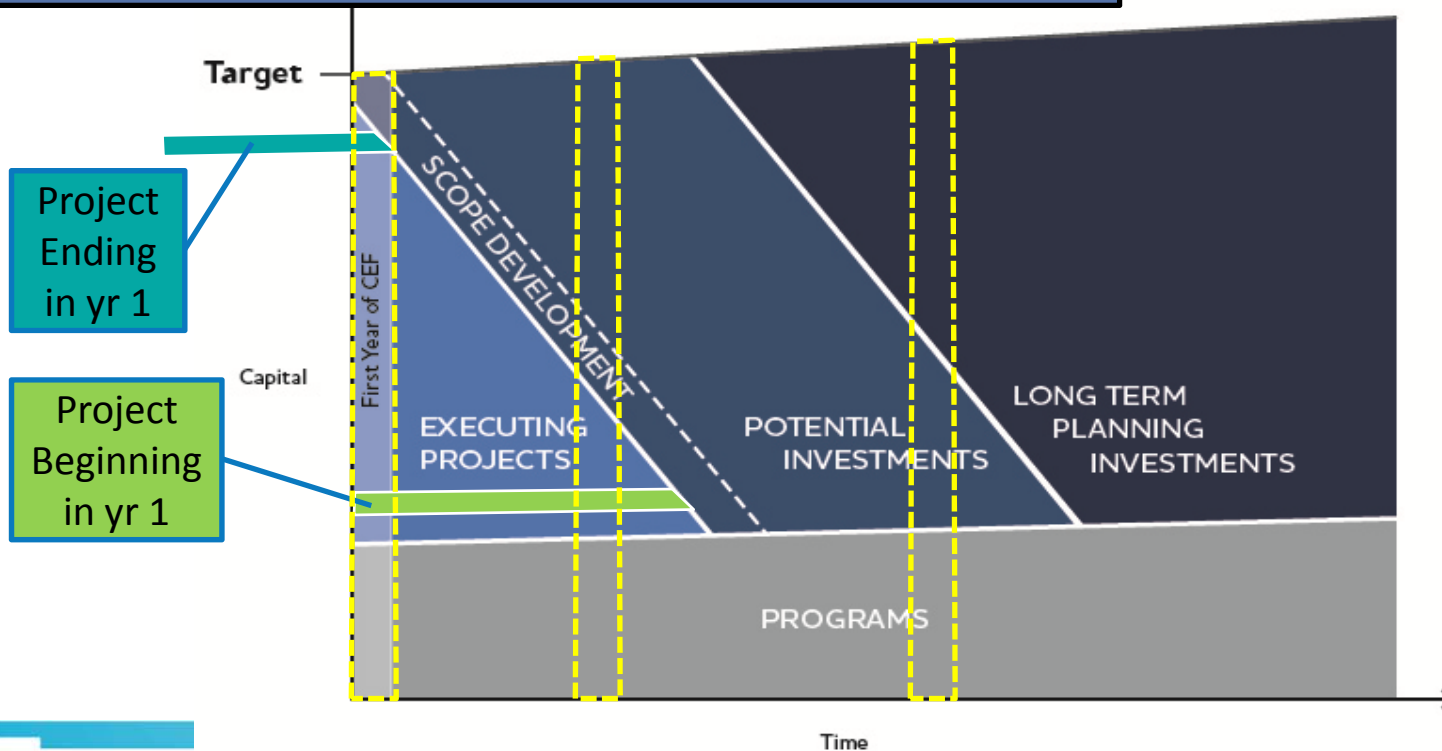
# Capital Planning Model



# Capital Expenditure Forecast (CEF) is a Snapshot in Time

**Potential Investments Portfolio**  
Projects and Scope Development under consideration

**Executing Portfolio**  
Projects in Flight + Yr 1 Projects Starts + Scope Development



# Capital Expenditures Forecast

- Portfolios:
  - Executing Projects
  - Potential Investments
  - Programs
- For each of:
  - Distributions
  - Transmission
  - Generation
  - Corporate Services (IT, Fleet, Facilities)
- Divided into investment categories

# Primary Investment Categories

## Capacity & Growth

- Investments required to expand Manitoba Hydro's generation, transmission, HVDC or distribution assets across the Province
- Provide for future load growth or address existing capacity concerns

## Sustainment

- Investments required to sustain the current and future performance capability of Manitoba Hydro's electrical system
- Address issue of degrading and obsolete assets

## Business Operations Support

- Investments that support business operations and are shared or common throughout the corporation
- Ex: IT investments, fleet, tools, administrative buildings

# Asset Investment Planning (AIP)

- Asset needs drive capital expenditures
- For immediate operational requirements
- For long term sustainability
- Balancing cost, performance and risk

# Asset Investment Planning

## Objective 1:

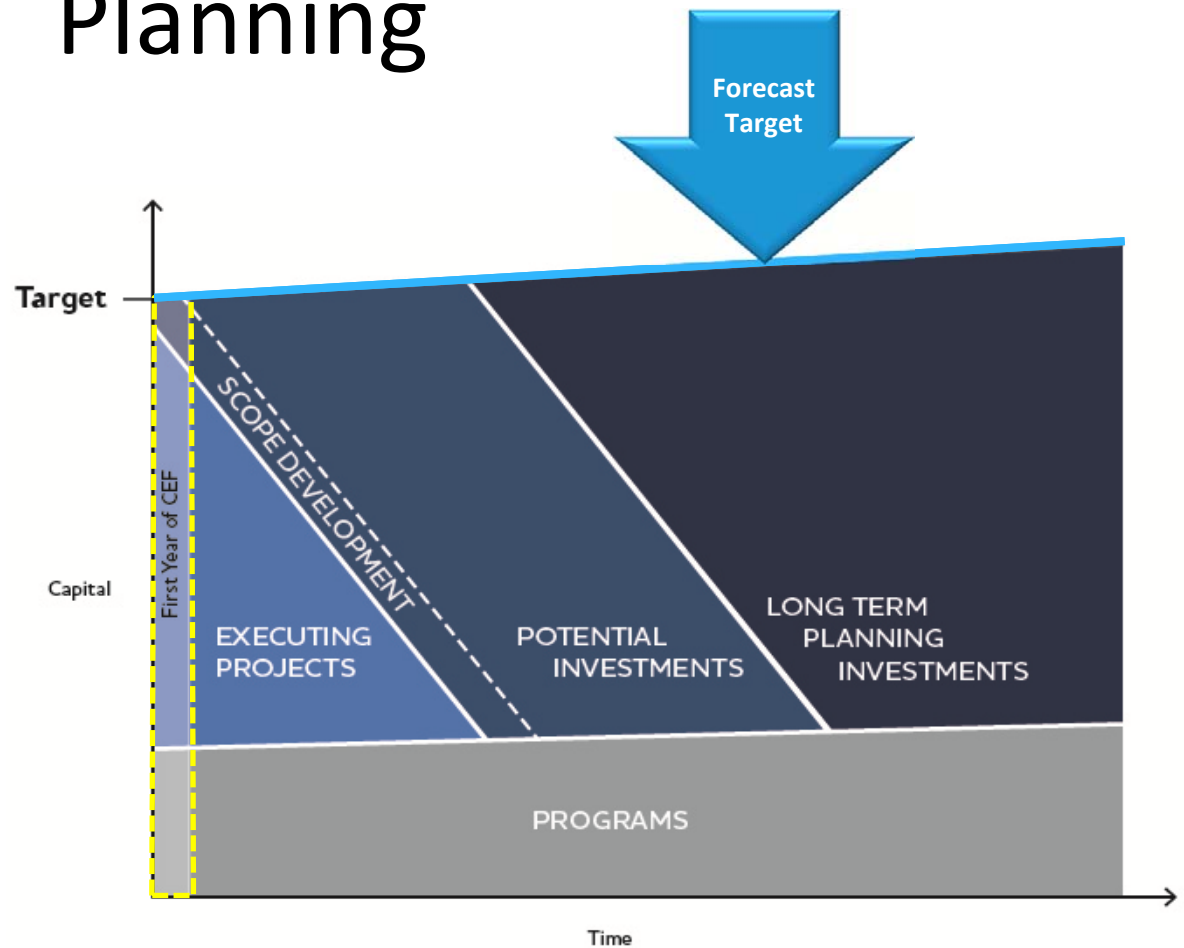
Optimize timing and scope of projects

## Objective 2:

Forecast long term capital investment requirements

Roadmap is under development

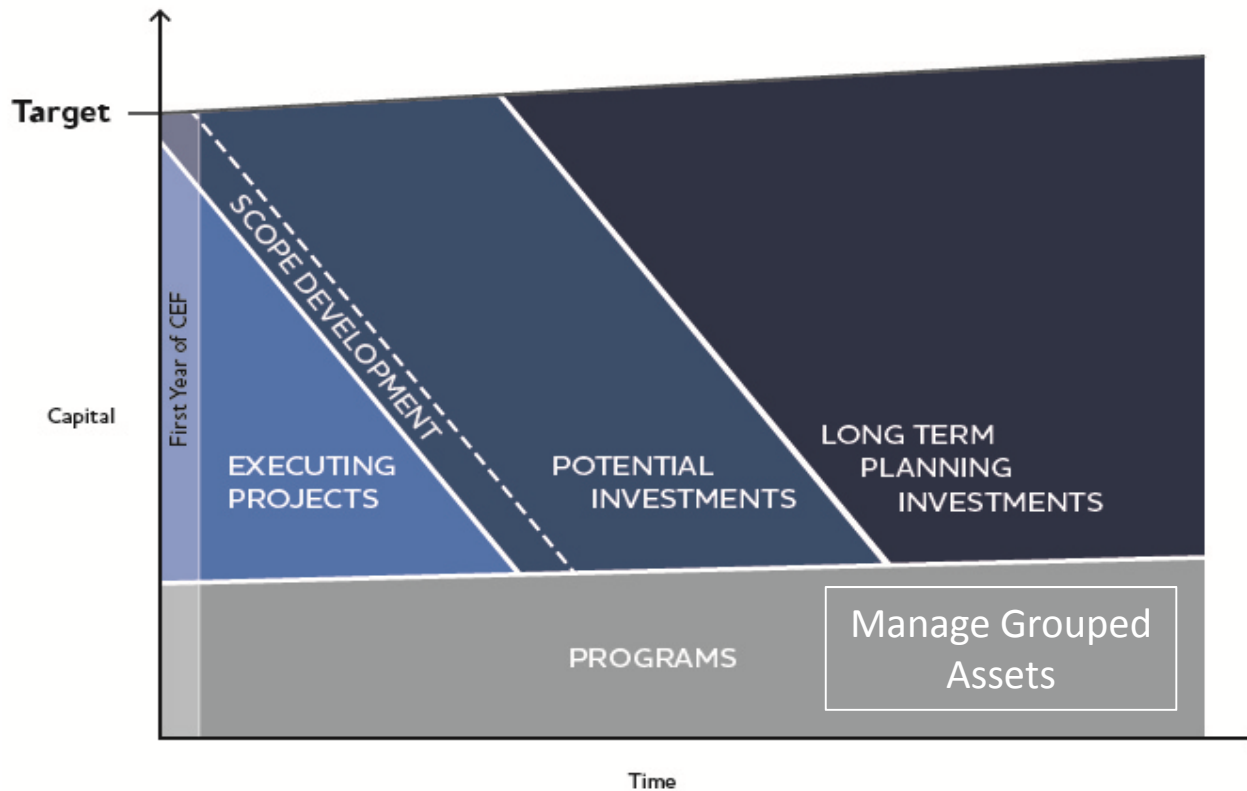
- Build processes, tools & data models
- Populate inventories, collect data
- Calibrate, refine & build proficiency



# Capital Portfolio Management (CPM)

- Based on capital planning model
- Standardization of tools and processes
- Implementation of Asset Investment Planning (AIP) technology - Copperleaf C55
- Development of Corporate Value Framework (CVF)
- Roll out complete by end of 2017

# Asset Investment Planning

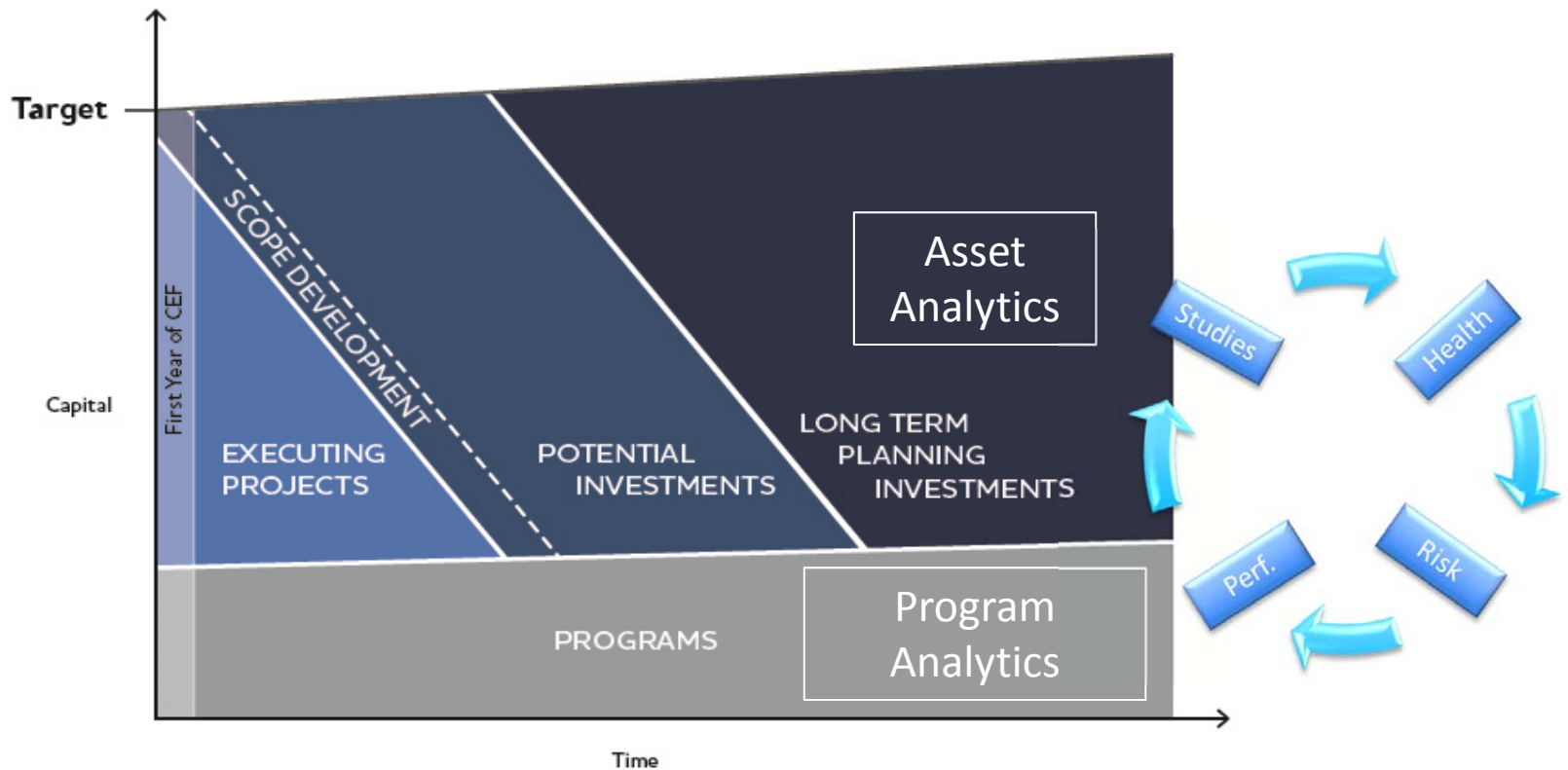




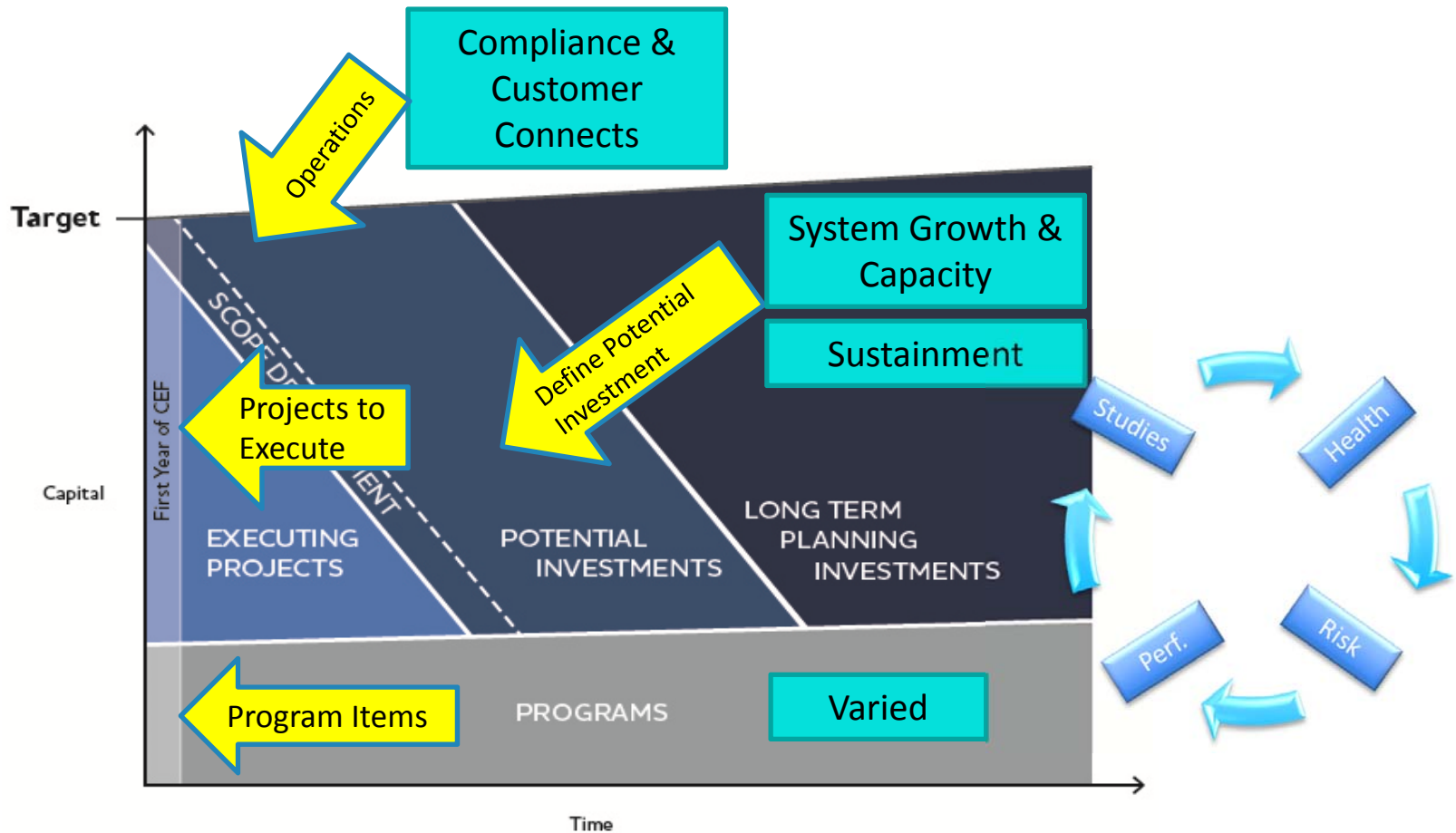
# Programs: Grouped Assets

- Grouped by class or by function
- Examples:
  - Annual replacement for population sustainability
    - Wood poles
  - Life extension
    - U/G cables
  - Run to fail
    - O/H transformers
- Capital expenditures forecasted based on:
  - Population sustainability
  - Projected failure rates

# Asset Investment Planning



# Planning to Execution



# Planning to Execution

## Potential Investments

- Multiple alternative solutions under consideration
- Each with:
  - Scope
  - Schedule
  - Budget
  - Value assessment
- No firm start date

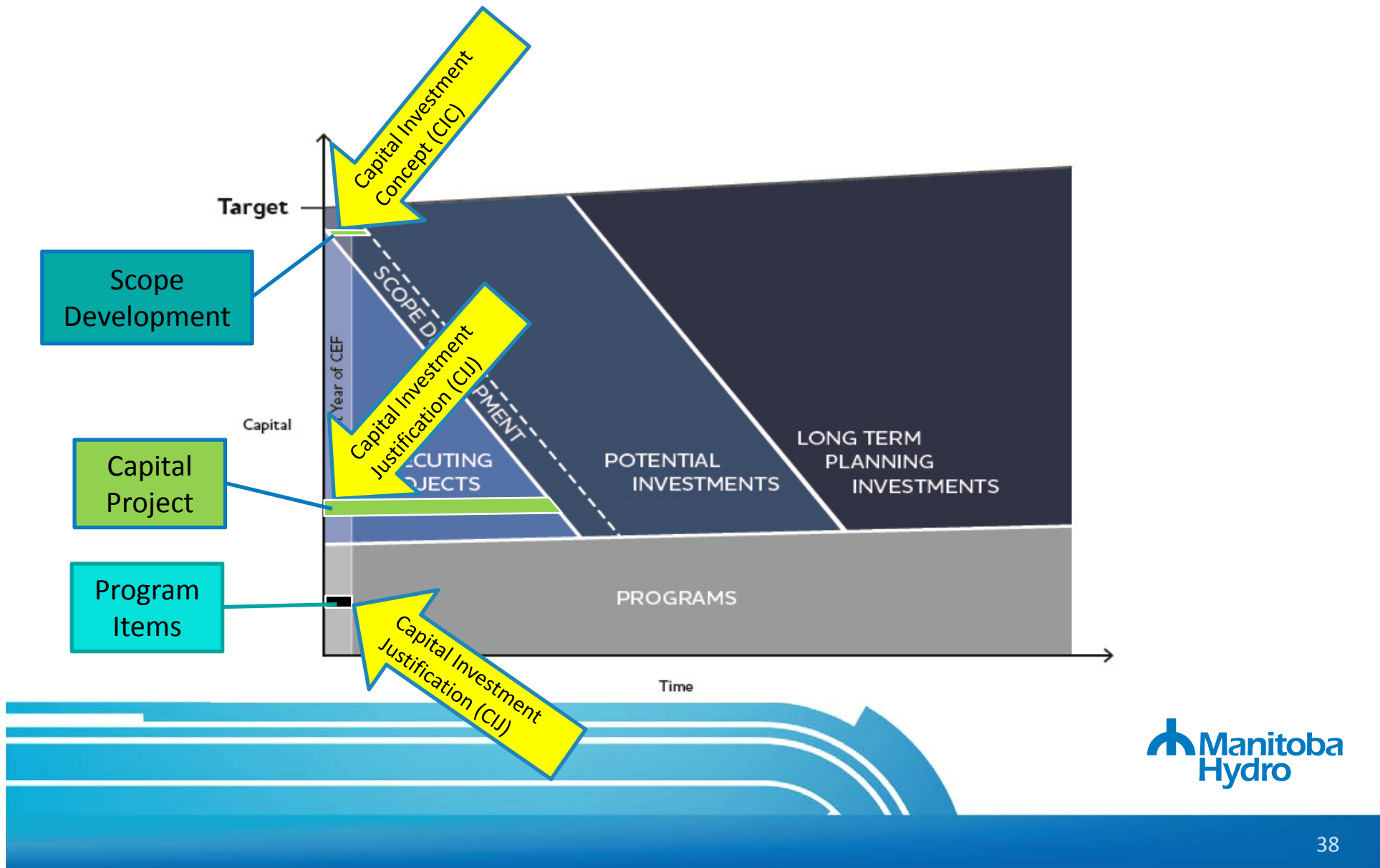
## Executing Projects

- Selected alternative
- Scope development phase completed, if required
- Confident:
  - Scope
  - Schedule
  - Budget
  - Value assessment
- Firm start date

# Capital Approvals & Documents

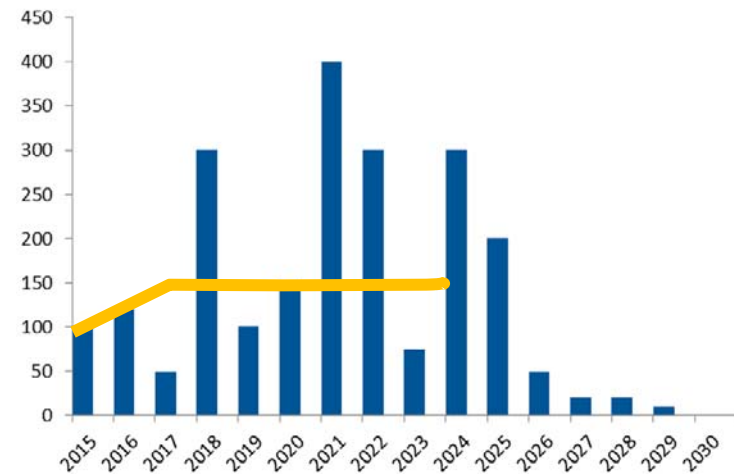
- Capital Investment Justification(CIJ)
  - Replaces Capital Project Justification (CPJ)
  - Funding request for Project, Program or Program Item
  - Authorization to execute
- Capital Investment Concept (CIC) - new
  - Request funding for scope development
  - Firm up scope, schedule, budget

# Authorization to Spend



# Portfolio Optimization

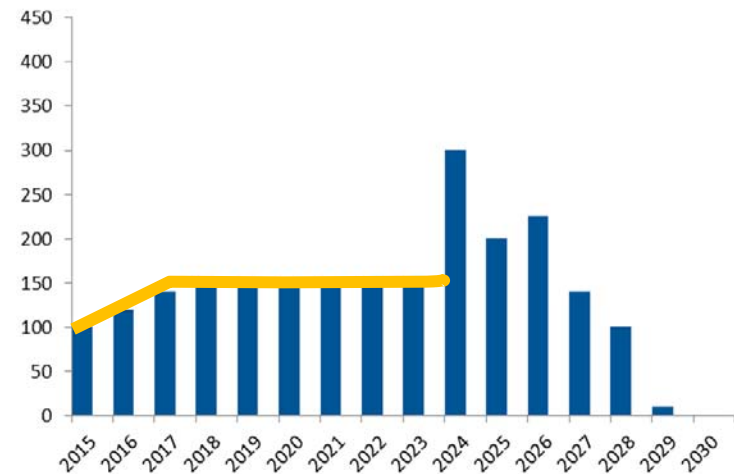
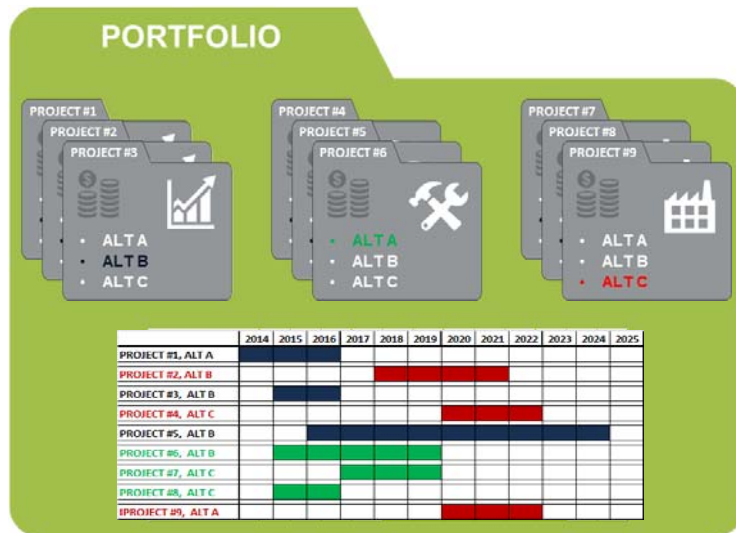
- *Select alternative and timing of investments*
- *To deliver the greatest value*
- *While respecting multiple constraints*



**Capital Portfolio Before Optimization**

# Portfolio Optimization

- *Select alternative and timing of investments*
- *To deliver the greatest value*
- *While respecting multiple constraints*



## Capital Portfolio after Optimization



# Portfolio Optimization

- *Select alternative and timing of investments*
- *To deliver the greatest value*
- *While respecting multiple constraints*

## CONSTRAINTS



Time  
Resources  
Money

## VALUE ASSESSMENT

- Quantify:
- Benefit
  - Risk
  - Cost

# Corporate Value Framework

Provide safe, reliable and affordable energy to the people of Manitoba.

## Financial

- Maximize cost savings
- Increase efficiency

## Reliability

- Maintain customer service
- Increase customer satisfaction

## Corporate Citizenship

- Public perception

## Environmental

- Environmental stewardship

## Safety

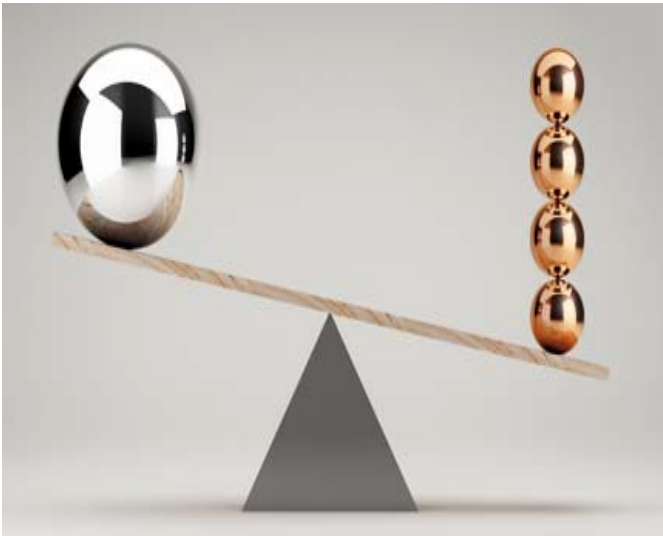
- Safety first for employees and community

# Corporate Value Framework

## Value Measures

Value Measure Categories	Value Measures	Value Measure Categories	Value Measures
• Financial	• Capital Financial Benefit	• Reliability	• Transmission Reliability Risk*
	• O&M Financial Benefit		• Electrical Delivery Capacity Risk*
	• O&M Costs		• Gas Delivery Capacity Risk*
	• Financial Risk*		• Import Transfer Capacity Risk*
	• IT Capacity Risk*		• Blackstart Delay Risk*
	• Lost Generation Risk**		• Distribution Reliability Benefit
	• Export Transfer Capacity Risk*		• Distribution Outage Recovery Benefit
	• Productive Workplace Benefit		• Gas Distribution Reliability Benefit
	• Risk of Project Execution (non-ITS)		• Safety Risk*
	• Risk of Project Execution (ITS)		• Security Risk*
	• Varying Cost or Revenue Benefit	• Corporate Citizenship	• Compliance Risk*
	• Generation Revenue Benefit		• Public Perception Risk*
	• Investment Cost		• Customer Service Benefit
• Environmental	• Environmental Benefit		
	• Environmental Risk*		

# Optimized Portfolio



- Considers net value (Value – Cost)
- Considers value gained per dollar (Value/Cost)
- Considers multiple project alternatives
- Considers different program levels
- Considers the effects of project deferral

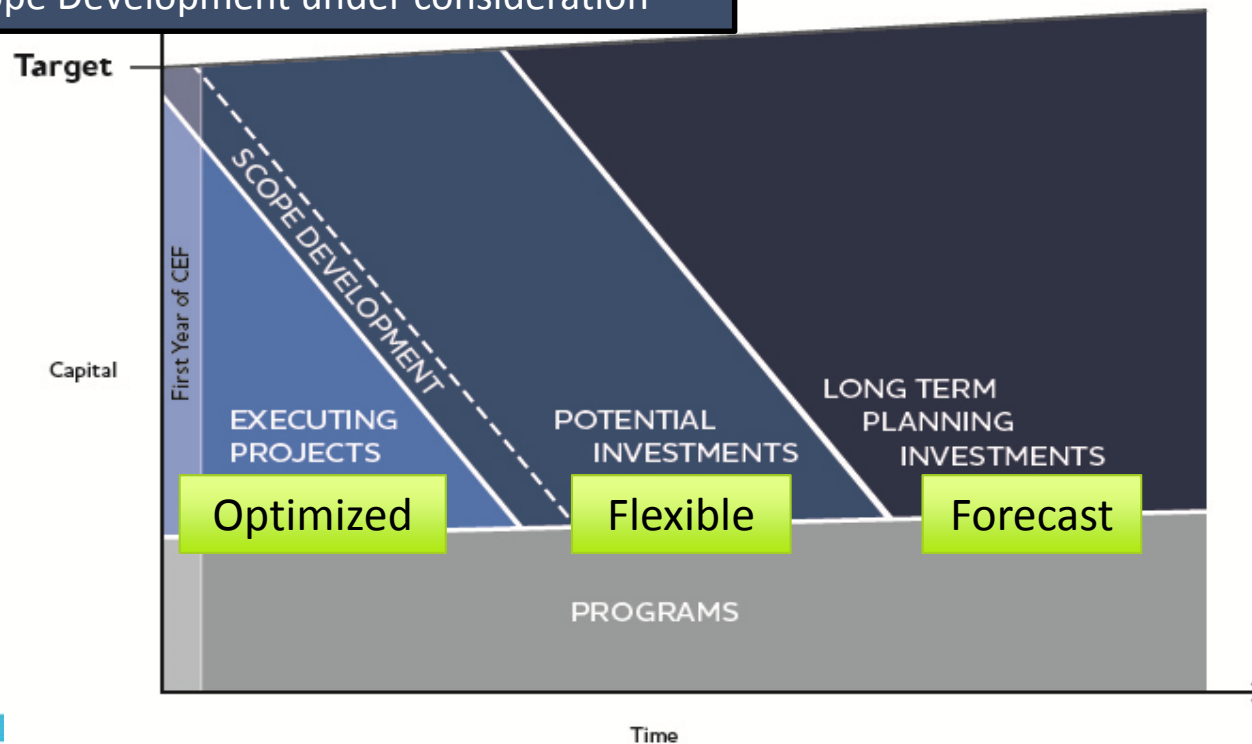
# Optimized Portfolio

## Executing Portfolio

Projects in Flight + Yr 1 Projects Starts + Scope Development

## Potential Investments Portfolio

Projects and Scope Development under consideration



# Forecasting Replacement

# Run to Failure

- Non critical asset
- Short time frame for replacement
- Low cost/common stock items
- Failure consequence acceptable
- Optimized life cycle is run to failure
- Example: pole top transformers



# Proactive Replacement

- Risk assessment and prioritization
- Risk = Probability of Failure (POF) x Consequence (Criticality)
- POF is calculated from the Health Index of your assets and “Effective Age” rather than chronological age
- Replace when  $RISK\ COST > REPLACEMENT\ COST$
- Economic end of life





# Obsolescence as End-of-Life

- **Functional Obsolescence**
  - Asset no longer meets performance criteria
  - Example: protection equipment does not meet increasing fault levels
- **Technical Obsolescence**
  - Asset no longer supported by the vendor
  - Spare parts no longer available
  - Example: digital equipment
- **Regulatory Obsolescence**
  - Asset no longer meets regulated minimums
  - Environmental (PCB Content)
  - Safety (Clearances, Fault Currents)

# Asset Condition Assessment

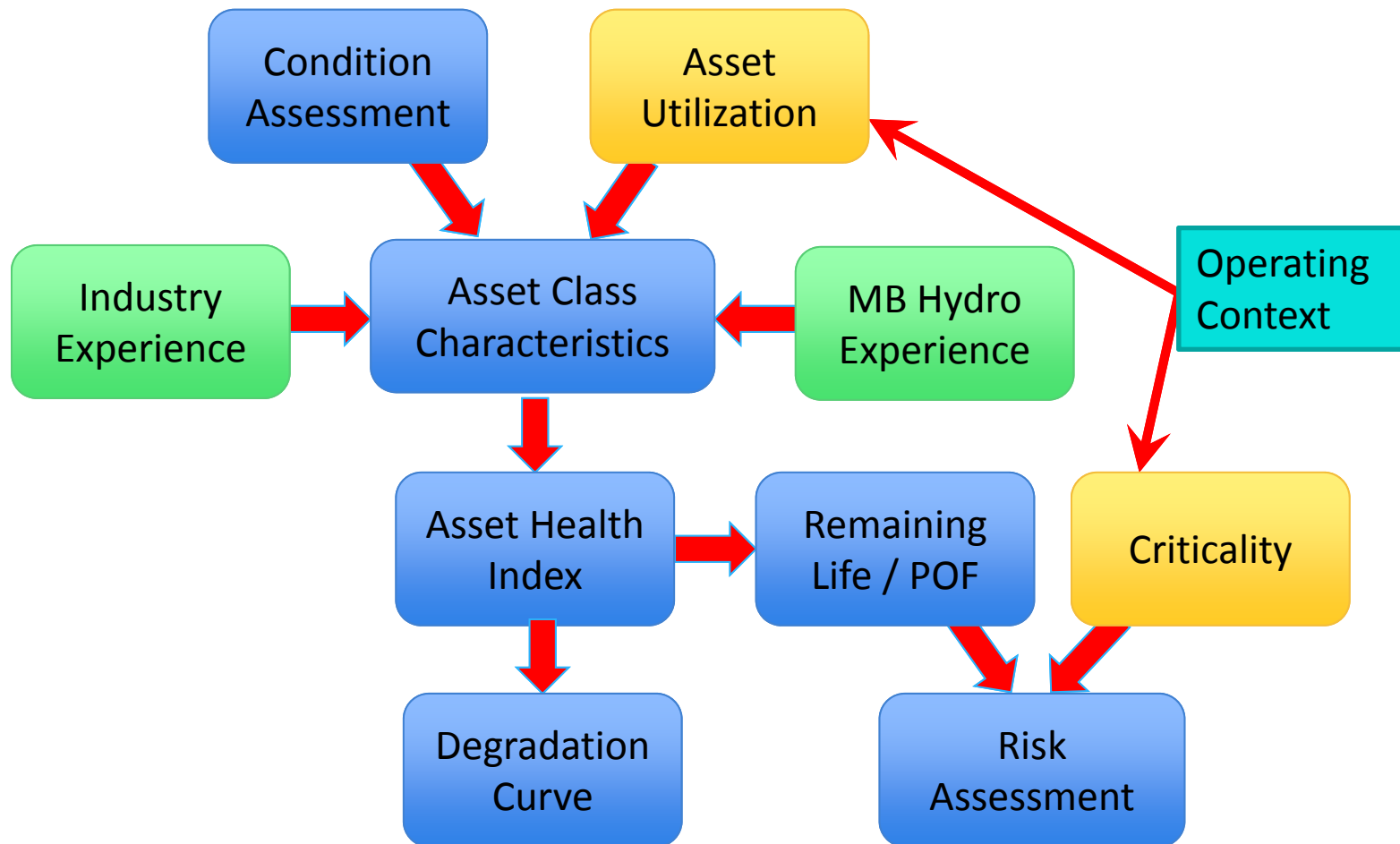
- Assessment of physical condition
- Methodology customized by asset class – “how to measure condition”
- Condition parameters and weighting factors
  - Measurement points
  - Visual inspections
  - Operating tests

# Asset Health Index (AHI)

- Asset Health Index (AHI) adds context to asset condition
- Gives an assessment of
  - Remaining life
  - Probability of failure
  - Degradation over time
- Based on:
  - Specific asset characteristics
  - Current condition assessment
  - Operating context



# Risk Assessment



# Asset Analytics

- Uses asset health and degradation curves to forecast asset risk in time
- Assesses changes in risk for varying levels of investment

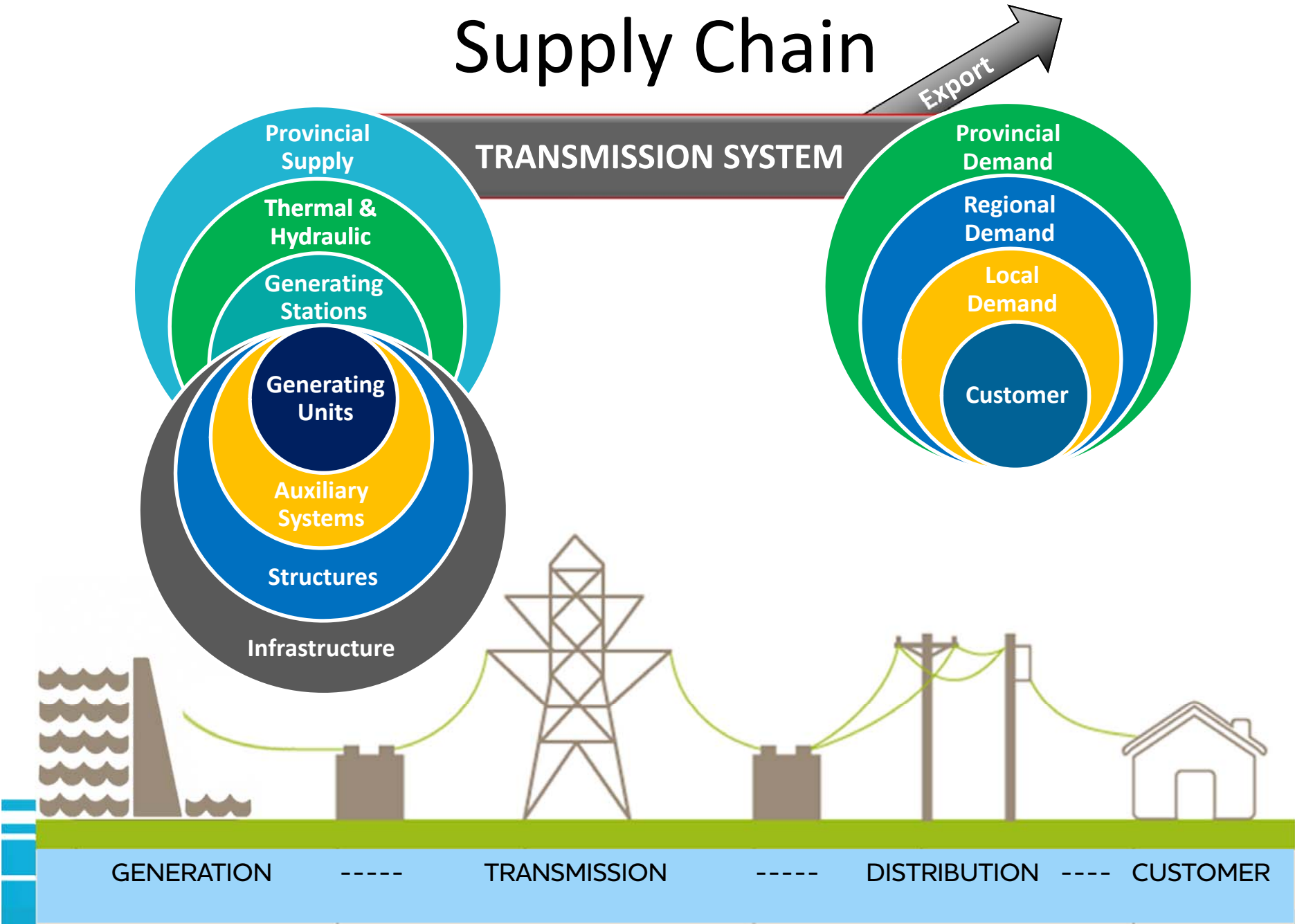
# Forecasting Asset Replacement through Condition Monitoring

- Limited to assets with:
  - Large capital replacement cost
  - Significant consequence of in-service failure
  - Measurable condition
  - Predictable degradation & probability of failure

# Program Analytics

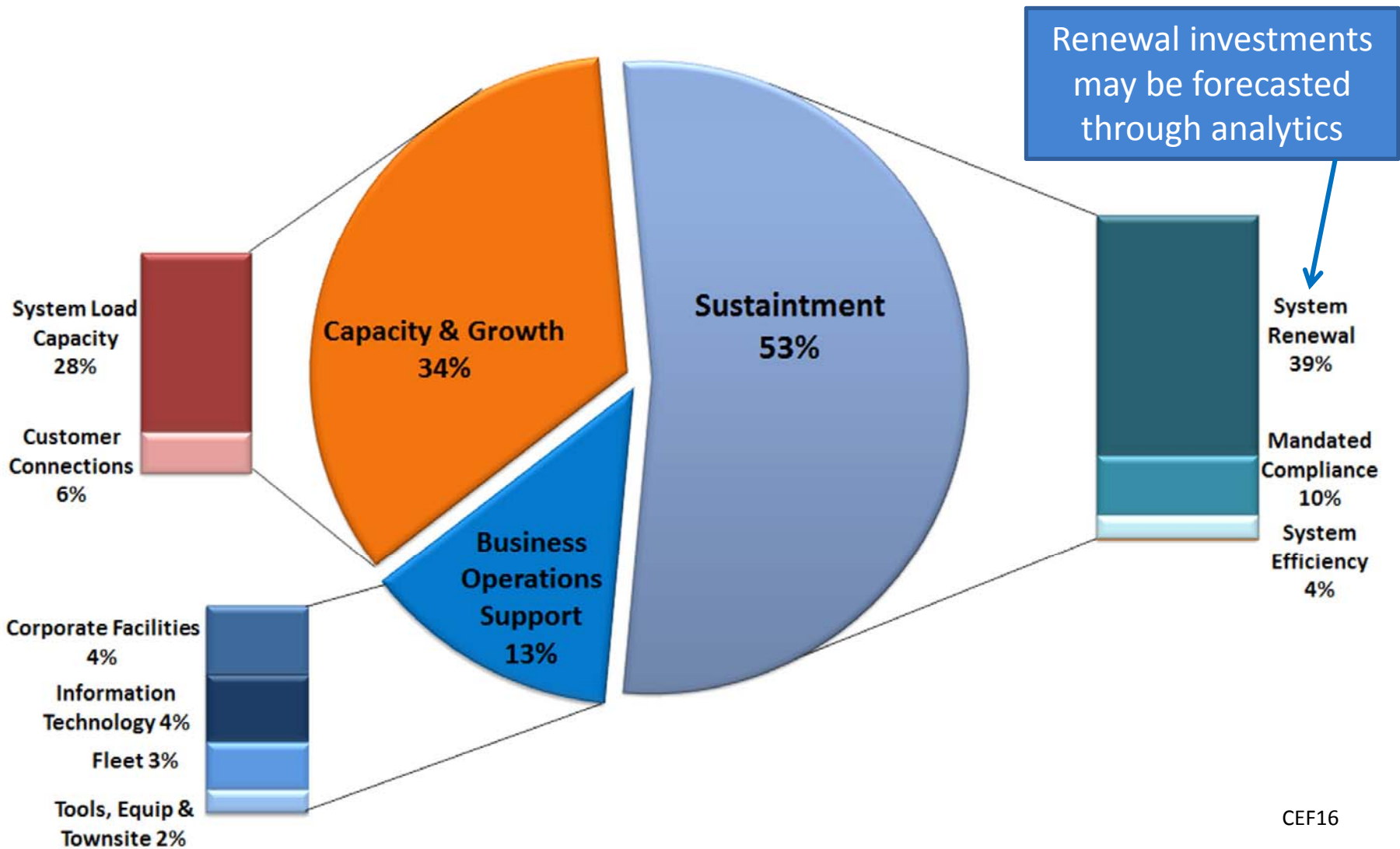
- Uses asset health and degradation curves to forecast aggregate asset population risk in time
- Assess changes in risk for varying levels of investment

# Supply Chain





# Electric Business Operations Capital Investment Category Fiscal Year 2017



CEF16

# Forecasting Capital Expenditures

- Timing of asset failures is uncertain
  - Operating context may change
  - Risk mitigation or life extension works
- Scope of replacement uncertain due to potential changes in:
  - Technology, codes/standards, methods
- Costs uncertain
  - Market conditions
- Forecast uncertainty increases further into the future

# SUMMARY

- Manitoba Hydro Operations & Assets
  - Complicated supply chain
  - Broad mix of assets
  - Regional load growth challenges
  - Concerns with degrading distribution system asset populations

# SUMMARY

- Corporate Asset Management (CAM)
  - Centralization
  - Framework for business alignment
- Improvement to Business Operations Capital tools & processes
  - Asset investment planning
  - Capital portfolio management
  - Asset condition assessment

# SUMMARY

- Forecasting Asset Replacement Expenditures
  - Limited in its application
  - Forecasts uncertain