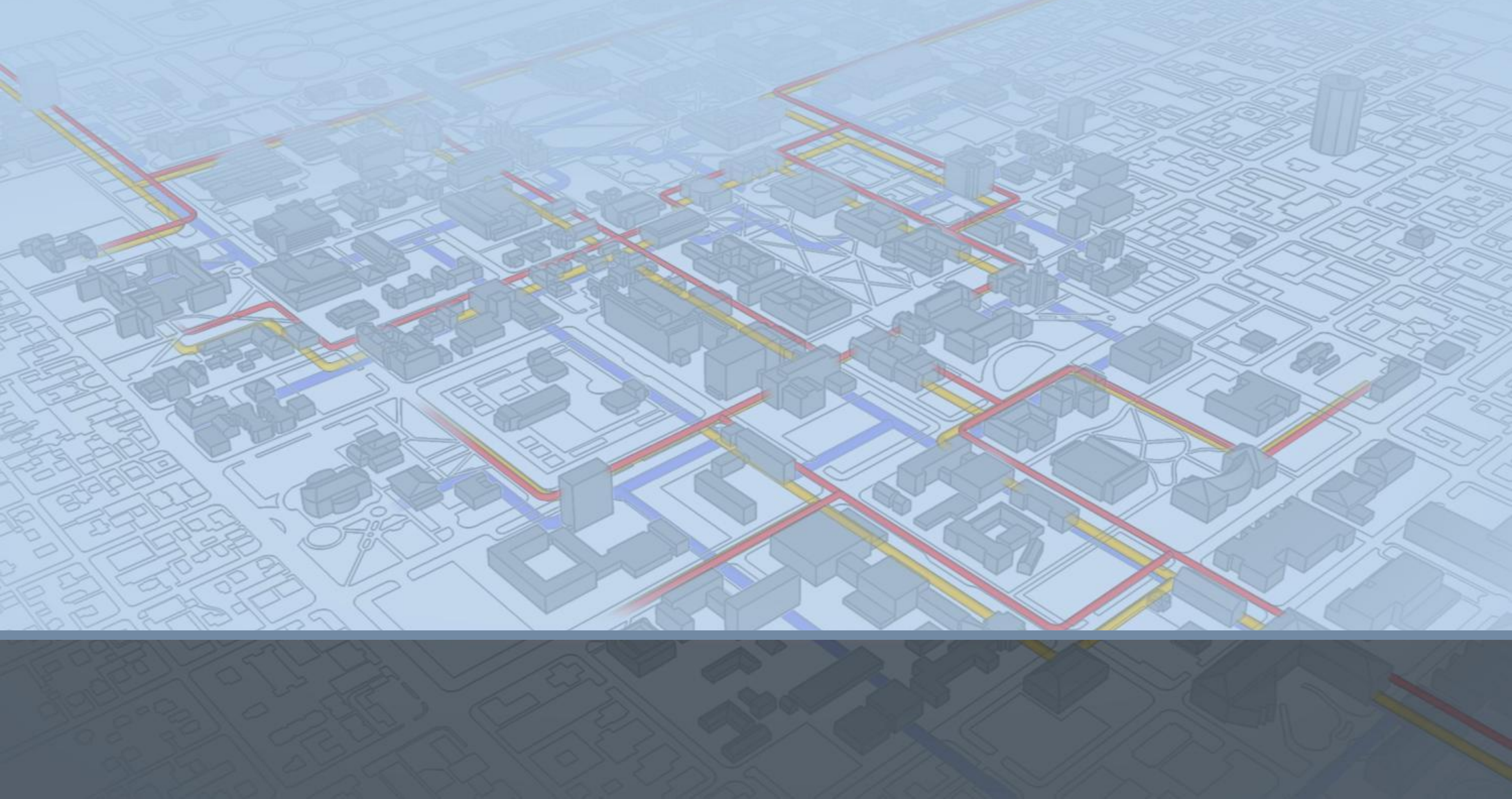
University of Illinois at Urbana-Champaign

Utilities Production and Distribution Master Plan

April 24, 2014



Agenda

- Current Status
- Utility / System Overview
- Overview of Condition Assessment
- Review of Peak Loads v. Annual Growth
- Stakeholder Involvement / Input
- Model Review / Overview
- Future Considerations

Importance of Utilities and Integrated Planning

- Master Plans are NOT a one-time Study
  - Continuously followed and adjusted with feedback
  - Periodic Comprehensive Evaluations
- For Energy, Supply and Demand Must be Integrated
  - Safe, Compliant, and Reliable Energy Delivery Imperative
  - Capital Cost, Operating Cost, and Optional Benefits / Risk must be Balanced Based on University Priorities
- Previous Comprehensive Plan Implemented ~ 2004
  - Central Chilled Water Plant - 2004 (from 1997 Study)
  - Abbott North Addition 2003- 2005 (NG Combined Cycle)
  - Electrical Main Campus Sub 69 KV 2003 – 2004 Cut-over

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UIUC Utilities Existing Energy Systems

- Production
  - Abbott Power Plant
    - Steam
    - Electricity
  - Chiller Plants
- Distribution
  - Steam
  - Chilled Water
  - Electrical
  - Natural Gas

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- Distribution
  - Steam
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Campus Central Utility System Advantages

- Production Advantages
  - Combined Heat & Power (CHP)*
  - Diversity Advantages of Aggregated Loads
  - Increased Reliability (N+1) at Central Plant
  - Opportunity of Thermal Energy Storage
  - Fuel Purchase Flexibility

Campus Central Utility System Advantages

- Building Associated Advantages
  - Production Equipment Remote from Building
  - Building Energy Conservation Allows Sharing Production Assets
  - Ability to add incremental Building Capacity
  - Large Central Production Equipment and Limited Equipment in Buildings

Peak vs. Consumption

Build infrastructure to meet peak load (fixed cost of energy)

Electricity Peak	80 MW
Steam Peak	600 kpph
Cooling Peak	31,000 tons

Steam Piping	31 miles
Electric Cable	294 miles
CHW Pipe	27 miles
NG Pipe	32 miles
Steam Tunnel	9 miles

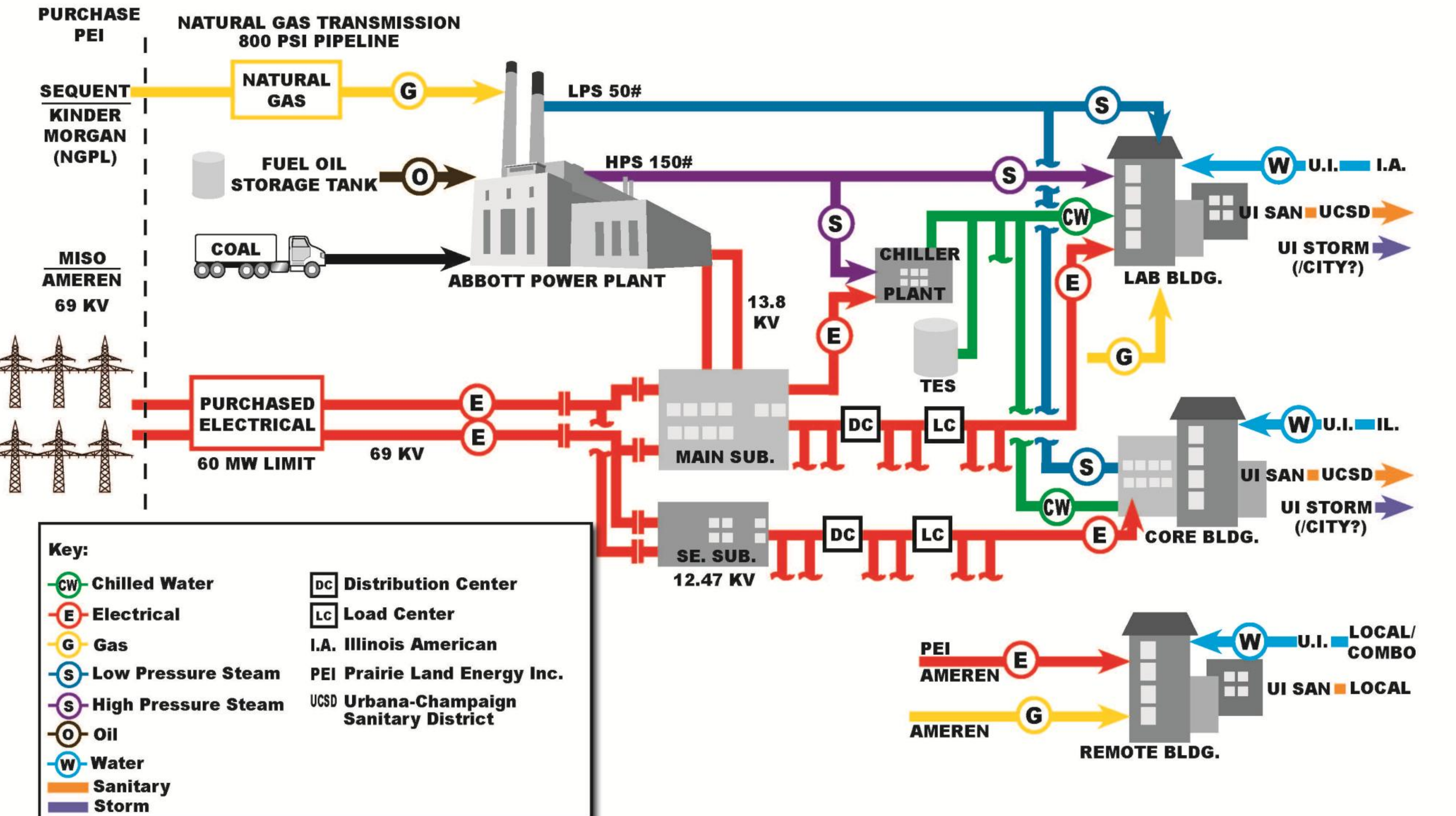
Consumption (variable cost of energy)

- ≈6 Trillion BTUs of total energy consumed

2.8 Square Miles

320 Main Campus Buildings

ILLINOIS UTILITIES



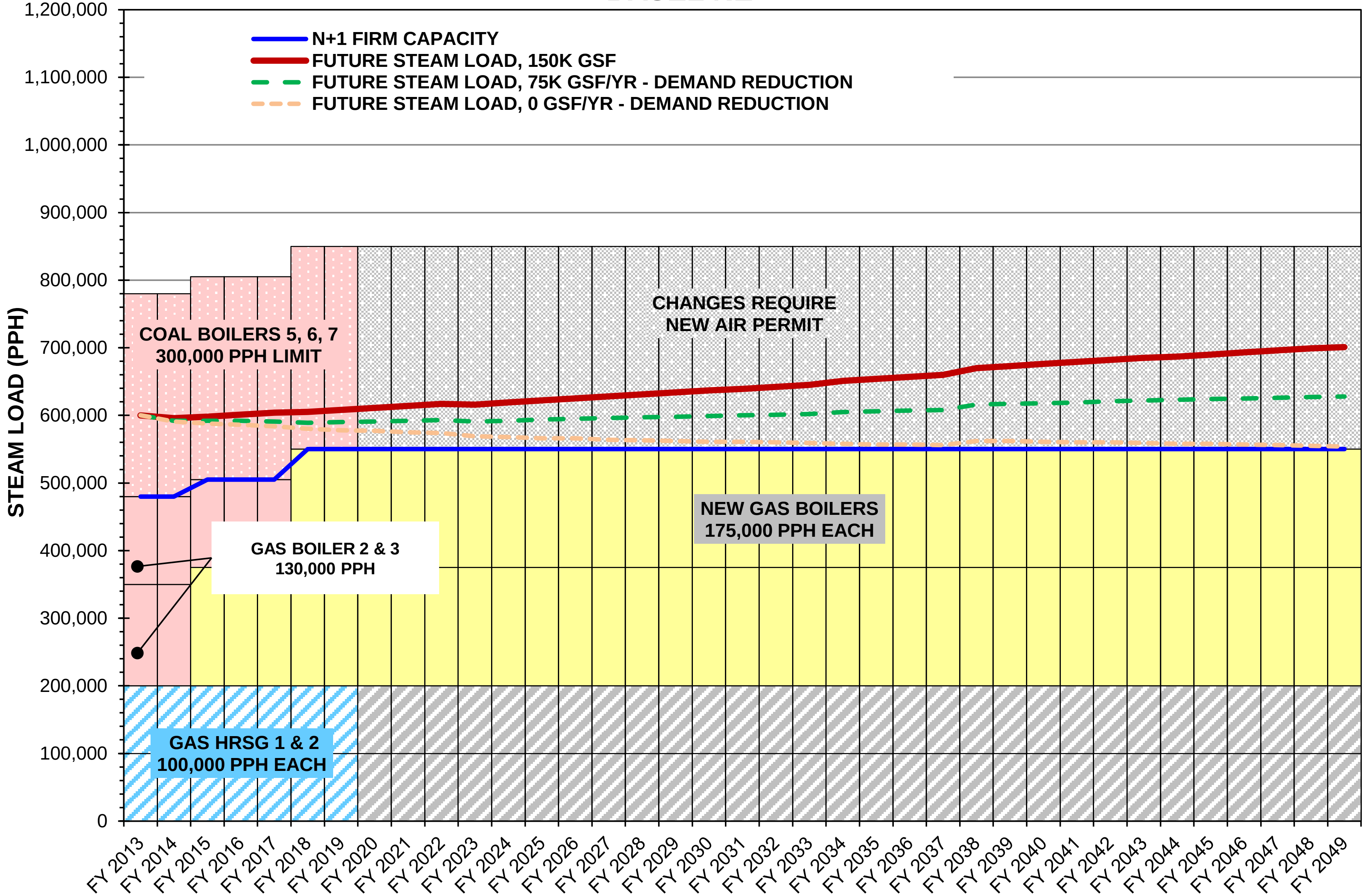
Implementation of Planned Strategies

- Long Term Infrastructure Commitments
  - Capital Financing
  - Compliance Permitting
  - Compliance Regulation Changes
  - Project Execution Duration
  - Energy Market Changes
  - Technology Changes

Implementation of Planned Strategies

- Infrastructure Requirements Change with Peak Demand
  - Cost Effective Solution Requires Accurate Target
  - Plan to Best Available Forecast
  - Control Demand by Following Integrated Plan

STEAM CAPACITY VS. FUTURE LOAD
BASELINE



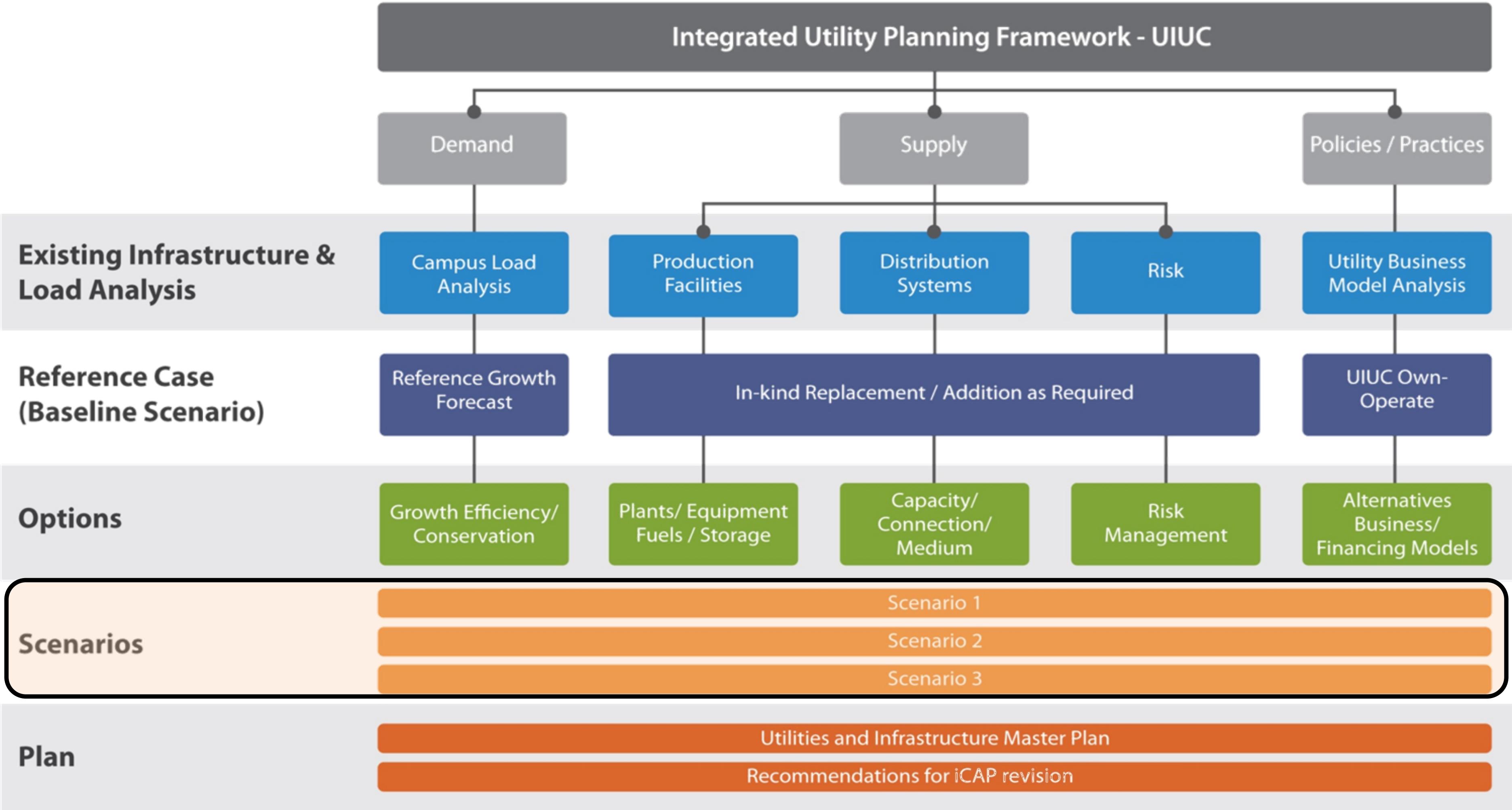
AFFILIATED ENGINEERS, INC.

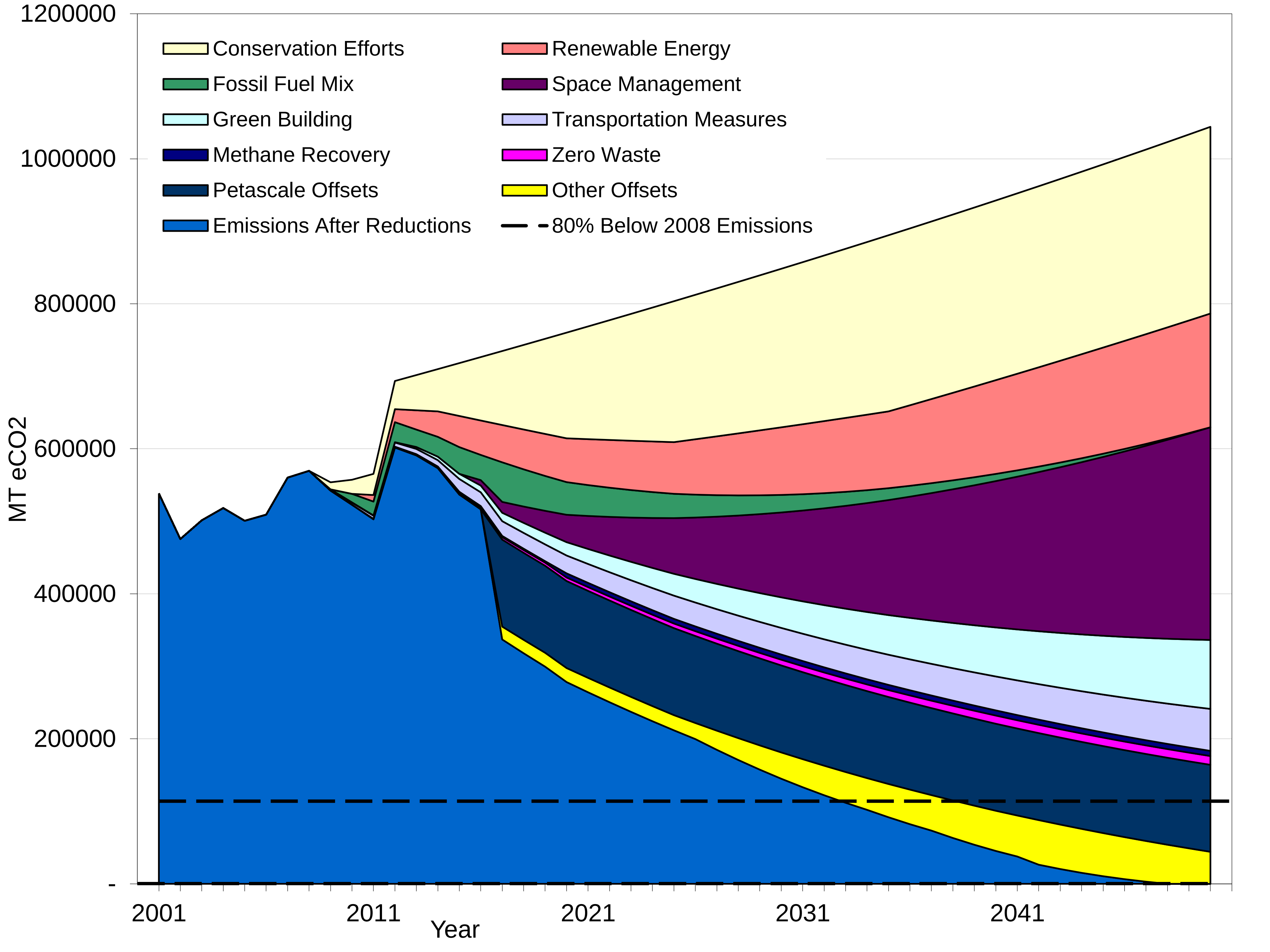
Master Planning Process

- Assessment – **complete**
- Technology research – **complete**
- Stakeholder criteria – **received**
- Option development and analysis – **in progress**
- Roadmap forward – **in progress**



Project Scope and Process

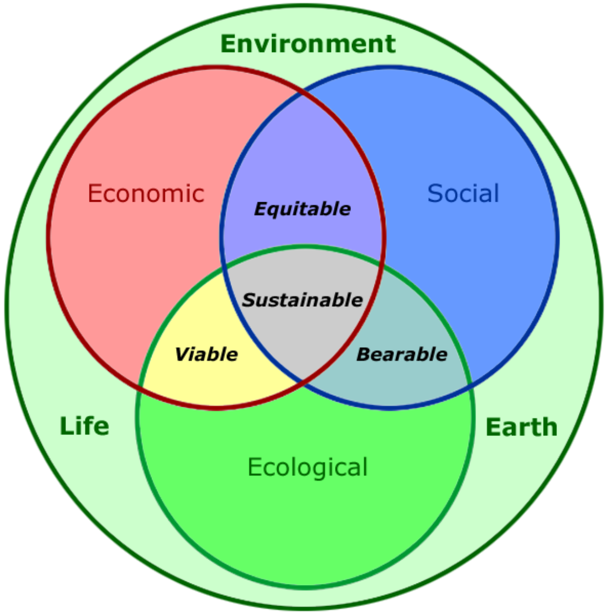




1200000
1000000
800000
600000
400000
200000
-
MT eCO2
2001
2011
2021
2031
2041
Year
Conservation Efforts
Renewable Energy
Fossil Fuel Mix
Space Management
Green Building
Transportation Measures
Methane Recovery
Zero Waste
Petascale Offsets
Other Offsets
Emissions After Reductions
80% Below 2008 Emissions

Stakeholder Concerns

- World Class Research – Reliable Energy
- Financial Risk – Utility Rate, Capital Expenses, Reduced State Funding, Market Changes
- Sustainability – Environmental Stewardship, iCAP goals



Stakeholder Involvement and Feedback

Non-negotiable:

- Safety
- Regulatory compliance

	Facility Operations	Faculty/ Students	Administration	Auxiliaries	Research
Reliability					
Financial Risk					
Sustainability					

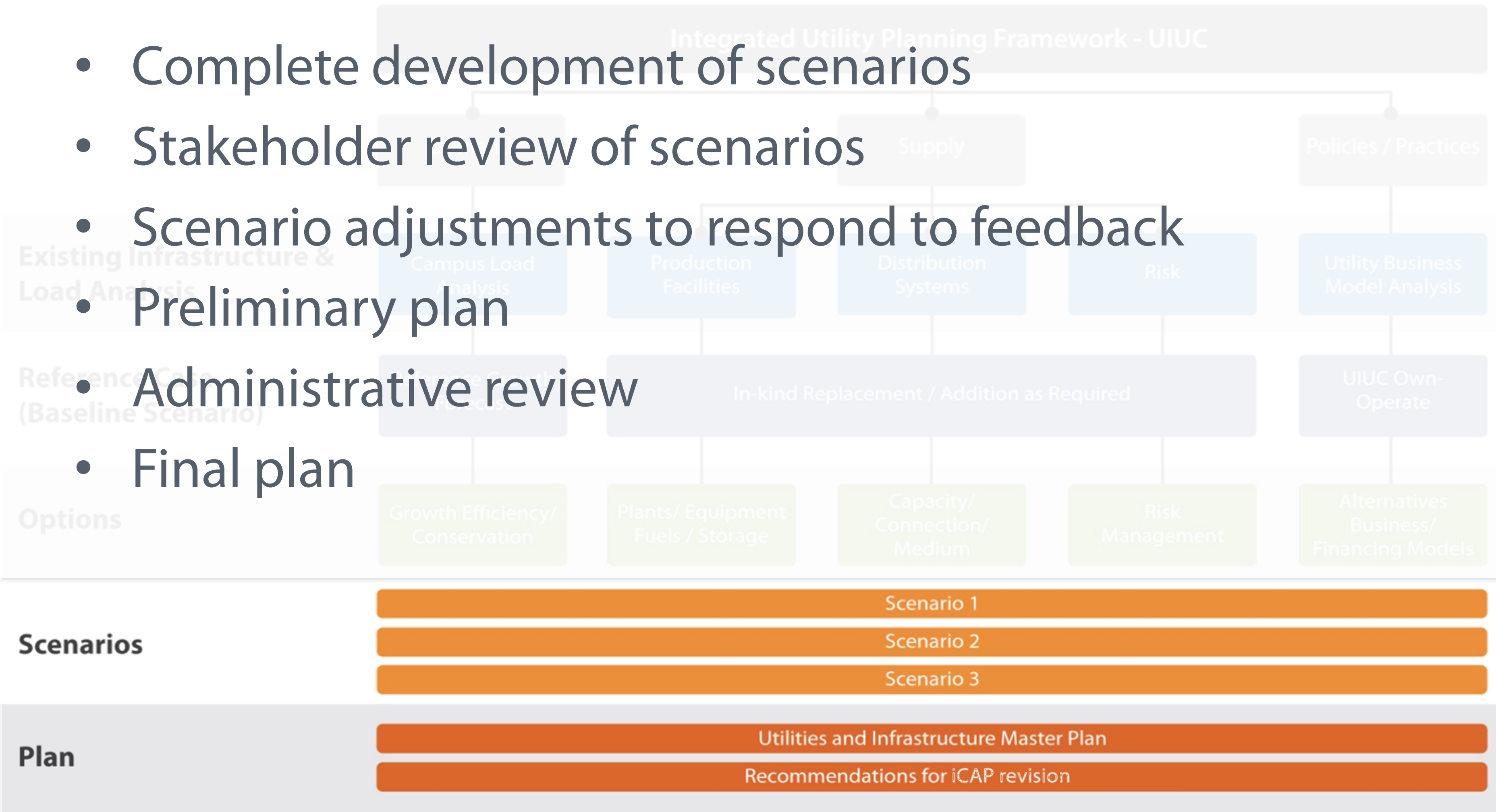
Groups will be contacted to provide feedback on direction

Future Considerations

- Campus space needs steady or increasing
- High reliability critical for research
- Building energy conservation
- Data Center demand
- Heat recovery and storage technology
- Renewable technologies
- Fuel Supply Risk management

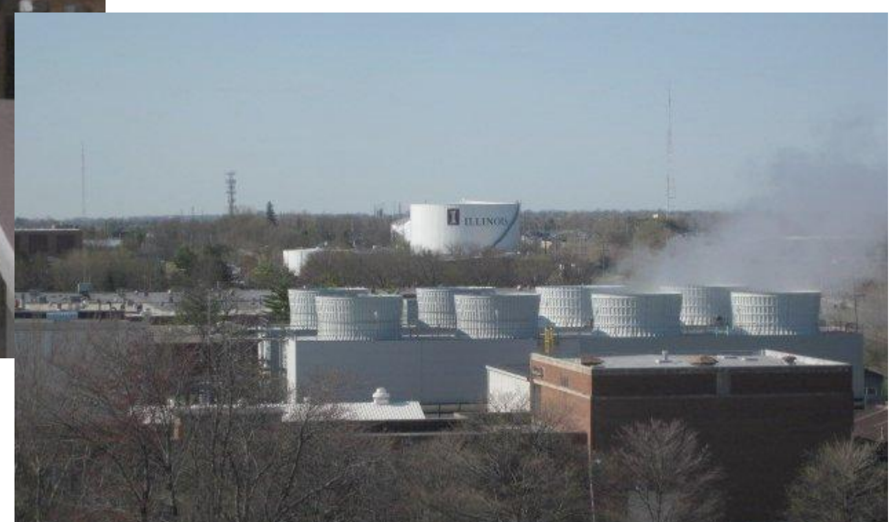
Next Steps in Getting to the Plan

- Complete development of scenarios
- Stakeholder review of scenarios
- Scenario adjustments to respond to feedback
- Preliminary plan
- Administrative review
- Final plan



Feedback

http://www.energymanagement.illinois.edu/index.cfm



Thank you for attending