Dynamic Utility Master Planning

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Why Master Plan?

- **Funding**
- **Sustainability Goals**
- **Operations & Maintenance**
- **Communication & Reporting**
- **Resiliency**
- **Transitions**
Energy Planning Components

- Condition Assessment
- System Modeling
- Load Growth Projections
- Infrastructure Renewal Planning
- Energy Efficiency Improvements
- Self-Generation/Fuel Diversity
- Distribution Analysis
- Demand Reduction/Energy Audits
- Cost Estimating/Life Cycle Analysis
- Funding/Phasing/Scheduling
- Environmental Strategies
- Reliability Improvements
- Economic Analysis
Energy Master Planning Overview

1. Visioning and Goal Setting
   - Visioning Strategy
   - Basis of Planning

2. Requirement Analysis
   - Existing Facility Assessment
   - Existing Infrastructure Assessment
   - Financial & Operational Assessment
   - Information Gathering

3. Strategic Options
   - A
   - B
   - C
   - D

4. Strategic Energy Plan

5. Execution
   - Report & Recommendation
   - Implementation Plan

Energy Exchange: Connect • Collaborate • Conserve
Key Outcomes

- Insure energy systems meet mission needs and address deferred maintenance
- Improve energy reliability & redundancy
- Strategic approach to reduce GHG emissions & operating costs
- Provides a road map that optimizes energy efficiency and defines capital requirements
Example: Several buildings are added to the base

- Cooling
- Heating
- Electrical
- Mandate compliance
Importance of Integration with ADP

Area Development Plan

Basis of Planning → Alternatives Development → Alternatives Selection → Finalize Plan

Baseline Development → MP Impact Analysis → Alternatives Development → Alternatives Selection → Finalize Plan

Energy Master Plan
Importance of Integration with ADP

What can be influenced through integration

Building locations: No(ish)
Space for utility facilities: Yes
Space for utility corridors: Yes
Importance of Integration

Energy efficiency and energy security can be one and the same

• Smart Grid and EMCS
• Combined Heat and Power
• Renewable Energy
• District Energy
Variables that Impact Master Plans

Changes or availability of TECHNOLOGY

PLAN HAS TO CHANGE
Variables that Impact Master Plans

Changes or availability of TECHNOLOGY → Availability of FUNDING → PLAN HAS TO CHANGE
Variables that Impact Master Plans

Changes or availability of TECHNOLOGY
Availability of FUNDING
Changes in GROWTH

PLAN HAS TO CHANGE
Variables that Impact Master Plans

- Changes or availability of **TECHNOLOGY**
- Availability of **FUNDING**
- Changes in **GROWTH**
- Changes in **PRIORITIES**

**PLAN HAS TO CHANGE**
How does your current master plan account for these variables?
Dynamic Master Plan

Static is a snapshot in time with a single set of directions.
Dynamic Master Plan

Dynamic allows for continuous evaluation of variables to optimize the path forward
Planning for today and tomorrow

Updated option analysis based on current conditions

<table>
<thead>
<tr>
<th>District energy</th>
<th>vs</th>
<th>Decentralized</th>
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<tbody>
<tr>
<td>Minimum capacity</td>
<td>vs</td>
<td>Redundancy</td>
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<tr>
<td>BAU</td>
<td>vs</td>
<td>Annual goal compliance</td>
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<tr>
<td>BAU</td>
<td>vs</td>
<td>Optimized infrastructure</td>
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![Graph showing cost comparison over time](image-url)

- BAU vs. Carbon Optimized
- Yearly cost comparison from 2017 to 2059

Energy Exchange: Connect • Collaborate • Conserve
Planning for today and tomorrow

Incorporate and evaluate new goals, mandates, & technologies

Energy Intensity

Clean Energy

Current Clean Energy (MMBtu)
Potential Clean Energy Projects (MMBtu)
Required Clean Energy (MMBtu)
Planning for today and tomorrow

Identifies utility requirements for supporting future projects

Heating Demand

Heating Demand with Redundancy

Cogen (5MW)

B-4

B-3

B-2

B-1

Heating (kBTU)
Dynamic Master Planning
Dynamic Master Planning
### Dynamic Master Planning

#### Building Data

<table>
<thead>
<tr>
<th>Building Name</th>
<th>Williamson Hall</th>
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#### Overall

**Existing**

- **Current Heating Demand (kBtu/h):** 602
- **Heating Intensity (kBtu/SP):** 0
- **Heating Consumption (kBtu):** 0

**Future**

- **Heating Demand (kBtu):**
  - [ ] Maintain Existing Load
  - [ ] Total Heating Demand (kBtu)
  - [ ] Heating Demand by Area (kBtu/SP)

**Heating Source:** District Plant

#### Equipment

<table>
<thead>
<tr>
<th>Tag</th>
<th>Type</th>
<th>Capacity (kBtu)</th>
<th>Age (if not built)</th>
<th>Efficiency (%)</th>
<th>Life Expectancy</th>
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- **Total Capacity (kBtu):** 0

#### Building Service (District Heating Connection Only)

<table>
<thead>
<tr>
<th>Service Type</th>
<th>Pipe Size</th>
<th>Pipe Type</th>
<th>Capacity (kBtu)</th>
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<tbody>
<tr>
<td>Steam</td>
<td>8</td>
<td>Carbon Steel</td>
<td>39580</td>
</tr>
<tr>
<td>Steam</td>
<td>0</td>
<td>Carbon Steel</td>
<td></td>
</tr>
</tbody>
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*Image showing a software interface for dynamic master planning with data entries and options for building energy management.*
Dynamic Master Planning

Utility Status

Steam

Chilled Water

Water

Electricity

Life Cycle Cost and Sustainability

Key Project Metrics at 2030

- 1,088,989 Megatons of Carbon
- 756,799,999 Gallons of Water
- 2,049,844,610 Kilowatt-Hours of Electricity
- $67,609,000 25-Year Life-Cycle Cost Savings

Energy Exchange: Connect • Collaborate • Conserve
Dynamic Master Planning

Savings By ECM
- LED Indoor Replacement: 10%
- RetroCo: 5%
- Control Upgrades: 0%
- Plumbing Improvements: 0%
- Low Flow Fixtures: 0%

Costs By ECM
- LED Indoor Replacement: 87%
- RetroCo: 0%
- Control Upgrades: 0%
- Plumbing Improvements: 0%
- Low Flow Fixtures: 0%

ECM Types
- Envelope Improvements
- Warehouse/Outdoor Lighting
- LED Indoor Replacement
- General Lighting Improvements
- Lighting Control
- Retro Commissioning
- HVAC Upgrades
- Controls Upgrades
- Hot Water Upgrades
- Plumbing Improvements
- Smart Grid
- Low Flow Fixtures

Building Types
- Lodging
- Other
- Service
- Education
- Health care
- Office
- Storage
- Public order and safety
- Public assembly
- Food service
- Religious Worship

Utility Rates
- Electric
- Gas
- Water

Results
- Building No: 1,291
- Square Feet: 27,087,952
- Electrical Savings: 26,156,990 kWh
- Fuel Savings: 28,470 MMBtu
- Water Savings: 30,024,289 Gals
- Total Savings: $5,134,929
- Average Cost: $172,842,808
- Payback: 54.10 Years

Return to Dashboard
Dynamic Master Planning

- SRM
- ECIP
- MILCON

Yearly expenditures for 2017 to 2025:
- 2017: $0
- 2018: $50,000,000
- 2019: $100,000,000
- 2020: $150,000,000
- 2021: $200,000,000
- 2022: $250,000,000
- 2023: $300,000,000
- 2024: $350,000,000
- 2025: $0
Summary

Responds to continually changing variables
Summary

Responds to continually changing variables

Collaborative effort and vision between ALL stakeholders
Summary

Responds to continually changing variables

Collaborative effort and vision between ALL stakeholders

Robust, actionable plan that meets energy and resiliency goals as efficiently as possible