Total Energy Management
Portfolio Role of CHP Plant
Consume Sparingly, Spend Wisely, Generate Responsibly, Analyze Continuously
IDEA Campus Energy, February 28, 2019
Agenda

- New Energy Management Challenges, Practices and Tools
- Supply Procurement & Performance Benchmarking
- Portfolio Optimization Framework in Evaluating Supply Options
- Role of the Central CHP Facility
- Q&A
Reflecting on the Past Decade – Greater Challenges Ahead

• Over the past decade, Higher Education has experienced many facilities related changes and challenges:

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<tr>
<th>Consumer Price Index (CPI)</th>
<th>+19%</th>
<th>State funding per student at public universities</th>
<th>-16%</th>
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<tbody>
<tr>
<td>Campus Building Space – Research Universities*</td>
<td>+14%</td>
<td>Facilities Operating Budgets* ($/sqft)</td>
<td>-5%</td>
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<td>Public HE DM Backlogs* ($/gsf)</td>
<td>+30%</td>
<td>Maintenance Coverage* (#FTE/gsf)</td>
<td>-20%</td>
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• *Sightlines

• In this environment, we must: 1) **Optimize our Assets**; and 2) **Do more with less**!
Total Energy Management Approach - Integrated approach to optimizing our assets and operations

Reduce: Use Less!
- Energy Efficiency
- Commissioning

Digitalization: Optimize!
- Automation / Monitoring / Integration
- Connectivity / Analytics / IoT

Integrate Planning

Produce: Generate Efficiently!
- Campus Utility Systems
- CHP / RE / Storage

Procure: Manage!
- Energy & RE Purchasing
- Energy Risk Management

Financing / Contracting / Partnership

Data-Driven Optimization
Tools Enabling Us to Optimize Our Assets and to Do More with Less!

Integrated Planning
- Energy and Climate Action Plans
- Supply Portfolio Planning
- Energy Master Planning

Digitalization
- Supply Portfolio Optimization
- TEM-based Asset Optimization
- Predictive Maintenance

Contracting & Partnership
- Planning / Energy Services / O&M
- ESCO / Solar PPA / DBOOM
- P3 / EaaS / Concession
Supply Procurement & Performance Benchmarking
Benchmarking Electric & Natural Gas Supply Procurement Performance

Demand Management, Peak Load Capacity Pricing and Self-Gen Balancing

Market-Based Block & Index Supply and Budget-Based Hedging Program

Baseline Long-Term Renewable Energy and Carbon Reduction Goals

Benchmark to CPP Values, PLC Reduction Value & Basic Residual Auction Values

Benchmark to Full Requirements Contract (FRC)

Benchmark to Market (LSE) Block & Index Value, Including Hedging, REC & Price Stability vs. Downside Participation Value
Portfolio Optimization Framework in Evaluating Supply Options
Portfolio Supply Optimization within a Probabilistic Framework

- Siemens Utilizes a Portfolio Supply Optimization Model to identify the range of probabilistic price & load outcomes over time (P-Value x Q-Value = Budget)

- New supply options are evaluated for how deep in-the-money they are relative to this Probabilistic Range of All-In Cost Outcomes

- Lost Opportunity Value of price decline is valued consistently with upside exposure cost, resulting in a probabilistic framework for evaluating new supply contract options relative to market alternatives
Portfolio Supply Optimization Model
Development Components

Data Analytics:
Key is collection of hourly load and price data, analysis and conversion to risk/reward metrics and Management Dashboards for tracking & interpreting portfolio performance

Probabilistic Value Analysis:
Applied to short, mid and long-term price & quantity relationships to ensure informed valuation and asset disposition relative to market, contract or asset-based alternatives

Portfolio Supply Optimization Model (including CHP)

- Probabilistic Outcomes, Sensitivity Analysis
- Historical & Projected Values
- Disposition Term Structure
- Temporal units
- Hourly to Multi-Year
- 8760 hours, Daily, Monthly Annual Rollups
- Price, Volume, Risk Exposure
- Probabilistic, Deterministic, Statistical Relationships, Values
- Dashboards
Role of the CHP Plant
Role of the CHP Plant in Portfolio Supply: NextGen Program

Indigenous Electric Load
Peaking
Baseload from Low Eff. HR
Reduction Relative to DER,
Market Incentives

PJM Market
Capacity – Energy – Ancillary Services

Distributed Energy Resources
Demand Response
Distributed Solar, Chilled Elec.
Battery Energy Storage Solutions
(Stand Alone & Hybrid)

Campus Steam Load,
Chilled Water

Portfolio Supply Optimization requires a responsive CHP to Serve Indigenous and Connected Steam and Electric Loads, while also responding interactively to internal DER and external capacity and Energy – AS market signals under a 3-Dimensional Dispatch Model, including Load, Distributed (Internal) and ISO (External) Sell, Serve & Buy Supply Service Options.
Future Rewards are Paid Forward by Integrated Portfolio Management

Forward Priorities:

- CHP Re-Power Solution & Commercial Structure
- Load Management and Smart Metering
- Climate Action Plan Update Meeting MD’s Clean Energy Targets
- RPS Legislation Readiness
- Evaluation of Battery Energy Applications
- Energy – Water Solution Integration
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