CHP at New Construction

Avila

Senior Living Center

CHP in New York State

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TA Engineering

CHP at New Construction

Avila

Senior Living Center

Upscale Senior Retirement Community

Owner: Roman Catholic Diocese of Albany

267,000 ft^2

152 Residential Units

- 24 Single Family Cottages
- 128 Apartments

75,000 ft^2 Common Area

Avila

Senior Living Center

Commissioning Team

Avila

Senior Living Center

INTELLIGENT ENERGY SOLUTIONS

- **ENtrust Energy Services, LLC**
- **KBE+, Inc.**
- **TA Engineering (Moore & Rentz, P.C.)**

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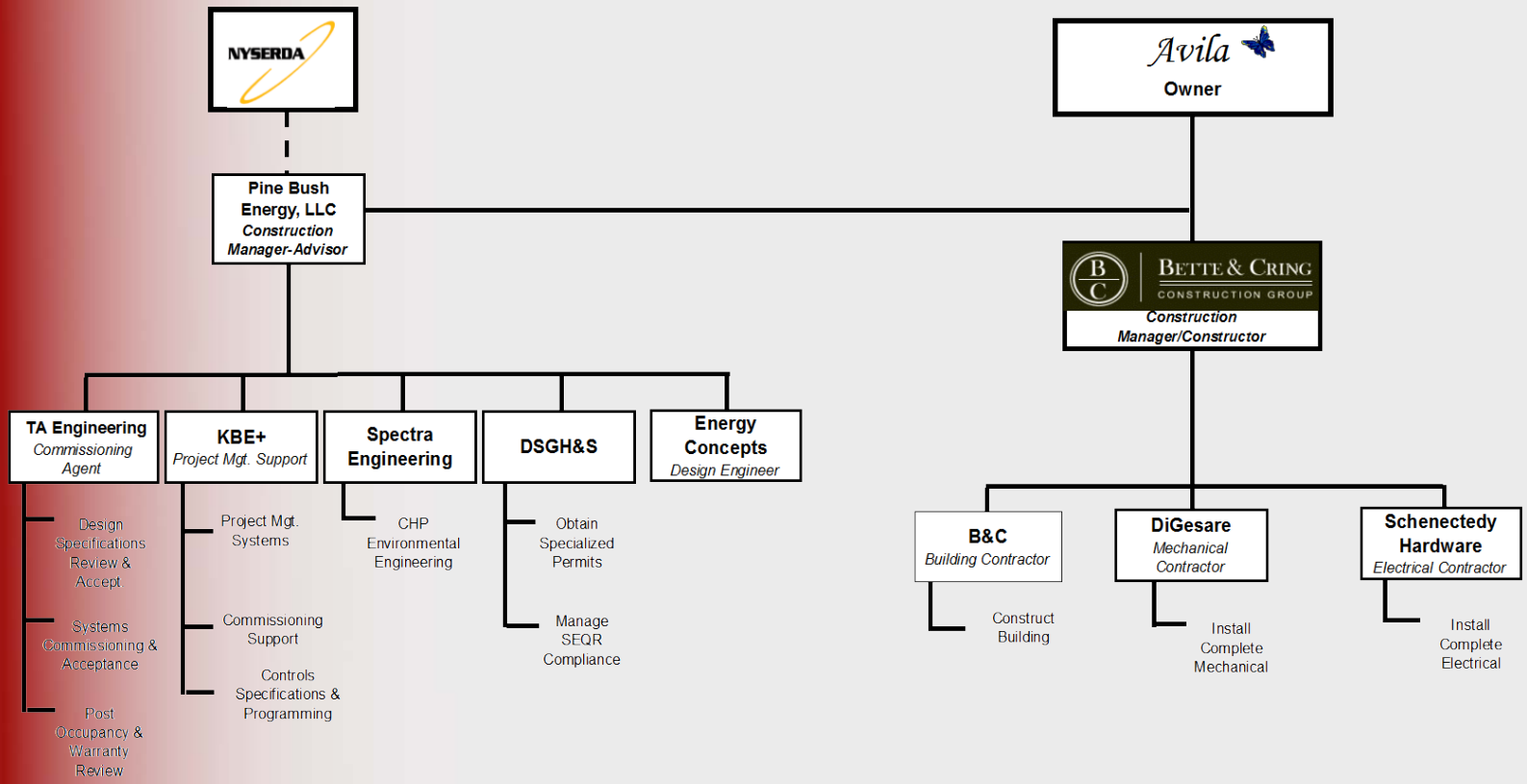
Avila CHP – Unique Challenges/Issues

- Uncertainty of Design Load
- Uncertainty of Load Behavior
- Significant Seasonality
- Environmental (Endangered Species)
- Site Density
  - Sound
  - Emissions
- Delayed Start of CHP Project
- Design/Build Nature of Facility Construction

Avila CHP – Project Team



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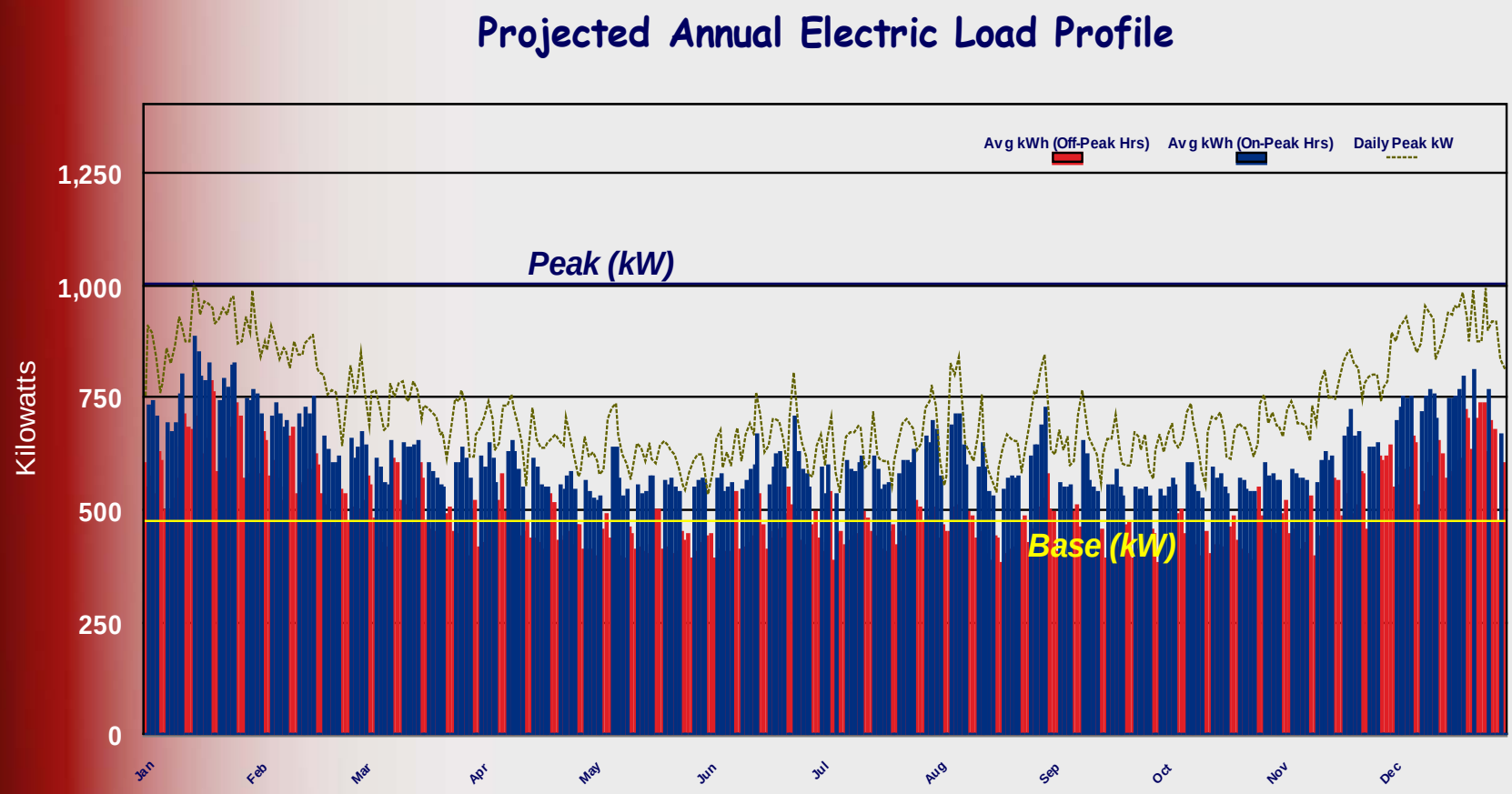
Avila Preliminary Load Assumptions

- Peak Electric Load – 1,000 kW
- Winter Peaking (Supplemental Resistance Heat)
- 50%+ Variation Day/Night Demand
- Expected Thermal Coincidence

Avila Preliminary Load Profile



Avila CHP – Major Developments

Detailed Load Study

&

Commissioning Process

Led To:

»Configuration Evolution

»Dispatch Strategy

Avila CHP Configuration Evolution

Configuration	Explanation
2 250 kW Microturbines 2 335 kW Internal combustion NG Engines 1 250 kW Diesel standby	NYSERDA PON 750-02 Submittal
4 250 kW Microturbines 1 500 kW Diesel standby	Owner need for single source of responsibility for service
3 250 kW Microturbines 1 750 kW Diesel standby	Detailed Load Study Backup for entire facility load
2 70 kW Microturbines 2 335 kW Internal combustion NG Engines 1 750 kW Diesel standby	Part-load efficiency did not match facility load
3 335 kW Internal combustion NG Engines 1 750 kW Diesel standby	Dispatch Strategy and Life Cycle cost analysis

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Key Elements of Commissioning Process

Design Phase:

- System performance objectives
- Design reviews
- Initiate Systems Manual
  - Description
  - Operation
  - Testing
  - Maintenance & Repair
- Training requirements

Commissioning Process (Cont'd)

Acceptance (Construction) Phase:

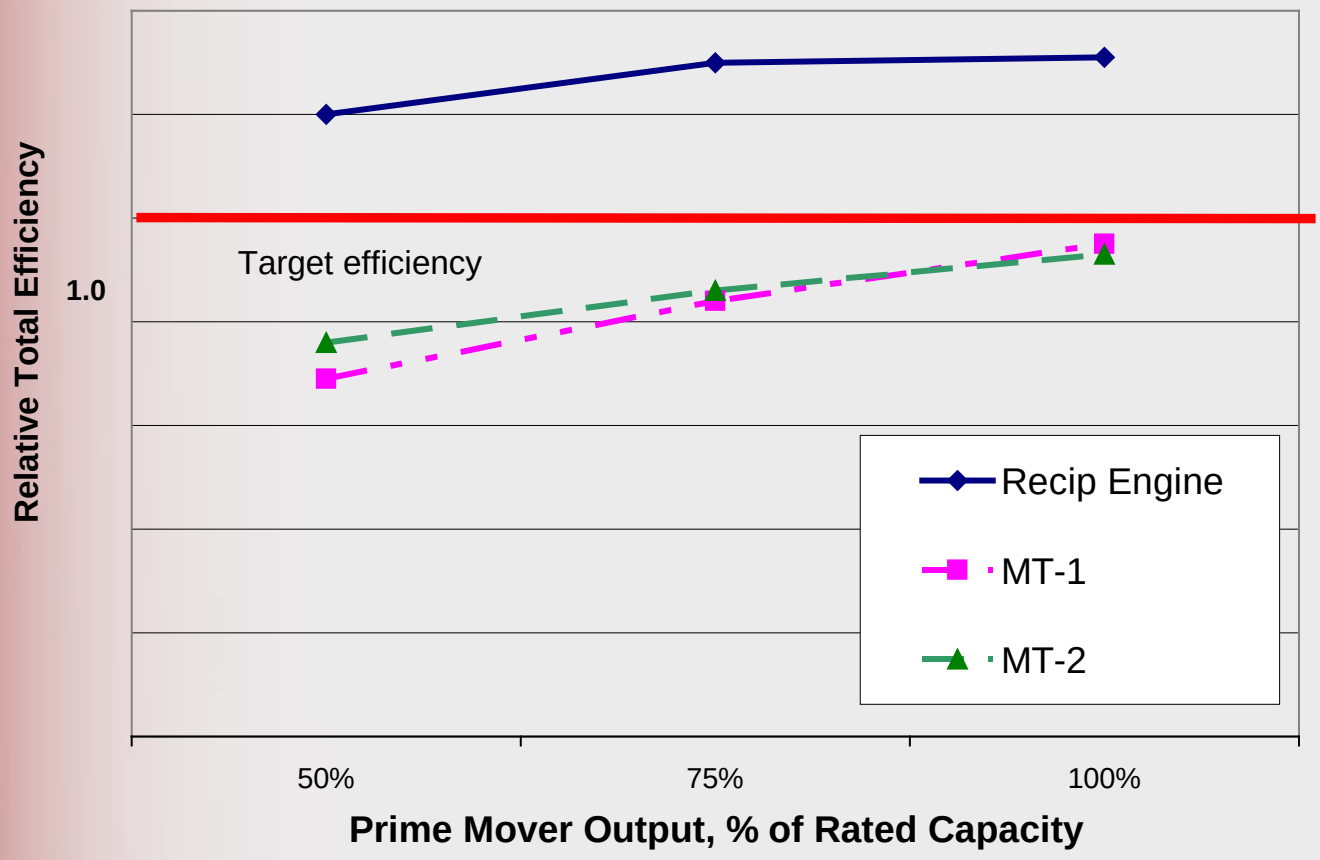
- Submittal reviews
- Change order reviews
- Progress meetings
- Pre-functional checklists
- Compile test procedures
- Testing and verification
- Training
- Prepare Report
- Finalize Systems Manual

Commissioning Process (Cont'd)

Post Occupancy:

- Complete training
- Opposite season performance verification
- Document and resolve performance issues
- Evaluate the process

Comparison of Total Efficiencies



Summary

- Formal Commissioning process is being applied to Avila CHP Project
- Results to date have been highly beneficial
  - Systematic methodology for determining performance attributes and compatibility with operating requirements
- Process provides a complete record of the design intent, construction, and operational capabilities of the system

Simulation Modeling Experience from Avila Project

Basic Tool(s) Utilized

- Building simulation software (Visual DOE), and
- Visual DOE Simulation Model (using Albany, NY weather data)
- Electric and thermal loads modeled on an hourly basis for the entire year.

Hourly load data exported to companion spreadsheet tools for detailed analyses of prioritization and CHP dispatch options

- Enables other analyses; e.g. electric to thermal load coincidence

Visual DOE Simulation Model: Principal Building Systems

- Water Source Heat Pump System
  - Unit performance from submittals; heat rejection system & boiler auto-sized by model.
  - Water Loop Heat Pump loop set at 82 F (summer) & 65 F (winter).
- Make-up Air Units (100 % outside air)
  - Serves the following “zones”: Corridors for Neighborhoods, “Virtual” zone for Commons
  - DX cooling (auto-sized) and gas furnace heating.
  - Air flow from DD drawings
- Domestic Hot Water
  - Assumed 40 gal/person/day with prescribed daily usage profile.
- Exterior Site Lighting.

Simulation Modeling as a Design, System Evaluation, and Commissioning Tool

Simulation tool uses:

- Assess Alternative Electric Dispatch and Thermal Interface Strategies
- Enable on-going systems evaluations as changes occur during the design process
- To identify alternative design options and re-verification of project economic goals
- To enable annual projections of system performance from observations during the Commissioning process
- For verification of system performance to meet contract requirements

Value of Simulation Tools re Commissioning Role

- Helped to optimize thermal Load Priorities
  - DHW, selected make-up air units and heat pump loop (winter operation)
- Annual Electric and Thermal Utilization of CHP
- Problem with initial prime movers performance
- Enabled real-time sensitivity analyses to optimize equipment selections & dispatch strategies, and
  - project economic performance
  - alternative prime mover candidates
- The tools will be updated during design, implementation, commissioning & operations

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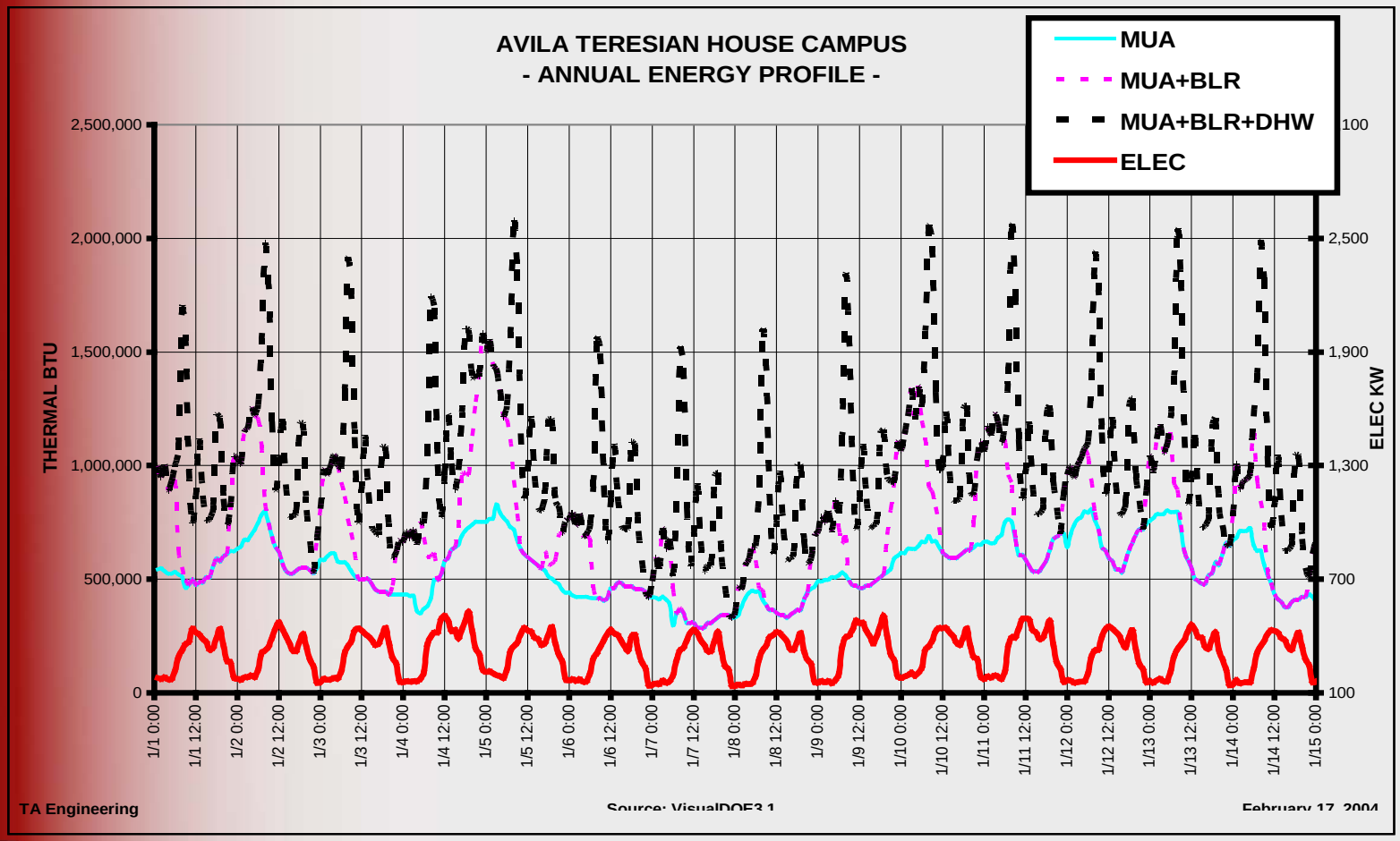
Representative Electric & Thermal Load Profile for Avila



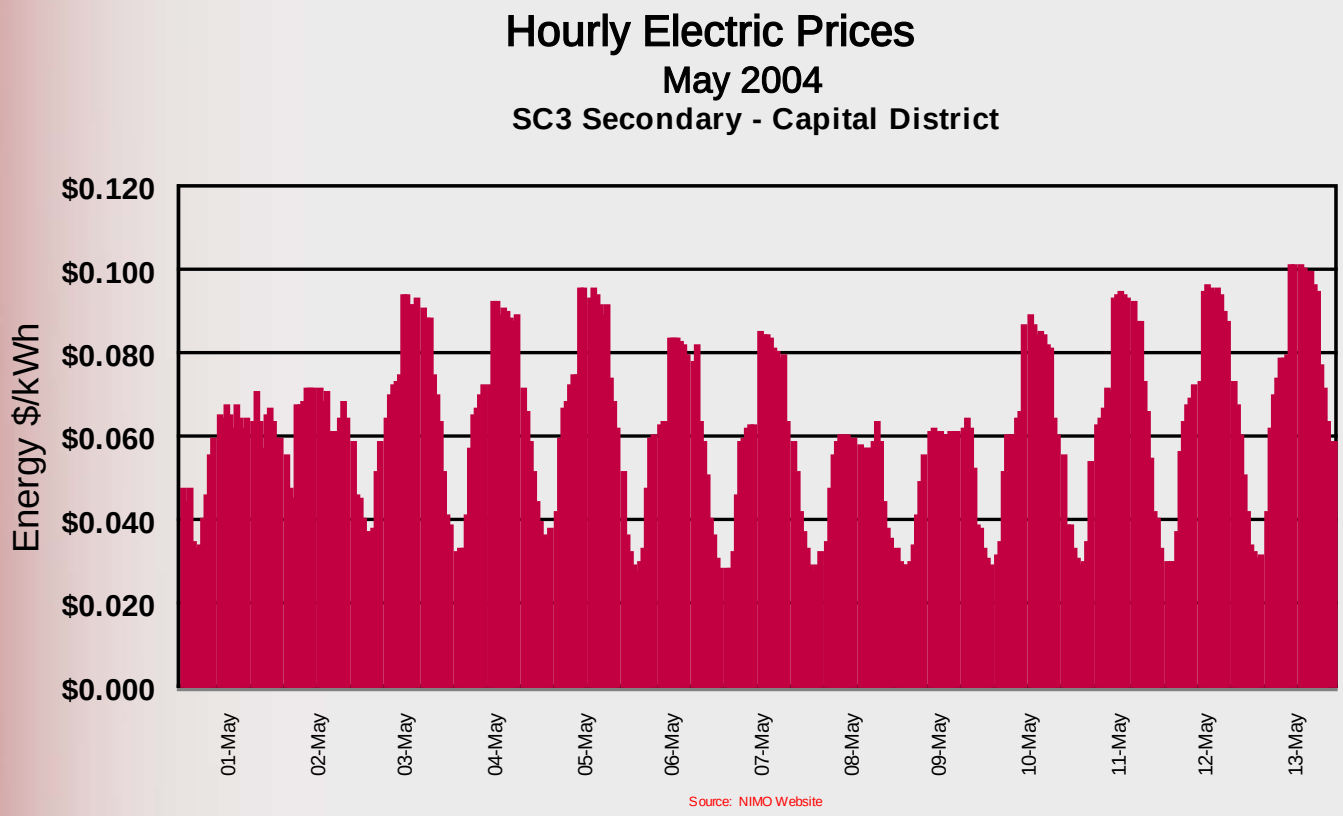
Visual DOE Simulation Results

ITEM	Value	COMMENTS
Electricity Consumption, kWh	2,811,600	
Electricity Peak Demand, kW	691	Summer Peak
Thermal Energy Consumed, Mbtu	4,385	

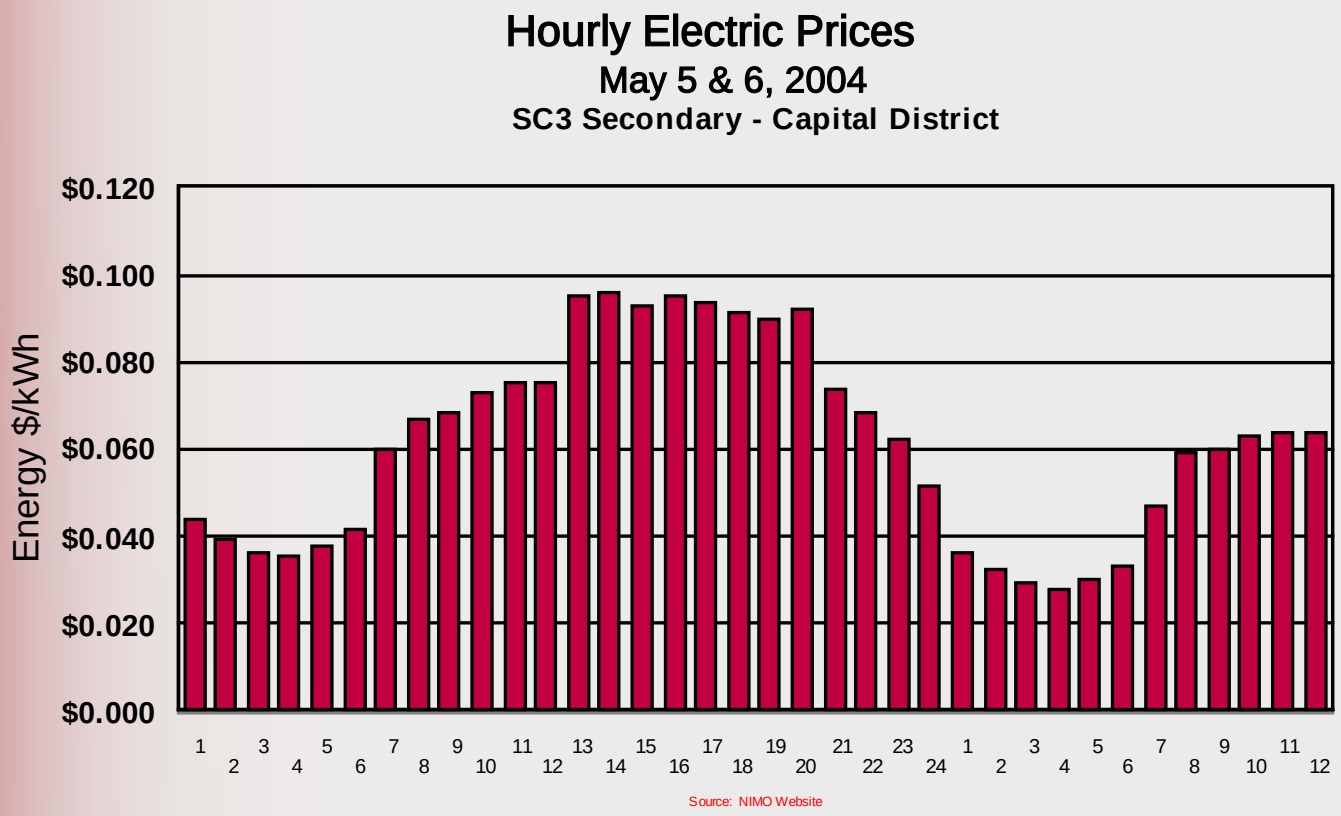
Key Tariff Provisions

- Niagara Mohawk SC7 Standby Tariff - applicable to Customers with on-site generation
- Actual hourly usage billing for commodity at customer election
- Contract Demand (all hours)
- Daily As-Used Demand (on-peak hours)
- Severe Penalties for Exceeding Contract Demand

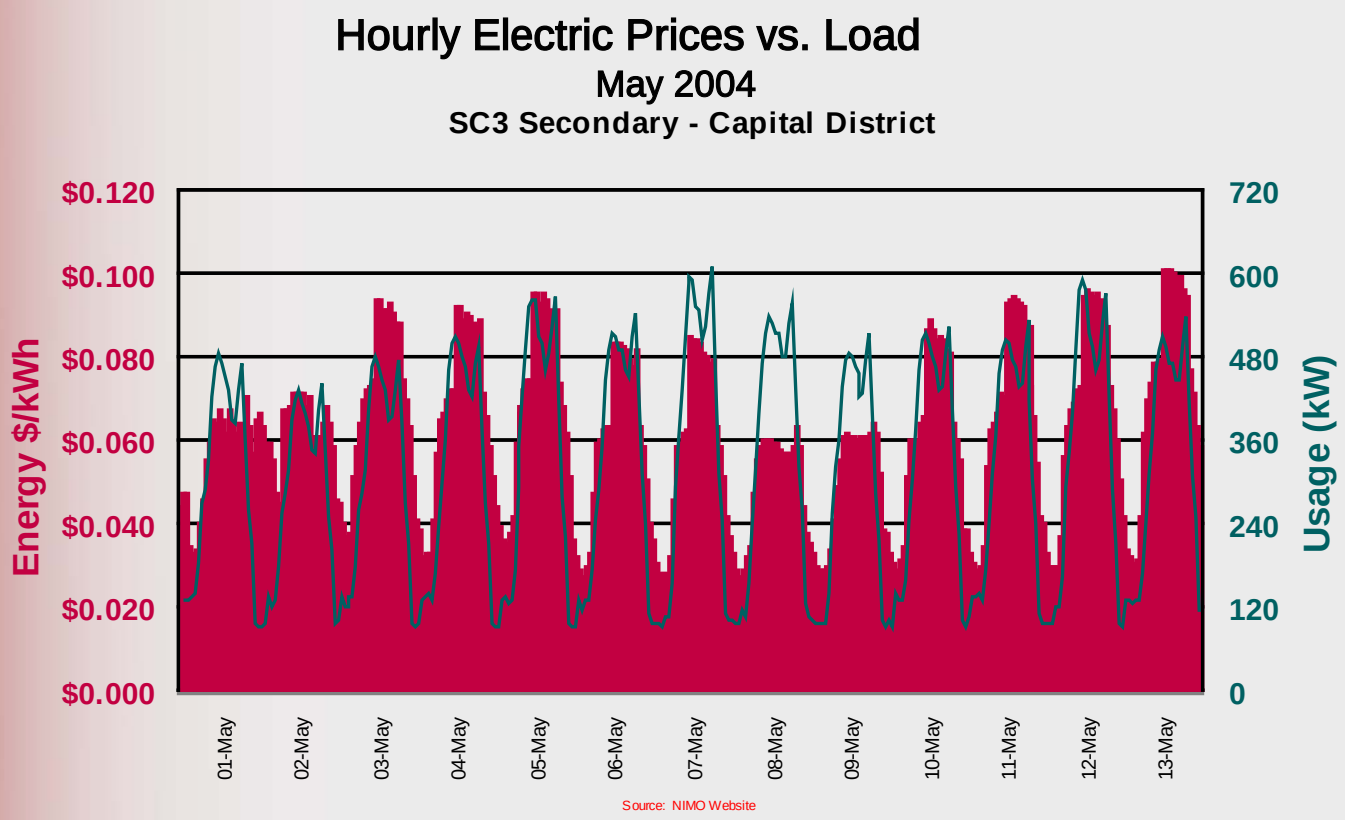
Dispatch Strategy



Dispatch Strategy



Dispatch Strategy

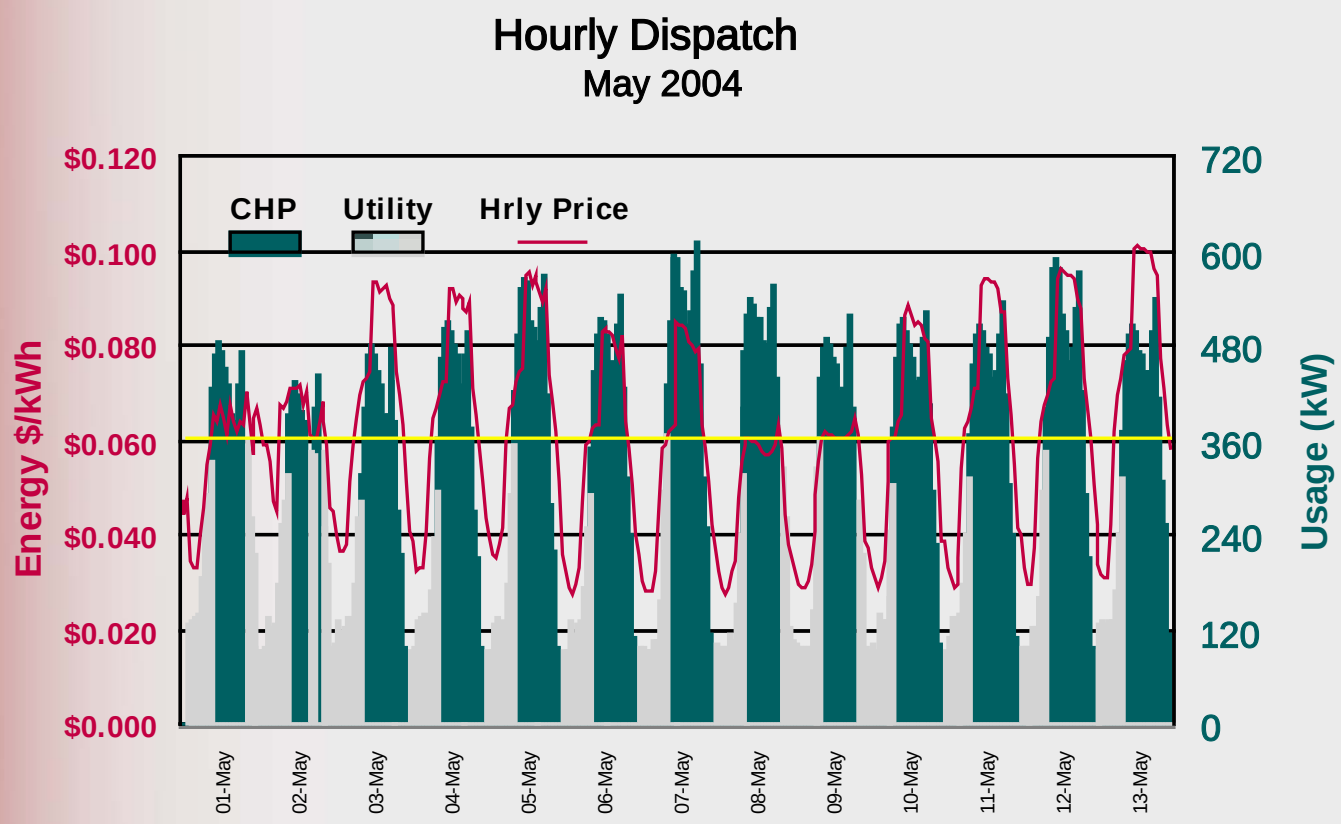


Dispatch Strategy

Daily Plant Dispatch Decision Criteria:

- Day Ahead Market Prices
- Tariff Rules
- Marginal Cost of Generation
- Availability of CHP Plant
- Fuel Supply Contract (Balancing)

Dispatch Strategy



Benefits of Avila CHP Strategy

- Client
  - Lower Energy Cost
- Utility
  - Retains Standby customer
  - Reduced On-Peak System Demand
- NYS
  - Reduced On-Peak System Demand
  - Reduced Fossil Fuel Consumption
  - Reduced Emissions