SYSKA HENNESSY

Zeckendorf Green Power Project

DG Integration and Telecommunications Facility

Project Manager: Doug Peck (Syska & Hennessy)

Sponsor: Department of Energy

ORNL Technical Project Officer: D. Tom Rizy

4/3/2001

Telecommunications Industry

Overview

End of 2001:

- 137M People Online (Equal to Half US Population)
- Current Power Grid Becoming Overtaxed
- 99.9% Reliable

Verizon:

- Merger between Bell Atlantic & GTE
- Services 63M domestic telephone lines
- In 1999 Verizon experienced 3 power disruptions

Telecommunications Industry

Energy Needs

- Highly Reliable (99.9999%)
- High Power Quality
- Economical Costs

Concern:

How do we meet the high energy demands while reducing the cost?

Zeckendorf Project

History

- Verizon Assembles Team:
  - Verizon (Owner of Facility)
  - Syska & Hennessy (Engineer)
  - International Fuel Cells (Fuel Cell Supplier)
  - Keyspan (Energy Supplier)
  - Tishman Construction (Construction)

Goal:

Select a Site For New Hybrid Energy System

Zeckendorf Project

- **Site Selection Process Criteria**
  1. Critical Nature of Facility
  2. Ability to Duplicate System at Other Facilities
  3. Potential for Environmental and Energy Savings
  4. Cost Effectiveness

- **Because of High Environmental and Economic Costs in New York, Team Selects Zeckendorf Facility in Long Island**

- **High Electrical Costs and Low Natural Gas Costs Coupled with a History of Commercial Power Outages**

Zeckendorf Facility

Zeckendorf Project

Zeckendorf Site

- 330,000+ s.f. Single Story Facility
  (Combination of 80% Office and 20% Switching)
- Controls Communication Traffic Throughout
  Most of Long Island-(4 Million Households & 125,000 Businesses)

Presently has:

- 3 – 500 Ton Electric Chillers
  (1 New/2 Need Replacement)
- 2 – 200 HP Boilers for Steam Heat
- 2 – 2.5 mw Combustion Turbines
  For Energy Stand-by Use

Energy Costs:

$2 Million/Yr.

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Zeckendorf Project

Oak Ridge National Labs Subcontract 1/31/01

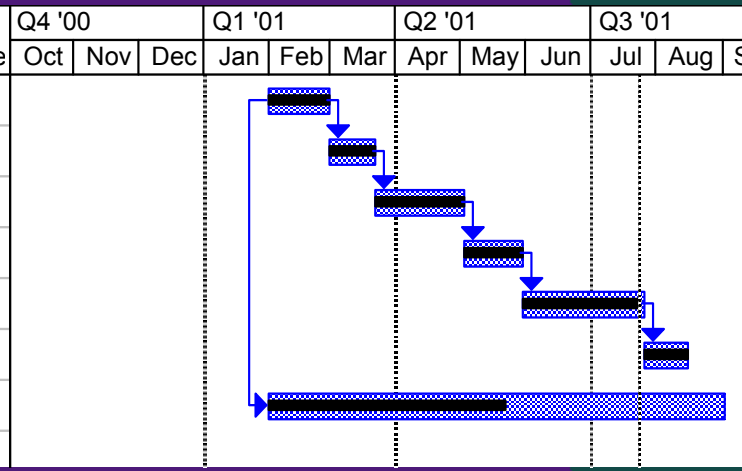
7 Tasks

1. Analyze Existing Electrical System
2. Evaluate Building Heating and Cooling System
3. Evaluate Heat Recovery Options
4. Assess Site Utilities
5. Develop Schematic Design
6. Develop Cost Estimate
7. Evaluate System Performance (Reliability)

Zeckendorf Project

Project Schedule

ID	Task Name	Duration	Start	Finish	Prede
1	Analyze Existing Electrical System	4 wks	Wed 01/31/0	Tue 02/27/0	
2	Evaluate Building Heating & Cooling Systems	3 wks	Wed 02/28/0	Tue 03/20/0	1
3	Evaluate Heat Recovery Options	6 wks	Wed 03/21/0	Tue 05/01/0	2
4	Assess Site Utilities	4 wks	Wed 05/02/0	Tue 05/29/0	3
5	Develop Schematic Design Documents	8 wks	Wed 05/30/0	Tue 07/24/0	4
6	Cost Estimates	3 wks	Wed 07/25/0	Tue 08/14/0	5
7	Monitor System Performance	30.6 wks	Wed 01/31/0	Fri 08/31/0	1SS



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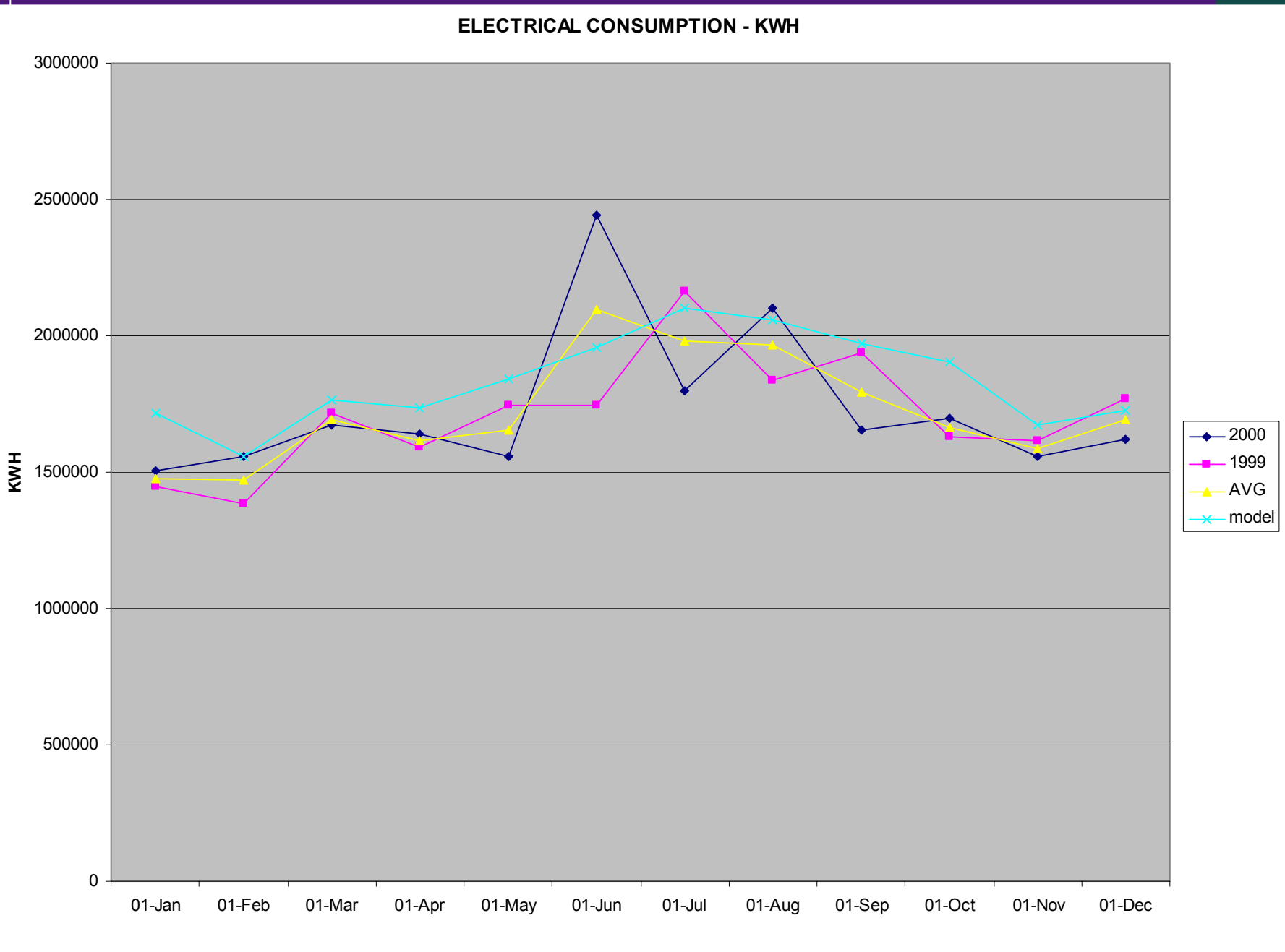
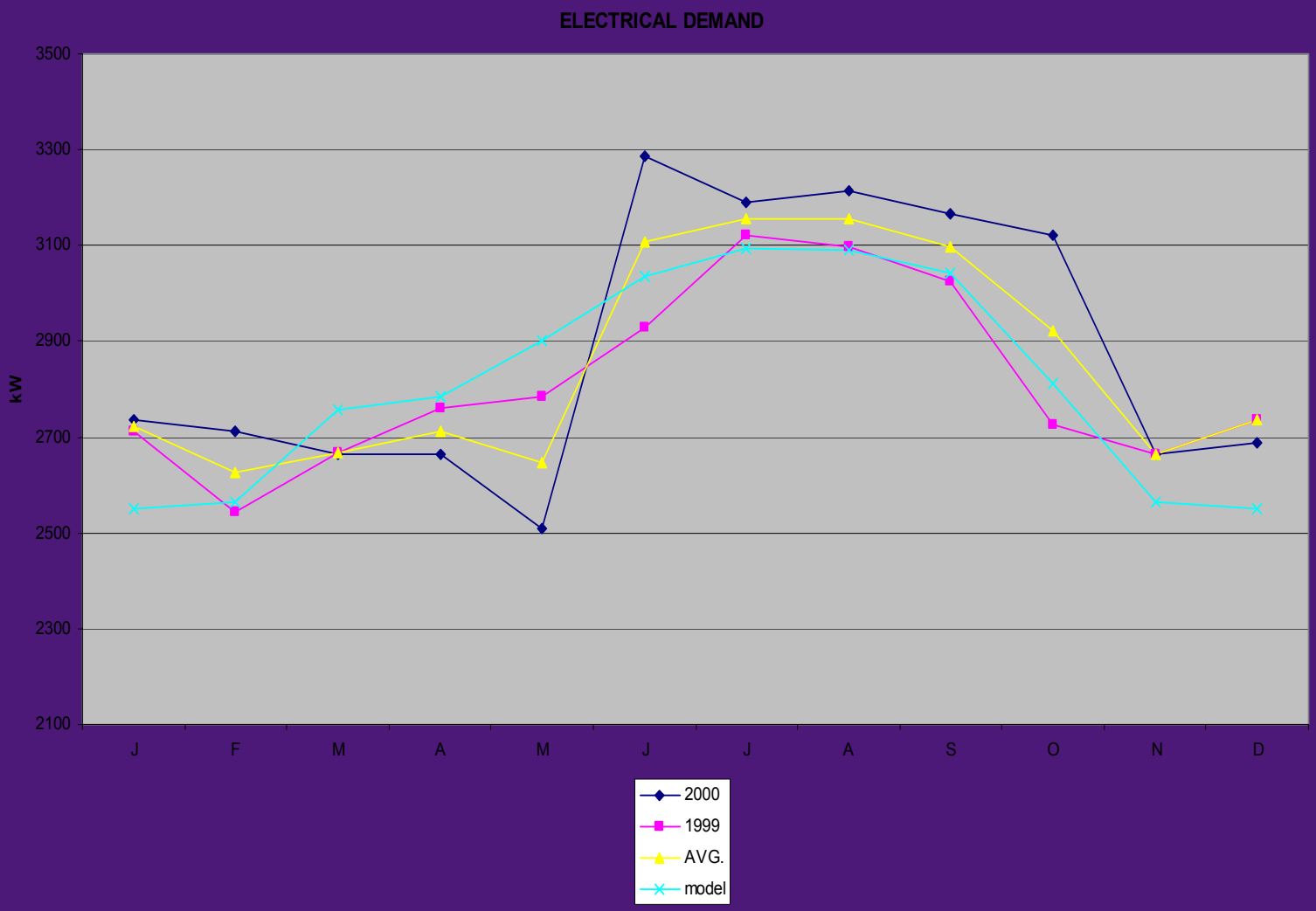

ELECTRICAL CONSUMPTION - KWH
KWH
3000000
2500000
2000000
1500000
1000000
500000
0
01-Jan
01-Feb
01-Mar
01-Apr
01-May
01-Jun
01-Jul
01-Aug
01-Sep
01-Oct
01-Nov
01-Dec
2000
1999
AVG
model



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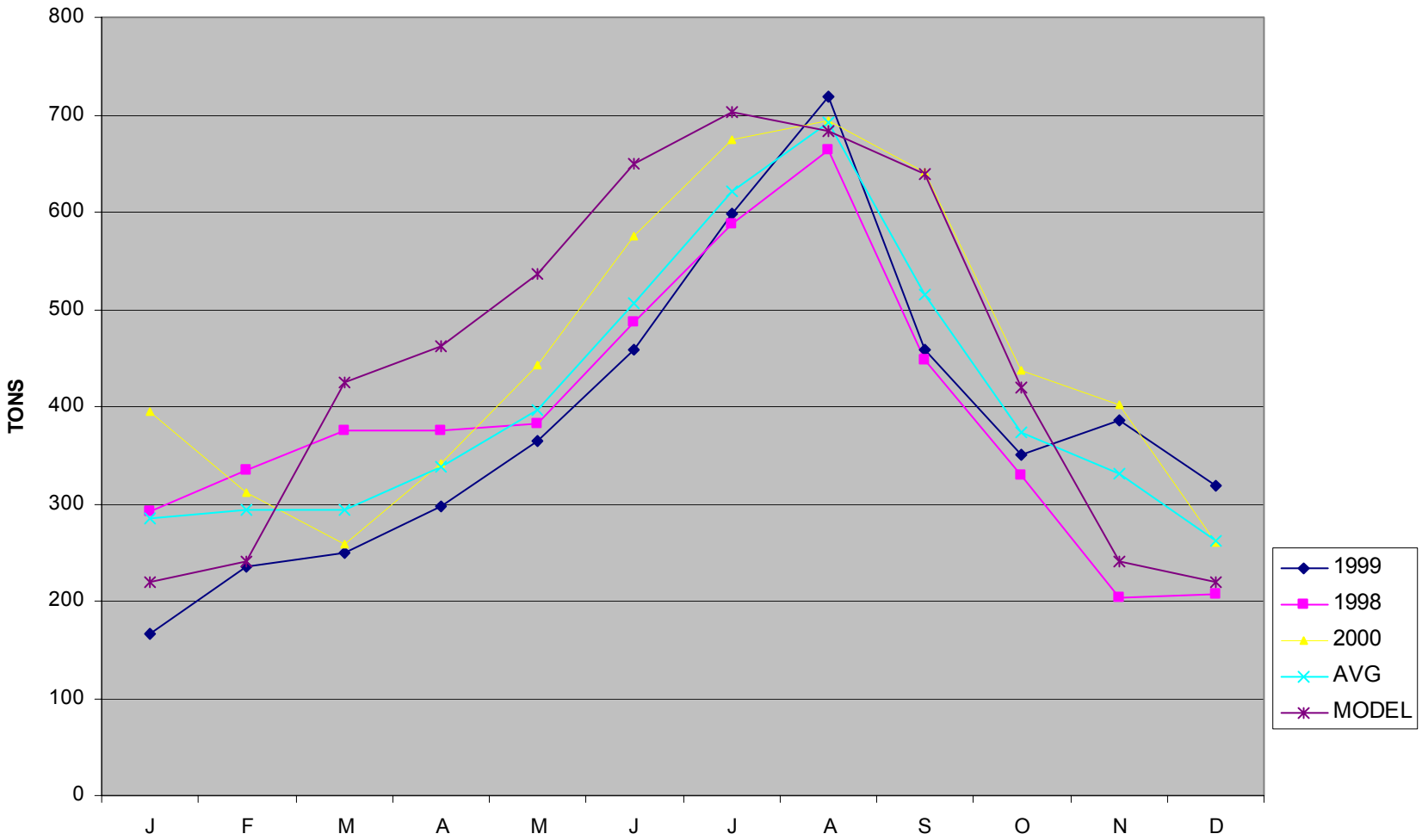
SUMMARY - CENTRAL PLANT - AVERAGE COOLING LOAD



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Concept

Create a Hybrid System

New Energy Technologies

✓PAFC Fuel Cells

Current Technologies

✓Reciprocal Natural Gas Fired Engine Generators

Concept

ONSI PC25

The 200kW PAFC manufactured by ONSI is 10′W x 18′L x 10′H. This consists of the fuel processor, cell stack, inverter, transformer, heat recovery, controls and diagnostics. Supplemental cooling module is 4′W x 14′L x 4′H.

Concept

Current Technology

Gas Fired Reciprocating Engine Generators

- ✓Highly Reliable
- ✓Low Emissions
- ✓Utilize Rejected Heat
- ✓Simple Design

Concept

How Do We Use This Hybrid System?

7 Fuel Cells

3 Engine Generators

→ Generates Power at:

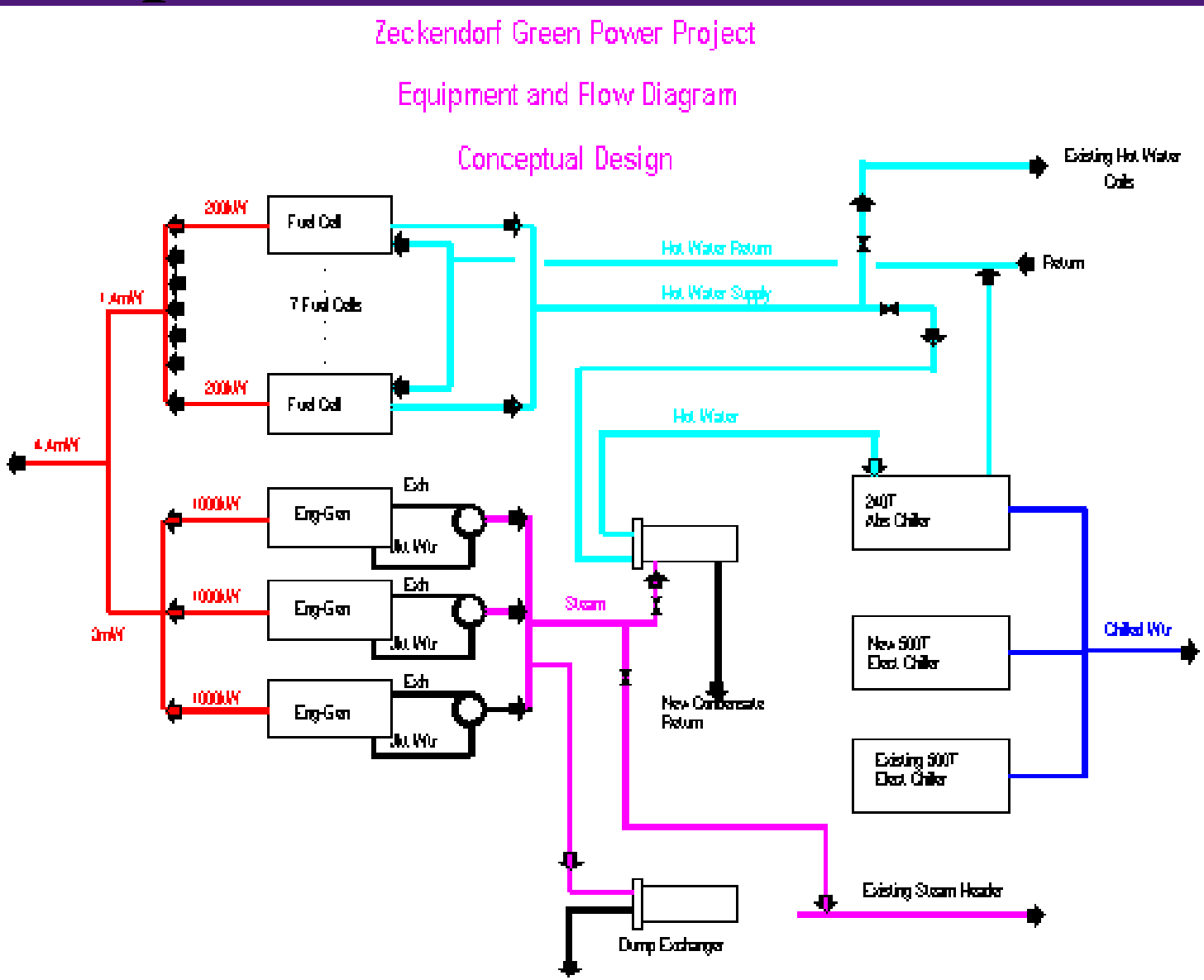
3.8 MW Max

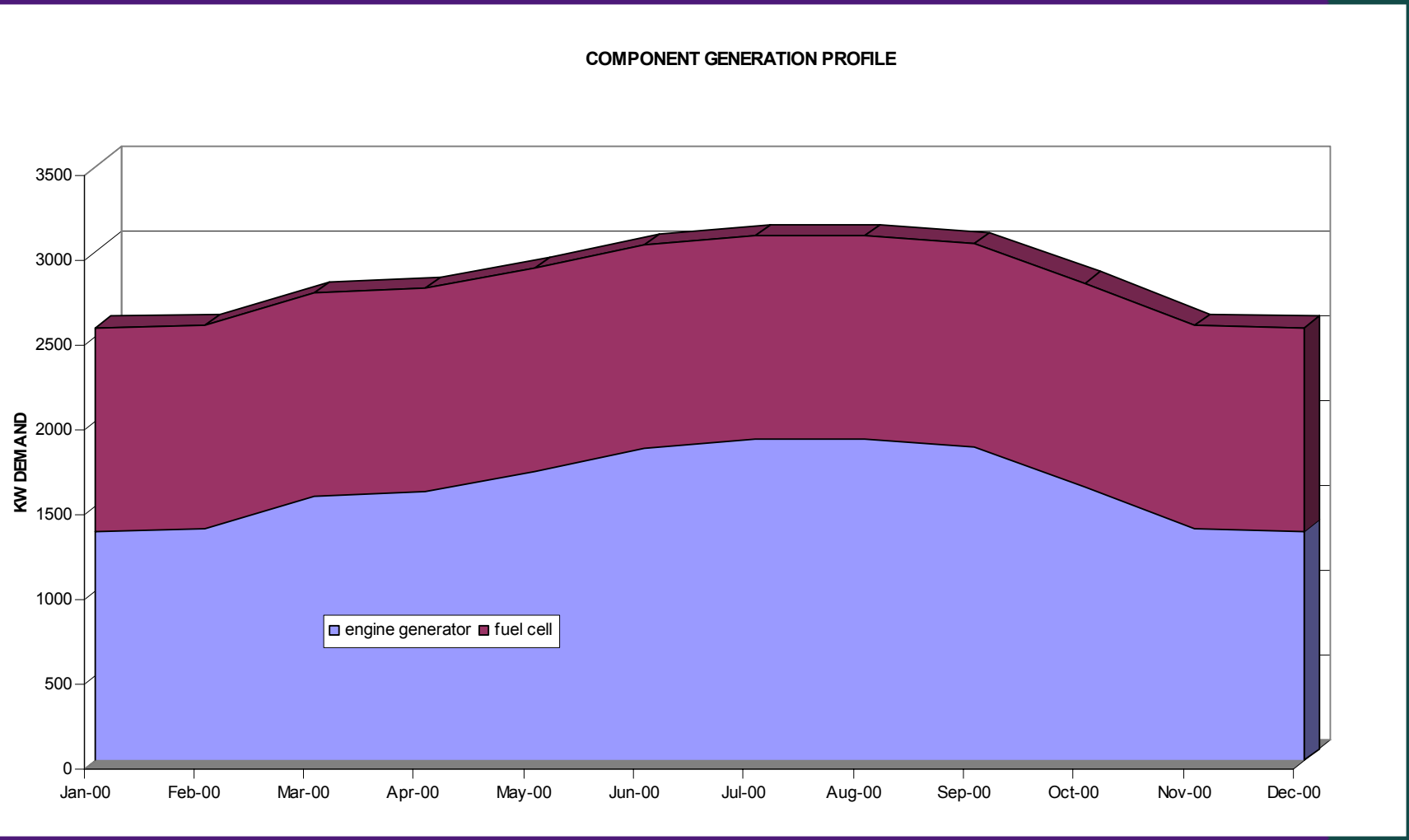
3 MW@N-1

✓Captured Waste Heat To Run 1 - 240 Ton Absorption Chiller

✓Additional Electric Centrifugal Fired Chiller (500 Ton)

Concept


Zeckendorf Green Power Project
Equipment and Flow Diagram
Conceptual Design
Existing Hot Water Coils
Return
Hot Water Return
Hot Water Supply
Hot Water
200kW
Fuel Cell
7 Fuel Cells
200kW
Fuel Cell
1.4mW
4.4mW
3mW
1000kW
Eng-Gen
Exh
Jkt. Wtr
1000kW
Eng-Gen
Exh
Jkt. Wtr
1000kW
Eng-Gen
Exh
Jkt. Wtr
Steam
240T
Abs. Chiller
New 500T
Elect. Chiller
Existing 500T
Elect. Chiller
Chilled Wtr
New Condensate
Return
Existing Steam Header
Dump Exchanger
Syska & Hennessy
Rev 0. April 1, 2001



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Economics

Cost = $17 Million

Original Estimate
$15,000,000
with
5 Year Payback

Fixed Cost

- Chillers
- Engines
- Fuel Cells
- Construction

Variables

- Reduced Energy Cost From Captured and Reused Waste Heat