Energy Storage/Distributed Resource Options at the University of Maryland

Energy Storage Systems Peer Review 2001

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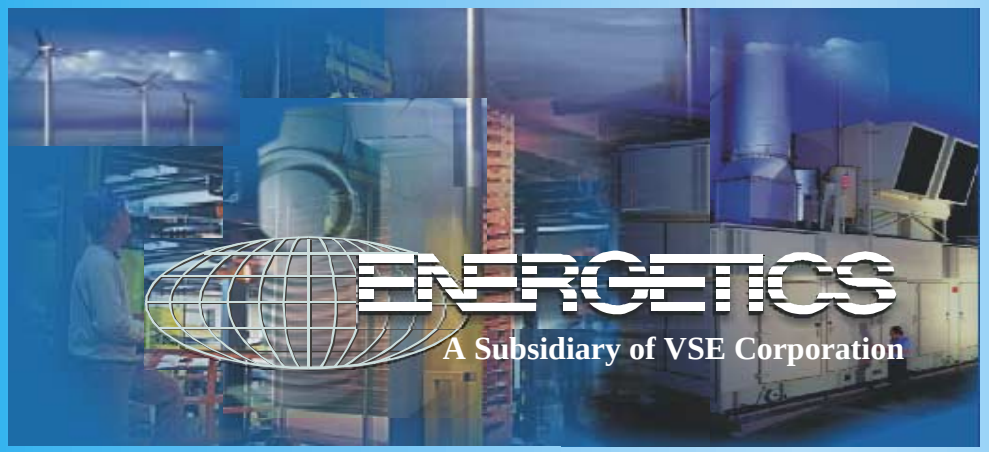


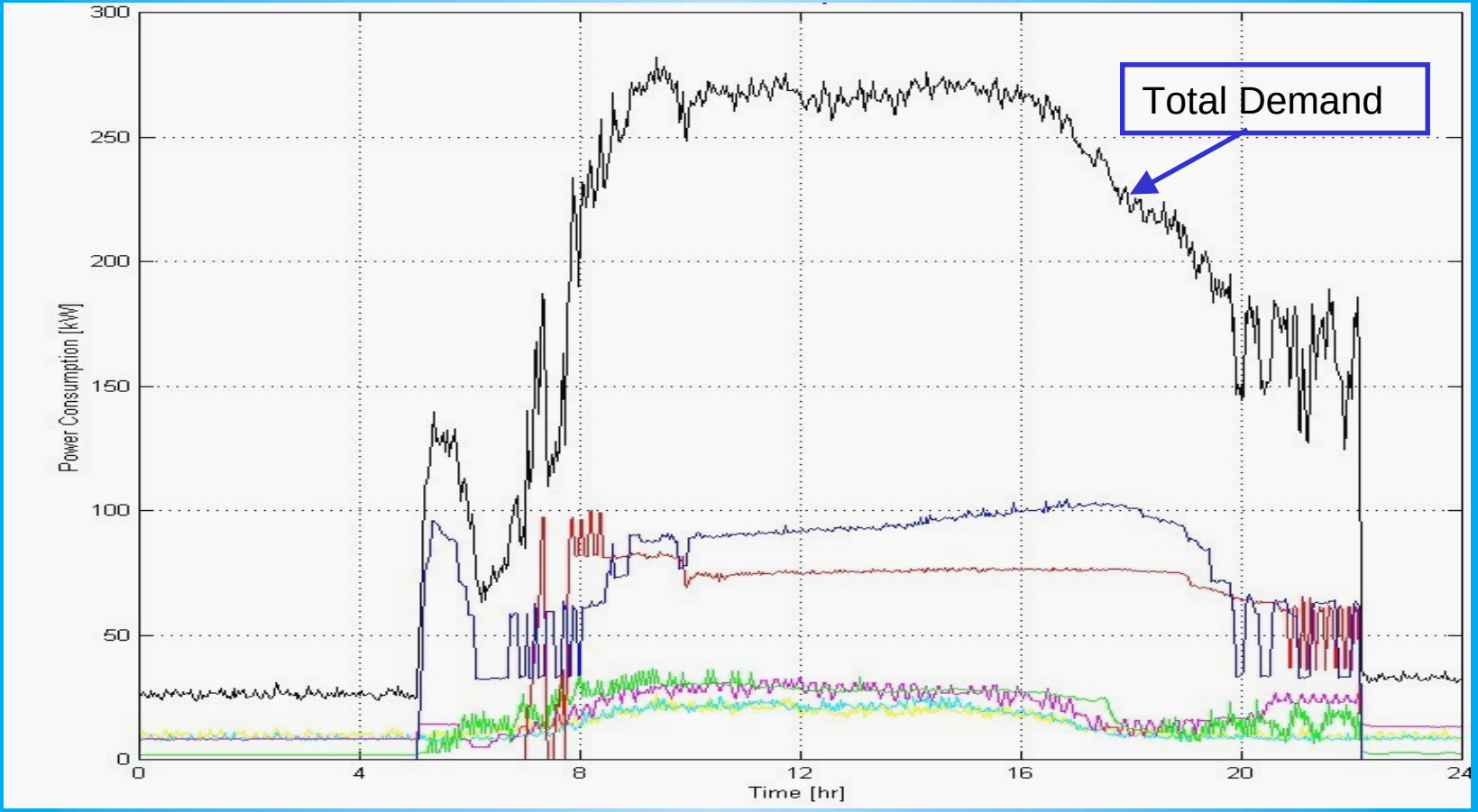
Project Objectives

- **Evaluate the net benefit of energy storage at University of Maryland (UM) Chesapeake Building**
- **Use enhanced distributed energy technology simulator**
- **Perform off-line economic analysis of hybrid microturbine/battery storage system**

UM Chesapeake Building

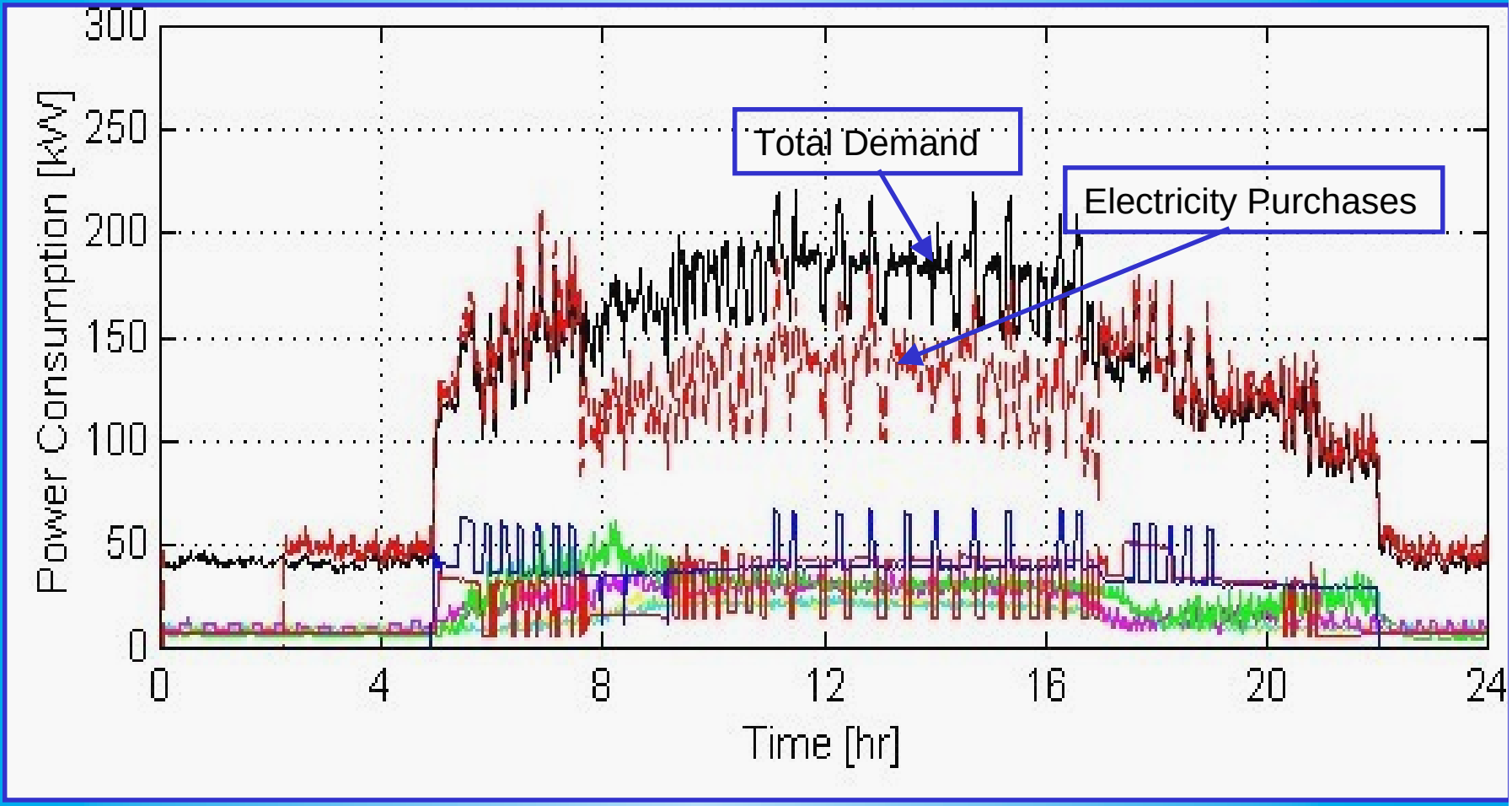
- **Medium Size Office Building - 51,000 ft^2**
- **4 Floors, 2 Zones**
- **200 Occupants**
- **Electric Peak ~ 300 kW**
- **Microturbine - 75 kW**
- **Building Cooling, Heating and Power (BCHP) System**

Chesapeake Building Load Profile without Microturbine BCHP



24-Hour Power History for 02-Jun-2000

Chesapeake Building Load Profile with Microturbine BCHP



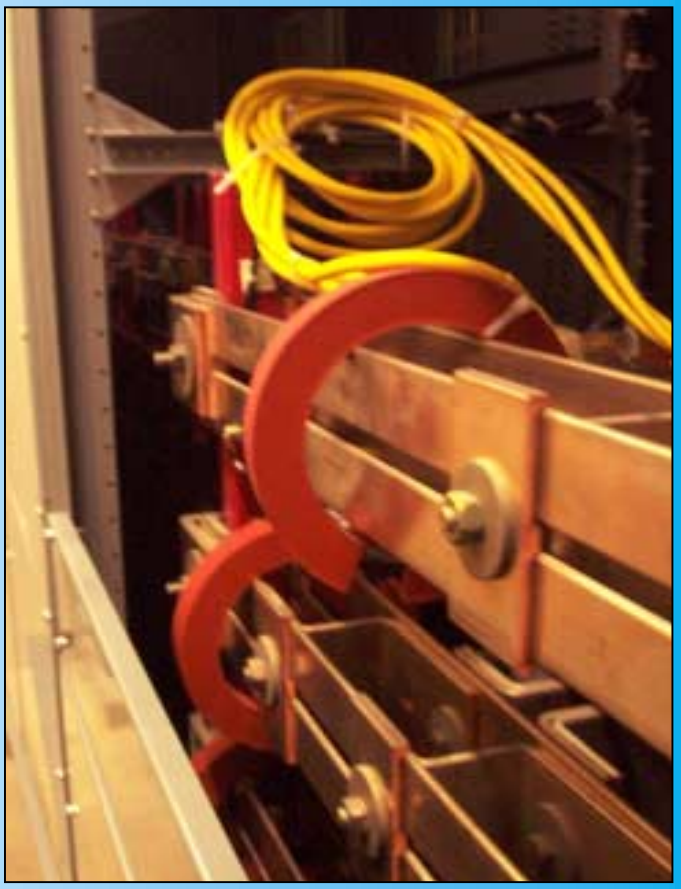
24-Hour Power History for 21-Sep-2001

Progress To Date

06/27/01	First UM facility visit
08/05/01	Simulator ZBB battery module validated
08/25/01	Pre-installation visit at UM
08/27/01	Simulator installed at UM
09/24/01	Tornado hit UM
10/05/01	Simulator IP address installed for remote control
10/19/01	Simulator VRLA battery module validated Honeywell microturbine dismantled
10/25/01	UM power outage
10/29/01	Battery demonstration began

Non-Intrusive Installation at UM

Simulator in the mechanical room



Current transformers used to read load data

Simulated Technologies

- Flooded Lead-Acid Battery
- Valve-Regulated-Lead-Acid Battery
- Zinc Bromine Battery
- Power Quality Battery
- Diesel Generator
- Microturbine
- Phosphoric Acid Fuel Cell

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Simulator Software Capabilities

- **Real-time meter data collection**
- **Virtual technology simulation**
- **Electricity purchases analysis**
- **Flexibility in technology sizes and operating algorithms**
- **Graph and tabular display of technical performance data in daily, weekly, and monthly summaries**
- **Tabular display of economic and environmental performance data in monthly summaries**

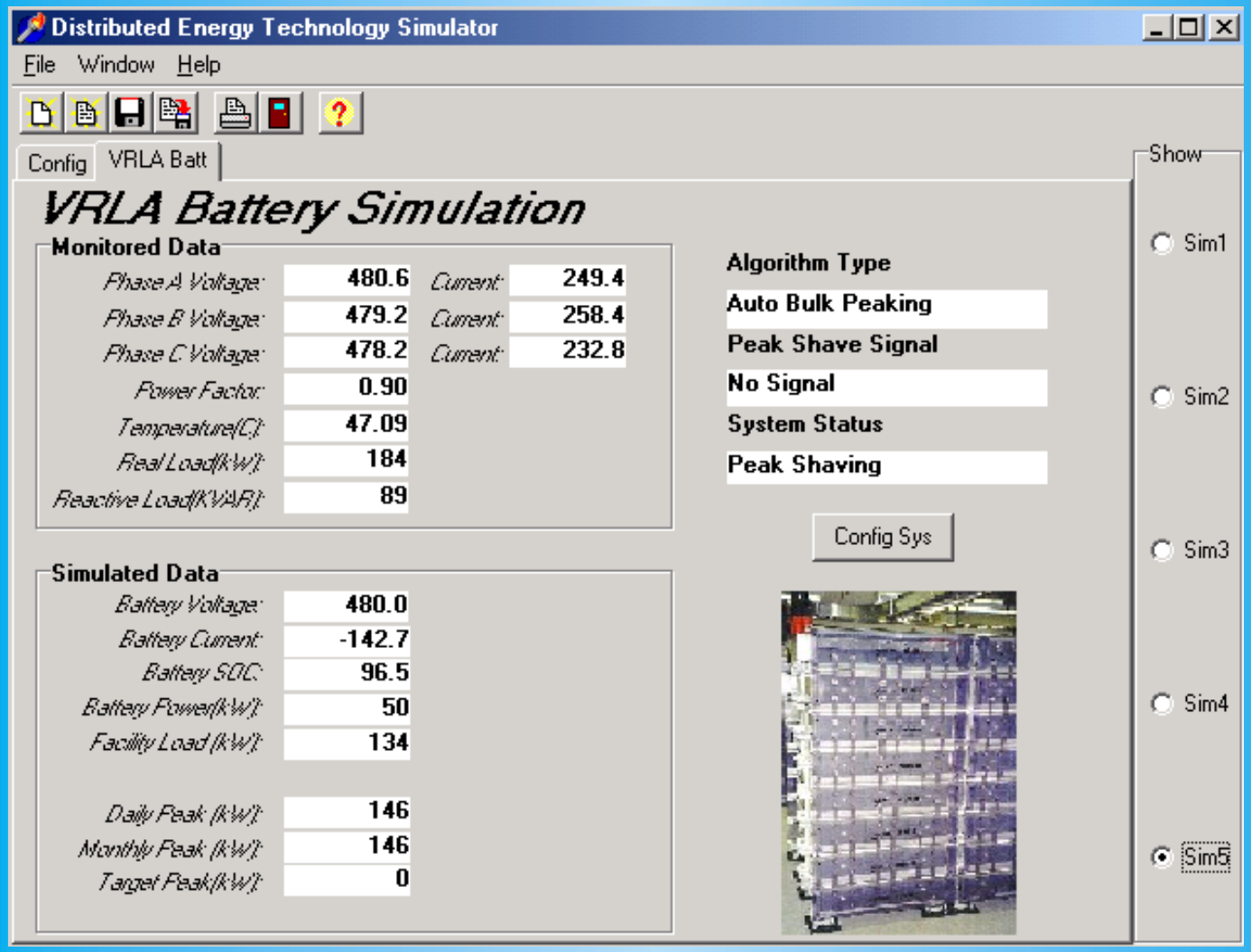
UM Chesapeake Simulation Parameters

Local Utility:	**PEPCO**
Peak Rate:	**$0.049/kWh**
Off-Peak Rate:	**$0.03/kWh**
Demand Charge:	**$4/kW**
Peak Period:	**12 – 5 PM**

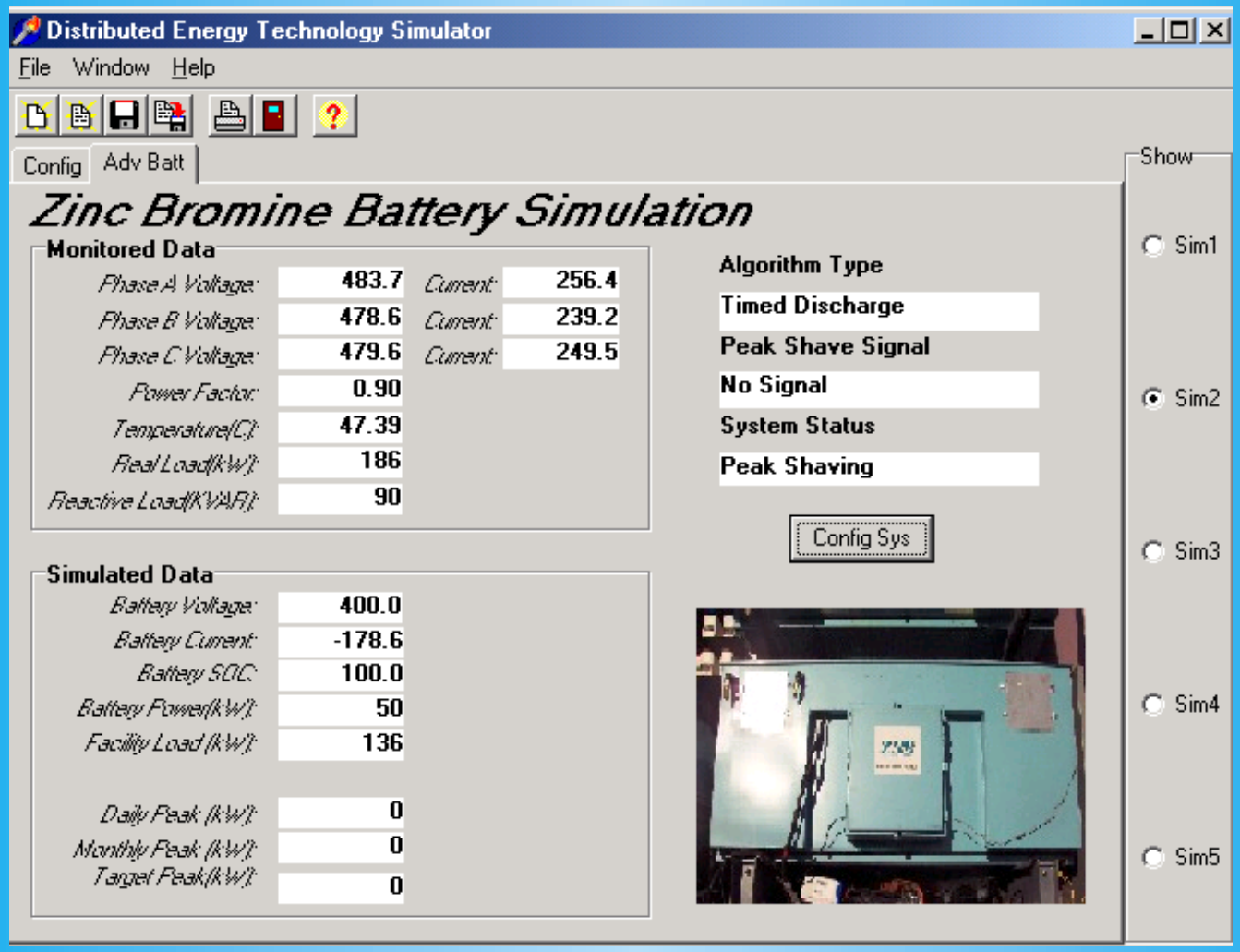
Peak AC Load:	**250 kW**
Peak Energy:	**1,000 kWh/day**
Off-Peak Energy:	**3,500 kWh/day**
Auto Bulk Peak:	**150 kW threshold**

- **50-kW/400-kWh battery to supplement 75-kW microturbine and BCHP system**
- **Five technology choices:**
  - **Flooded lead acid battery on timed discharge**
  - **VRLA battery on timed discharge**
  - **VRLA battery on auto bulk peaking**
  - **Zinc bromine battery on timed discharge**
  - **Zinc bromine battery on auto bulk peaking**

Virtual VRLA Battery Operation



Virtual Zinc Bromine Battery Operation



Simulated Technology Comparison October 29 - November 12, 2001

Measure	Flooded	Zinc Bromine		VRLA	
	Timed	Timed	Auto-Bulk	Timed	Auto-Bulk
Energy Output (kWh)	2,675	2,762	2,712	2,687	2,649
Peak kWh Purchases	7,939	7,852	8,484	7,927	8,547
Off-Peak kWh Purchases	40,334	40,206	39,623	40,987	40,366
Energy Cost Savings ($)	76	84	82	57	56
Demand Charge Savings($)	164	250	250	186	186
Monthly Savings ($)	240	334	332	243	242

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Next Steps

- **Minimize total energy bill for Chesapeake building**
- **Provide variable electricity supply for fans and compressors of BCHP system**
- **Evaluate cost-effective source of electricity for recharge**
  - **Off-peak electricity purchases**
  - **Microturbine generation**
- **Perform seasonal analysis**

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FY 02 Plans

- Incorporate hybrid technologies into simulator
- Develop modules to emulate other energy storage systems
- Pursue cost-shared demonstration of simulated storage technologies at other sites
- Present results at EESAT 2002
- Present results at 8ELBC