Fuel Cells for Supermarkets

DOE Hydrogen and Fuel Cell Technical Advisory Committee

Benny Smith

Vice President of Facilities

Price Chopper Supermarkets, Schenectady NY

Member of the Fuel Cell Users Panel

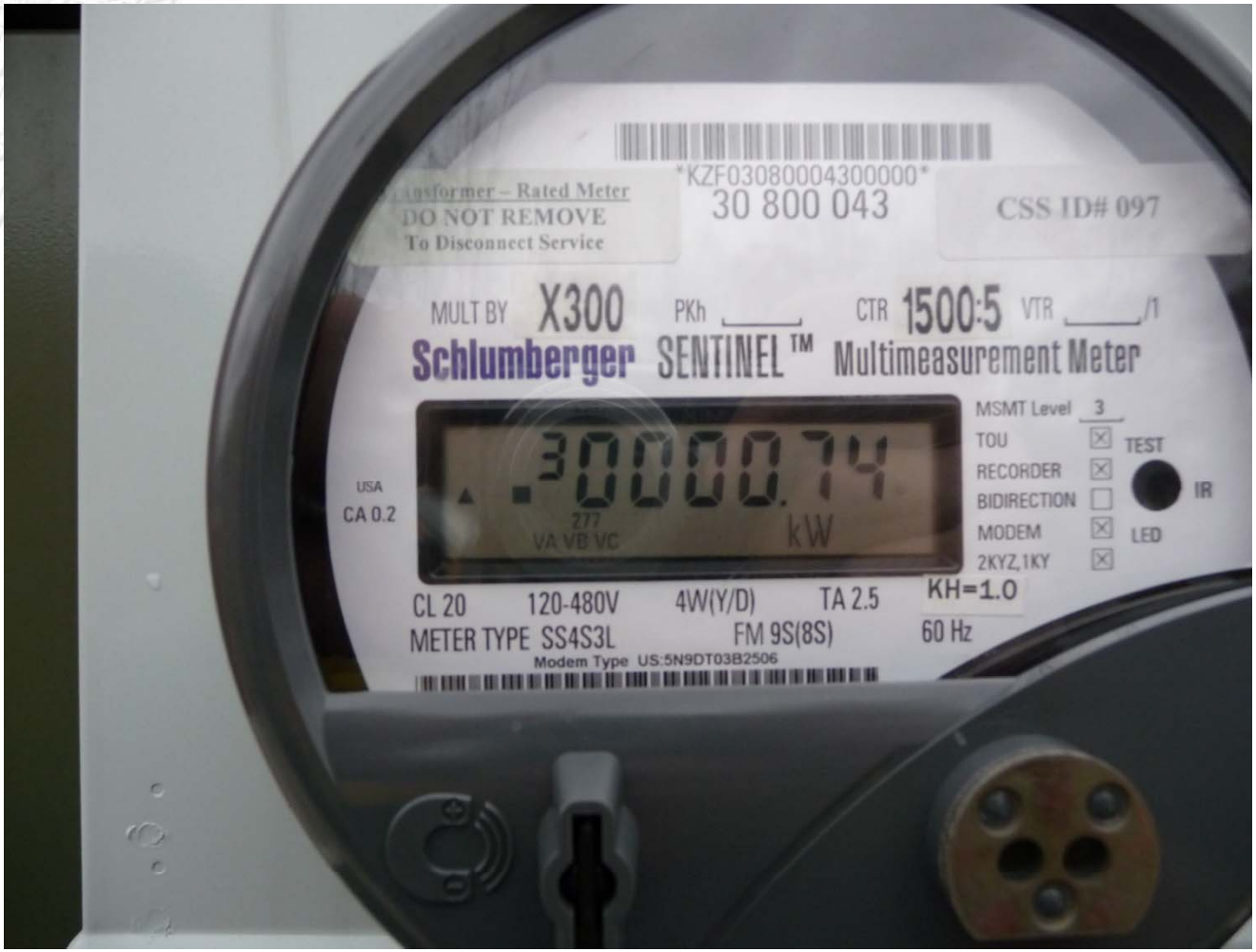
growinggreener

Who is Price Chopper?

- Price Chopper owns & operates 128 supermarkets throughout New York, Vermont, Massachusetts, Connecticut, New Hampshire and Pennsylvania.
- We are privately owned.
- By incorporating cutting edge technology we strive to effectively reduce our carbon footprint.

WHY FUEL CELLS?

Electricity Costs are a Factor



Incentives and Grants are Available

- **Partnership with NYSERDA has yielded opportunities to reduce grid dependence**

Operates 24 Hours a Day/7 Days a Week

- Continuous heat and power demands
- Standby ability

Experts in the Field

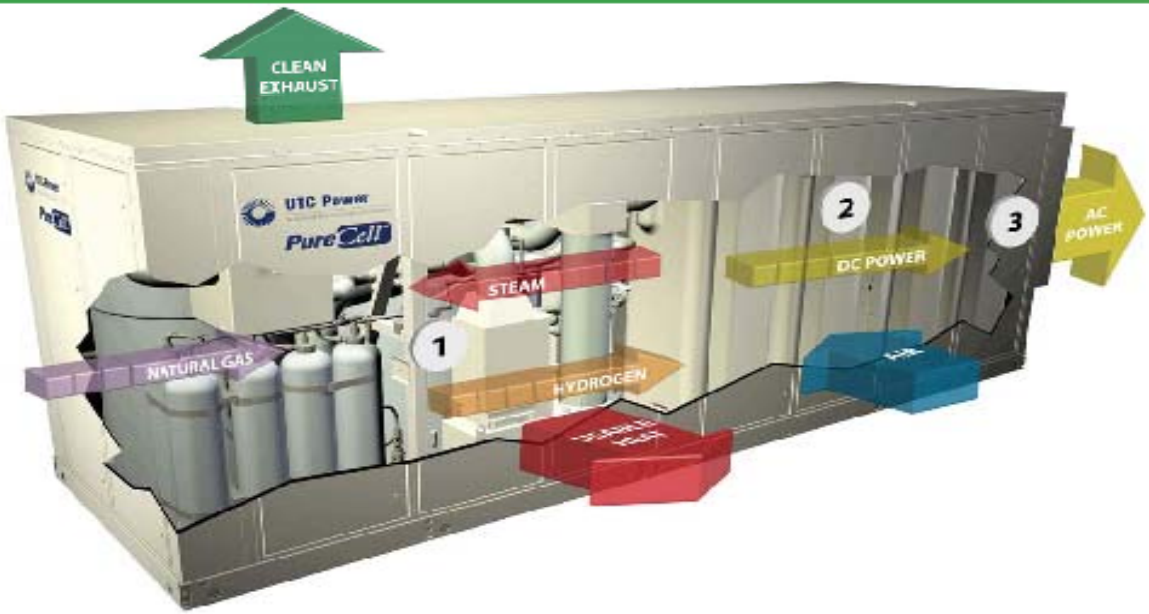
- UTC experience
- NYSERDA support
- First site converted
- First Field Connected UTC 400Kw cell

HOW A FUEL CELL WORKS

PureCell® System

A fuel cell is an electrochemical device that combines hydrogen fuel and oxygen from the air to produce electricity, heat and water. Fuel cells operate without combustion, so they are virtually pollution-free. Since the fuel is converted directly to electricity and heat, a fuel cell's total system efficiency can be much higher than internal combustion engines, extracting more energy from the same amount of fuel. The fuel cell itself has no moving parts — making it a quiet and reliable source of power.

Inside the PureCell® System



1 Fuel Processor (Reformer)

The Fuel Processor reforms the fuel (natural gas) to hydrogen gas to feed the Fuel Cell Stack.

2 Fuel Cell Stack

Hydrogen gas and air are combined in an electrochemical process that produces Direct Current (DC) power, pure water and heat. The byproduct water is utilized in the operation of the power plant. The usable heat is available for meeting other facility energy requirements (e.g., hot water, space heating, air conditioning and cooling).

3 Power Conditioner

The DC power provided by the Fuel Cell Stack is conditioned to provide high quality Alternating Current (AC) power output.

Price Chopper®

UTC Power
A United Technologies Company

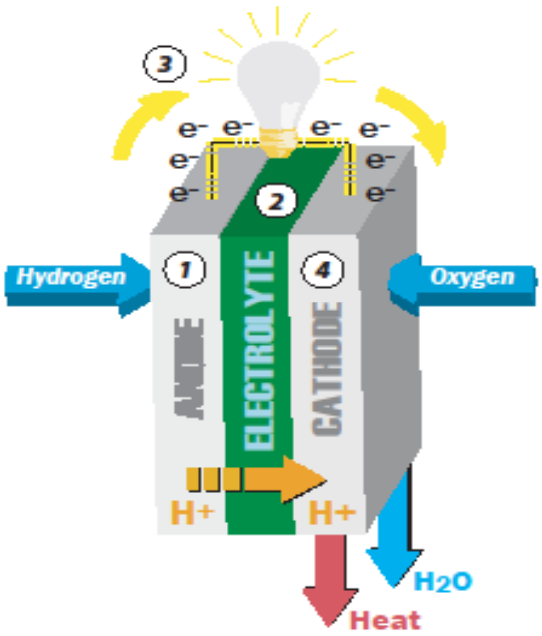
HOW IT WORKS
PureCell® System

HOW A FUEL CELL WORKS

PureCell® System

The fuel cell is composed of an anode (a negative electrode that provides electrons), an electrolyte in the center, and a cathode (a positive electrode that accepts electrons).

Inside the Fuel Cell



1 Anode

As hydrogen flows into the fuel cell anode, a catalyst layer on the anode helps to separate the hydrogen atoms into protons (hydrogen ions) and electrons.

2 Electrolyte

The electrolyte in the center allows only the protons to pass through the electrolyte to the cathode side of the fuel cell.

3 External Circuit

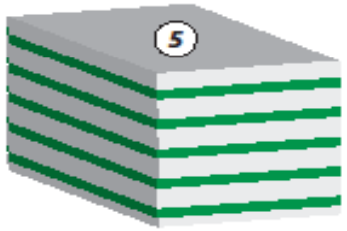
The electrons cannot pass through this electrolyte and, therefore, must flow through an external circuit in the form of electric current. This current can power an electric load.

4 Cathode

As oxygen flows into the fuel cell cathode, another catalyst layer helps the oxygen, protons, and electrons combine to produce pure water and heat.

5 Fuel Cell Stack

Individual fuel cells can be combined into a Fuel Cell "Stack" to increase the total electrical output.



HOW IT WORKS

PureCell® System

UTC Power
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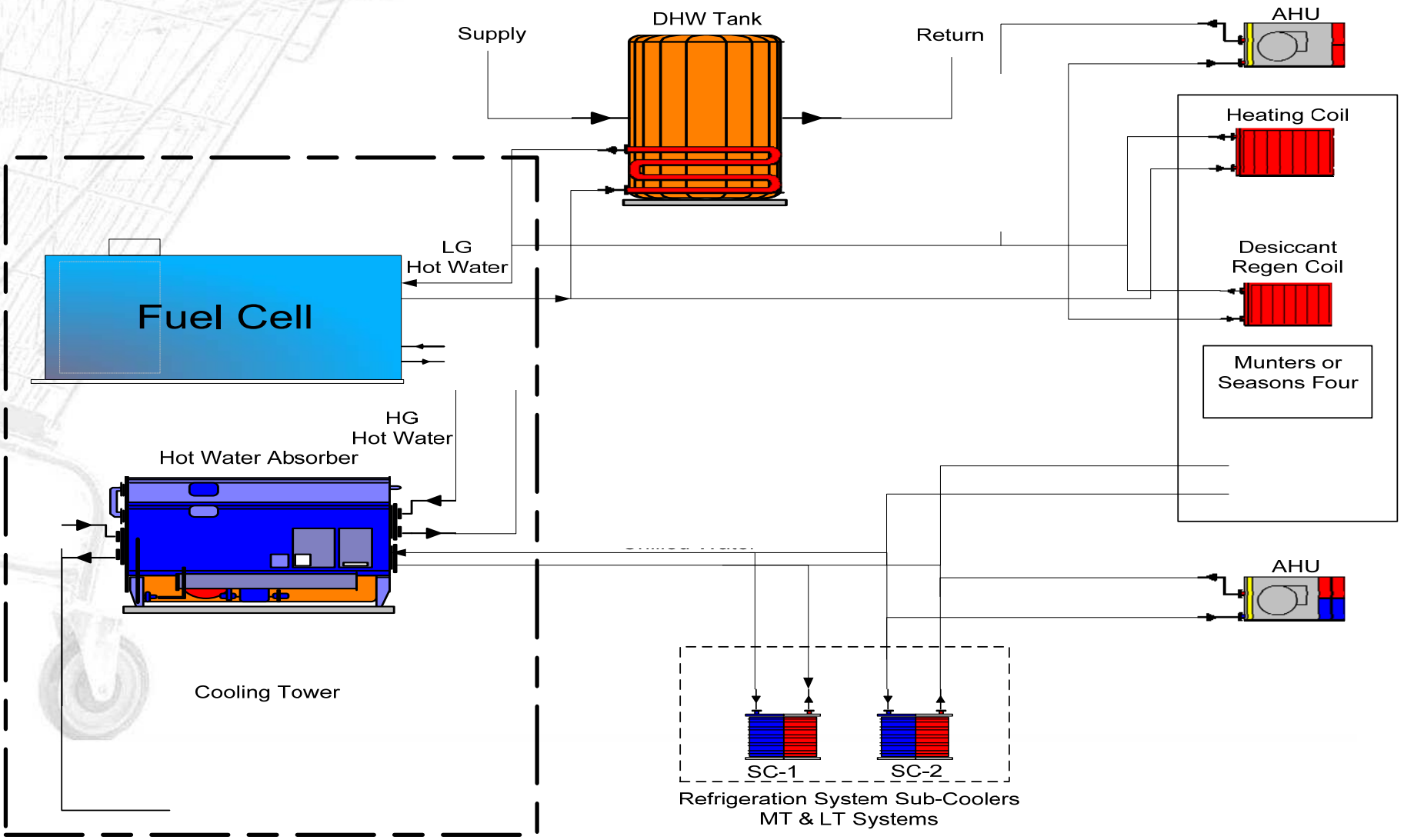
Supermarket Installation – Thermal Utilization

Energy Productivity, Security, Responsibility

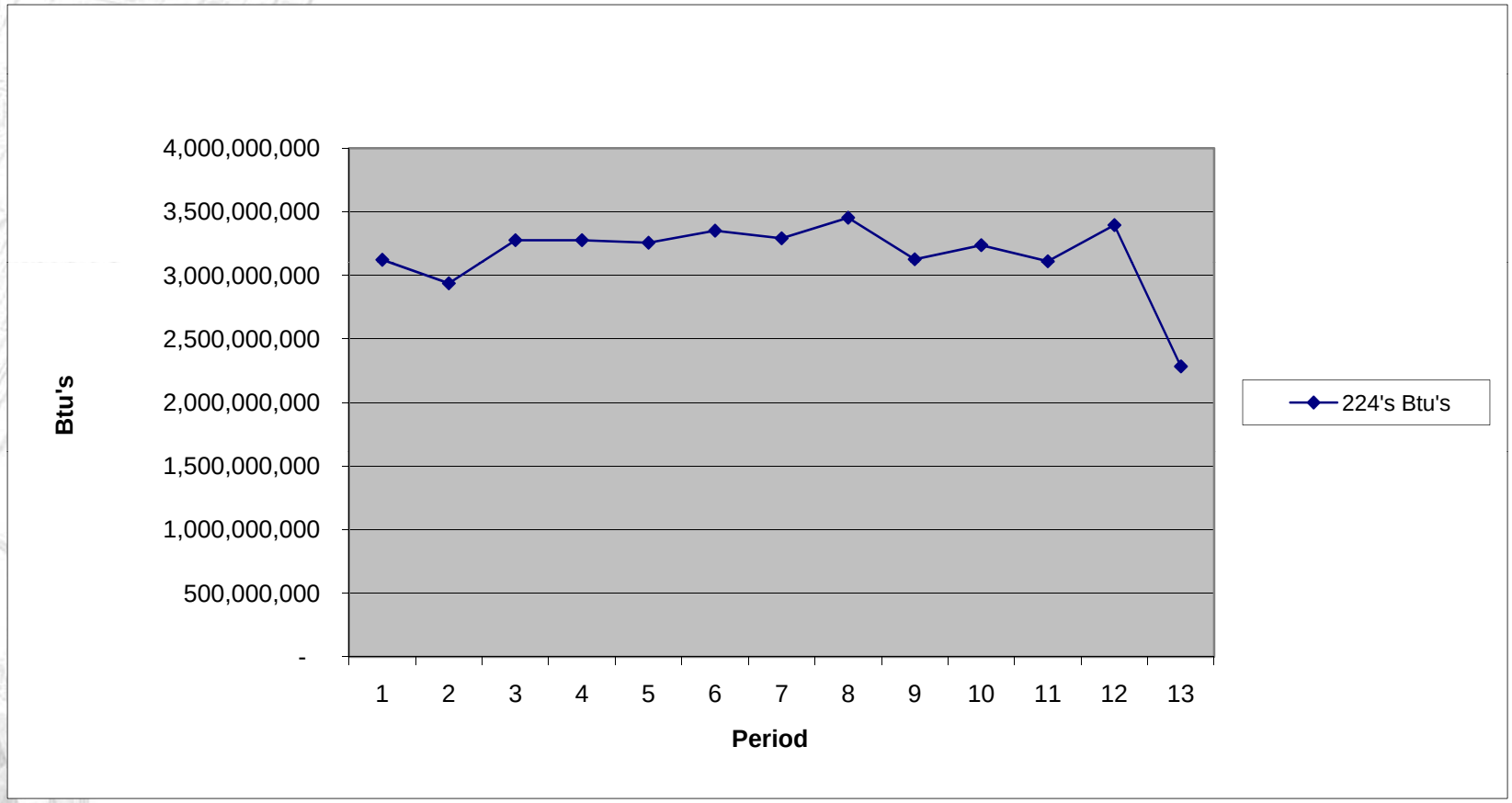


Green Initiative

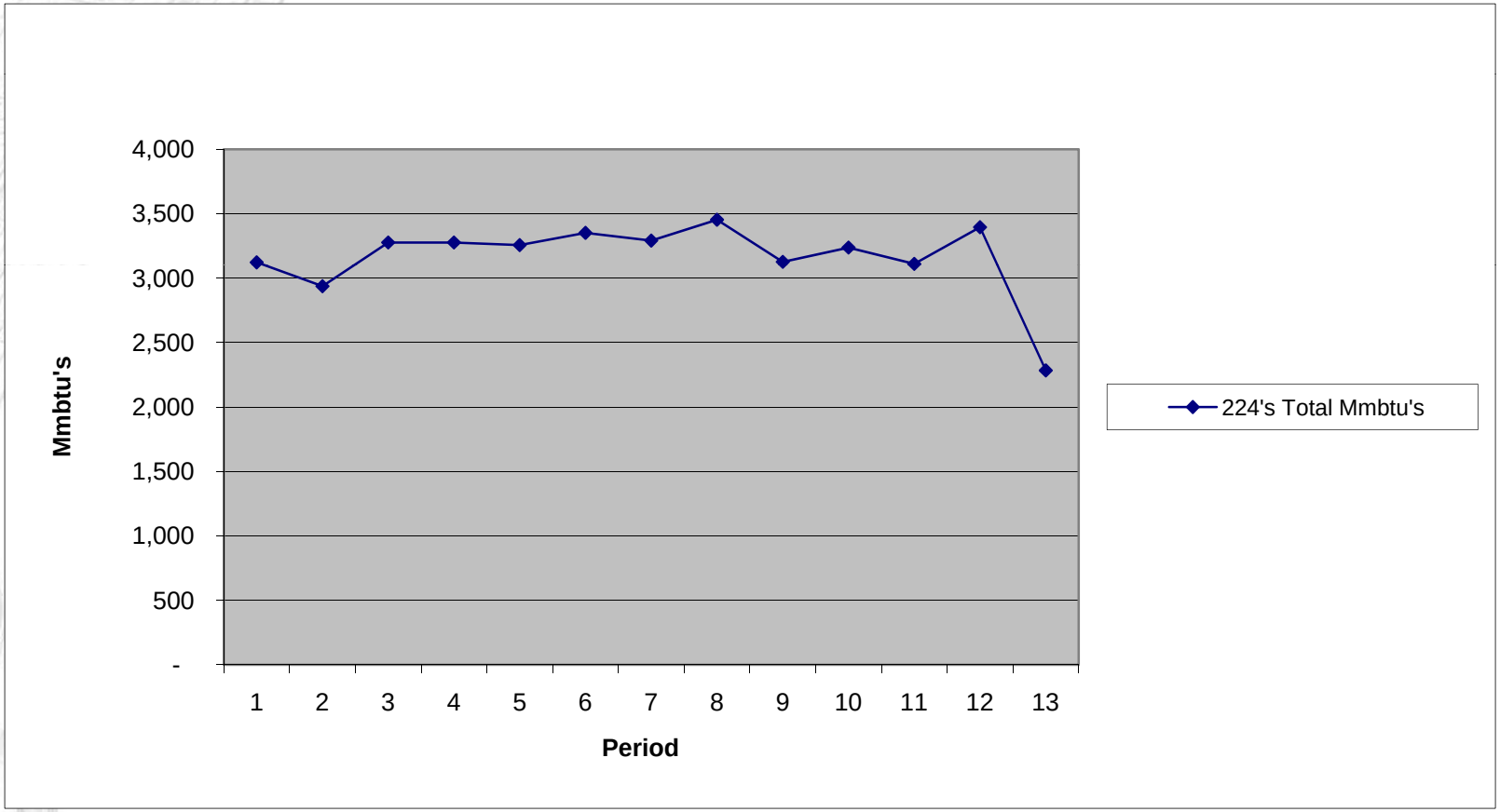
- ✓ Building Construction
- ✓ Refrigeration System
- ✓ Energy Production
- ✓ Lighting

First Installation – Colonie NY

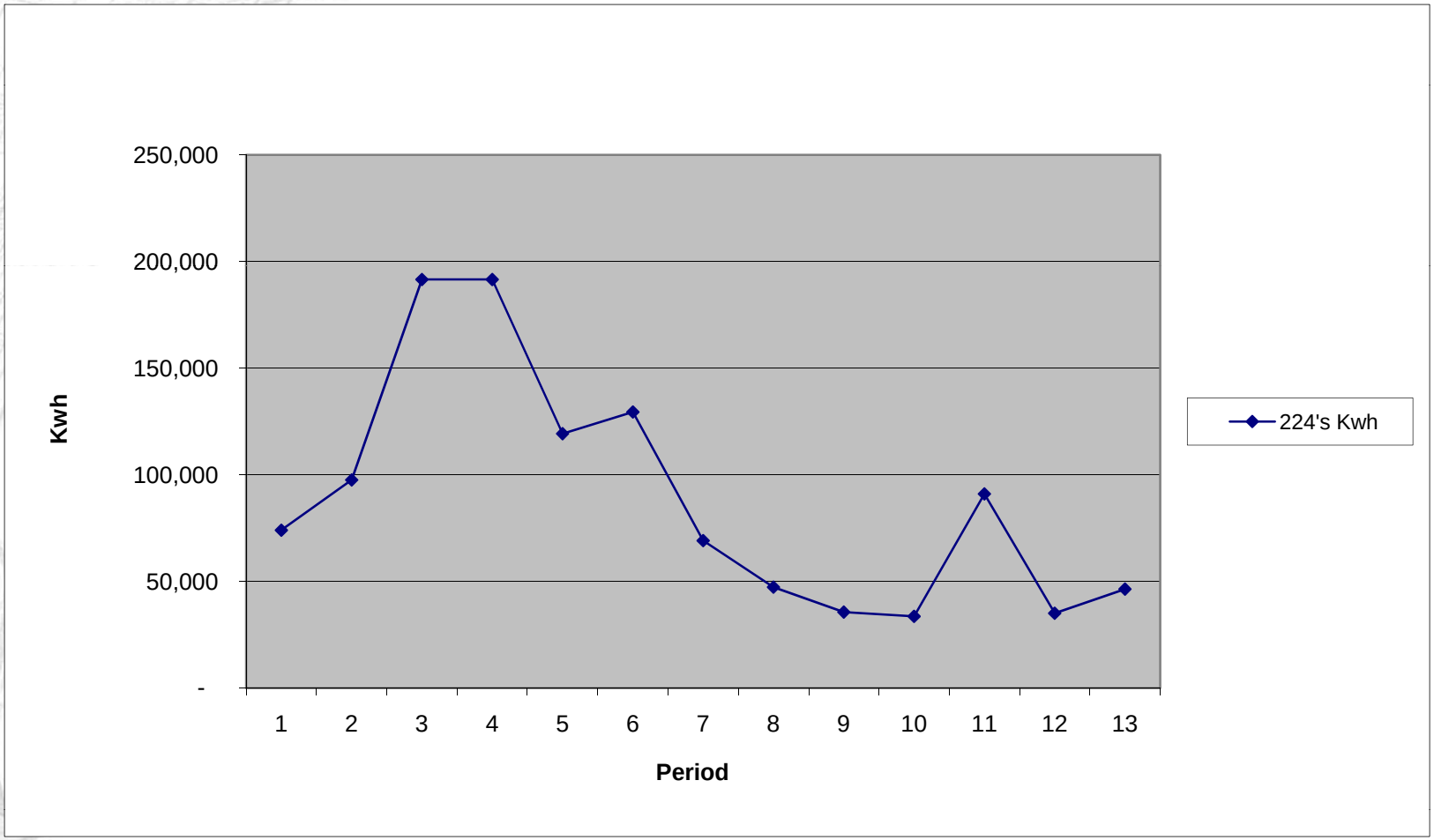
Colonie Actual Btu's 68 to 69 Square Feet



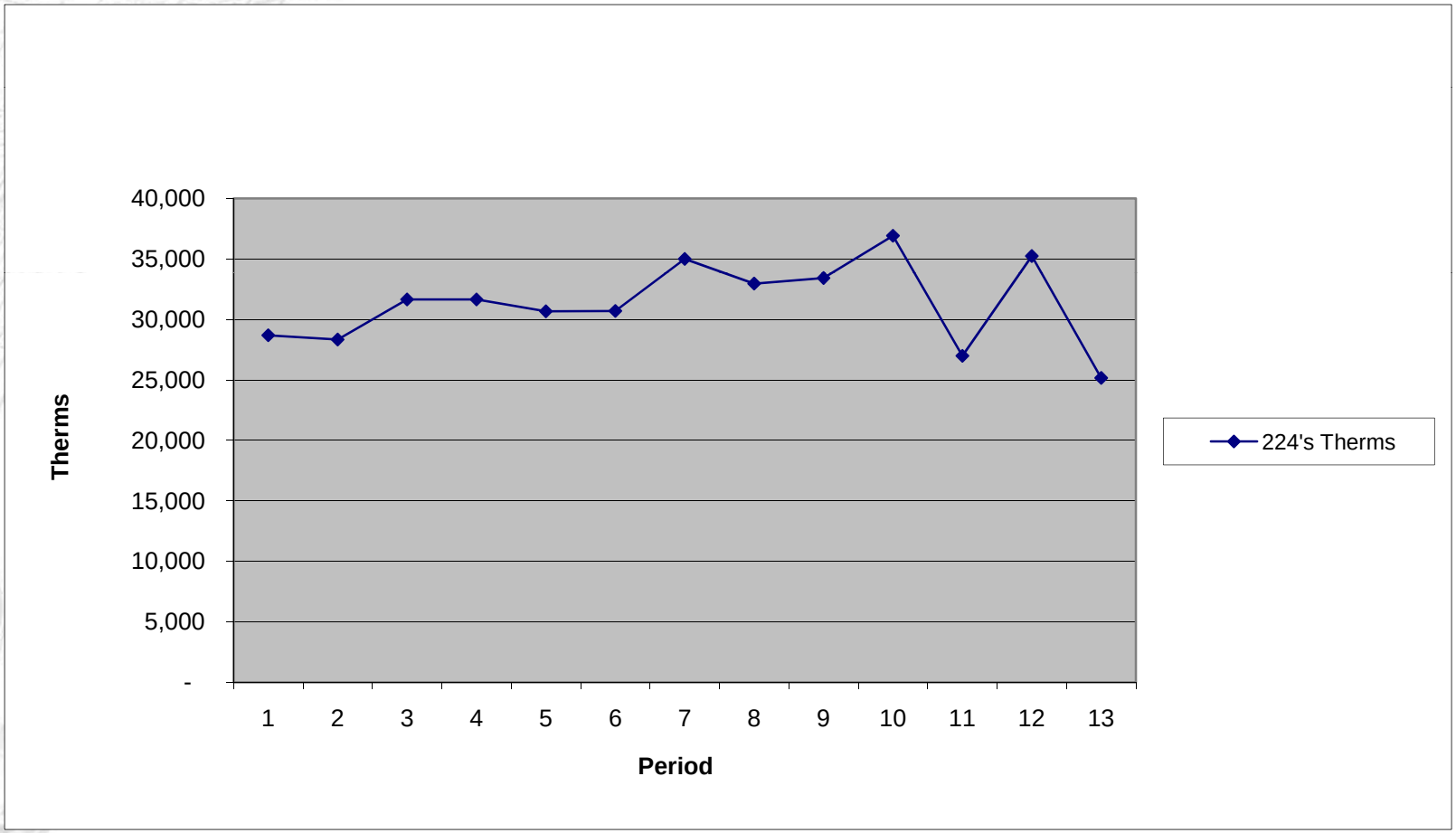
Colonie Energy Usage Actual Mmbtu's 68 to 69 sf



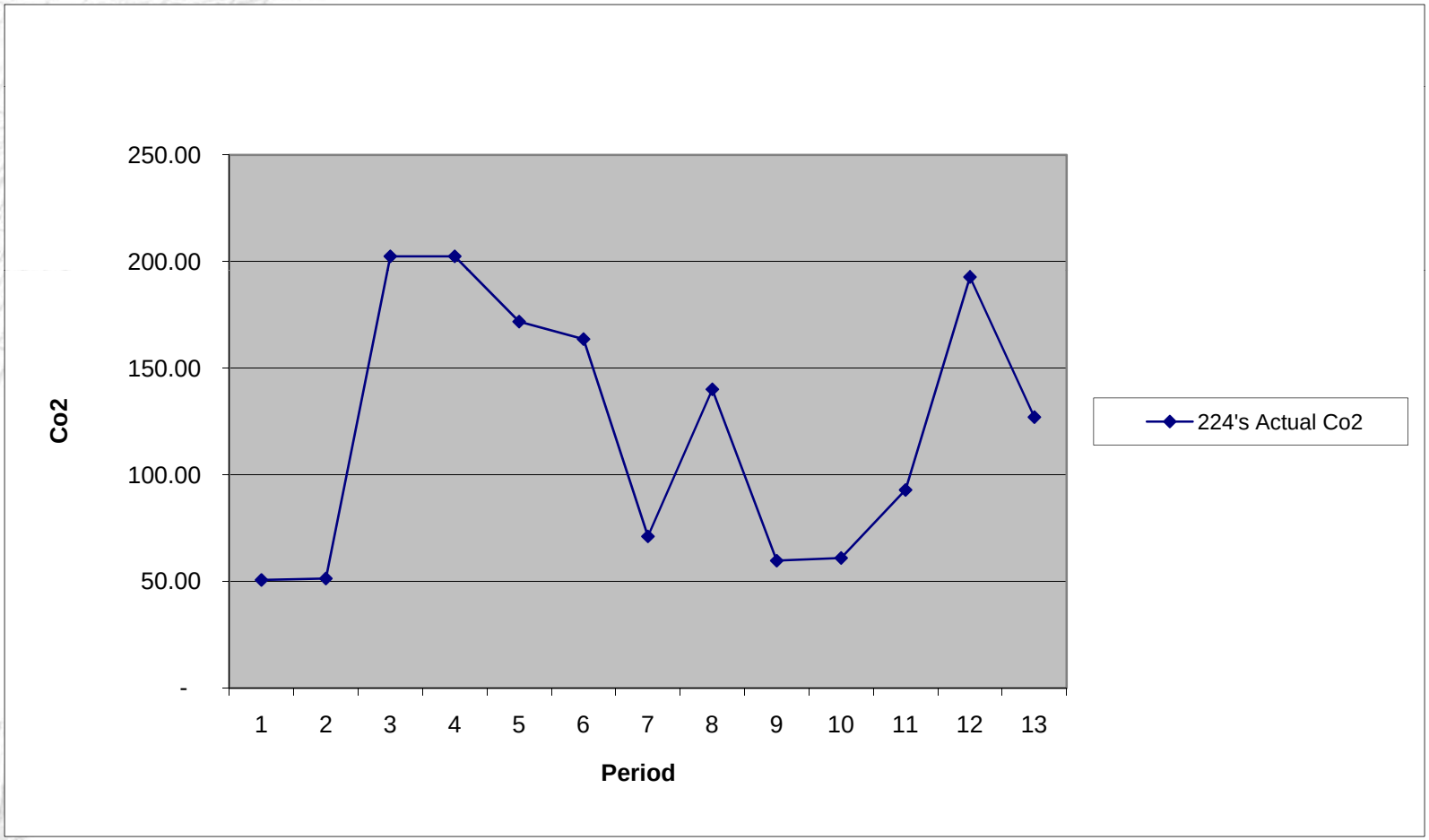
Colonie Energy Usage Total Actual Kwh 68 to 69 sf



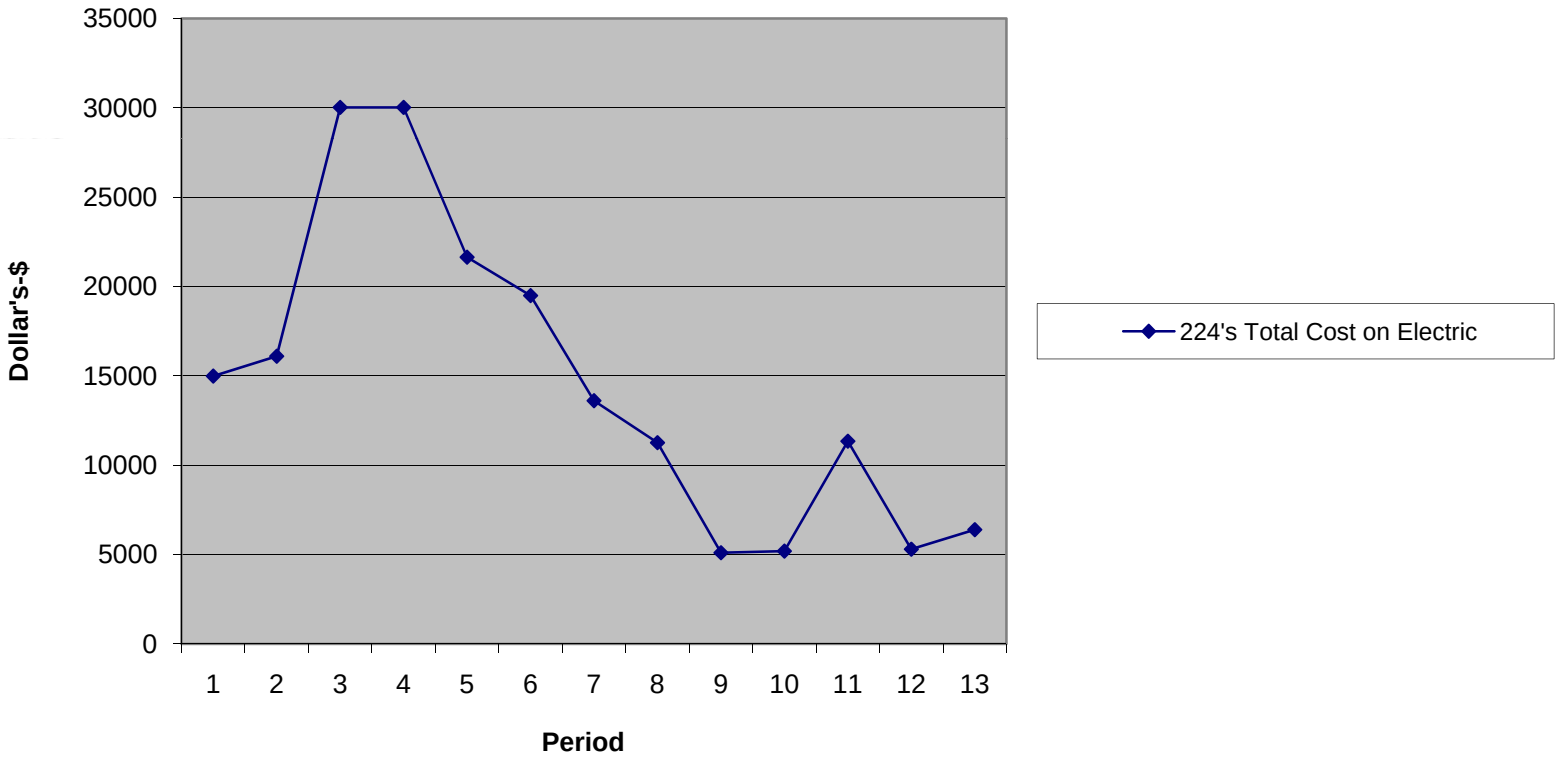
Colonie Energy Usage Total Actual Therms 68 to 69 sf



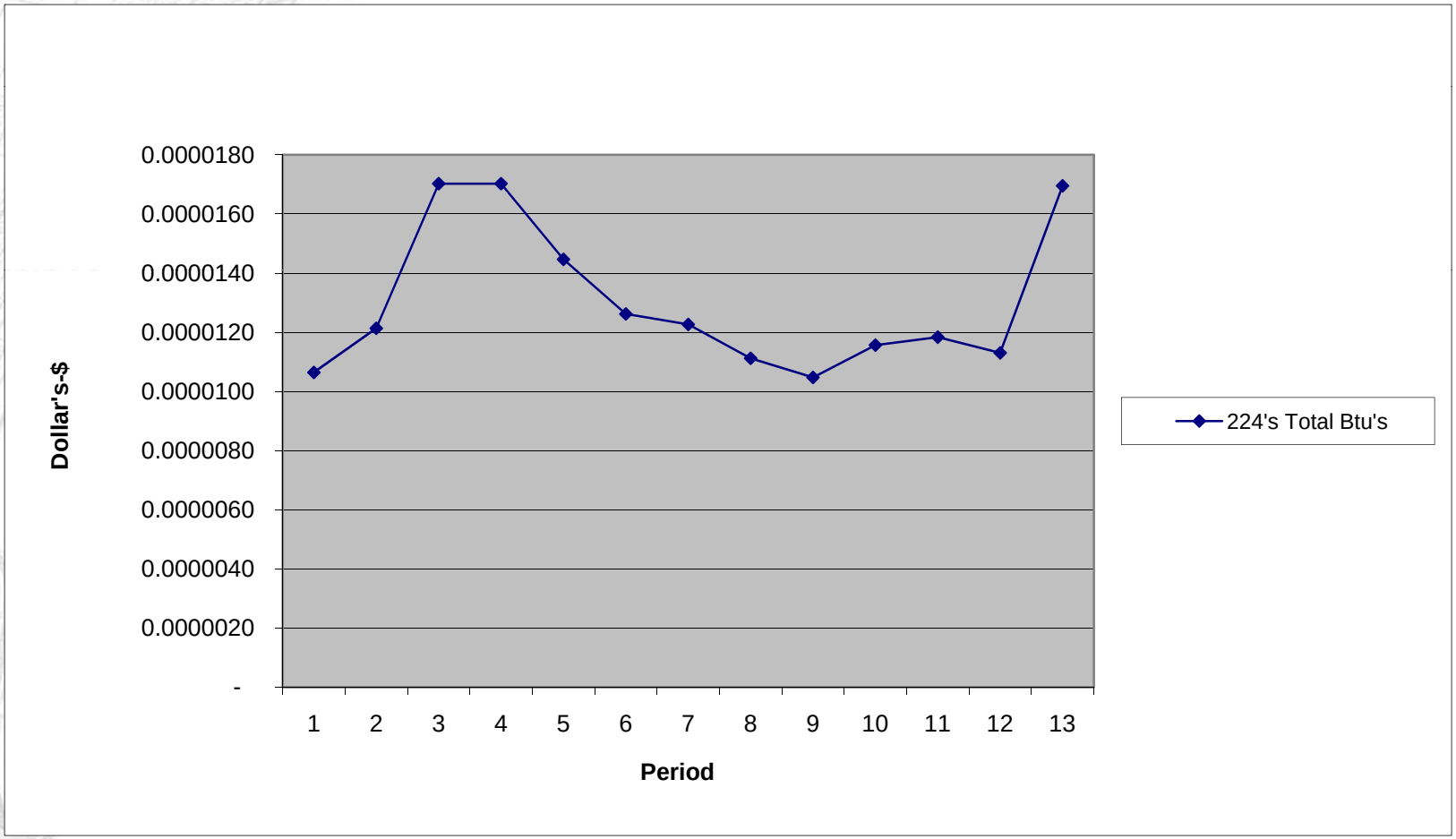
Colonie Energy Usage Actual Co2 68 to 69 sf



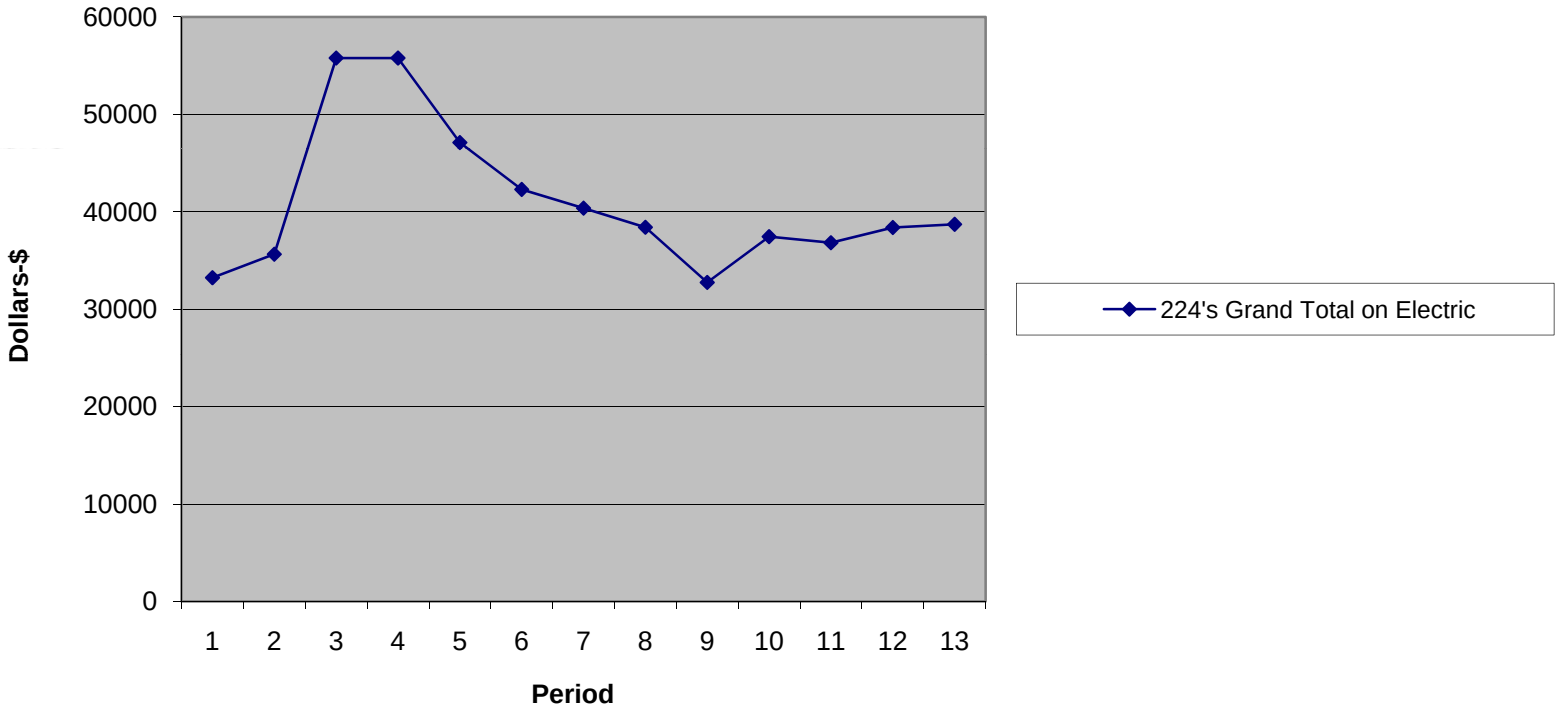
Colonie Total Cost on Electric 68 to 69 sf



Colonie Total Dollars per Btu 68 to 69 sf



Colonie Grand Total on Electric & Gas 68 to 69 sf



Results

- Initial install is operating at 92% uptime.
- Still analyzing payback and return on investment. Generally it is five years or less.
- Optimizing use of heat is an evolving process.

Questions?