

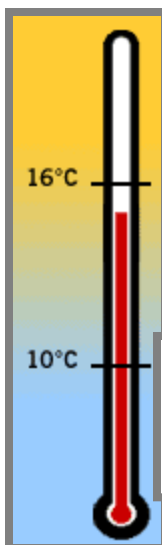
The Virtual Campus

Real Time Operating System

Spencer Wood, Humber College
Chris Trewartha - PADI



Humidity: can add up to **3,000 MW** due to increased a/c load



Cloud Cover: can reduce heat and demand by **1,000 MW**, but can increase demand for lighting



Time of day:

Daytime electricity use can be **10,000 MW** higher than during the night.

Temperature: each degree above 16°C incrementally raises demand by much as **150 MW** a degree and **50 MW** a degree below 10°C

Days of the Week:

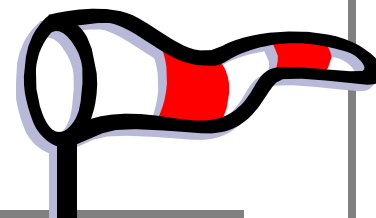
A Monday peak is generally **2,100 MW** higher than a Sunday peak

Holidays:

Thanksgiving: **↓2,500 MW**
Christmas: **↓4,400 MW**

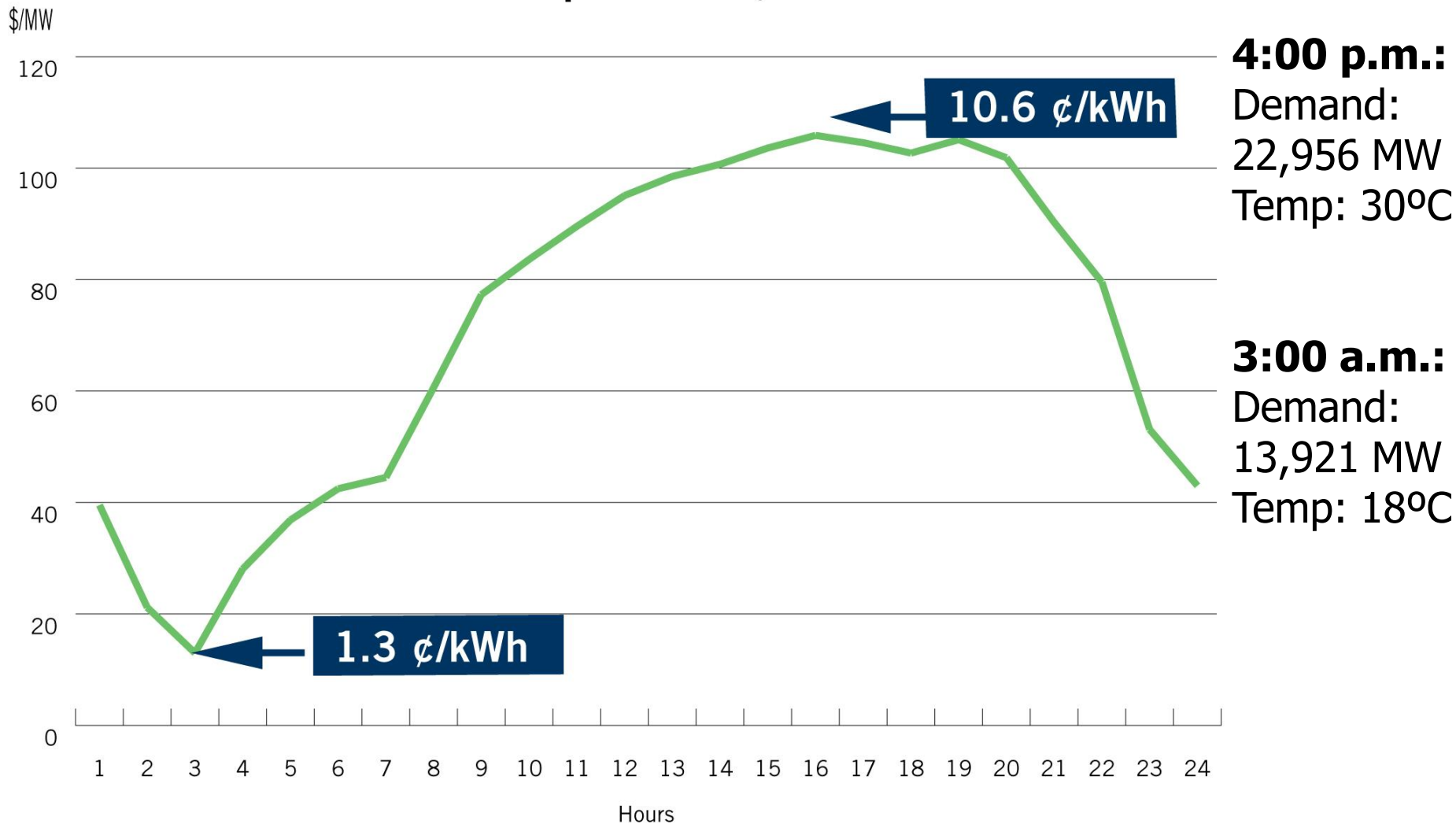


Wind: strong winds (30 km/h and up) on cold days (-10°C) can increase demand by **800 MW**

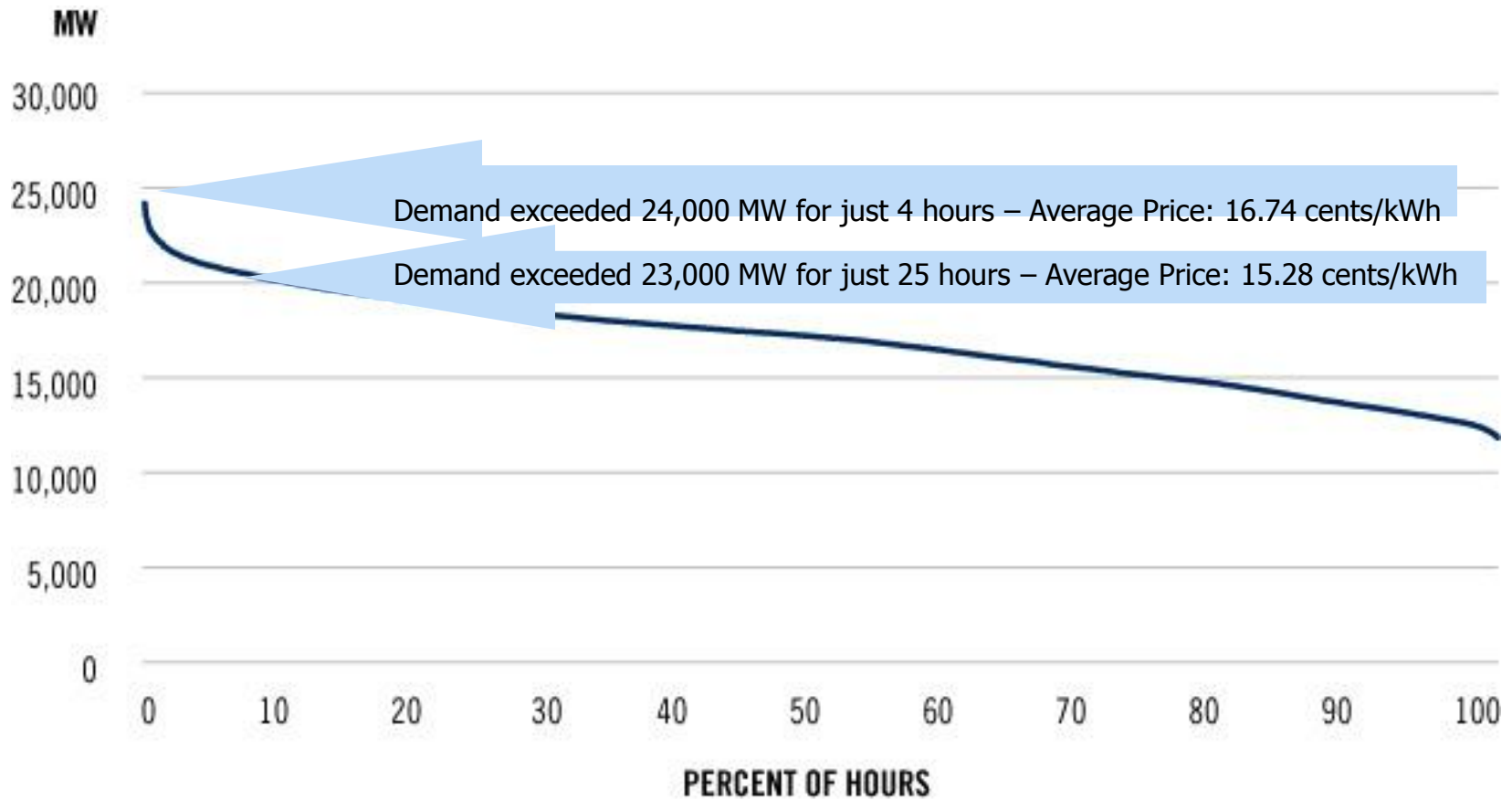


Hourly Electricity Pricing: A Sample Day

September 3, 2008



Ontario Load Duration Curve (2008)



Source: Independent Electricity System Operator



Background

- Annual spend on utilities ~\$48 million
- Can't manage what you don't measure
- Energy efficiency + procurement
- More \$ available for other priorities (competitiveness)
- Environmental benefits, sustainability



Real Time Operating System

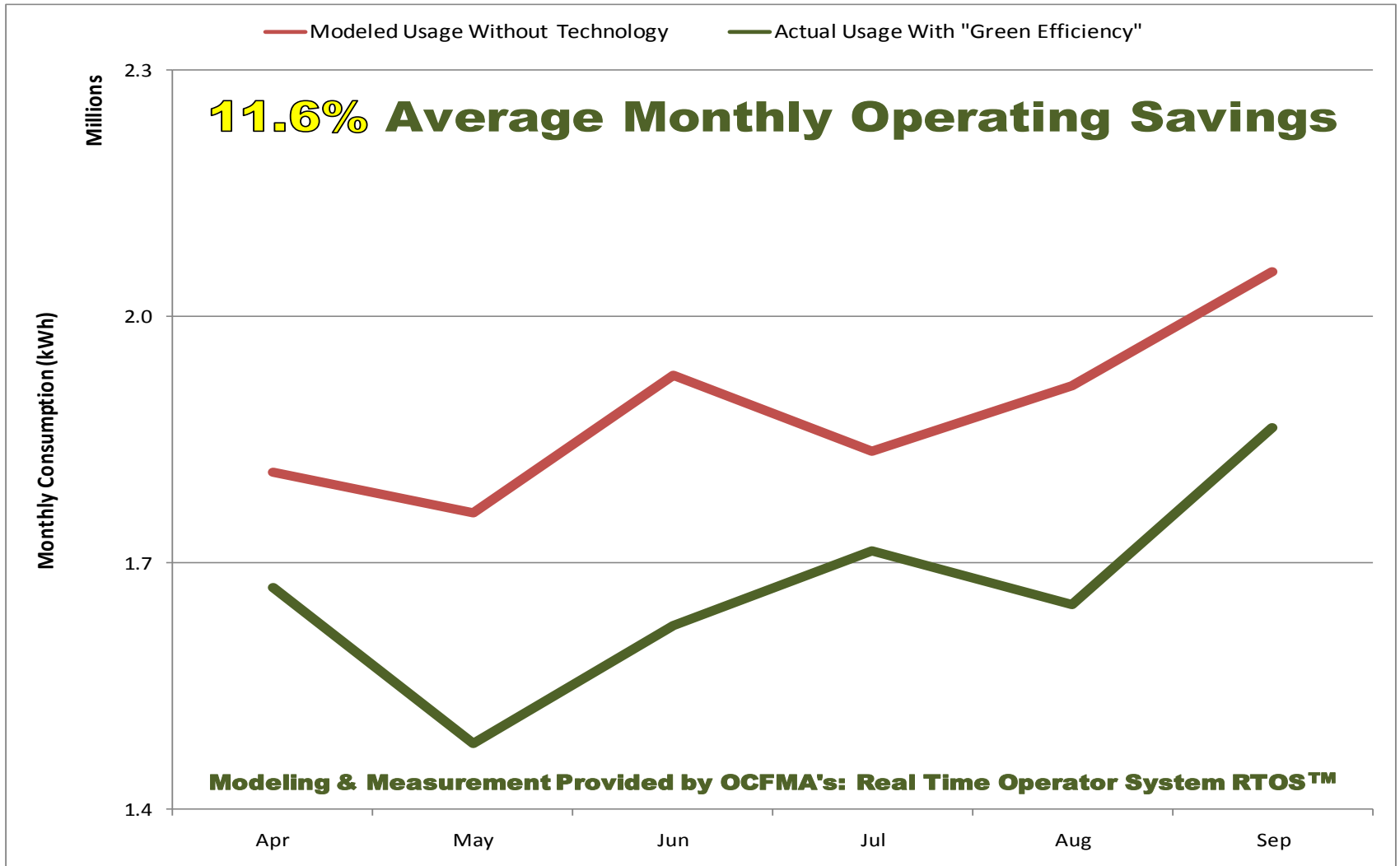
- Provincial wide energy monitoring and management system
- Centralized and shared resource
- Local and aggregated analysis and control
- Ontario Buys funding to purchase RTOS – solely College owned



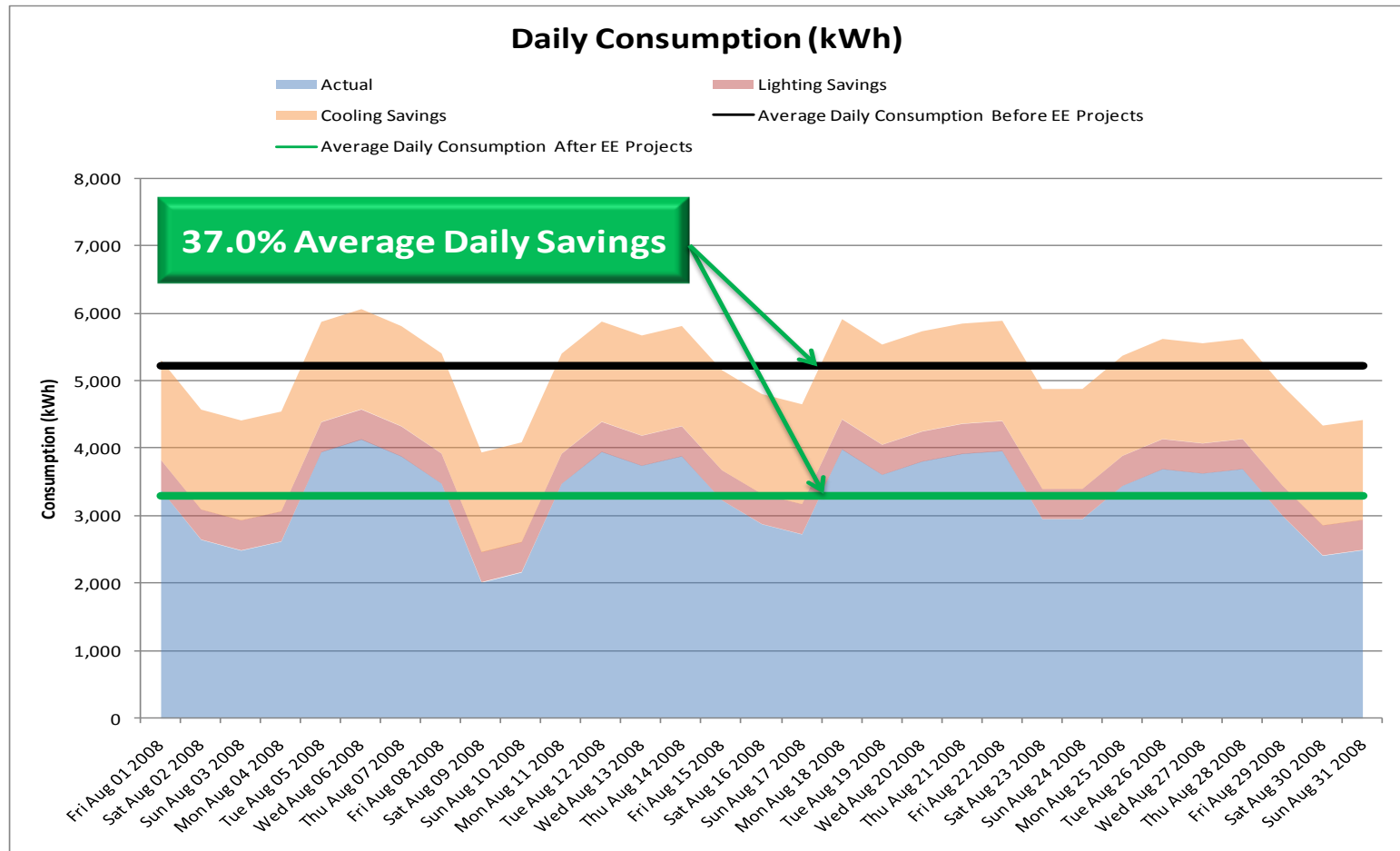
Benefits / Goals

- Save Operating Costs
- Demand management / load shedding
- Profiles for better procurement
- Shared Resources – Centralized Bill 21
(Energy Conservation and Leadership Act)
- Verify and Demonstrate Efficiency Results
- Benchmarking
- Calculate Carbon footprint

Energy Conservation Works



Energy Conservation Works



Demo – Real Time Display

Seneca Vista

SENECA

Energy Management System

Total Metered Load : 0.94 MW

NEWNHAM



687.2 kW

PF : -92.0 %

606.4 VII

350.2 VIn

735.0 A

MARKHAM



248.6 kW

PF : 91.7 %

609.9 VII

352.1 VIn

276.0 A

Demo – Real Time Display

Seneca Vista

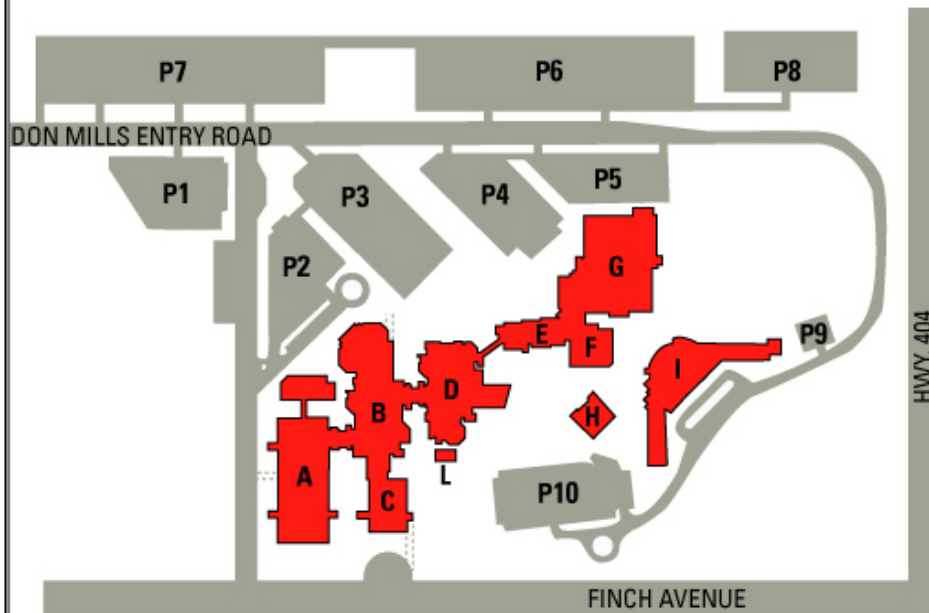
[HOME](#)

SENECA - NEWNHAM

Energy Management System

[BACK](#)

Total Newnham Load : 676.3 kW



Building Loads

A :	151.1 kW
B :	166.1 kW
C :	22.9 kW
D :	154.3 kW
EF :	78.1 kW
G :	66.8 kW
H :	14.4 kW

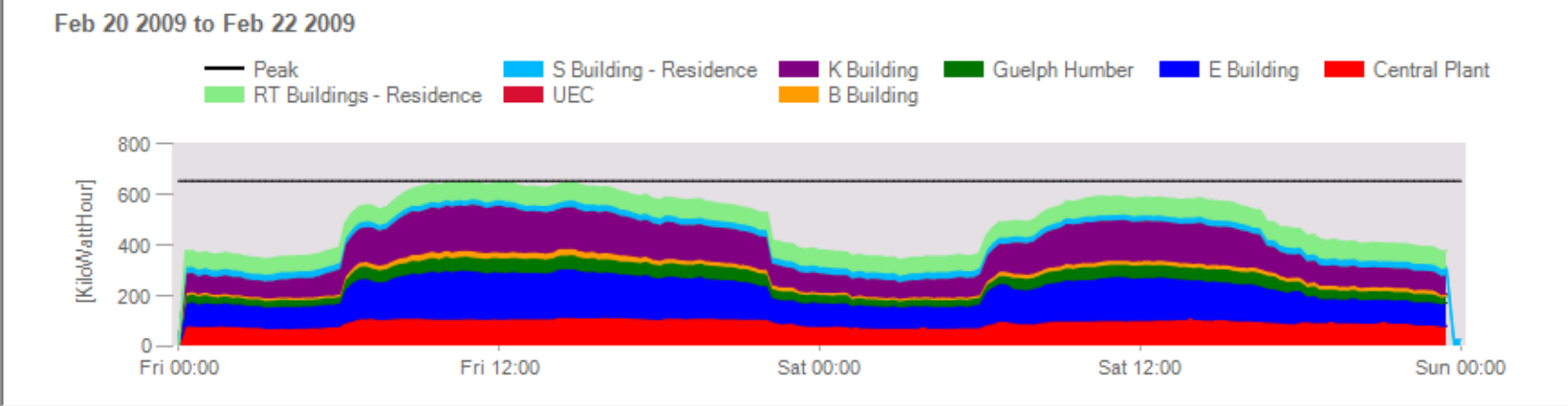
Sub Metered Loads

Annex :	22.7 kW
Bus Garage :	6.9 kW
Maintainance Bldg :	26.4 kW
D Parking Lot Lights :	15.0 kW
B Main Floor Tim's :	3.0 kW

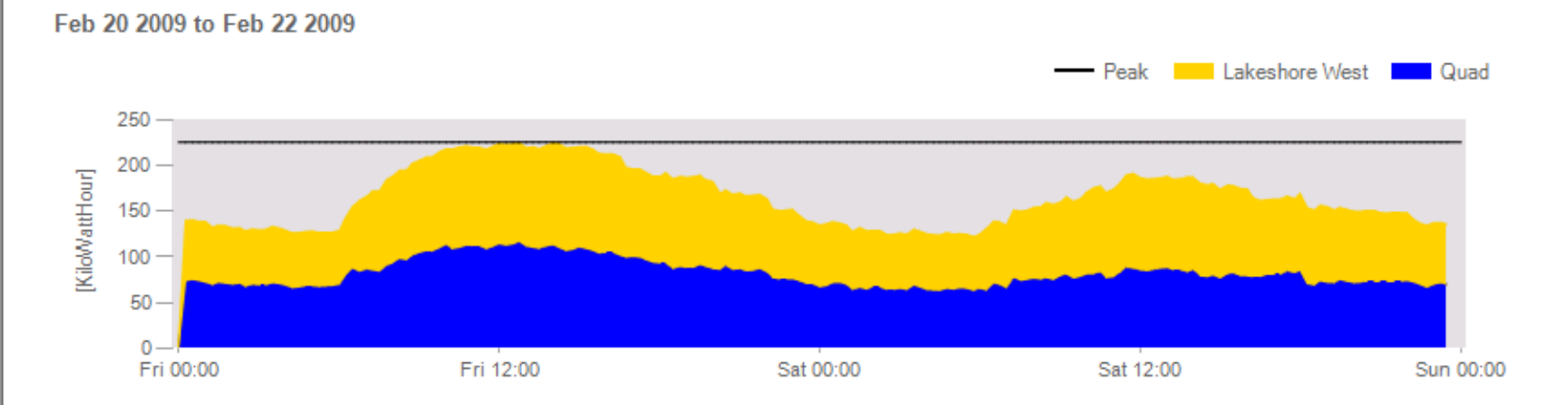
Demo – Real Time Load Profile Monitoring

Humber Campus Load Profiles

North Campus Total



South Campus Total

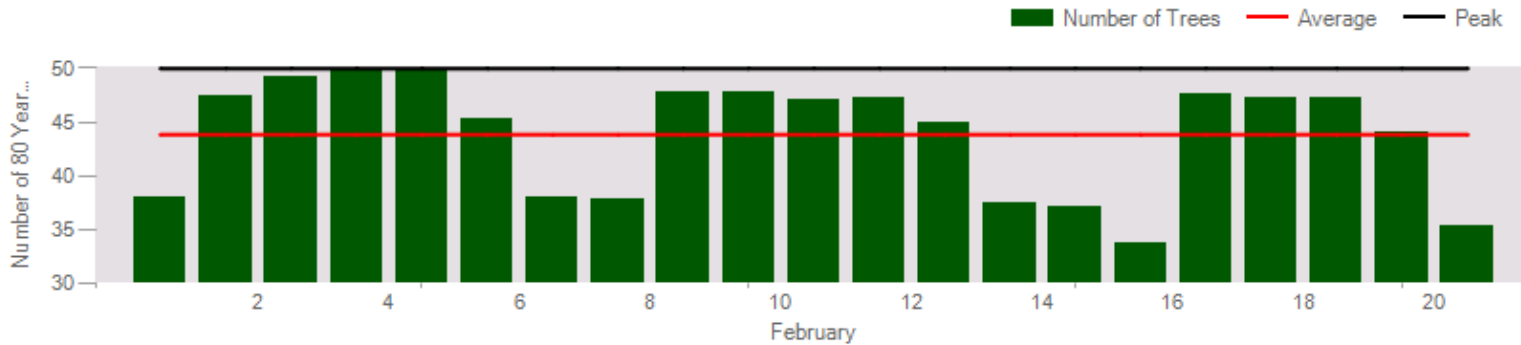


Demo – Green House Gas

Green House Gas Emissions

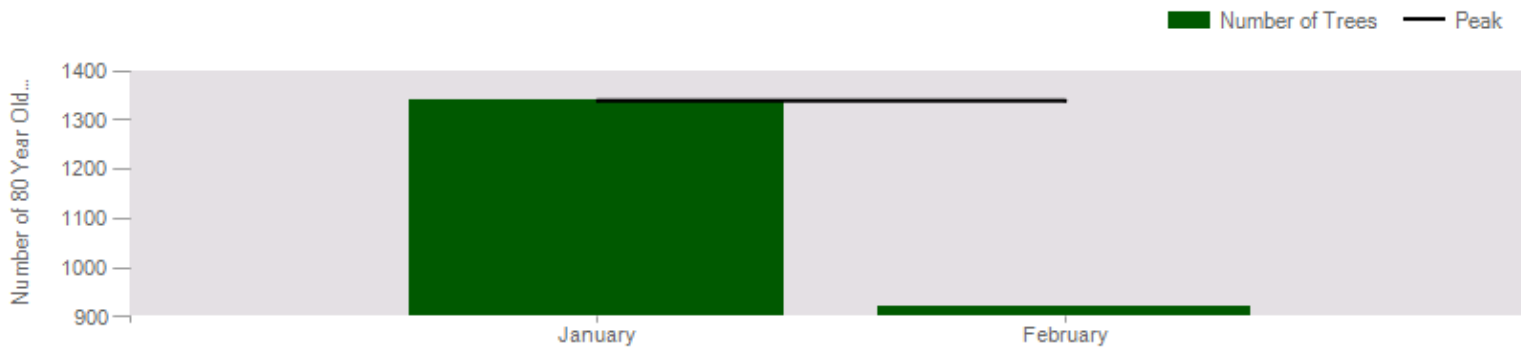
Kingston - Number of Trees Offset

Feb 01 2009 to Feb 22 2009



Kingston Number of Trees Offset by Month

Jan 01 2009 to Feb 22 2009



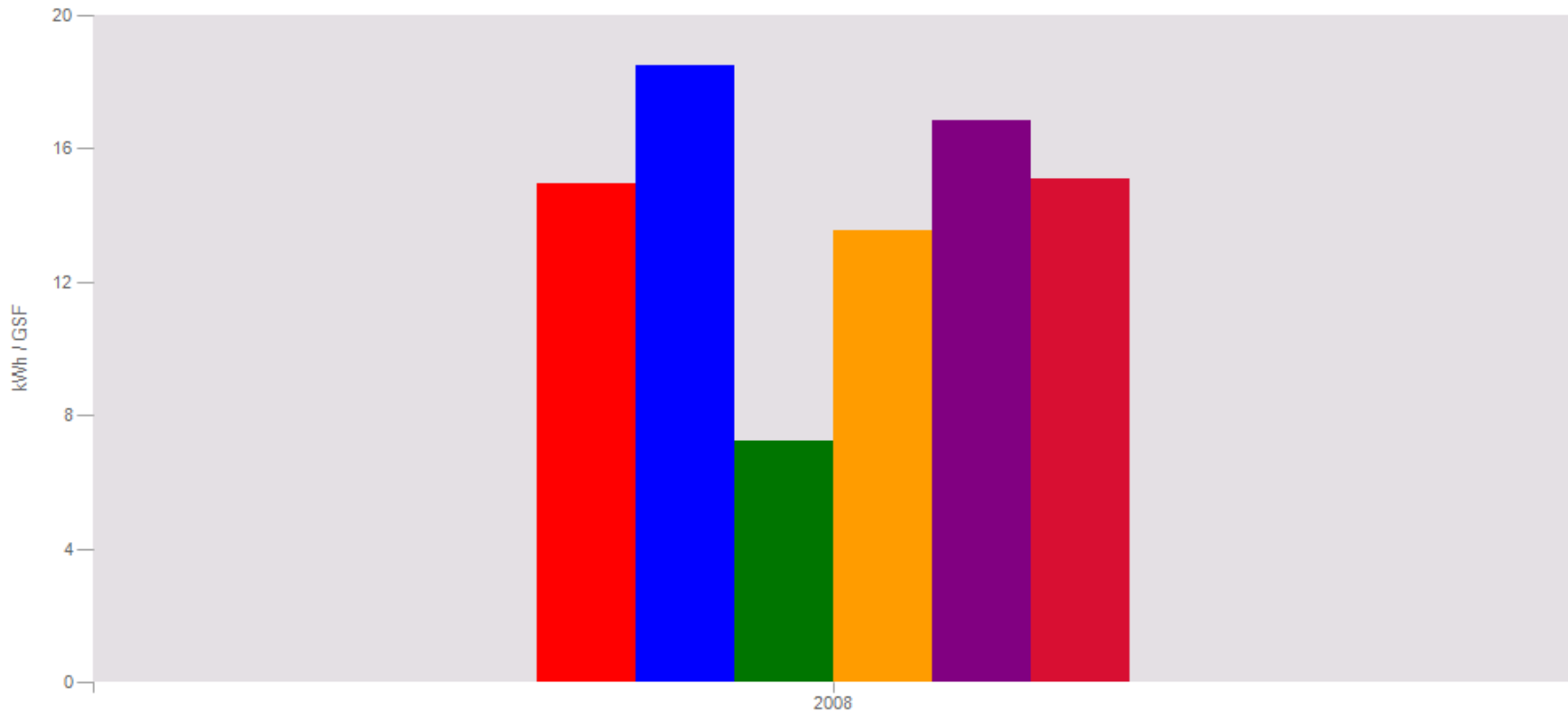
Demo – Province Wide Benchmarking

kWh per GSF 2008

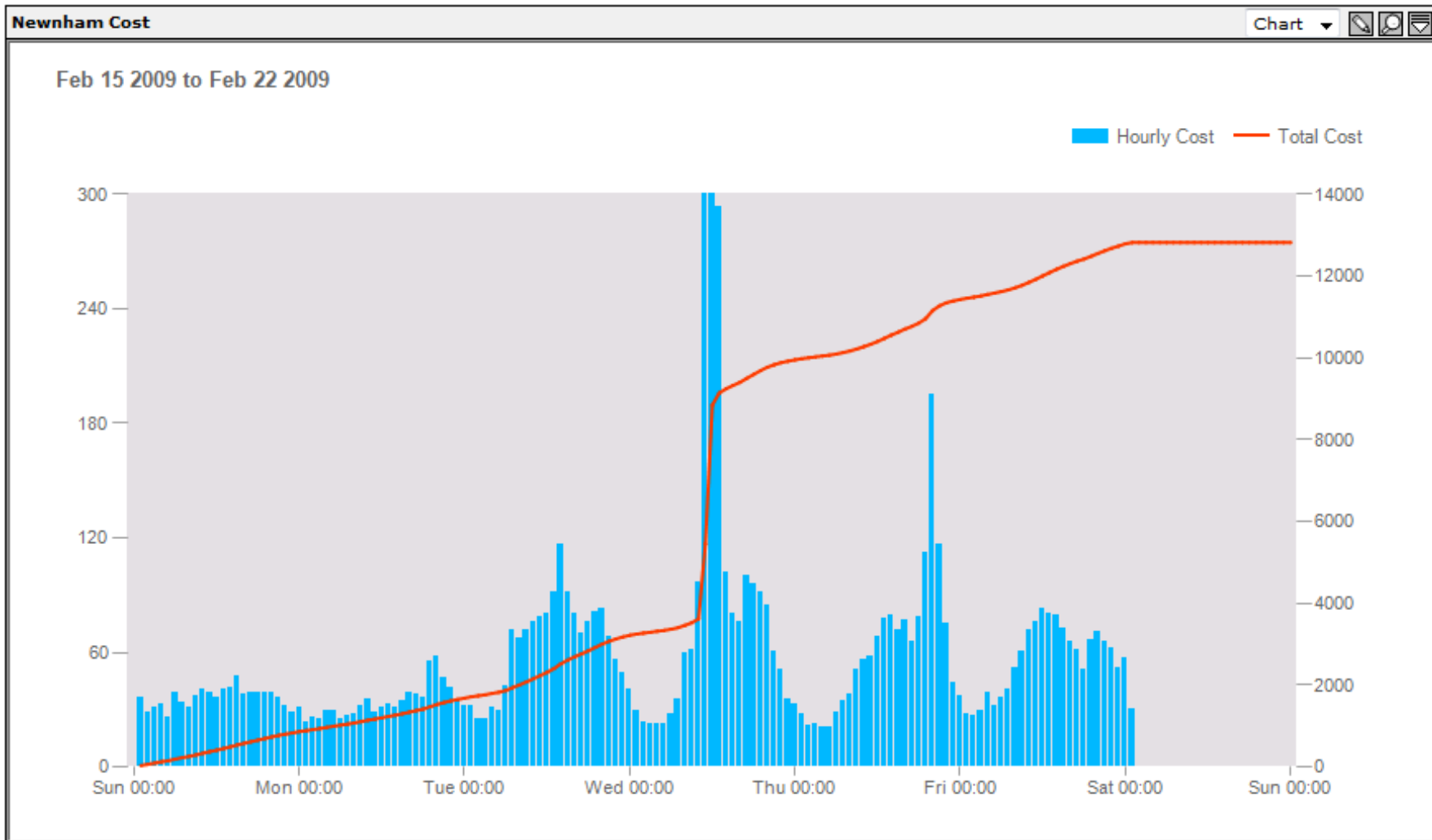
Chart ▾

Jan 2008 to Jan 2009

C1 C2 C3 C4 C5 C6



Demo – Hourly Costs





Curriculum tie-in

- Data available to students
- Real-time look at the building they are learning in.
- Student ideas can be implemented
- Sustainability – students are very “green”
- Excellent training in the smart grid of the future



Facilities Design

- Metering now part of standard specification
- Industry trend to “Green Building”, LEED
- Energy efficiency can be tracked, compared to predicted, monitored over time.
- Commissioning, monitoring and verification (LEED)



Power grid of the future

- Decentralized, distributed
- Smart grid
- Automated grid is essential for renewals because the production is constantly fluctuating
- Companies like Google are investing heavily
- Major component to Obama's stimulus plan