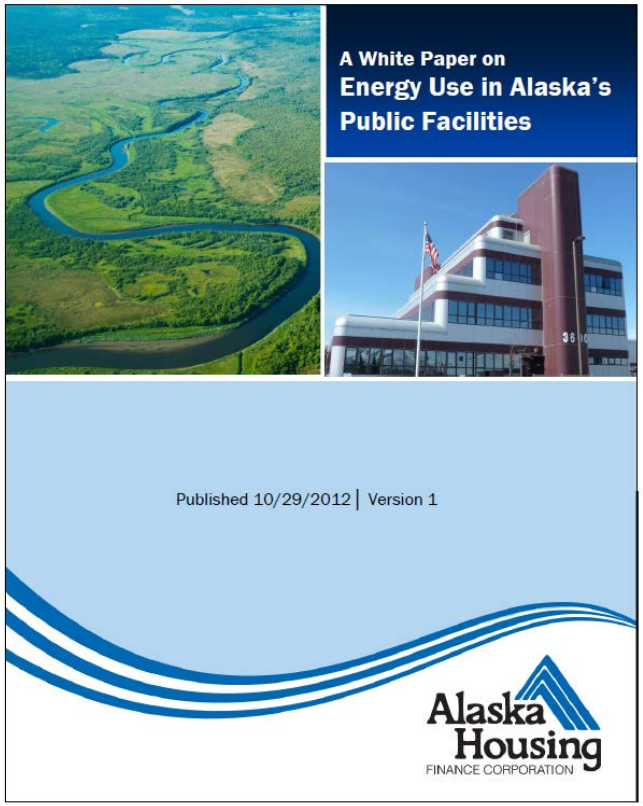
Energy Use in Alaska's Public Facilities

Measurement, Modeling and Monitoring

Scott Waterman
State Energy Program Manager
Alaska Housing Finance Corporation



INTRODUCTION – WHY ARE WE HERE?

As part of the Alaska Sustainable Energy Act:

AS 37.07.040 (12): Office of Management and Budget is required to work with state agencies to develop a standardized methodology to collect and store energy consumption and expense data.

Alaska Energy Efficiency Revolving Loan Program (AEERLP)

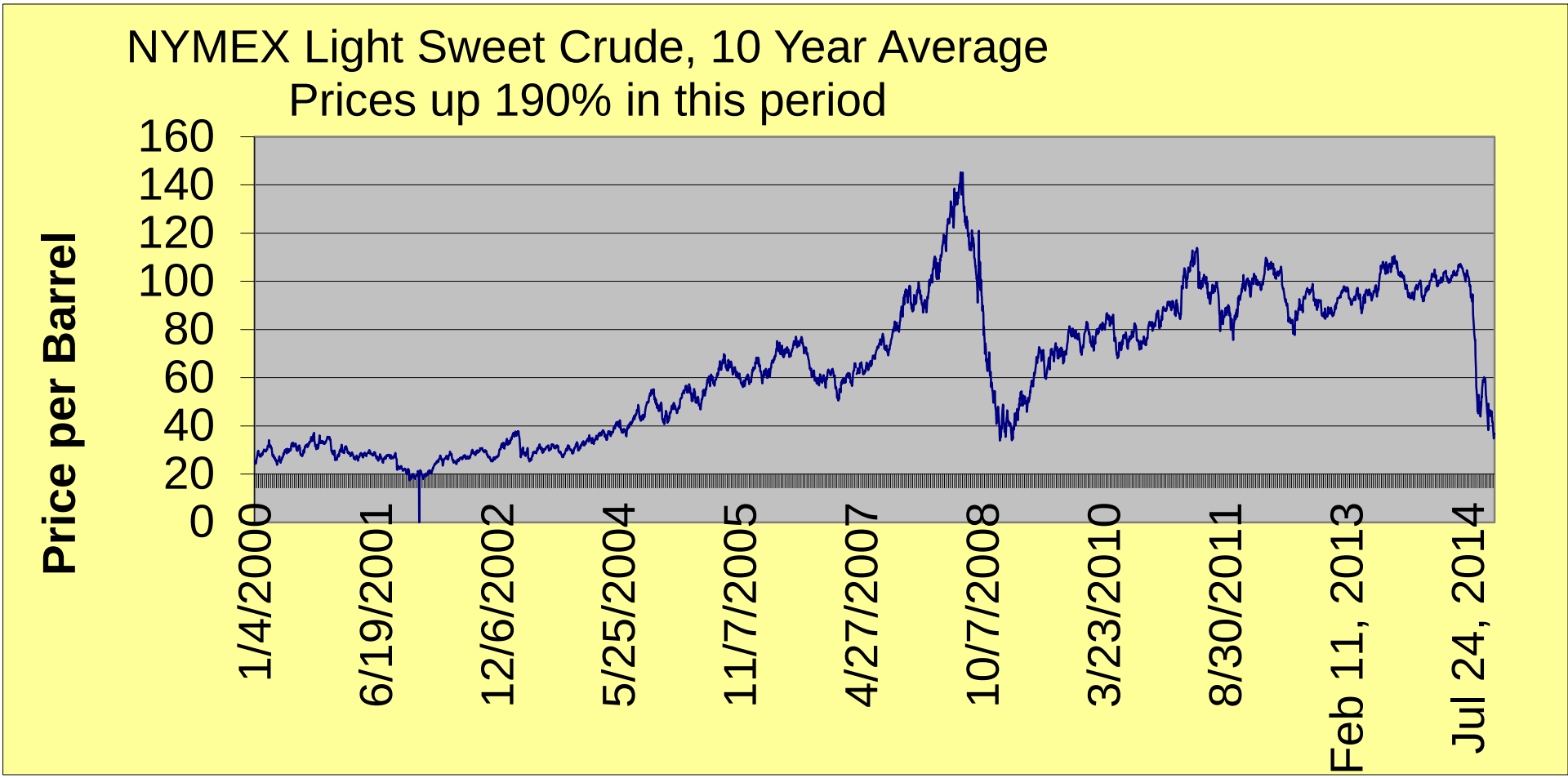
$250m available for energy efficiency improvements for:

-Schools	-State facilities
-University of Alaska	-Municipal facilities

Savings from energy efficiency improvements may be used to pay off the loan

Photo Credit: CAEC

Bets on Fuel prices? ↑ or ↓



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Stewardship

- All public facility energy use is publicly funded, through state grants, PCE, revenue sharing, local tax dollars, etc.
- Basic stewardship of public dollars means utilizing our energy efficiently
- Millions of dollars per year are available to harvest, for your operating budgets

WHITE PAPER

Surprises

- Energy use does not correlate to energy cost
- Fairbanks schools use half the energy of Anchorage schools, but pay 1/3 more – cost of fuel
- Overall, Fairbanks does better than all the rest of the state
- Age of building had little correlation to energy use
- Climate had little correlation to energy use

Key Findings and Recomendations:

- **Create energy policy**
- **Hire Energy Manager**
- **Remotely monitor energy consumption, DDC controls**
- Provide more operator training
- Upgrade interior/exterior lighting
- Setback thermostats have fast payback
- Shut down boilers in summer when not used for domestic hot water
- Retro-commission buildings
- Tune up boilers semi-annually
- Replace leaky, poor fitting, poorly insulated overhead doors
- Reduce lighting levels to industry standards, use dimming or multiple light levels
- Install indirect water heaters where large hot water demand exists
- Install setback thermostats
- Control lighting and cooling on vending machines
- Install swimming pool covers
- Put back-up boiler on cold standby

Key Findings and Recomendations, cont:

- Install pipe insulation where missing
- Upgrade plumbing fixtures to low water consumption
- Install arctic entries where missing
- Reduce excessive infiltration
- Upgrade boilers & furnaces to high efficiency units
- Install VFD controls on fans, pumps where appropriate
- Turn off standby circulators
- Cycle headbolt heaters based on OSA temperatures
- Provide destratification fans in high places
- Upgrade motors
- Upgrade building insulation
- Upgrade appliances
- Provide demand controlled ventilation, monitor & control IAQ
- Lower temperatures in transition zones

- **Alaska Retrofit Information System (ARIS)**
  - Excel form used to collect benchmark data, or direct entry into ARIS web
  - Alaska specific tool similar to the Energy Star Portfolio Manager
- **AKWarm Commercial**
  - A modeling software developed by AHFC
  - Used to standardize all information gathered for audited buildings
  - Uploaded into the ARIS Database
- **Building Monitoring**
  - Real-time building performance data to gauge energy use, aid in design, troubleshoot problems, and reduce maintenance costs

Public Facility Energy Use

- Over 5,000 public buildings in Alaska
- 2012 ~$640,000,000 est. annual energy budget
- 495 Schools with over $90,000,000 annual energy use
- 10% savings is not low hanging fruit, but lying on the ground
- 15-20% savings is relatively easy with a good effort

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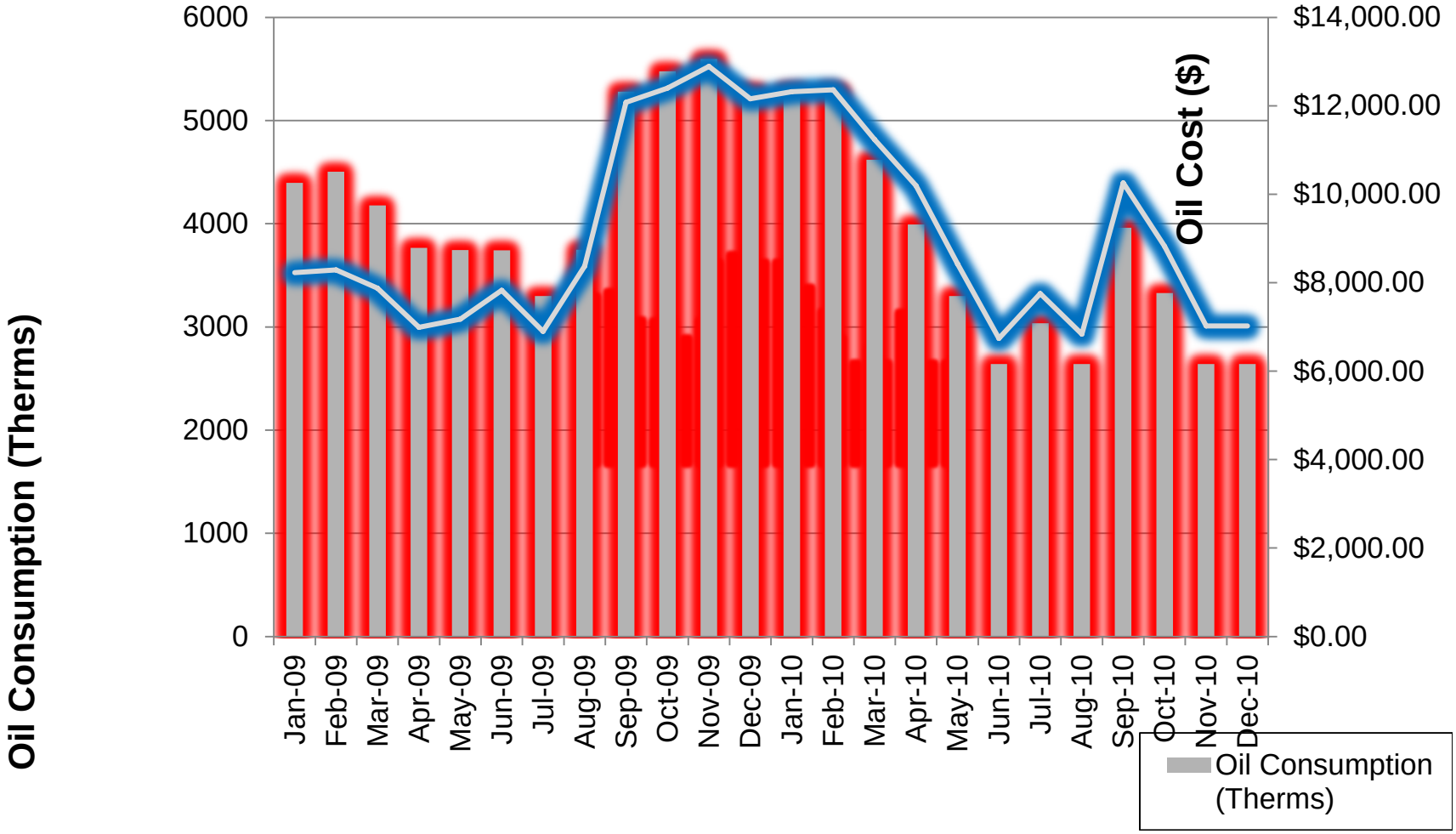
Your best tool for managing energy dollars, is knowing where they are going now

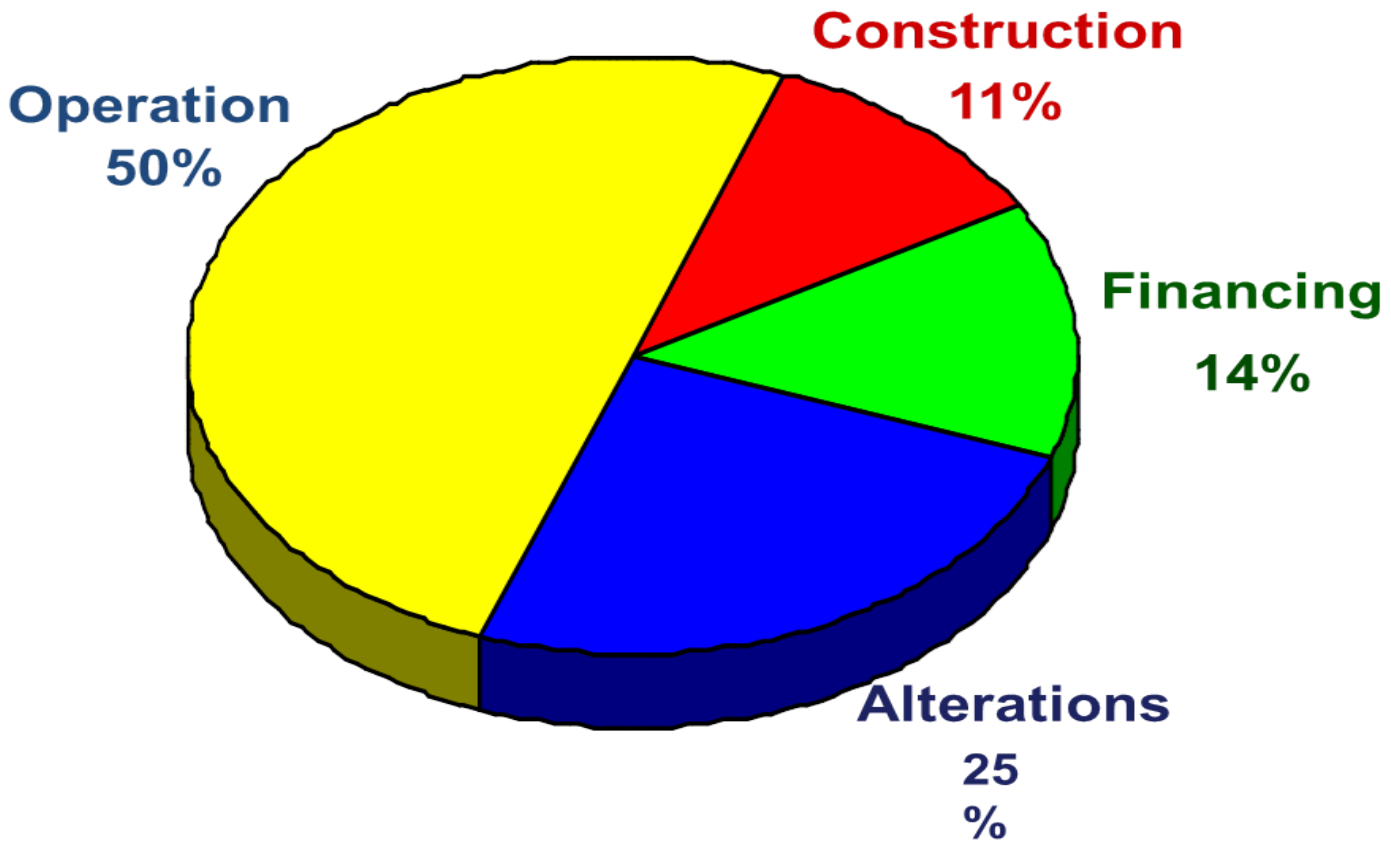
You cannot manage what you don’t measure

Community Medical Center - Oil Consumption (Therms) vs. Oil Cost ($)



The Big Picture: Lifecycle Costing

A buildings' costs over 40 years



ASHRAE - American Society for Heating, Refrigeration & Air Conditioning Engineers

ARIS Introduction

ARIS (the Alaska Retrofit Information System) is the instrument to accomplish this.

- Developed by the Alaska Housing Finance Corporation.
- Web Based interface allowing us to enter in the utility expense and consumption data right into the database, from any location, by anyone with a user account.
- The vision is that ARIS will be able to see buildings Statewide for all agencies, and organizations; keep track of the energy consumption and expenses for the buildings each year. Goal is that energy consumption will go down through the years as we improve the energy efficiency of our facilities.
- ARIS User accounts are given to us through the AHFC. All department, state owned facilities to be entered.
- Data to be entered in a monthly basis.

Alaska Retrofit Information System
(ARIS Database)

- Provide analysis on community, regional or statewide costs and savings
- Houses multiple data sets including:
  - **Residential:** Information on over 80,000 unique residential units
    - Over 40,000 units rated in either the Weatherization or Home Energy Rebate Program
    - Over 24,000 new homes certified as meeting or exceeding the Building Energy Efficiency Standard (BEES).
  - **Commercial**
    - Benchmark data on over 2,400 public facilities
    - Extensive construction and energy use data on almost 500 facilities
    - Tracks energy use in all State-owned facilities (required by SB220)

323
588

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www.MLandP.com
E-mail us at: askmlp@muni.org

BILL DATE	DUE DATE
06/27/12	07/22/12
TOTAL DUE	10,241.56

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SERVICE MAY BE DISCONTINUED IF PAST DUE BALANCE IS NOT PAID WITHIN 25 DAYS OF BILL DATE

ACCOUNT NUMBER	SERVICE ADDRESS	CYCLE	METER NUMBER	LOCATION NUMBER	RATE
213896001	4300 BONIFACE PKWY	484	1200475	173791028101	LARGE COMMERCIAL

SERVICE FROM	SERVICE TO	NO. DAYS	READING PREVIOUS	READING PRESENT	BILL TYPE	MULTIPLIER	KWH USAGE	CHARGES
05/25/12	06/26/12	32	49344	49831	0	200	97400	

DEMAND:	READING	ACTUAL	BILLED
	1.473	294.600	294.600

RECEIVED BY ACCOUNTING
JUL 0 3 2012
PTP Management, Inc.
JUL 2 2012

PREVIOUS AMOUNT DUE		9260.36
THANK YOU FOR YOUR PAYMENT 06/19/12		-9260.36
ENERGY CALCULATION		
97400 KWH X 0.03604 =	3510.30	
294.600 KW X 12.66000 =	3729.64	
CUSTOMER CHARGE =	44.15	
TOTAL ENERGY		7284.09
COST OF POWER ADJUSTMENT		
97400 KWH X 0.027820		2709.67
REGULATORY COST CHARGE		
97400 KWH X 0.000492		47.92
MOA 2% UNDERGROUND SURCHARGE		199.88

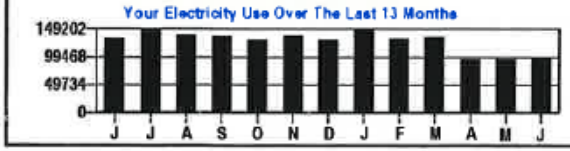
VENDOR M L+P INVOICE#
INV. DATE 10/27 REC. DATE 7/2 PMT. DATE

DESCRIPTION	PROPERTY	GL CODE	AMOUNT
Elec	4300	5370	10,241.56

INVOICE TOTAL
TERM INITIAL HAVE W-9? YES NO
W/C G/L
COMMENTS:
APPROV: CK DATE CK#

COMPARISONS	DAYS SERVICE	TOTAL USAGE	AVG. USAGE/DAY	COST PER DAY
CURRENT BILLING PERIOD	32	97400	3043	312.30
PREVIOUS BILLING PERIOD	29	94200	3248	311.49
SAME PERIOD LAST YEAR	29	131000	4517	490.63

TOTAL DUE 10,241.56
DUE DATE 07/22/12 BILL IS DELINQUENT AFTER DUE DATE
A late fee of $2.00 for residential, or 1% of current bill for commercial will apply if payment is received after due date.



BEGINNING MAY 1, 2012 ALLOWABLE CREDIT CARD PAYMENTS WILL BE $5,000 PER TRANSACTION PER CUSTOMER. QUESTIONS? EMAIL US AT ASKMLP@MUNI.ORG OR CALL 263-5340.

(907) 452-1151 or 1-800-770-4832

www.gvea.com

GOLDEN VALLEY ELECTRIC ASSOCIATION, INC.

P.O. Box 71249, Fairbanks, Alaska 99707-1249

ACCOUNT NUMBER	CUSTOMER NAME
[redacted]	[redacted]

SERVICE LOCATION	BILL DATE
[redacted]	11/21/2012

SERVICE FROM	SERVICE TO	DUE DATE	AMOUNT DUE
10/19/2012	11/20/2012	12/17/2012	$15,571.34

Electronic Voting #:

Rate Schedule: GS2P Lg General Service Primary

Meter Number: [redacted] District [redacted]

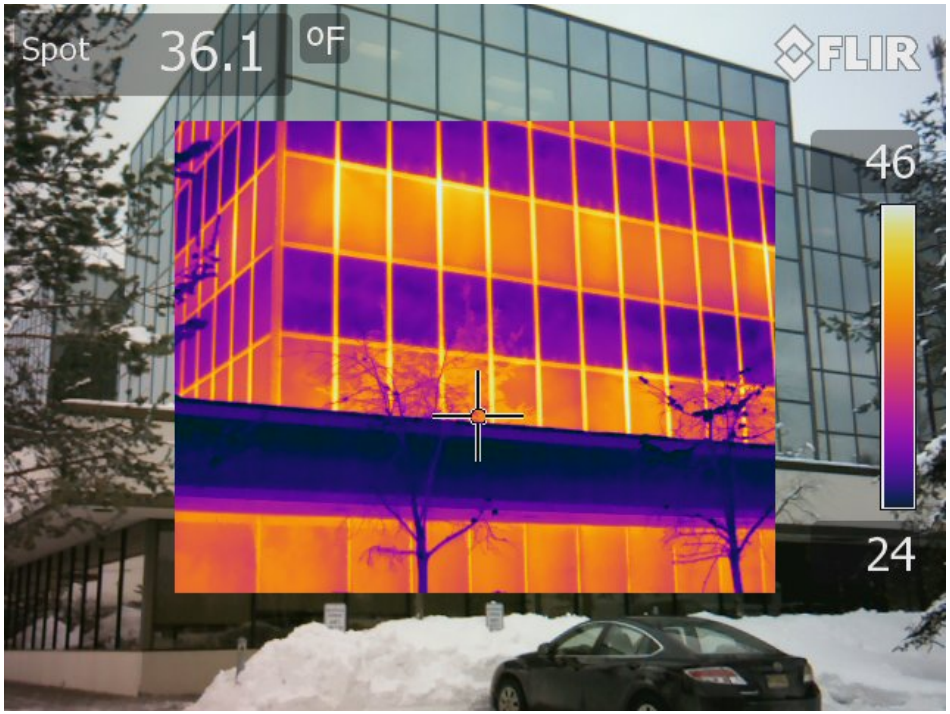
READ DATE		KWH	KVARH	KW
11/20/2012	CURR READ	20310	4239	1.51
10/19/2012	PREV READ	20121	4230	0.00
	MULTIPLIER	300	300	300
	KWH USED	56700	1.00	470

GVEA awards eight scholarships each year. Right now, we are accepting applications for seven of them. Find out more and download an application on our website: www.gvea.com.

CHARGE DESCRIPTION	AMOUNT
PREVIOUS BALANCE	**11,764.89**
TOTAL PAYMENTS	-11,764.89
BALANCE FORWARD	**0.00**
Customer Charge	30.00
Fuel & Purchased Power 56700 kwh @ 0.13768	7,806.46
Utility Charge: 56700 kwh @ 0.04843	2,745.98
Demand Charge 469.56 kw @ 11.06	5,193.33
Regulatory Cost Charge 56700 kwh @ 0.000568	32.21
Primary Service Discount 1.5%	-236.64
CURRENT CHARGES	**15,571.34**
TOTAL DUE	**15,571.34**
Good¢ents Donation	0.00

EE works in my buildings

HVAC replaced 2012



- Very efficient boilers
- ~$800,000 higher first cost
- ~$153,000 Annual savings
- 5.3 year payback
- 18% from building monitoring and better operations
- 86 on ES Portfolio Manager

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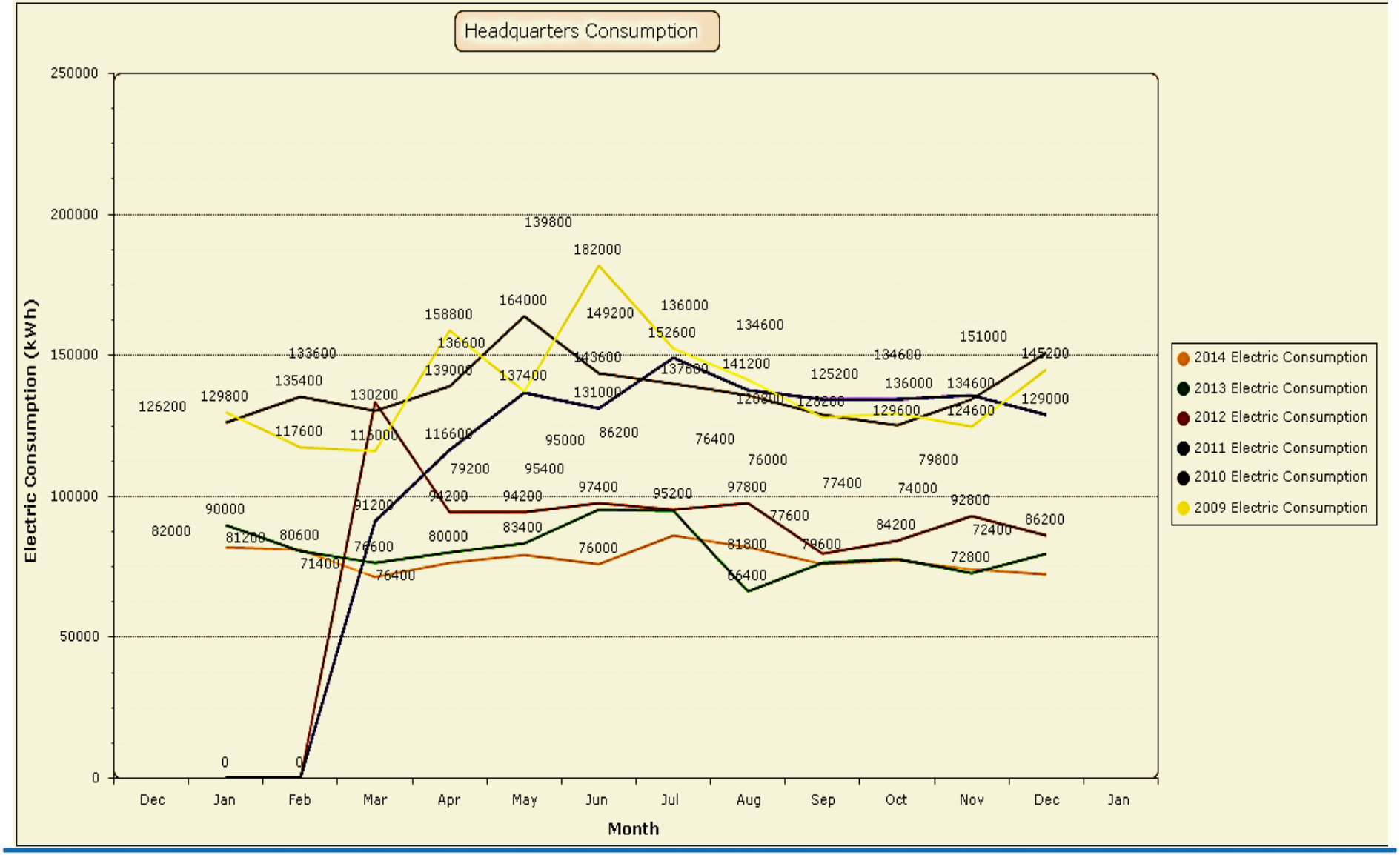

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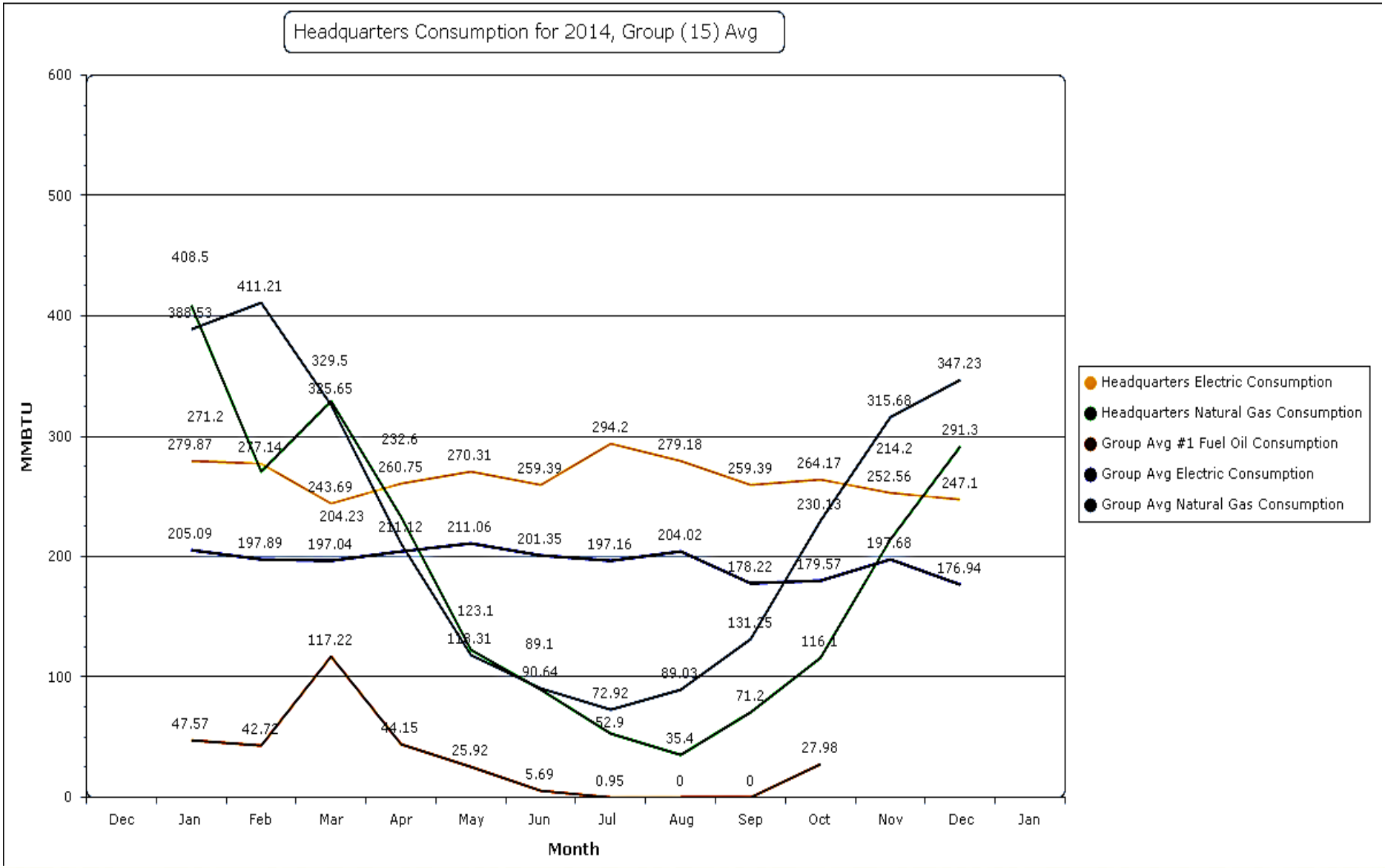

Questions?

http://www.ahfc.us/efficiency/research-information-center/energy-efficiency-public-facilities/

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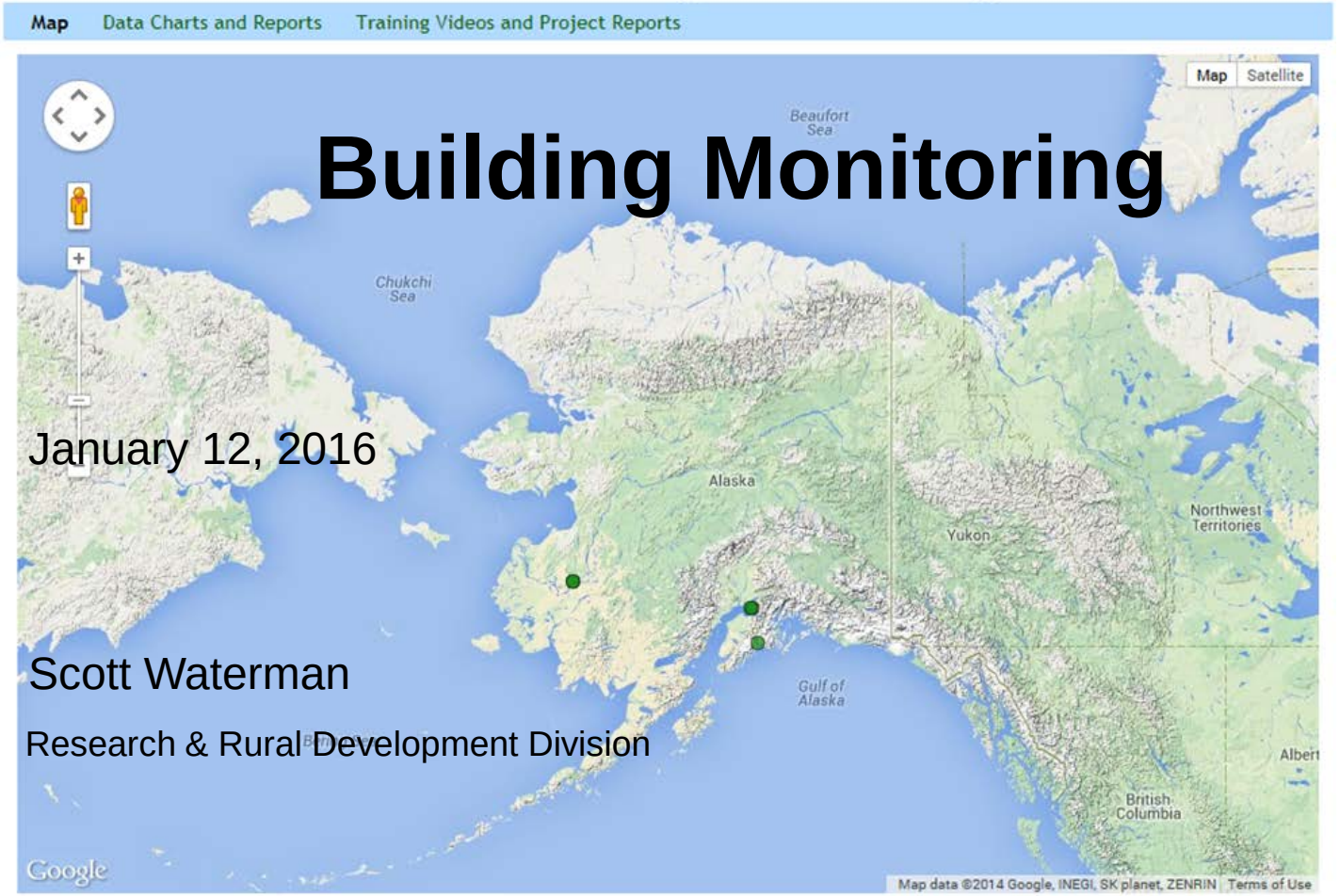
AHFC Building Monitoring



Building Monitoring

January 12, 2016

Scott Waterman

Research & Rural Development Division

Building Monitoring Project History

- 2013: Installed Monitoring Systems in Three Large AHFC Buildings
  - AHFC Headquarters
  - Chugach Manor Senior Housing
  - Glacierview Senior Housing, Seward
  - Built Web System for Storing and Analyzing Data
- 2014:
  - Chugach View
  - Four smaller 3-8 Plexes

Advantages over other systems

- Non-proprietary & Open source
- Multiple source inputs and analysis
- Much less expensive
- Can be modified by user to adapt to local situations
- Can be seen by multiple users

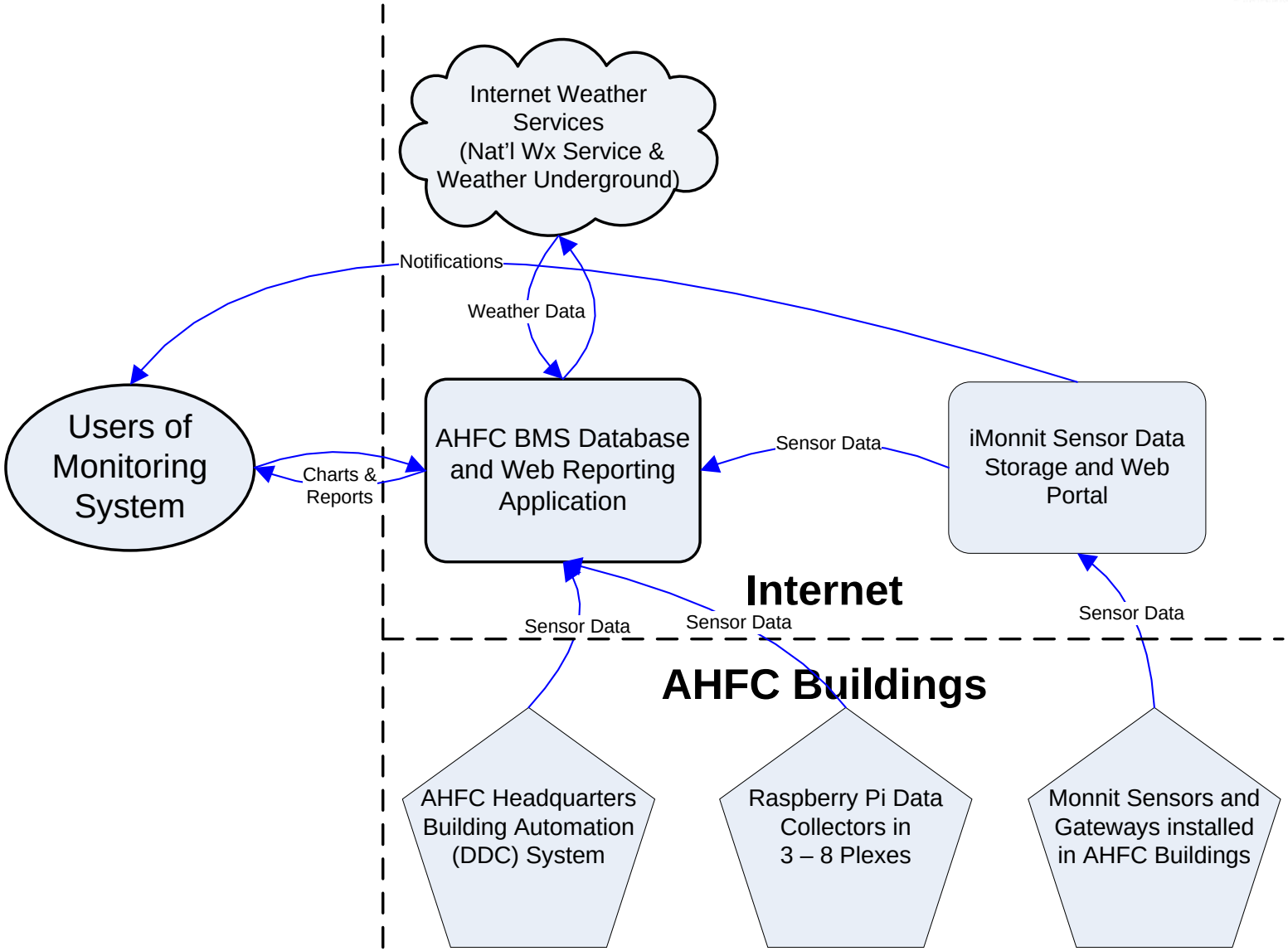
Uses

- Real time performance data on building operations
- Analysis of energy use during operations and unoccupied periods – improved performance and efficiency
- Troubleshooting of systems
- Reduced Maintenance Burden
- Warns of freeze or failure

Uses

- Design Benefits – actual data for retrofit, rather than guesses – allows for proper sizing of equipment
- Single interface can link multiple inputs
  - Weather stations, automation systems, sensors, other data bases
- Dashboard and graphing
- Peak Demand Load reduction

Monitoring System Architecture



Sensor Installs

Gas Meter
(AHFC Headquarters)

Electric Meter
(Chugach Manor)

Sensor Installs

Oil Flow Meter (Glacierview, Seward)

Pipe Temperature

Sensor Installs

Boiler Alarm
(Glacierview, Seward)

Fluid Flow
(Chugach Manor)

Data transmission

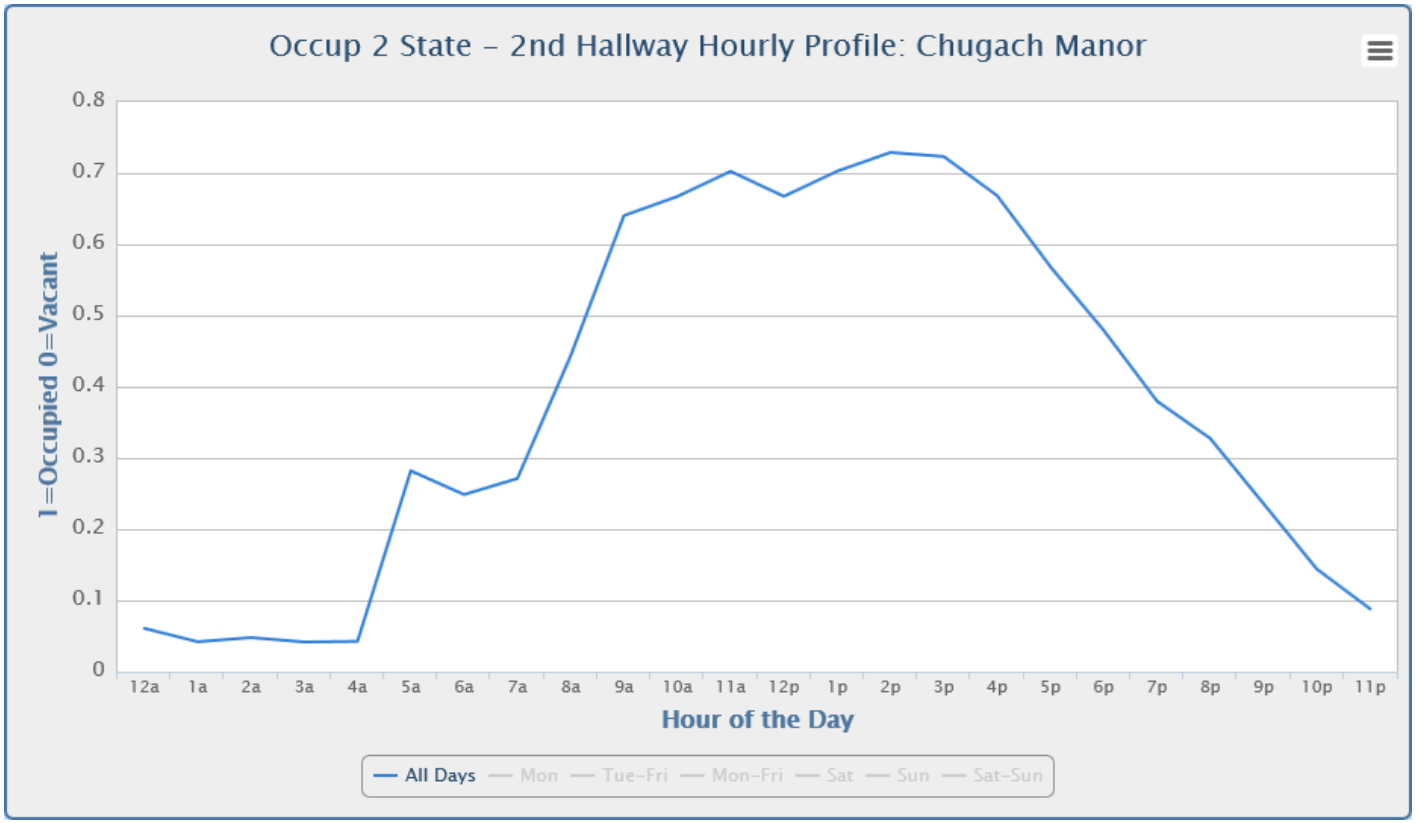
- Over installed network or cellular based
- Some concern with IT people over security, though the system can be isolated from networks
- Allows multiple inputs to a single interface

Case Studies - Ventilation

Ventilation

- Air handler set to operate to dry carpet after cleaning – not set for one time event
- Continuous use Sat. Noon through Monday eve shutdown
- Unintended cost – $7,990/year + $1,280 reduced gas use - $9,270 total

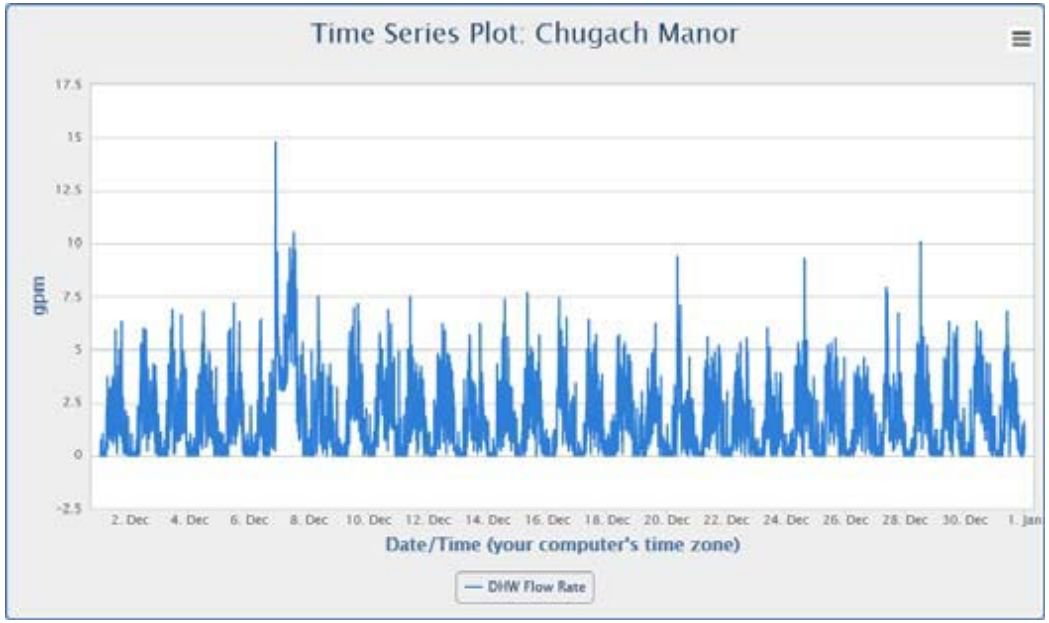
Corridor Dimming



Corridor Dimming

- Occupied less than 25% of time between 8am and 6pm
- Reduced lighting during unoccupied times with occupancy sensors to light when occupied
- Saves $5,000 per year on $4,000 invested

Water Heating



Water Heating

- Two 35 GPM water heaters installed
- Peak flow was <15 GPM over one year
- Average was 10 GPM – 50% of ASHRAE value
- Oversized by 313% - $210,000 lower cost for replacement

Building Monitoring Web Sites

- AHFC
  - bms.ahfc.us
  - code.ahfc.us/energy/bmon
- ANTHC
  - rm.anthc.webfactional.com/map/

Other Users

- Alaska Native Tribal Health Consortium (ANTHC): Wireless Sensors in 20 Water / Sewer Facilities
- Alaska Center for Energy and Power will monitor power plants and renewable energy systems for research and performance
- AEA has their HQ building now installed.
- Colorado Cooperative Extension – soil moisture

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Questions?

Scott Waterman

- Alaska Housing Finance Corporation
  - Research and Rural Development Division
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  - swaterman@ahfc.us
  - www.ahfc.us