

**National Frozen Foods**

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**Energy Projects**

**National's Albany Plant**

## National Frozen Foods

- 1912 National Fruit Canning Company established in Olympia Washington.
- 1936 NFFC put its first fast-freezing tunnel in Chehalis, Wa. processing peas and corn.
- In the past 30 years NFFC has grown by adding plants in Chehalis, Moses Lake, Quincy Washington, and Albany Oregon.




# National Frozen Foods

- During the past 10 – 15 years, National Frozen Foods has been more proactive at sustainability and energy conservation due to economics, costumer demands, and consumers.
- Sustainability
- Carbon Emissions
- EPA, DEQ Regulations
- Food Safety



## From the Beginning

- In 2002, an energy study was performed by Cascade Engineers with the objective to combine plant 4 and 5 refrigeration systems with a newer Compressor Control System.
  - This CCS was going to consolidate plant 4 – 5 refrigeration loads. (Cold Storage Rooms)
  - The project consisted of many equipment replacements and updates.
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## Management Support

- We have traditionally focused primarily on equipment upgrades and process improvements.
- National Frozen Foods, Albany is committed to reducing total plant electrical usage by 20 percent or 2,000,000 kWh in order to reach sustainability goals and cost reduction between April, 2009 through May, 2012.

## Management Responsibility (Education)

- The impact from the electrical consumption by poor decision making from your operators can scalade up to \$100,000 or more.
- Many other operators do not have the understanding of the correlation between running an engine room and an energy conservation sense.



# Projects Supported By Energy Trust

- 2009 Refrigeration Control System Upgrade
- 2009-2010 Kaizen Blitz
- 2011 Compressed Air leak
- High Pressure Water Pump Upgrade
- Ongoing Lighting Upgrades



# Energy Trust of Oregon


- Independent non-profit organization serving customers of PGE, Pacific Power, NW Natural and Cascade Natural Gas
- Focused on energy efficiency and renewable energy
- Technical services
- Cash incentives



# The Kaizen Blitz

- **Kaizen:** Japanese word meaning “incremental, continuous change for the better” or “continuous improvement”
  - Team effort to solve problems
  - Objective assessment & fact-based decisions
  - Shares traits with a system tune-up or retro-commissioning project

## Kaizen Blitz Onsite Work

- 2 to 5 days on site
  - Engineer and outside technician plus team from plant
  - Identify no-cost and low-cost improvements
    - Low-risk changes made immediately with support of plant personnel
  - Document all opportunities — Allowing to track progress
  - Not limited by subsystem: “Look for anything on the meter”
  - Closing meeting: Discuss changes, action items, next steps, etc.
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# KB Action Item Overview

- 45 Identified
- 30 Refrigeration-related
- Significant Overlap with RCS
- Some examples: *New practices*
  - Increase suction, lower condensing
  - Repair limit switches on slide valves
  - Run condenser wet through winter
  - Recalibrate motor current on compressors prone to current limiting
  - Increase oil cooling SP for liquid injection

## KB Action Item Overview



*Before*

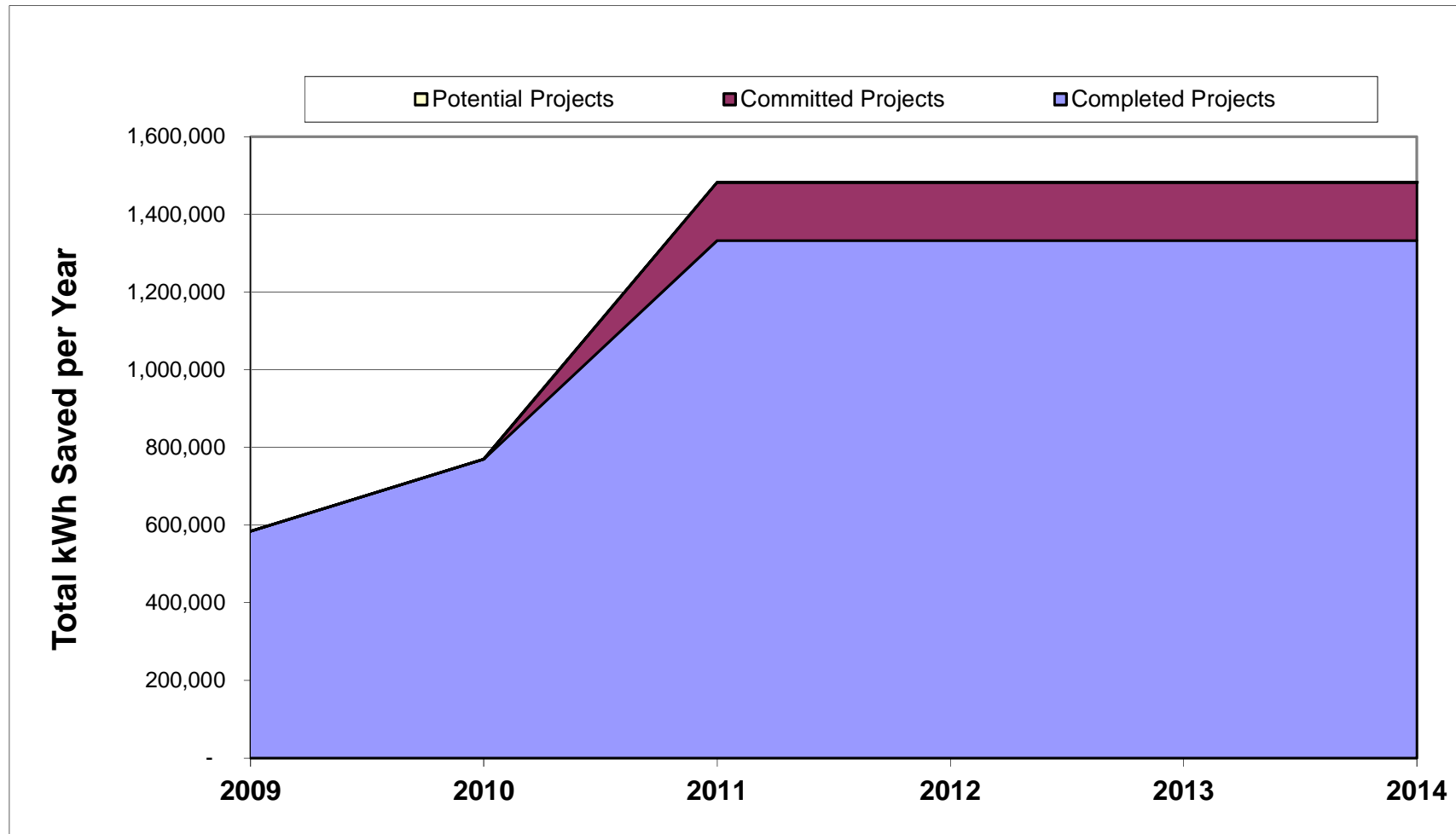


*After*

**These pictures were taken before and after the new LED lights were installed in one of our cold storage rooms.**



# Annual Electrical Energy Savings

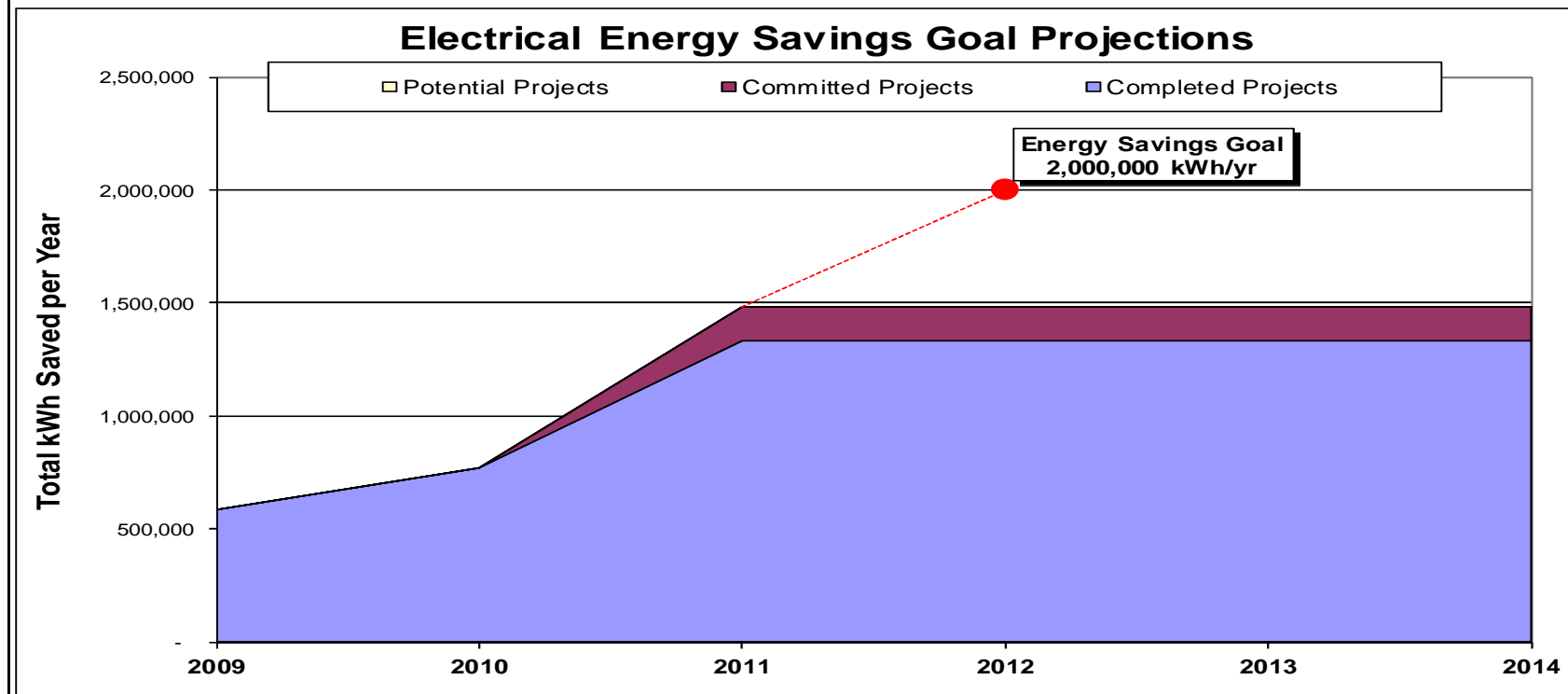


# Electricity Energy Savings Goal

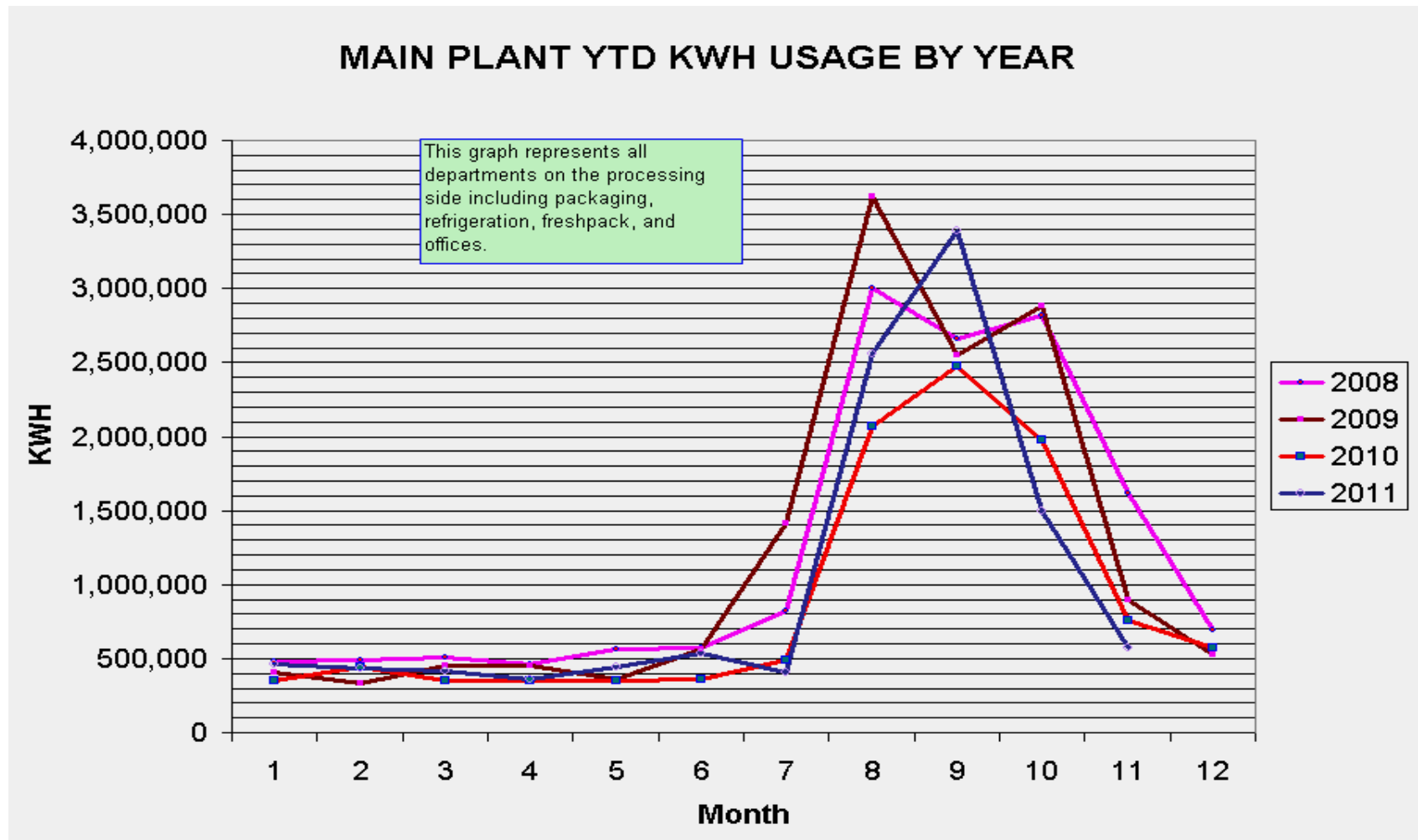
## Electrical Energy Savings Goal Summary

|  |                        |
|--|------------------------|
| <b>Additional Annual Energy Savings (kWh) Needed to Meet Energy Savings Goal (after committed projects are installed):</b> | <b>517,544 kWh/yr.</b> |
| <b>Additional Energy Savings (kWh) Needed to be Identified to Meet Efficiency Goal:</b>                                    | <b>517,544 kWh/yr.</b> |
| <b>Estimated Pre-Incentive Capital Required to Meet Efficiency Goal (including committed projects):</b>                    | <b>\$9,250</b>         |

## Electrical Energy Savings Goal Projections



# Main Plant Baseline Energy Use



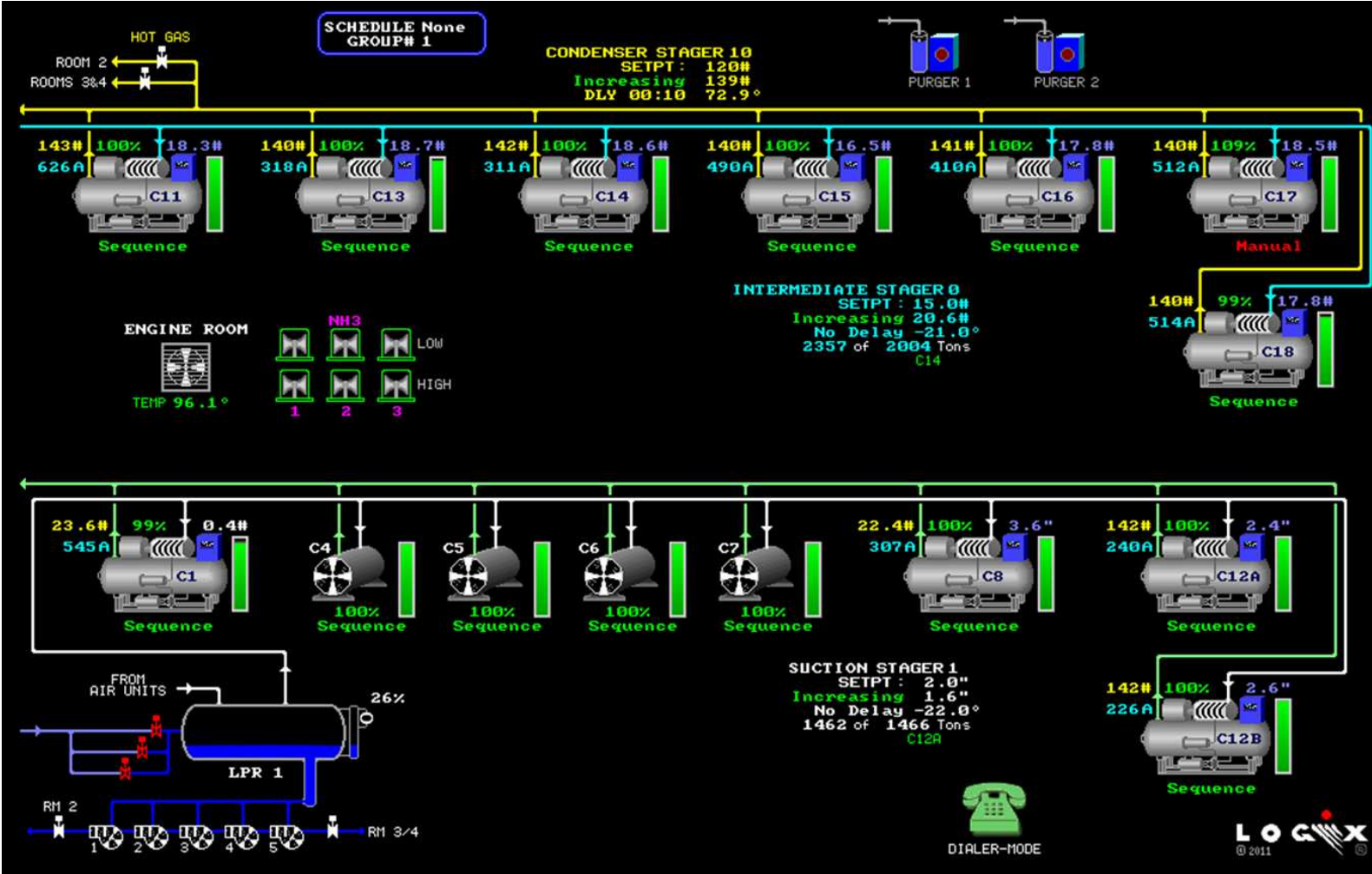
## Refrigeration Overview at National - Albany

- Nearly 70% of National's electric energy is consumed by the large refrigeration system — with heaviest usage from late June — mid October.
- Three ammonia systems
  - Main plant with over 5,000 hp compressors
  - Plant 4 with a single 250 hp compressor
  - Plant 5 with a dual 250 hp compressors

# Refrigeration Overview at National - Albany

- **Main Plant:**
  - Large system with  $>5000$  hp in compressors
  - 15 compressors (booster, high stage, single stage)
  - Serves 4 freezing tunnels, multiple water chillers, cold storage evaporators, and a puree process
  - Big seasonal peak during summer fresh pack
  - Off-season puree operation at different times of the year
  - Low non-production loads offseason

# Main Plant Compressor Room




# Key RCS Algorithms & Features

- Common:
  - Single set-point control
  - Wet bulb approach control
- Less Common:
  - Compressor Sequencing Strategies for each season (freshpack, puree, off-season)
- Rare:
  - Entire System Cycling in Plants #4 & #5
  - Cold Storage Evaporator Load Shedding during puree production
- Limits:
  - Electromechanical control (1<sup>st</sup> Generation RCC)
  - Manual Sequencing



## Fresh Pack Overview

- July thru October
  - Green Beans, Corn, Squash Puree
  - High loads — often at refrigeration system capacity
  - Big swings in loads as tunnels come online and offline
  - Refrigeration staff have numerous obligations making it difficult to manually optimize equipment sequencing
  - Large infiltration loads in refrigerated spaces
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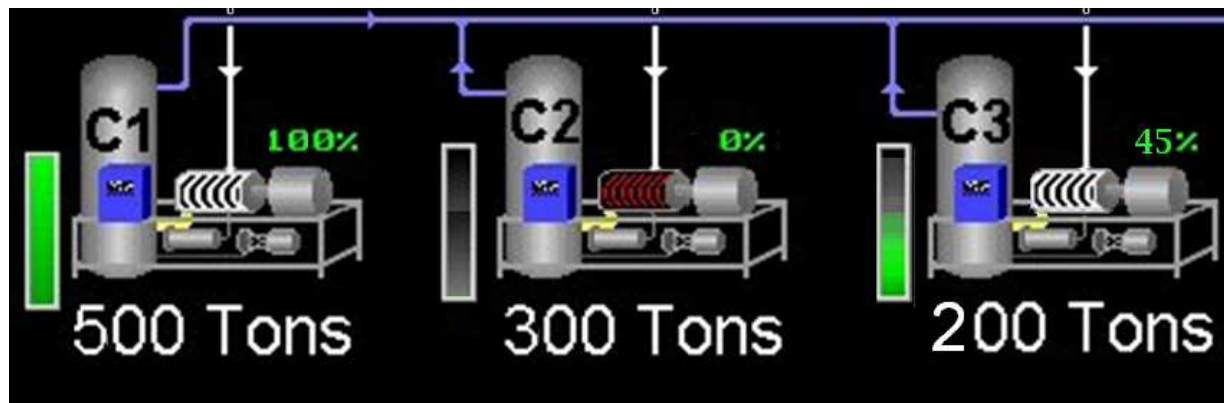
## Fixed Lead List Inadequacies

- Only have one available → set for full load conditions
- What if load is less?
  - Do you have the most efficient lead list?



# Fixed Lead List Inadequacies

- What if load is less?
- Fixed lead list solutions
  - Scheduler implements predefined fixed lead lists to predictable load size changes
  - Measure load and implement best fit from a selection of predefined fixed lead lists



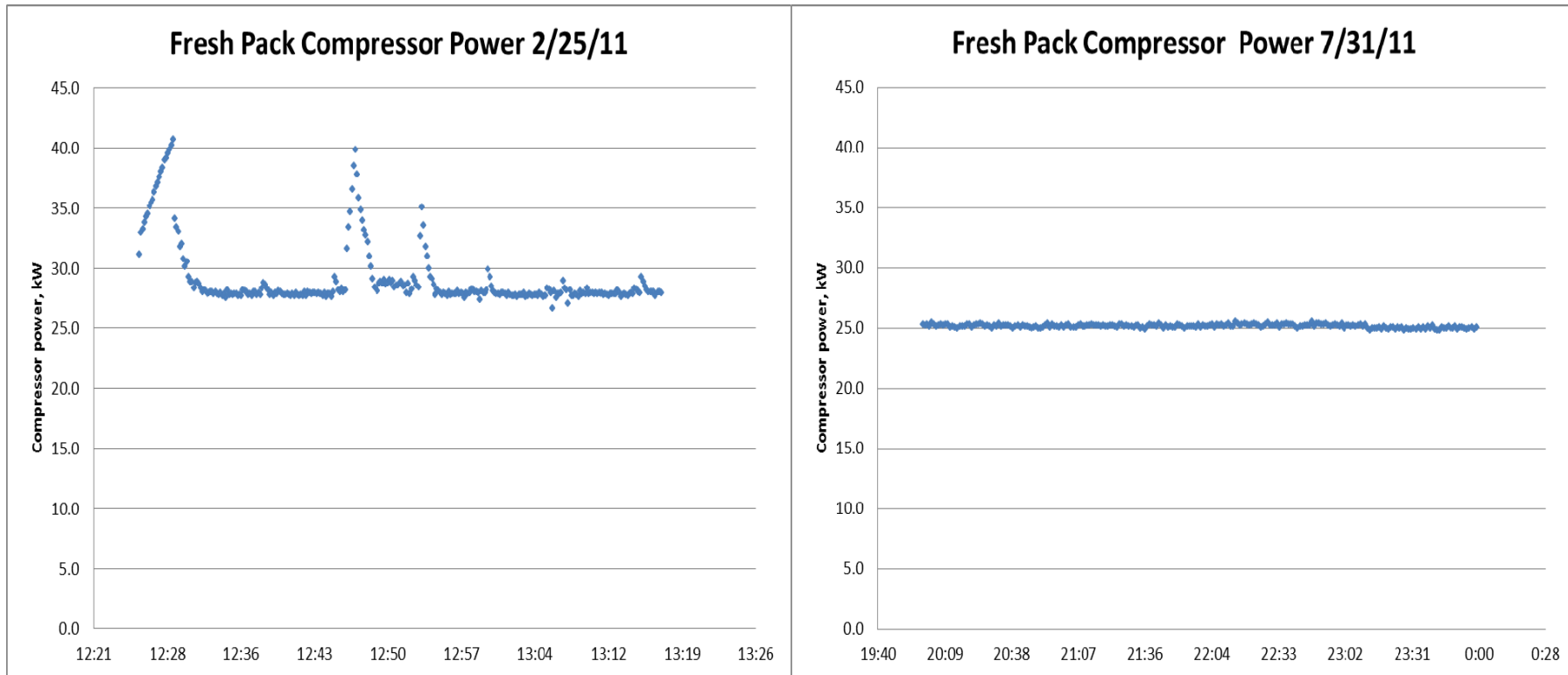
# Sub-metering System

- Allows energy monitoring to be segregated among the three major departments: Fresh Processing, Warehousing, and Packaging.
- Ability to make informed energy efficiency decisions by using real time data.
  - Hydraulic units running during sanitation time.
  - Air compressors running during setup time.

Graphs



# Compressed Air Leak Project



*Before air leak project*

*After air leaks were fixed*



# Sub-metering System

The screenshot displays the Cascade Energy web application interface. At the top, the Cascade Energy logo is on the left, and navigation links for QuickLinks, Logout, and Help are on the right. A menu bar below the logo includes Configuration, Site, Meter, Analysis, Reports, Forecasts, Bill Verification, Alarms, Data Exchange, Users, and About.

The main content area is titled "Edit Reports" and features a left-hand navigation tree under "Reports". The tree includes categories like Consumption, Emission Reports, Financial, Invoice, M & T, Management, and various report types such as Monthly Max Min Report, Monthly Meter Profile, Production vs Consumption, Weekly Meter Profile, and Yearly Comparison Report.

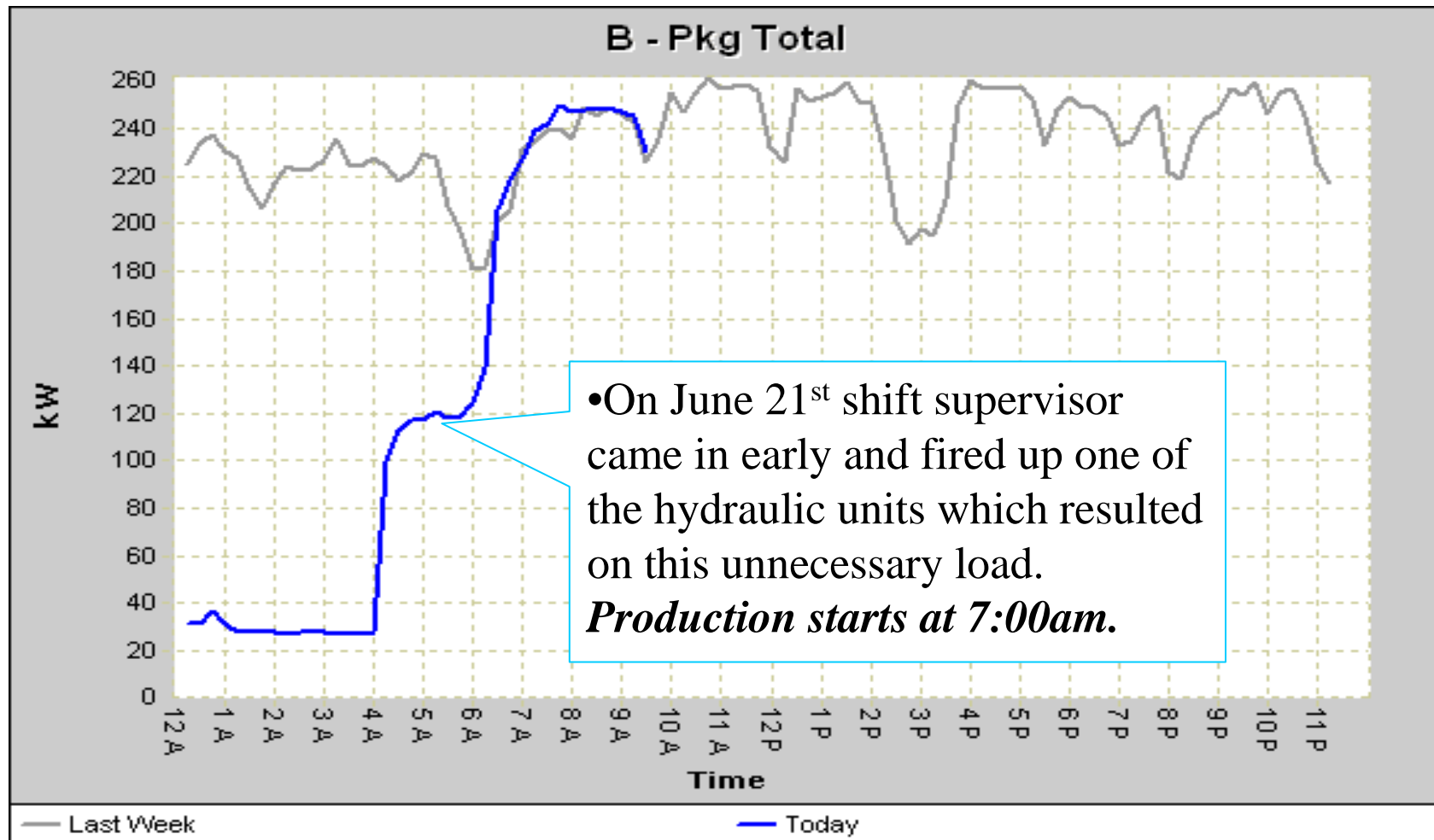
The central panel, "Selected Report Information", is for the "Weekly Meter Profile Report". It includes a description: "Profile for each day of the week" and a "Notes" section. Under "Report Parameters", the "Meter" is set to "Energy Trust \ National Frozen Foods \ B Pkg Total" and the "From Date" is "10/9/2011 12:00 AM". Two "View selected report" buttons are located at the bottom of this panel.

An inset window titled "Report - Windows Internet Explorer" shows a preview of the report. The preview includes a header with the Cascade Energy logo and a table with the following data:

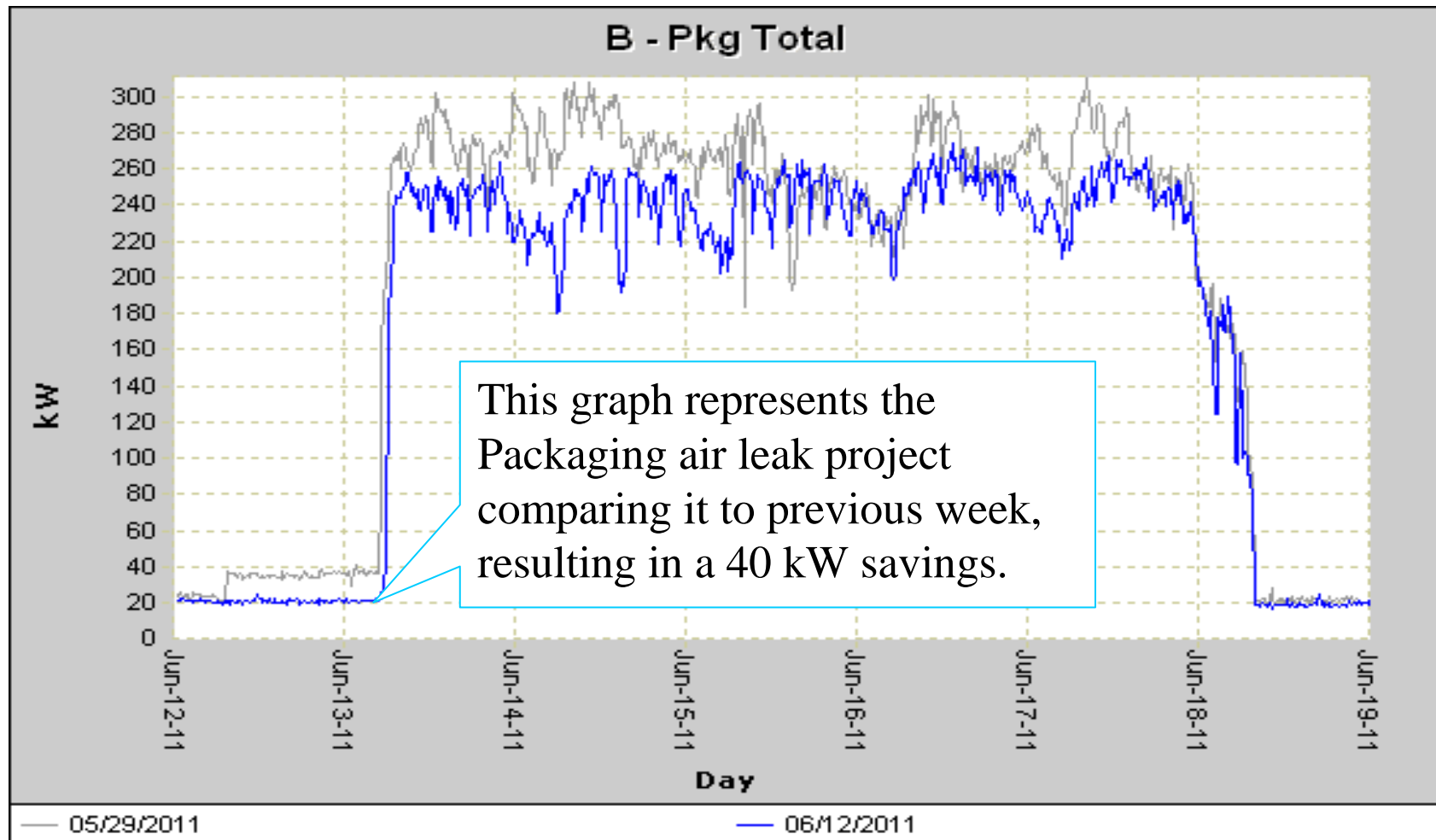
| Company     | Energy Trust             | Site  | National Frozen Foods      |
|-------------|--------------------------|-------|----------------------------|
| Meter       | B Pkg Total              | Units | LbM                        |
| Period From | Sunday, October 09, 2011 | To    | Saturday, October 15, 2011 |

Below the table, the report preview displays seven line graphs, one for each day of the week (Sunday through Saturday). Each graph shows energy consumption over a 24-hour period. The x-axis for each graph is labeled with hours from 2 to 22. The y-axis represents energy consumption. The graphs show varying levels of activity throughout the week, with some days showing higher consumption during certain hours.

# Sub-metering System



# Sub-metering System




# Results

- Actual savings up to date
  - Refrigeration Control System 499,378 kWh savings
  - Kaizen Blitz 34 of 45 action items completed 466,218 kWh savings
  - Compressed Air Leak Repair 181,876 kWh savings
  - Lighting Projects 286,457 kWh savings
  - Wash Down Pump Replacement w/VFD 94,018 kWh savings
  - Kaizen Blitz last 2<sup>nd</sup> year (11 items pending) 100,000 kWh savings
  - Lighting Project (plant 5) possible savings 91,148 kWh savings

Energy savings since goal was set — 1,719,095 kWh's

## Future Possibilities

- RCS provides invaluable insight into operations
    - key to taking it to the next level
  - Evaporator, Condenser, and Compressor VFDs in Plants #4 & 5
  - Thermosiphon or Electronic Expansion Valve on Liquid Injection for Plants #4 & 5
  - Strive to increase suction pressures further in Main Plant
  - Support Preventative Maintenance for air leaks
  - Finish all lighting upgrades
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## Summary

- 1) A refrigeration control system is the backbone of a successful drive to improve efficiency.
- 2) Work, commitment, and collaboration is now required from all key employees and our **Energy Conservation Committee**.
- 3) Energy Trust (and other program providers in the region) have moved beyond capital projects with a selection of Energy Management offers. The EM offers are a tremendous resource to unlock cost-effective savings and make measurable progress toward Nationals goal of 20% or 2,000,000 kWhs.

# National Frozen Foods

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**THANK YOU**