AUGUST 21-23, 2018 • CLEVELAND, OHIO
Shooting for the Moon: Planning and Execution Towards a Big Energy Goal such as 25%
Shooting for the Moon: Reaching Big Goals at IPG

Presented by
Philip Kauneckas
pkauneck@itape.com

2018 Energy Exchange
Cleveland, OH
August 23, 2018
Company Profile

- The second largest tape manufacturer in North America
- Employs ~2,600 people
- Approximately 68% of sales from products with a Top 2 market position in North America

![Pie chart showing 2017 Net Sales](chart.png)

- Tapes: 14%
- Films: 18%
- Woven & Other: 68%

2017
$898 million
Net Sales

Check out our corporate video on YouTube
Achievements

ISO 14001:2004
Environmental Management System

2014 & 2015 ENERGY STAR Partner of the Year

2016, 2017, & 2018 ENERGY STAR Partner of the Year – Sustained Excellence

11 Plants Achieved ENERGY STAR Challenge for Industry (to reduce energy intensity by 10% within 5 years)

2016 NASCAR Green E3 Challenge (Danville, VA plant)
BIG Goals

BEETTER PLANTS

Better Plants is partnering with leading manufacturers and water utilities to improve energy efficiency and competitiveness in the industrial sector, saving money in the process. Through Better Plants, partners voluntarily set a specific goal, typically to reduce energy intensity by 25% over a 10-year period across all their U.S. operations.
Planning

• Support from Senior Leadership
• Building Corporate Program
• Energy Action Plan
Corporate Support

Senior VP Operations
VP Operations

Chief Executive Officer

Senior VP – Logistics & Supply Chain
## History of Energy Management at IPG

<table>
<thead>
<tr>
<th>Year</th>
<th>Event Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>2004</td>
<td>NC State Energy Audit (Danville, VA Plant)</td>
</tr>
<tr>
<td>2006</td>
<td>Corporate Energy Team Created</td>
</tr>
<tr>
<td>2007</td>
<td>Energy Efficiency Projects Implemented (Danville, VA)</td>
</tr>
<tr>
<td>2009</td>
<td>Energy STAR Performance System Implementation</td>
</tr>
<tr>
<td>2011</td>
<td>Conducted first energy treasure hunt</td>
</tr>
<tr>
<td>2012</td>
<td>ENERGY STAR POY</td>
</tr>
<tr>
<td>2013</td>
<td>ENERGY STAR POY Excellence</td>
</tr>
<tr>
<td>2014</td>
<td>Conducted 4 Treasure Hunts (DV, BC, MM, MW)</td>
</tr>
<tr>
<td>2015</td>
<td>DOE IN-PLT Training (DV)</td>
</tr>
<tr>
<td>2016</td>
<td>ISO 50001 Implementation (DV, TN)</td>
</tr>
<tr>
<td>2017</td>
<td>Conducted 14th Treasure Hunt</td>
</tr>
<tr>
<td>2018</td>
<td>DOE IN-PLT Training (BS)</td>
</tr>
</tbody>
</table>

---

**Planning**

- Held 1st Annual IPG Energy Summit
- EPA E3 Assessment (Danville, VA)
- Conducted 4 Treasure Hunts (DV, BC, MM, MW)
- Conducted IRP Training (DV)
- Conducted ISO 50001 Implementation (DV, TN)
- Conducted 14th Treasure Hunt
Building Corporate Program

- Plant Energy Teams
  - Comprised of engineering, maintenance, & production employees
    - Meet once per month
    - Treasure Hunts, air Leak audits, kaizen events, training, contests
  - Plant Energy Coordinator is a member of corporate energy team
- Intertape Performance System (IPS)
  - Interfacing energy with production
- Corporate Finance
  - Metrics, reporting
- Logistics/Supply Chain
  - Regional Distribution Center Expansion
  - Suppliers/Customers
- Business Transformation Office
  - New plant and equipment design
  - Corporate standards
  - M&A Activities
Energy Action Plan

Intertape Polymer Group is committed to operating its facilities in an efficient, environmentally responsible, and cost-effective manner. We will uphold legal and other requirements involving energy. Our goal is to reduce energy intensity by 20 percent within 10 years and reduce CO2 emissions by 30 percent. We will achieve this goal by implementing a continuous improvement program and employing training assistance across our manufacturing locations. Energy performance will be a consideration in design of new equipment and processes, along with modifications to existing equipment and processes. The Plant Energy Team has set the goal of reducing energy usage, identifying energy efficient projects, and providing a chance for identifying best practices. It is the responsibility of every employee to be highly involved in reducing energy usage.

Objectives

1. Reduce energy intensity by 2.5% per year
2. Reduce CO2 emissions by 30% per year
3. Achieve the Energy Star Partner of the Year (EPY) - Sustained Excellence Award

Current Conditions

- IPG Energy spend
- Energy intensity per unit
- Total energy savings

Long Term Plan (5 years)

Program Activities

- Benchmarking against external companies
- ISO 50001 Certification
- Incorporate energy management into new plants
- Incorporate energy management into suppliers
- Energy Champions
- Normalize Data

Energy Action Plan

- Energy Action Plan
- Energy Management Software
- Energy Management Software at Plants

Implementation Plan

- 2017 Schedule
- Monthly Team Conference Call
- Monthly Data Report
- Monthly Start-Up Managers
- Training Meetings
- Supplier Training

Company Activities (Goals and Objectives)

2017 Program Activities

- Energy Champions
- ENERGY STAR Challenge
- Energy Management Software
- Energy Management Software at Plants

Status

- Plants continue to work on meeting goals
- 5 CEM target is met
- Complete 5 plants in 2016
- Target 3 plants for 2015
- Target 3 plants for 2016
- Complete 5 plants in 2017
- Update process models with 2016 data
- Implement and continuously improve for 2018
- Select for DOE pilot programs
- 10-month process for certification

Savings

- Y1 Savings: $15,000
- Y2 Savings: $25,000
- Y3 Savings: $35,000
- Y4 Savings: $45,000
- Y5 Savings: $55,000

Cost Benefit Analysis

- Compressed Air
- Lighting
- Steam
- Process Heating

Intertape Poly Group
Execution

• Training new team members
  – Tools and Resources
• Building Energy Efficiency Into New Plant and Equipment Design
• Intertape Performance System
Training New Team Members

• Building energy teams
  – “Playbook”
  – Professional Development
  – Annual IPG Energy Summit
    • Networking
    • Learning best practices → Implement
    • Recognition

• Treasure Hunts
  – Conducted 14 since 2013
  – Engagement (183 employees)
  – Expectation → Implement findings!!

Execution
Building Energy Efficiency into New Plant & Equipment Design

• Greenfield manufacturing facility in Midland, North Carolina to support our growing water-activated tapes business.
  – Included best practices in energy management in design
  – Educate employees on energy efficiency during on-boarding process
  – Operations Manager is CEM

• Regional Distribution Center Expansion
• Developing corporate standards for energy efficiency
  – Energy efficiency is discussed during capital request process
• New film lines (TU, DV)
How does IPS work?

• Promote engagement within our most valuable asset → our associates

• Promotes engagement through pillar activities
  – Safety (focused on hazard identification and correction)
  – Quality (focused on processes that impact external and internal quality)
  – Visual Communication (creates the visual plant and ownership in key metrics)
  – Equipment Optimization (focuses on equipment reliability and key process conditions)
  – Organizational Development (focuses on training needs and employee growth strategies)
  – Stewardship (focuses on our impact to the environment and our community)

• Continuous Improvement
  – This team provides direction for all pillars with a primary focus on training all associates how to identify opportunities for improvement and provide the vehicle to become change agents
  – Provides a structured Plan, Do, Check, Act method and sustainability plan
Interfacing energy with production

1. Red Tags - identifying machine abnormalities by creating a tag and attaching to the machine. There are 12 categories of machine abnormalities and include:
   - air leak
   - water leak
   - damaged parts
     - Insulation
     - contamination
Interfacing energy with production

2. Standard Cadence – Turn off/turn down procedures

3. Visuals
Results from IPS

- Improved safety – 50% reduction in TCIR
- Improved quality – major improvement in quality returns and 1st pass yield
- Improved metrics & visual communication – are we winning?
- Improved employee engagement
- Achieving record levels of production
Challenges

Acquisition Growth

- Acquired Anchor Continental 1996
- Acquired Anchor Continental 1998
- Acquired REXFORD 1996
- Acquired Tesa Tape 2000
- Acquired Polymer International 1989
- Acquired Masking & Duct tape Business of Tesa Tape 2004
- Acquired Crowell Brand (WAT) 2011
- Acquired Crowell 2015
- Acquired Better Packages, Inc & Tara Tape (Tara Tape consolidated into Carbondale location in 2016)
- Distribution Agreements with V. Hinrichs USA and Bunker Tape 2017
- Acquired CanTech
- Acquired majority stake in Capstone 2016

Intertape Polymer Group™

- Acquired Fibope 1995
- Acquired American Tape Co. 1997
- Acquired Central Products 1999
- Acquired Spileaker Electrical Tape 2003
- Acquired the remaining 50% of Fibope 2005
- Acquired Flexitec & Fib-Pak 2006
- Acquired 74% stake in Powerband Industries 2016

www.itape.com
Results

SUCCESS
WHAT PEOPLE THINK IT LOOKS LIKE

SUCCESS
WHAT IT REALLY LOOKS LIKE
THANK YOU!
Shooting for the Moon, Planning and Execution for a Big Energy Goal

Making every KW count
A trip down Memory Lane

- Then: 2006 Hedging strategy to combat out of control energy prices
- Now: Implementing a PPA to save money and fix price in the future.
- Then: 2005 How to justify and install metering
- Now: How to justify and use analytics to effectively manage tons of data from many meters and sources
- Then: 2007 How to justify and pay for T8 high bay lights and fixtures
- Now: How to install an use complex control schemes to maximize the benefit of LED lighting
- Then: <2005 driving HVAC by single thermostats to achieve employee comfort.
- Now: Using single zone VAV in manufacturing areas, partial load efficiencies and using Psych charts and RH for control.
ISO Program
- 30 sites certified to ISO 50001 in program 2018
- 21 sites with SEP certification
- Target sites with ISO 14001 certification
- Exposure to Management system
- Seat at table
- Verified results by 3rd party
- Benchmarking for Enterprise
- Documented and Verified Results

Demographics
- 72 buildings
- 55 locations
- 12 M ft²
- 105 people
- 7 Regional Leaders
- 12 Facility Managers
- Across North America
- Across all Businesses

2018 Better Buildings Summit
Share credible results at all levels

Cumulative Energy Savings

Based on energy performance reports normalized for weather, production and/or occupancy, as applicable

NAM Regional Energy Performance

Energy performance by country through year end 2016
Milestones

• Active energy program since 2006
• Worked towards a consistent 3.5% year over year goal since 2006
• > 45% normalized energy savings since 2006
• Completed a Better Buildings challenge commitment in 2011 by achieving and documenting a 26% savings in 2016.
• Resigned the Better Buildings commitment in 2017 for an additional 12 years and 20%.
• Participated in 2011 ISO50001/SEP demonstration project and since have certified 30 sites to ISO50001 and 21 to SEP.
• The Smyrna site is the 2nd site to be 3x Platinum and we have 10 other sites with Platinum certification.
• Carbon Neutral by 2050
Foundation Principles

- Management Commitment and Support
# Planet & Society Barometer

## Overall score (out of 10)

<table>
<thead>
<tr>
<th>Objective</th>
<th>Start 01/2015</th>
<th>Results Q4 2015</th>
<th>Results Q1 2016</th>
<th>Target 12/2017</th>
</tr>
</thead>
<tbody>
<tr>
<td>10% energy savings</td>
<td>-</td>
<td>4.5%</td>
<td>4.5%</td>
<td>10%</td>
</tr>
<tr>
<td>10% CO₂ savings from transportation</td>
<td>-</td>
<td>8.4%</td>
<td>8.4%</td>
<td>10%</td>
</tr>
<tr>
<td>Towards zero waste to landfill for 100 industrial sites</td>
<td>34</td>
<td>64</td>
<td>69</td>
<td>100</td>
</tr>
<tr>
<td>100% of products in R&amp;D designed with Schneider ecoDesign Way™</td>
<td>-</td>
<td>13.3%</td>
<td>8.9%</td>
<td>100%</td>
</tr>
<tr>
<td>75% of product revenue with Green Premium™ eco-label</td>
<td>60.5%</td>
<td>67.1%</td>
<td>66.7%</td>
<td>75%</td>
</tr>
<tr>
<td>100% of new large customer projects with CO₂ impact quantification</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>100%</td>
</tr>
<tr>
<td>120,000 tons of CO₂ avoided through maintenance, retrofit and end-of-life services</td>
<td>-</td>
<td>44,777</td>
<td>56,137</td>
<td>120,000</td>
</tr>
<tr>
<td>x5 turnover of Access to Energy program to promote development</td>
<td>-</td>
<td>x2.07</td>
<td>x3.04</td>
<td>x5</td>
</tr>
<tr>
<td>100% of our recommended suppliers embrace ISO 28000 guidelines</td>
<td>48%</td>
<td>64.7%</td>
<td>65.2%</td>
<td>100%</td>
</tr>
<tr>
<td>All our entities pass our internal Ethics &amp; Responsibility assessment</td>
<td>-</td>
<td>88%</td>
<td>88%</td>
<td>100%</td>
</tr>
<tr>
<td>30% reduction in the Medical Incident Rate (MIR)</td>
<td>-</td>
<td>17%</td>
<td>37%</td>
<td>30%</td>
</tr>
<tr>
<td>One day training for every employee every year</td>
<td>79%</td>
<td>85.6%</td>
<td>85.6%</td>
<td>85%</td>
</tr>
<tr>
<td>64% scored in our Employee Engagement Index</td>
<td>61%</td>
<td>61%</td>
<td>61%</td>
<td>64%</td>
</tr>
<tr>
<td>85% of employees work in countries with Schneider gender pay equity plan</td>
<td>-</td>
<td>57%</td>
<td>57%</td>
<td>85%</td>
</tr>
<tr>
<td>150,000 underprivileged people trained in energy management</td>
<td>73,339</td>
<td>102,884</td>
<td>108,365</td>
<td>150,000</td>
</tr>
<tr>
<td>1,300 missions within Schneider Electric Teachers NGO</td>
<td>480</td>
<td>878</td>
<td>938</td>
<td>1,300</td>
</tr>
</tbody>
</table>

*The arrow shows if the indicator has risen, stayed the same or fallen compared to the previous quarter. The colour shows if the indicator is above or below the objective of 8/10.*

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**2018 Better Buildings Summit**
Foundations Principles

- Management Commitment and Support
- Earn a seat at the table
Foundation of an Energy Management Program

Do you have a seat at the table for capital and expense planning?

Do you have challenges obtaining capital for energy projects?

Do you struggle with consistent management support of energy programs?

Do you face competing priorities when planning energy projects?

Are you able to affect or make changes to process energy?

Does your management know, understand, believe your energy performance?

Do you have issues with correctly stating and communicating your energy performance?

Do you have training, employee involvement and awareness programs for energy efficiency?
Active Energy Management

• Understand and Use your corporate strategy
• Share credible results at all levels
• Use and share your strategy, and make it relevant to local operations
• Use a sound M & V protocol
Schneider Energy Action – Active Energy Actions

Scope and process flow

Use and share your strategy, and make it relevant to local operations

Strategic Planning & Review

Energy Performance Reporting

Comprehensive Site Assessments

Training & Knowledge Dissipation

Energy Project Planning & Tracking

2018 Better Buildings Summit
Foundations Principles

- Management Commitment and Support
- Earn a seat at the table
- Tell your story to anyone that will listen
Our Energy Story

- Use and share your strategy, and make it relevant to local operations

**Getting started**
- Energy assessments
- Metering (can’t manage what you don’t measure)
- Chicago Climate Exchange
- Supply-side management

**Santa Claus projects**
- High-bay fluorescent lighting (~20,000 lamps)
- Building automation systems
- New air conditioning units (aging infrastructure)
- LED lighting
- Renewable energy (Smyrna, Rojo Gomez, Palatine, City of Knowledge, Andover, Cocasset)

**Working with production**
- Variable frequency drives
- Process improvement (molding, paint lines, etc.)
- Operational control

**Establishing a management system**
- ISO50001 EnMS
- Building analytics (Advisor)
- Real estate strategies

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2018 Better Buildings Summit
Not the End!!!

- Use and share your strategy, and make it relevant to local operations

Early-to-mid 2000s

- Energy assessments
- Metering (can’t manage what you don’t measure)
- Chicago Climate Exchange
- Supply-side management

2012-2015

- High-bay fluorescent lighting (~20,000 lamps)
- Building automation systems
- New air conditioning units (aging infrastructure)
- LED lighting
- Renewable energy (Smyrna, Rojo Gomez, Palatine, City of Knowledge, Andover, Cocasset)
- Variable frequency drives
- Process improvement (molding, paint lines, etc.)
- Operational control

2017 WEEC

Chart showing percent reduction from baseline:
- ISO50001 Certified
- Non-ISO50001 Certified
- PERCENT REDUCTION FROM BASELINE

ISO50001 Certified
Non-ISO50001 Certified
Foundations Principles

- Management Commitment and Support
- Earn a seat at the table
- Tell your story to anyone that will listen
- Embrace the future
"In 2016, Schneider Electric joined the Science-Based Targets initiative to align its objectives... to limit global warming to 2°C maximum.

In line with the science-based targets, Schneider Electric takes the following engagements:

- 35% absolute CO2 reduction in scopes 1 & 2 by 2035 (baseline 2015)
- 53% absolute CO2 reduction in scopes 1 & 2 by 2050 (baseline 2015)

These are minimum targets set for the Group, corresponding to a 2.1% year-on-year emission reduction from 2015. They will contribute to the objective of achieving carbon neutrality for Schneider Electric and its ecosystem by 2030. A dedicated carbon committee has been set up to drive these commitments."
More ELECTRIC

2X faster growth of electricity demand compared to energy demand by 2040

Source: IEA WEO 2014

DIGITIZATION

10X more incremental connected devices than connected people by 2020

Source: Cisco, Internet World Statistics

DECARBONIZATION

82% of the economic potential of energy efficiency in buildings and more than half in industry, remains untapped

Source: World Energy Outlook 2012, Internal Analysis

DECENTRALIZATION

70% of new capacity additions will be in Renewables by 2040

Source: BNEF
The Next Chapter – Our Future

- Energy efficiency will still be a driver and our foundation in the future.
- My energy bills are too high, and/or are not predictable
- Grid Resiliency
- Grid stability
- Price certainty
- Carbon reduction goals
- How do we prepare?
- I have ambitions to be more sustainable
- Balancing Real Estate, Sustainability, and Energy Efficiency
- Outages and poor power quality cost me money, harm my assets, and undermine the safety of my employees
We are thinking about Energy in a New Way

- Reduce energy consumption
- Improve and monetize flexibility
- Energy / Fuel source arbitrage

**Efficiency**

- kWh

**Supply**

- $-

**Active Energy Management**

- Innovative Product and Hedge Structures
- Global Program
- Real-time-price forecasting
- Portfolio Risk Management

**Sustainability**

- Reduce Greenhouse Gasses
- Minimize carbon footprint

**Resiliency**

- Service site loads during times of grid instability
- Protect assets against harmful effects of poor power quality
What is a Microgrid?

An integrated energy system consisting of interconnected loads and distributed energy resources…

…which as an integrated system can be controlled as a single entity and operate in parallel with the grid or in an intentional islanded mode.
Microgrid as a Service

The evolution of the business model

Value Proposition
- Lower / No Upfront Capital
- Cost avoidance
- Less volatile energy costs
- Better resiliency
- Better sustainability
- Site upgrades

Partners
- Solar
- CHP
- Battery Storage
- EPC & GC

Investor / Owner
- PPA

Partner
- Solar
- CHP
- Battery Storage
- EPC & GC

Site
- Partner
- Schneider Electric
Shooting for the Moon, Planning and Execution for a Big Energy Goal

Foundation Principles

• Management Commitment and Support
• Earn a seat at the table
• Tell your story to anyone that will listen
• Embrace the future

Our Story

Part one – it is complete but not finished
• Energy Efficiency
• Management Systems and Practices

Part two – Still writing the story
• Sustainability
• Resiliency
• Cost Certainty

Life Is On
How Nissan is Shooting for the Moon
With Energy Savings
By Brett Rasmussen
More than **22,000** employees in the U.S.
Nissan has 4 U.S. manufacturing facilities capable of producing 114 million vehicles, 1.5 million engines, 1.4 million forgings and 475,000 castings annually.

Nissan Smyrna Vehicle Assembly Plant and Battery Plant
Employees: 8,400 | Production: 642,000
Our vehicle production plant in Smyrna, Tenn., is the largest not only in the U.S. but in the Americas.

Nissan Canton Vehicle Assembly Plant
Employees: 6,400
Production: 450,000
Canton, Miss.

Nissan and Infiniti Decherd Powertrain Plant
Employees: 1,900
Production: 1.5 million engines
Decherd, Tenn.

More than 22,000 U.S. employees including 16,000 manufacturing jobs

15 million vehicles proudly manufactured in the U.S. since 1983

10 million engines proudly manufactured in the U.S. since 1997

$14 billion spent with 300 suppliers in 30 states in U.S. in 2016

$11 billion investment in manufacturing in the U.S. since 1981
U.S. MANUFACTURING

NISSAN GROUP OF NORTH AMERICA

MISSISSIPPI
CANTON VEHICLE ASSEMBLY PLANT

TENNESSEE
SMYRNA VEHICLE ASSEMBLY PLANT

NISSAN

PATHFINDER

FRANKLIN, TN
Americas HQ

Smyrna, TN

Engines

Smyrna, TN

Vehicles

Dcherd, TN

Vehicles

Canton, MS

Vehicles
CANTON PLANT ENERGY STAR 2017 CERTIFICATION
12 YEARS
DOE Recognizes Canton for ISO 50001
DOE Recognizes Canton for ISO 50001

Canton Vehicle Plant
Nissan North America Inc.

Recognized by the U.S. Department of Energy for implementing ISO 50001 and Superior Energy Performance program standards, and improving energy performance by 20.9% over 3 years.
SEU Determination
Known energy systems were ranked (Histogram Chart) based on total annual energy consumption. The largest energy use for Nissan Canton is Chilled Water Generation.

NNA-C 2015 Criteria and Ratings Worksheet for Ranking SEU’s
MAX 16,616 KW
Canton Utilities Plant (CUP)

Largest Chiller Plant in State of Mississippi 25,500 Tons
CUP Chillers 2550 Ton
Energy Dashboard for Chiller Plant
System kw/ton running at 2:00 PM
7/20/2016

12495 kW | 18033 TR | 0.69 kW/TR | OAT: 92.1 °F  | WB: 76.7 °F | 20-Jul-2016 14:00 CDT
### Nissan - Mississippi - Chiller Plant Upgrade Energy Savings Summary

<table>
<thead>
<tr>
<th>A</th>
<th>CHW Pump Optimization</th>
</tr>
</thead>
<tbody>
<tr>
<td>Estimated existing PCHW pump energy</td>
<td>752,494 kWh</td>
</tr>
<tr>
<td>Estimated existing SCHW pump energy</td>
<td>3,262,280 kWh</td>
</tr>
<tr>
<td>Projected PCHW pump energy</td>
<td>194,530 kWh</td>
</tr>
<tr>
<td>Projected SCHW pump energy</td>
<td>2,278,301 kWh</td>
</tr>
<tr>
<td>Projected CHW pump energy savings</td>
<td><strong>1,541,943 kWh</strong></td>
</tr>
</tbody>
</table>
Primary Pumps are Off – Pull Water Through
Secondary Chiller Water Pumps
## Reduced Thermal Load From CHW

### Nissan - Mississippi - Chiller Plant Upgrade Energy Savings Summary

<table>
<thead>
<tr>
<th></th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Reduced CHW pumping electrical energy</td>
<td>1,541,943 kWh</td>
</tr>
<tr>
<td>Reduced pumping brake hp</td>
<td>2,066,947 BHP</td>
</tr>
<tr>
<td>Equivalent cooling reduction</td>
<td>438,365 Tons</td>
</tr>
<tr>
<td>Estimated current plant efficiency</td>
<td>1.00 kW / Ton</td>
</tr>
<tr>
<td>Estimated electrical savings</td>
<td>439,033 kWh</td>
</tr>
</tbody>
</table>
# Condenser Pump Optimization

## Nissan - Mississippi - Chiller Plant Upgrade Energy Savings Summary

<table>
<thead>
<tr>
<th></th>
<th>kWh</th>
</tr>
</thead>
<tbody>
<tr>
<td>Existing CDW pump energy</td>
<td>2,675,533</td>
</tr>
<tr>
<td>Projected CDW pump energy</td>
<td>1,302,602</td>
</tr>
<tr>
<td>Projected CDW pump energy savings</td>
<td>1,372,932</td>
</tr>
</tbody>
</table>
Condenser Pumps – Added VFDs
## Nissan - Mississippi - Chiller Plant Upgrade Energy Savings Summary

<table>
<thead>
<tr>
<th>D</th>
<th>Chiller Water Temperature Optimization</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Current Efficency Rating CDW = 77°F, CHW = 41°F</td>
</tr>
<tr>
<td></td>
<td>Projected Efficiency Rating CDW = 72°F, CHW = 42°F</td>
</tr>
<tr>
<td></td>
<td>Projected Water Temperature Savings</td>
</tr>
<tr>
<td></td>
<td>Rated Chiller average efficiency</td>
</tr>
<tr>
<td></td>
<td>Current annual chiller kWh</td>
</tr>
<tr>
<td></td>
<td>Projected annual chiller kWh</td>
</tr>
<tr>
<td></td>
<td>Savings from water temperature optimization</td>
</tr>
</tbody>
</table>
## Nissan - Mississippi - Chiller Plant Upgrade Energy Savings Summary

| Chiller Sequence Optimization |  
|------------------------------|---|
| Current Chiller average efficiency | 0.726 kW/ton |
| Projected Chiller average efficiency | 0.596 kW/ton |
| Chiller average efficiency savings | 0.130 kW/ton |
| Cooling Production | 35,639,438 ton-hours |
| Projected Chiller energy savings | 4,622,630 kWh |
Chiller kw/ton running at 3:00 PM
7/20/2016

45.9 °F  19579.7 gal/min

Process HVAC
Energy Dashboard for Chiller Plant

- System Load: 18175 tR
- Annual Target: 0.7 kW/tR
- Year to Date: 0.63 kW/tR
- Monthly Target: 0.9 kW/tR
- Month to Date: 0.70 kW/tR

- System Efficiency: 0.69 kW/tR
- Chiller Efficiency: 0.56 kW/tR
- CHW Pump Efficiency: 0.04 kW/tR
- CDW Pump Efficiency: 0.06 kW/tR
- CT Fans Efficiency: 0.03 kW/tR
- System Power: 12512 kW
- Chiller Power: 10267 kW
- CHW Pumps Power: 705 kW
- CDW Pumps Power: 1045 kW
- CT Fans Power: 495 kW
## Cooling Tower Fan Optimization

### Nissan - Mississippi - Chiller Plant Upgrade Energy Savings Summary

<table>
<thead>
<tr>
<th>F</th>
<th>Cooling Tower Fan Optimization</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Current Cooling Tower Fan energy</strong></td>
<td>2,520,612</td>
</tr>
<tr>
<td><strong>Projected Cooling Tower Fan energy</strong></td>
<td>2,424,059</td>
</tr>
<tr>
<td><strong>Savings from water temp optimization</strong></td>
<td><strong>96,553</strong> kWh</td>
</tr>
</tbody>
</table>
Chiller Cooling Towers
## Nissan - Mississippi - Chiller Plant Upgrade Energy Savings Summary

### Annual Savings Summary

<table>
<thead>
<tr>
<th></th>
<th>kWh</th>
<th>$*</th>
</tr>
</thead>
<tbody>
<tr>
<td>Estimated electrical savings A</td>
<td>1,541,943</td>
<td>$84,807</td>
</tr>
<tr>
<td>Reduced thermal load B</td>
<td>439,033</td>
<td>$24,147</td>
</tr>
<tr>
<td>Projected Efficency Rating CDW = 72°F, CHW = 42°F C</td>
<td>1,372,932</td>
<td>$75,511</td>
</tr>
<tr>
<td>Projected annual chiller kWh D</td>
<td>1,746,332</td>
<td>$96,048</td>
</tr>
<tr>
<td>Cooling Production E</td>
<td>4,622,630</td>
<td>$254,245</td>
</tr>
<tr>
<td>Projected Cooling Tower Fan energy F</td>
<td>96,553</td>
<td>$5,310</td>
</tr>
<tr>
<td><strong>Totals</strong></td>
<td><strong>9,819,423</strong></td>
<td><strong>$540,068</strong></td>
</tr>
</tbody>
</table>

* Energy cost - blended average 0.06 $ / kWh

**Overall improvement 0.28 kW per ton**
<table>
<thead>
<tr>
<th>Month</th>
<th>Actual Savings</th>
<th>MWHR</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sep-15</td>
<td>829</td>
<td></td>
</tr>
<tr>
<td>Oct-15</td>
<td>1230</td>
<td></td>
</tr>
<tr>
<td>Nov-15</td>
<td>844</td>
<td></td>
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<tr>
<td>Dec-15</td>
<td>608</td>
<td></td>
</tr>
<tr>
<td>Jan-16</td>
<td>574</td>
<td></td>
</tr>
<tr>
<td>Feb-16</td>
<td>724</td>
<td></td>
</tr>
<tr>
<td>Mar-16</td>
<td>834</td>
<td></td>
</tr>
<tr>
<td>Apr-16</td>
<td>741</td>
<td></td>
</tr>
<tr>
<td>May-16</td>
<td>902</td>
<td></td>
</tr>
<tr>
<td>Jun-16</td>
<td>513</td>
<td></td>
</tr>
<tr>
<td>Jul-16</td>
<td>509</td>
<td></td>
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<tr>
<td>Aug-16</td>
<td>0</td>
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<tr>
<td>Total</td>
<td>8308</td>
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</tr>
</tbody>
</table>

At $0.06$/KWHR total savings
$498,480

<table>
<thead>
<tr>
<th>Month</th>
<th>Actual Savings</th>
<th>MWHR</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sep-16</td>
<td>935</td>
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<tr>
<td>Oct-16</td>
<td>1350</td>
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<tr>
<td>Nov-16</td>
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<tr>
<td>Jan-17</td>
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<tr>
<td>Feb-17</td>
<td>626</td>
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<tr>
<td>Mar-17</td>
<td>907</td>
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<tr>
<td>Apr-17</td>
<td>847</td>
<td></td>
</tr>
<tr>
<td>May-17</td>
<td>906</td>
<td></td>
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<tr>
<td>Jun-17</td>
<td>707</td>
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<tr>
<td>Jul-17</td>
<td>331</td>
<td></td>
</tr>
<tr>
<td>Aug-17</td>
<td>560</td>
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<tr>
<td>Total</td>
<td>9980</td>
<td></td>
</tr>
</tbody>
</table>

At $0.06$/KWHR total savings
$598,800
Over 4000 KW DROP 2016 to 2017
Over 4000 KW DROP 2016 to 2017

Savings per Month
$20,000*12 = $240K/year
Questions???