Maximize Your Efficiency Through Monitoring, Targeting & Reporting (With Recommissioning) & BioScrub EFM to Control Energy Costs

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Terminology

• Commissioning (Cx)
  ➢ Commissioning is a “quality-oriented process” designed to ensure that a building, facility or system is designed, constructed and operated to meet the Owner’s Project Requirements (OPR). Performed by a Commissioning Agent/Authority (CxA)

• Recommissioning (RCx)
  ➢ The commissioning of an existing building, facility or system that was previously commissioned. Review the original commissioning documentation and identify changes. Update original document and retest to verify systems are running as designed.

• Retro-Commissioning (RCx)
  ➢ The commissioning of an existing building or facility that was not previously commissioned.

• Existing Building Commissioning (EBXc)
  ➢ Recommissioning and Retro-Commissioning also known as EBCx.

• Continual Commissioning (MBCx)
  ➢ A continuous process ensuring that the operational requirements are maintained over the design life. Monitoring Based Continual Commissioning (MBCx)
Why do Monitoring, Targeting and Reporting or Recommissioning? Effective VS Efficient

- Effective but NOT Efficient
- Latest Technology Efficiency
- Capital Upgrade
- Ongoing Performance Monitoring
- Maintain Optimum Efficiency and Effectiveness

Building/System Project Concept
Technology Development
Design
Installation
Adjustment
Maintenance
Deviations from Optimum
Effective but NOT Efficient
Lost Efficiency
Maintain Optimum Efficiency and Effectiveness
Today

Energy Efficiency
Time

Deviation from Optimum
Effective but NOT Efficient
Latest Technology Efficiency
Ongoing Performance Monitoring
Capital Upgrade
Maintain Optimum Efficiency and Effectiveness
Why do Monitoring, Targeting and Reporting or Recommissioning? Effective VS Efficient
What is Monitoring, Targeting and Reporting

- The goal of MT&R is to provide **Energy Management strategies** that will **achieve energy savings and lower operating costs** long term.

- **Monitoring**
  - Use utility bills and sub-metering equipment to establish building baseline.
  - Evaluate energy and demand performance of selected equipment/systems, operation/production and other influencing variables.
  - Get a complete picture of current energy consumption.

- **Targeting**
  - Identify Energy Efficiency Measures (EEMs) that can be implemented (e.g. operational changes).
  - Estimate demand and electricity savings (kW/kWh) based on implementing EEMs.
  - Implement changes and EEMs.

- **Reporting**
  - Provide documentation to verify implementations and validate claimed savings.
  - Ensure ongoing energy management and that savings are being sustained.
  - Capture available Incentives.
Why do Monitoring and Targeting and Reporting

Why do Monitoring and Targeting?

- Electricity consumption represents a significant portion of operating costs. *Increased operating costs affect profitability and sustainability of a business!*

- The need to reduce cost becomes important as energy costs increase, requiring “Energy Management”

- Detect anomalies with the electrical activity of the heart
- Prescribe methods of treatment to minimize or prevent health issues

- Evaluate energy profile data
- Identify anomalies on energy consuming equipment
- Validate energy reduction and savings post operational/equipment changes or corrections
## Benefits of Monitoring & Targeting

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<thead>
<tr>
<th>Icon</th>
<th>Benefit Description</th>
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<tbody>
<tr>
<td>🌋</td>
<td>Reduce common areas energy waste</td>
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<td>⌦️</td>
<td>Lower overall energy cost</td>
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<tr>
<td>📉</td>
<td>Accurate Energy use – improve operations</td>
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<td>🔧</td>
<td>Proactive vs. Reactive maintenance</td>
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<tr>
<td>℃️</td>
<td>Detect efficiency issues</td>
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<tr>
<td>🌐</td>
<td>Validate and align BMS settings</td>
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<tr>
<td>⏰</td>
<td>Reduce background consumption</td>
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<td>Support capital investment decisions</td>
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Advantages of Monitoring & Targeting Reports

- Proactive reporting and actionable insights
- Data Analysis and recommendations in real time
- Proven results based on ongoing analysis and Commissioning Agent best practices
- Documentation that will meet requirements for IESO saveONenergy incentive approval
How to do Monitoring, Targeting and Reporting

Plan
- Plan how to collect Baseline Information
- Develop Project Metering and Education Plan

Monitor/Collect Data
- Collect baseline data on current equipment operation including electricity consumption (kWh) and electricity demand (kW)
- Monitor System for up to 6 months or longer to get an accurate baseline

Implement Measures
- Identify anomalies or deviations from design standards
- Identify Energy Efficiency Measures (EEMs) to be implemented (<1 year payback)
- Identify Systems for Recommissioning
- Provide estimated savings targets (kW/kWh) based on EEMs

Analyze
- Use ongoing analysis or findings based on real-time logged data to support changes
- Calculate actual energy and demand savings in accordance with IPMVP guidelines (kW, kWh)
- Demonstrate savings are achieved and maintained
- Reporting for Incentives and to demonstrate SUCCESS

Verify Results/Reporting
- Perform Recommissioning
- Implement EEMs
- Monitor equipment for subsequent six (6) months ("Retrofit" Period)
- Document Equipment and Operational changes

• Identify Energy Efficiency Measures (EEMs) to be implemented (<1 year payback)
• Identify Systems for Recommissioning
• Provide estimated savings targets (kW/kWh) based on EEMs
“You Can’t Manage What You Don’t Measure”

Focus on the big energy users and the easily controlled Systems first

Select metering equipment that provides easy access to usable data
Sub-metering- New innovative technologies have made panel, system and even device level real-time visibility possible.

Typically easy to install, non invasive and cost effective systems. Data help conservation of energy, predict maintenance issues and device failures whilst improving operations on multiple levels.
Look for Sub-Metering at Panel / Device Level and the IoT

- Quick and effective state-of-the-art technology for Device Level monitoring with a Cloud Based Solution
- The Internet of Things (IoT) is here so embrace it!

1. **Snap**
   - Easy install
   - Wireless
   - No disruption
   - No maintenance
   - Unlimited scale

2. **Connect**
   - Plug & Play
   - Cellular or WiFi

3. **Set Up**
   - Role definition
   - Executive reports and alerts
   - Set goals
   - Measure benchmarks

4. **Start Saving**
   - Scheduled reports
   - Real time alerts
   - Online analytics
   - Manage chain-wide

**Ongoing customer engagement**
The First Step: Think Outside the Box

We have always learned to do things the “traditional” way. Making small changes can make a big difference to the outcome. Even altering the way we tie our shoes can determine if the knot will remain strong long term or have to be a high maintenance task on an ongoing basis!
Consider Key Performance Indicators (KPIs)

KPIs – are set of variables that organizations use to assess, analyze and track business processes. These performance measurements are commonly used to evaluate success in relation to goals and objectives and are very applicable to energy and M&T Projects.

WHAT THEY ARE:

• Quantifiable/measurable and actionable
• Measure Factors that are critical to the success
• Tied to the goals and targets
• Limited to 5-8 key metrics
• Applied with consistency

WHAT THEY ARE NOT:

• Metrics that are vague or unclear
• “Nice to know” or metrics that are non-actionable
• Complex Reports
• Exhaustive set of metrics that create over-complication
• Refutable
KPIs with Monitoring

- Energy Data
  - Consumption Categories
  - Compare multiple Systems
  - Normalization
  - Historical Analysis
  - Benchmarking

- Device Energy Profile
  - Device specific data
  - AC, Air compressor, etc.
  - Analyze Device KPIs
  - Check Incorrect settings
  - Perform Maintenance
  - Advance failure detection

- Operational Data
  - Device state (on, off, idle)
  - Device sequencing
  - Interconnection of devices
  - Anomaly detection
  - Device efficiency
Reduce Energy Consumption based on Targeting

Energy Consumption exceed plan by 5,000 kWh. Optimization of production process will cut costs by $500/day = >$25,000/year by adjusting this day only

- Using energy per Unit in the production line as the KPI to Plan usage
- Monitoring and review KPI: Detect variations from Plan
- Target new Energy goal to reduce consumption
Reduce Energy Consumption based on Operational Patterns

- Identify Operational Patterns
- Utilize data to shift loads to lower time of use hours
- Load Shedding can lower Utility demand costs
- Is this Pattern necessary or habitual
- Target new Energy goal to reduce consumption

Highest Compressor Load occurs every day at 7am
Benchmark and Set Targets

- Compare multiple Systems
- Select most efficient System and target to get all systems to this level
- Identify issues/anomalies and implement recommended EEMs
- Monitor and measure operational and equipment changes on Systems
- Demonstrate target achievement and savings success and ensure that savings don’t degrade over time
Identify and Fix Issues

Unnecessary Heat Pump operation is avoided when the building is unoccupied through adjustments to BAS.
Identify and Fix Issues

- Are these energy spikes deleterious to the asset?
- Does the compressor need to be left on when product is not being produced? If so, could you use the back-up compressor?
- Is there a valid reason for these devices to start-up so early before the first shift?
- No early startup before second shift!
Validate Changes through M&V

Average of 3kW reduction directly after adjustment of VFD on a conveyor motor in an Industrial Facility
IESO Save ON Energy Incentives

- Incentives are available through current Independent Electricity System Operator’s (IESO) Save ON Energy Programs

- **Two M&T Options**
  - **Process and Systems (PSUP) M&T**
    - Requires an Energy Manager
    - 0.2MW Peak Demand Savings plus energy savings of 0.2MW x Facility Load Factor x 8760
    - Implementation of all measure with less than 1 Year simple payback
    - Annual Reporting for 5 Years
    - Program Provides 80% of eligible costs (metering, installation of M&T system) up to $75,000
  - **Retrofit M&T**
    - No special requirements
    - Incentive paid for proven (M&V) savings created through operational changes and EEMs at $0.10/kWh
    - Incentives cover up to 50% of eligible project cost (metering, installation of M&T system, engineering/consulting).
    - Maintain savings for 48 months

SPEAK TO YOUR LOCAL ELECTRICITY PROVIDER FOR MORE DETAILS
# IPMVP Options

<table>
<thead>
<tr>
<th>IPMVP Option</th>
<th>How Savings are Calculated</th>
<th>Example Applications</th>
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</table>
| **Option A: Measure or System Level** | - Engineering calculation of baseline  
- Short-term or continuous measurements of key operating parameter(s)  
- Estimated values  
- Routine/non-routine adjustments as required | **Lighting changes**  
- Spot measure of power draw  
- Estimate lighting hours based on facility schedule and occupant behaviour |
| **Option B: Measure or System Level** | - Short-term or continuous measurements of baseline and reporting period energy  
- Actual measurements of Energy use  
- Routine/non-routine adjustments as required | **VFD changes to pump**  
- Measure power and energy consumption on pump pre and post with energy meter installed |
| **Option C: Whole Building or Sub-Facility Level** | - Analysis of whole facility baseline  
- Analysis of reporting period (utility) meter data  
- Routine/non-routine adjustments as required | **Multifaceted Energy Management program**  
- Continual monitoring of Utility data over annual period to achieve savings |

**Minimum M&V requirement for M&T Projects**

IPMVP: International Performance Measurement and Verification Protocol
TOOLS FOR SUCCESS
CASE STUDIES

LOTS OF ACCURATE DATA AND AN EASY WAY TO USE THE DATA
Discover BMS Issues that create huge energy waste

**Background:**

- 187,000 sq.ft. commercial office building in Southern Ontario
- 7 Floors – Fully Occupied by Commercial Tenants
- Building Enrolled in Save On Energy Retrofit M&T Program
- Electrical sub-metering installed on all Electrical Panels in the Building – 21 sub-metering points
- Approximate initial investment by the Client to Participate in the Program $12,000 (metering, installation and preliminary reporting)
Discover BMS Issues that create huge energy waste

Day-time Profile on Saturday and Sunday is 20kW less than the Night-time Weekday Profile!!
Discover BMS Issues that create huge energy waste

Day-time Profile on Saturday and Sunday (over Christmas) is 80kW less than the Night-time Weekday Profile!!!
Discover Control Issues that create huge energy waste

New Control System Produced over 58% Energy Savings in Heat Pumps
SOFTWARE FEATURE

AUTOMATIC FUNCTIONALITY AND EASY TO USE!
Deployment and Software Configuration

The Panoramic Power Deployment happened in late December 2017 and Baseline Data has been logged.
Detailed Power Hierarchy and Grouping in the Software

GROUPED INTO FLOORS FOR EASY USE

DETAILED HIERARCHY
Examples of Functionality of Software

Device Energy Profiles - 1st Floor and 2nd Floor

Stacked Energy Profiles – 3 elevators

Energy Flow and Intensity

Heat Map showing Intensity
IS THERE REALLY AN OPPORTUNITY?

HERE’S AN EXAMPLE WITH REAL DATA TO GET YOU THINKING!
GOAL: Reduce Energy Consumption based on Operational Patterns

- Identify Operational Patterns
- Is this Pattern necessary or habitual
- Target new Energy goal to reduce consumption
• Traditional HVAC Cleaning Methods are Outdated, Unproven and Unreliable
  • The standard cleaning methods use harsh chemicals and only reach into the first row of the coil structure leaving the majority of the inner area un-affected by the cleaning process

• The GreenAir® BioScrub EFM System removes Biofilm and is a complete Coil Remediation Process that is the Next Step in Building System Optimization
Why is Proper Coil Cleaning Important

According to a Southern California Edison Study

**Dirty Condenser Coil**
- Cooling capacity reduced by up to 40%
- 60% increase in discharge pressure reduces refrigeration effect up to 30%
- Compressor energy increased by 70%
- EER reduced by 60%

**Dirty Evaporator Coil**
- Cooling capacity reduced by 40%
- EER reduced by up to 35%
New high efficiency HVAC units are now using these Micro-channel coils for condensers and evaporators.

Every Fin has Tens of Gill Type Slits Running in Opposite Directions.

All Aluminum Construction means only Water and Garden Hose is the recommended Protocol for Cleaning which is ineffective (no use of chemical cleaners).
Video – Cooling Tower Cleaning

Please email d.cooper@renteknikgroup.com for the link to the video

Video File Size is too Large for Email
Video - Cleaning Coils

Please email d.cooper@renteknikgroup.com for the link to the video

Video File Size is too Large for Email
BioScrub Probiotic - Case Studies

Fallsview Casino – Summer and Winter System Cooling Towers – 5,000 tons and 3,000 tons

Condo/Hotel Toronto – 2 Air-cooled Trane Chillers – 150 tons each
• Performance improvement can be seen at part and high load.
  • Under these circumstances, the additional heat rejection achieved from the Probiotic Cleaning assists the System in maintaining lower Cooling Tower return and condensing temperatures. This results in lower Energy Consumption.

• 11% Energy Savings (785,000 kWh Annual Energy Savings)
EVALUATION OF SAVINGS
CONDOMINUM TOWER, Toronto, ON

- Performance-Based Probiotic Cleaning of Air-cooled Chiller
- 4.5% Energy Savings (85,000 kWh Annual Energy Savings)
- 2.76% Peak Power Reduction (16.3 kW)
## PROJECT ECONOMICS SUMMARY

- Measurement and Verification of the implementations is required in order to evaluate the Project Economics
- The Probiotic Cleaning provides a quick return on investment
- A continual monitoring of the System will ensure that the achieved Savings are maintained overtime

<table>
<thead>
<tr>
<th>SYSTEM</th>
<th>PRE-CLEANING (kWh)</th>
<th>POST-CLEANING (kWh)</th>
<th>ENERGY SAVINGS (kWh)</th>
<th>ENERGY COST SAVINGS*</th>
<th>CLEANING COST</th>
<th>SIMPLE PAYBACK</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fallsview Chiller System</td>
<td>6,859,981.84</td>
<td>6,071,684.03</td>
<td>788,297.81</td>
<td>$114,303.18**</td>
<td>$21,550.00</td>
<td>0.19 Years</td>
</tr>
<tr>
<td>Condominium</td>
<td>1,855,939.59</td>
<td>1,771,110.56</td>
<td>84,829.03</td>
<td>$12,300.21**</td>
<td>$7,500.00</td>
<td>0.61 Years</td>
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*Energy rate based on Ontario’s blended Energy Cost of $0.145/kWh

**Cost in Canadian $