CIRCUITMETER

Making energy visible. Making energy manageable.

Energy Solutions Canada – February 19, 2020

MARKET NEED

Billions lost annually because management doesn't know where energy is wasted

$275B

spent annually
on electricity in North America in commercial, multi-unit residential and industrial facilities

$80B

wasted per year
30% of total use (estimated)

Electrical Submetering & New Technologies

Electricity Submetering is defined as:

- Meters installed downstream of the utility meter that:
  - Provide disaggregated energy and power quality information
  - Enable key decision-makers (facilities managers, building owners, tenants, etc.) to increase efficiency and more readily monitor systems

Disruptive new submeter technology

- Significantly lower price on a per circuit basis makes broad installation economic
- Real time cloud communication integrated with Big Data Energy Analytics software
- Broad array of technical features enables new applications in energy management creating an entirely new value proposition in submetering

CircuitMeter is a leading example of real time, circuit level metering with integrated Real Time Energy Management software

MAJOR GROWTH IN MARKET SIZE

Low-cost software-driven submetering will transform the industry

$2B (2020)

Annual energy submetering market – growth driven by landlord sub-billing

$20B (2035)

Annual energy management services market – growth driven by low-cost data

Major Market Forces will Accelerate Demand

- Regulations mandating submetering
- Subsidy & demonstration programs
- Mandated energy reduction programs; ESOS
- Carbon taxes; CRC

GOVERNMENT ACTIONS

MARKET TRENDS

TECHNOLOGICAL ADVANCEMENTS

- Industrial Energy Management, ISO 50001, DOE Better Buildings, Better Plants
- Best practices, standards & benchmarking; LEED, Energy Star
- Lean energy management; Six Sigma

Real time submetering
RTEM, CLASP etc., occupies the sweet spot of emerging market forces
- Major cost reductions
- Advanced functionality

TECHNOLOGY HITTING MARKET AT EXACTLY THE RIGHT TIME

- Market Forces & Emerging Best Practices promoting Adoption of Advanced Submetering
- Governments promoting submetering with subsidies, laws, regulation & demonstration programs
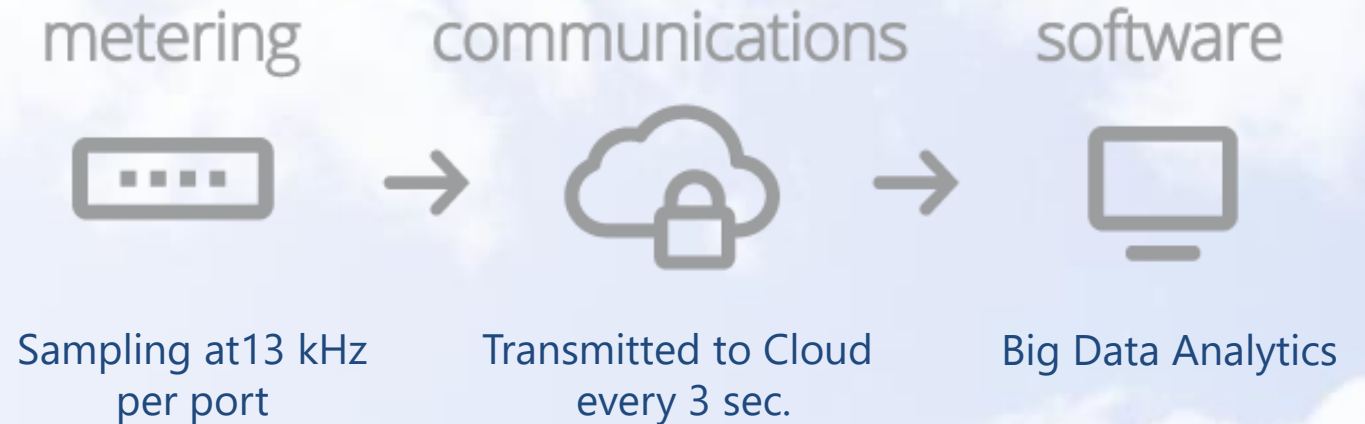
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Design Breakthrough
ICT Technology Migrates to Energy Sector

CircuitMeter combines into one technology:

- Meter – multi-port design handles 48 circuits
- Real-time data processing and cloud communication
- Big Data software & portfolio level database analytics

metering   communications   software

Sampling at13 kHz per port

Transmitted to Cloud every 3 sec.

Big Data Analytics

Hardware – WebMeter48

WebMeter48 features:

- 48 circuit capacity – accepts pulse data from 3rd party meters e.g. gas, water, steam, BTU

- Real time data processing & secure cloud communication (does not require ports open in firewall)

- Full energy data collection & processing: energy, real power, amperage, voltage, power factor, apparent power, reactive power, system/equipment operating time

- Quicker, easy installation lowers total cost function

- Meters up to: 600V @200,000Hz; 6,000A @13,000Hz; 1, 2, or 3 phase circuits

Real Time Metering System
WebMeter48E

CircuitMonitoring™ Software

Platform features:

- Real Time and Historic Data Visualization

- High speed (proprietary) software engine enables Big Data Energy Analytical processes

- Data available via CircuitMonitoring, cloud based software, or through API to 3rd party systems

- Software features real time notifications when conditions exceed pre-defined limits i.e. system tells you when energy wasting events occur

- Software enables new practices of "Forensic Energy Management", "Virtual Energy Audit" and "Continuous Energy Audit" – *redefining Energy Management practices*
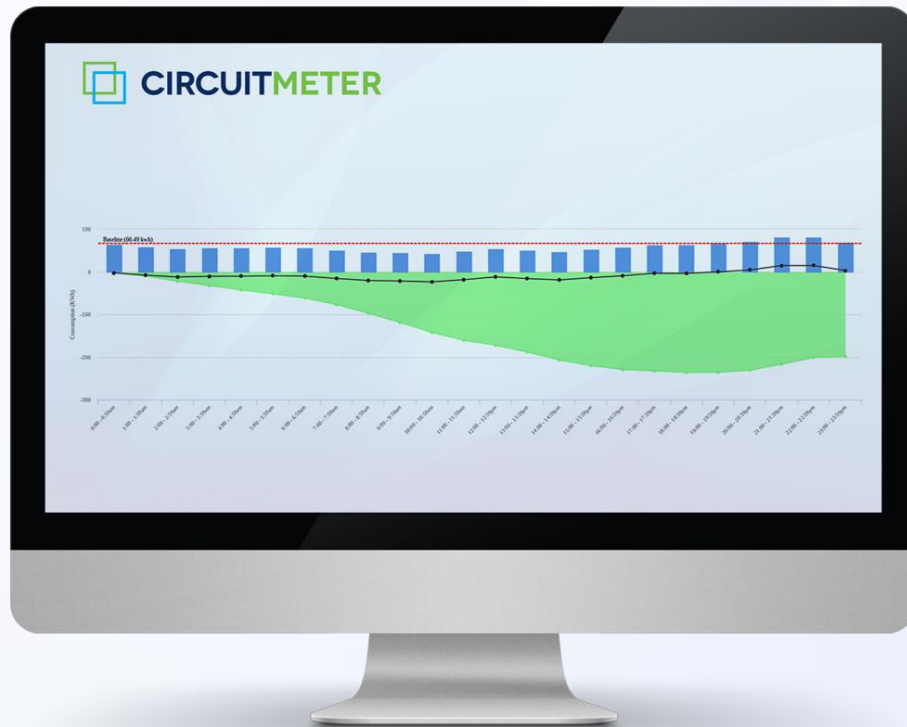
Monthly Energy Use Analyses – Typical

- Energy Consumption (kW-hr) vs. Outside Temperature
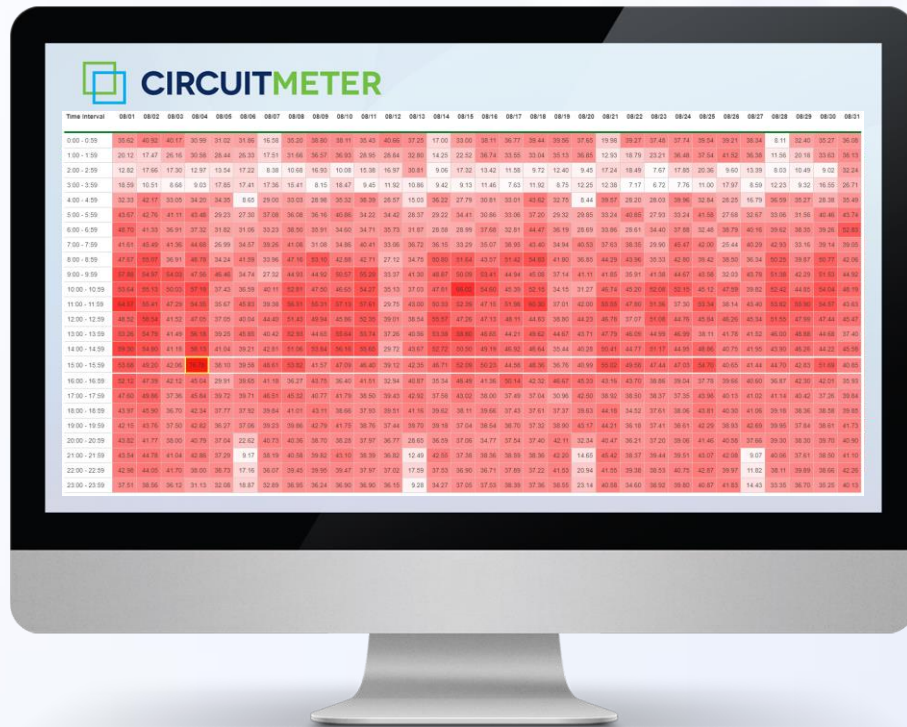
- Energy Consumption vs. Degree Days (Heating or Cooling)

Baseline Reporting Center – Typical

- Reporting feature supports Monitoring & Verification requirements of Provincial Funding Programs
  - Actual monthly energy use
  - Monthly energy savings from baseline
  - Cumulative energy savings

Peak Profile Report – Heat Map & Breakdown

- 15 minutes colour coded format
- Highlight day & time of peak usage

- Loads contributing to peak are quantified

Low Cost, Real Time Energy Data in the Cloud

CircuitMeter – The Low Cost Energy Data Producer

Accurate capture of real time data into the cloud – *will be required for most major technology and market advances in facility management & operations*

- Precision Maintenance

- (Near) Net Zero Commercial/Residential developments & micro grids

- Machine Learning, IoT, AI applications & Automated Energy Analytics

CircuitMeter Enables "Forensic Energy Management™ "

- Conservation and Continuous Energy Audit – Identify/monitor energy of all equipment/systems Circuit Level Granularity
- Detailed Demand Response
- Precision Maintenance
- Advanced Data Metering Applications
- GHG Emissions Reporting & Reduction

CircuitMeter Enables "Forensic Energy Management™"

- Conservation and Continuous Energy Audit – Identify/monitor energy of all equipment/systems Circuit Level Granularity
  - Eliminate equipment powered on when unnecessary
  - Benchmark power use for all equipment
  - Compare "like" equipment consumption
  - Notifications when power exceeds pre-set thresholds
- Detailed Demand Response
- Precision Maintenance
- Advanced Data Metering Applications
- GHG Emissions Reporting & Reduction

CircuitMeter Enables
"Forensic Energy Management™ "

- Conservation and Continuous Energy Audit – Identify/monitor energy of all equipment/systems Circuit Level Granularity

- Detailed Demand Response
  - Machine level, real time energy use data in historic database allows large users to pinpoint makeup of peak demand
  - Targeted reductions can save on demand charges while lessening disruption and costs of shutdown or slowdown

- Precision Maintenance
- Advanced Data Metering Applications
- GHG Emissions Reporting & Reduction

CircuitMeter Enables "Forensic Energy Management™ "

- Conservation and Continuous Energy Audit – Identify/monitor energy of all equipment/systems Circuit Level Granularity
- Detailed Demand Response
- **Precision Maintenance**
  - Monitor power use and electrical characteristics to identify problems as they occur & analyze performance
  - Predictive and just in time maintenance; avoid unscheduled shutdowns
  - Power Factor accounting to provide predictive analytics
- Advanced Data Metering Applications
- GHG Emissions Reporting & Reduction

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VALUE PROPOSITION EXAMPLE
Low Cost + High Functionality = High ROI

- **Major hotel in downtown Toronto**
  - $2.8 M per year in electricity
  - All major systems in hotel (except suites) covered: HVAC, fans, pumps; kitchens, restaurants, shops, atria; central services, lighting, etc.
  - 27 WebMeter48s metering 650 circuits (electrical) + 3 BTU meters for 3 chillers

- **Projected Return On Investment (ROI) to Owner ranges from 700% (conservative) to 1,700% (management) (reference Appendix)**
  - Even minimal "low ball" savings estimate of 2% – 4% in first two years yields 2 year payback

- **First year cost of $175 K including hardware, software, installation, energy management services + recurring annual costs of approximately $15 K**

- **Early success will lead to adoption across portfolio (next 3 buildings in various stages of review & scoping)**

Hotel Benefit Summary Matrix

Site name, description:	Hotel – Savings Scenario
Display results in:	Cost $
Baseline total electricity use:	$2,804,347

Period	Year 1	Year 2	Year 3	Year 4	Total
Calendar Year	2018	2019	2020	2021	
Efficiency Initiatives	Cost $ saved (%)	Cost $ saved (%)	Cost $ saved (%)	Cost $ saved (%)	4 year Total Cost $ saved
1. Eliminate usage	1.3%	2.0%	2.0%	2.0%	$217,904
2. Reduce operating hours	0.6%	1.0%	1.0%	1.0%	$108,952
3. Precision maintenance / Continuous audit	0.1%	0.4%	0.6%	0.6%	$48,606
4. Equipment replacement	0.0%	0.0%	0.0%	0.0%	$0
5. Other	0.0%	0.0%	0.0%	0.0%	$0
6. Demand management	0.5%	1.4%	1.4%	1.4%	$138,301
Site-wide total	2.6%	4.9%	5.3%	5.5%	$513,763

All savings percentages are shown as a percentage of either site-wide total usage or site-wide total cost

Baseline electricity cost	$2,804,347
CircuitMeter installation cost	$145,519 *(1) includes BTU meter option*
Software service - 4 years	$27,216
Initiative capital costs	$0
Management costs	$55,000
4 year net savings benefit	$486,547
Return on investment	**150%**

Payback period (years)	1.99

Even low percentage energy reductions yield quick payback

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Hotel Savings and Return on Investment Scenarios

- Modest savings scenario of 2% in Years 1 & 2 yield 2 year payback
  - More realistic projections show very attractive returns of 700 – 1,700 percent

Period	Year 1	Year 2	Year 3	Year 4	Total	ROI
Calendar Year	2018	2019	2020	2021		
Energy Saved	saved (%)	saved (%)	saved (%)	saved (%)	$	%
Low ball (2 year Payback)	2.3%	4.3%	4.5%	4.7%	$446,075	148%
Conservative	6.4%	12.1%	13.1%	13.5%	$1,275,677	709%
Management Forecast	6.9%	22.4%	32.7%	35.8%	$ 2,769,442	1721%

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Hotel Fan Systems (38): Hourly Energy

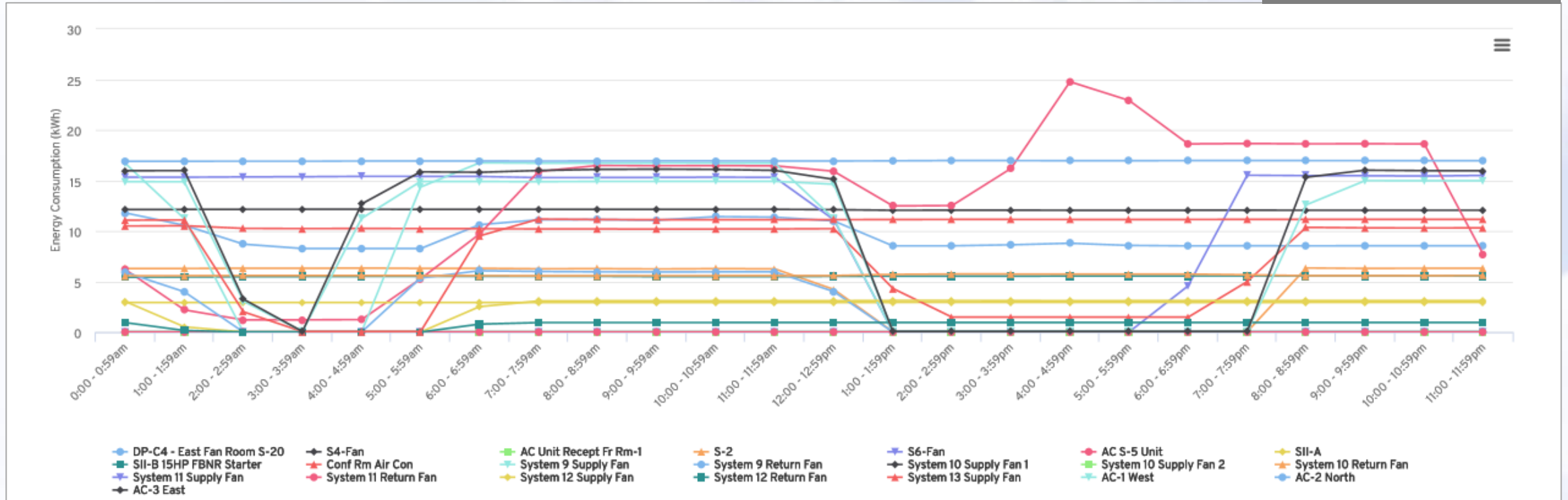**Total Energy Consumption (kWh)** Grouped by **Hour of Day** and
Sub-grouped by **Equipment ID**
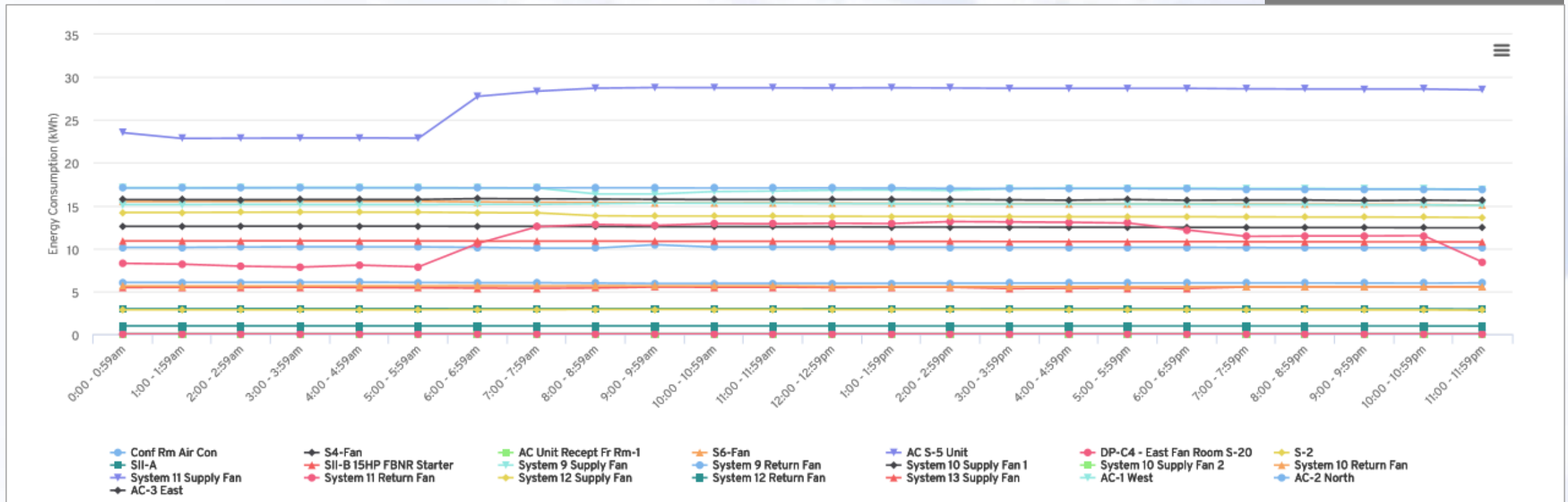
Hotel: AHUs – Hourly Energy

Total Energy Consumption (kWh) Grouped by **Hour of Day** and
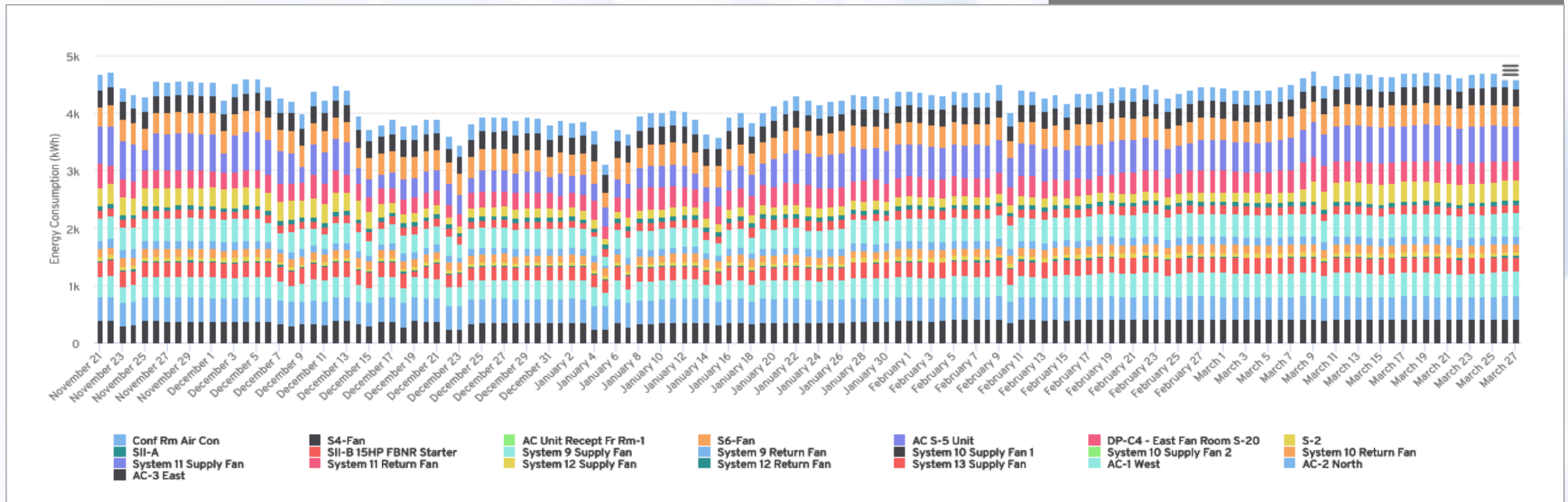Sub-grouped by **Equipment ID**

January 5, 2019

Hotel Report: MTD – AHUs Fans – Daily Energy

Total Energy Consumption (kWh) Grouped by **Date** and
Sub-grouped by **Equipment ID**

Legend:
- Conf Rm Air Con
- SII-A
- System 11 Supply Fan
- AC-3 East
- S4-Fan
- SII-B 15HP FBNR Starter
- System 11 Return Fan
- AC Unit Recept Fr Rm-1
- System 9 Supply Fan
- System 12 Supply Fan
- S6-Fan
- System 9 Return Fan
- System 12 Return Fan
- AC S-5 Unit
- System 10 Supply Fan 1
- System 13 Supply Fan
- DP-C4 - East Fan Room S-20
- System 10 Supply Fan 2
- AC-1 West
- S-2
- System 10 Return Fan
- AC-2 North

Commercial Office – evolv1

Canada's 1st Certified Zero Carbon Building (CaGBC)

- Designed to be Net Positive (Energy) on an annual basis
  - Includes solar generation, geothermal HVAC, no gas on property
  - 100,000 sq. ft. multi-tenant space in Waterloo, Ontario

- Real time, Circuit Level submetering by CircuitMeter
  - 4 WebMeter48™ monitoring 102 circuits including solar generation, HVAC, lighting & building service
  - Tenant monitoring planned (2019)
  - EnergyWindow™ in lobby including custom presentation of broad range of sustainability metrics

Major Hospital – Toronto
Energy Efficiency Strategy

- Hospital awarded $1 M in government grants to implement Energy Efficiency measures
  - Project funding subject to conditions and require verification of savings
- Facility Management staff select CircuitMeter due to dual ability to:
  - Meet Monitoring & Verification requirements of gov't funding, and
  - Provide facility wide, circuit level metering to enable discovery of operating cost savings i.e. wasted energy & cost due to unnecessary or inefficient equipment and system operations

Global Contract Manufacturing Firm
Advanced Energy Management Plan

- **U.S. based high tech manufacturer** *(confidential)* **with 25 plants in U.S., Europe and Asia**
  - Adopting Advanced Energy Management globally using principles of ISO50001 & Six Sigma to implement its own leading edge program
  - Initial deployment – approx. 150 machines (10 CircuitMeter WebMeter48 metering 3 phase supply) each at 1/3 of plant locations (8-9 plants)
  - Expand to 100% coverage based on lessons learned

Global Contract Manufacturing Firm
Advanced Energy Management Plan

- Vision for Energy & Operations Management
  - Sub-meter electrical performance of each machine in process in real time
  - Use software to maintain metrics on energy consumption of each production line and component machine in process
  - Compile energy use statistics according to shift and production output to understand energy and cost metrics per unit output
  - Benchmark energy consumption at machine level and use software to identify deviations beyond acceptable parameters in real time – enabling Precision Maintenance

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PUBLIC SPACE AWARENESS
EnergyWindow™

A new frontier in energy management

COMMERCIAL

INDUSTRIAL

INSTITUTIONAL

RESIDENTIAL

Thank You

CIRCUITMETER