EcoPilot Canada | USA is a privately owned and operated company headquartered in Halifax, Nova Scotia and are the exclusive suppliers of Ecopilot® in North America. Ecopilot® is the longest running HVAC AI optimization tool in the world.

The EcoPilot Canada solution draws on the very best in the business. Through our contractual partnership agreement with **Nordomatic** of Sweden, Scandinavia's largest system integrator within Smart Buildings, and the genius of **Altacogni/Yanzi**, Nordomatic partners, and leaders in highly efficient, scalable, and secure SaaS platforms for large property owners, we have direct access to a wealth of knowledge and experience, and the state-of-the-art products and services necessary to deliver the best solution available.

HISTORY

Ecopilot® is based on extensive academic research from the KTH Royal Institute of Technology in Stockholm, Sweden, dating back to the 1970's. The research group sought to demonstrate the importance of a holistic approach to regulating indoor climate by taking advantage of a building's thermodynamic properties - construction material, heat emitted by machines and people, and solar radiation, all of which is naturally stored in the framework of a building and released over time. This consideration had the potential to simplify building controls and temperature management while reducing the frequency and necessity of control system interventions.

FIRST COMMERCIAL INSTALLS

Based on this research, from 2001-2008, Swedish controls company, Kabona AB, completed significant product development and commercialized the Ecopilot® software as a value-add tool into their existing Building Automation System (BAS) platform. The company quickly recognized the market potential to segment Ecopilot® as an independent solution and in 2008, the company released the first commercial stand-alone Ecopilot® solution.

TODAY

Ecopilot® is the longest running autonomous HVAC optimization tool in the world, with more than 1,200 global installations worldwide. Ecopilot®'s Artificial Intelligence (AI) has optimized building control in the commercial, multi-residential and institutional sector, and based on all installations, averages annual HVAC energy consumption savings of 25% and a simple pay back of just three years.

Ecopilot®'s value proposition includes the priority of occupant comfort, energy consumption savings, identifying issues and supporting further efficiency measures driven by data. Ecopilot has been used to enhance the operational requirements for programs such as LEED, WELL, BOMA Best, and does not impact local building code.

> "Automatic, continuous and results driven are all key components we experienced with Ecopilot® and ones we believe can advance the building automation industry. Ecopilot® is working in the background, 24/7, and alleviating the expense, time and effort required to manually achieve similar results. Automation of our HVAC energy savings allows us to focus on other initiatives, like daily operations or long-term maintenance planning. Utilizing the same assets, we are saving energy, extending the life of equipment, and identifying issues we weren't aware of."
>
> **Andy Selig**
> **South Shore Regional Centre for Education**

ENERGY SAVINGS - GUARANTEED

Based on the maturity of the Ecopilot® product and the extensive library of commercial references and experiences, every project proposal is delivered with a guaranteed energy savings offer.

From the second Ecopilot® is turned on, it gets to work reducing energy consumption - no learning time required. That's because before installation, Ecopilot®'s expert technical team have conducted a thorough building assessment and compiles a corresponding job report, that captures details about the building, space, automation system, HVAC, existing onsite sensors, meters, and any other relevant building considerations as well as a history of energy consumption and costs which becomes the reference data for savings.

Ecopilot®'s technical team thoroughly assesses a building, and using our own proprietary energy modeling template, a cost proposal is generated and outlines what systems Ecopilot® will intelligently control, the minimum *guaranteed* energy savings, carbon emission savings, and simple pay back.

> "With sustainability being at the heart of our corporate culture and identity, energy conservation is central in our operation and processes. In Ecopilot®, we have identified a solution that enhances the intelligence and expands the capabilities of our Building Management System."
>
> **John Johnson**
> **Parexel**

HOW IT WORKS.

Ecopilot® acts as a brain to *any* automation system and uses real-time indoor data, a 5-day weather forecast, and the thermodynamics of a building to prepare a building for its long-term HVAC needs. Ecopilot® optimizes the performance of connected systems *automatically* and *continuously*. It can simply be described as a tool that **continuously re-commissions every 2-minutes.**

Ecopilot® uses proprietary algorithms, assessing the static (thermal mass) and fluid elements of the building, such as internal heat sources generated from computers, lighting, people, and weather; outside temp, solar incident radiation, wind speed/direction, internal load, precipitation, humidity, etc.; to calculate the variable balance point temperature of a building every two minutes, based on the current and future conditions that will affect a property. It then offsets the BMS from its prescribed set-points to follow the calculated balance point temperature rather than the outside temperature. The result is elimination of any unnecessary system overlaps (heating and cooling in the same day, or even at the same time), a reduction in fluctuation, which equates to a reduction in consumption and therefore costs, while maintaining an optimal indoor climate. The integration of Ecopilot® with a BMS generally delivers energy consumption reductions of 15-40%.

3. The result is a new setpoint of 68.8°C while maintaining an average tenant comfort of 22.75°C.

2. Ecopilot is sending an offset of -14.62°C (and it will re-calculate this every 2-minutes)

1. BAS is currently calling for 83.4°C boiler supply temperature.

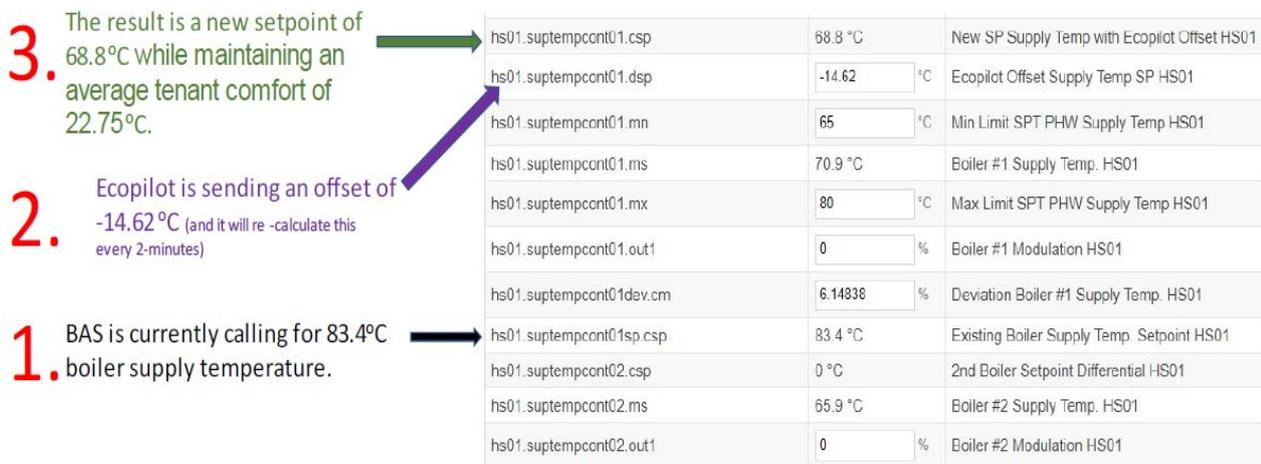|			
hs01.suptempcont01.csp	68.8 °C		New SP Supply Temp with Ecopilot Offset HS01
hs01.suptempcont01.dsp	-14.62	°C	Ecopilot Offset Supply Temp SP HS01
hs01.suptempcont01.mn	65	°C	Min Limit SPT PHW Supply Temp HS01
hs01.suptempcont01.ms	70.9 °C		Boiler #1 Supply Temp. HS01
hs01.suptempcont01.mx	80	°C	Max Limit SPT PHW Supply Temp HS01
hs01.suptempcont01.out1	0	%	Boiler #1 Modulation HS01
hs01.suptempcont01dev.cm	6.14838	%	Deviation Boiler #1 Supply Temp. HS01
hs01.suptempcont01sp.csp	83.4 °C		Existing Boiler Supply Temp. Setpoint HS01
hs01.suptempcont02.csp	0 °C		2nd Boiler Setpoint Differential HS01
hs01.suptempcont02.ms	65.9 °C		Boiler #2 Supply Temp. HS01
hs01.suptempcont02.out1	0	%	Boiler #2 Modulation HS01

Figure 1 Every 2-minutes, Ecopilot® calculates the building balance point temperature and provides a new offset to the BAS based on ever-changing building variables. The result is energy savings while maintaining occupant comfort.

HARDWARE

Hardware requirements for Ecopilot® include the Ecopilot® Secure Edge Gateway, wireless temperature sensors and sensor access points, and energy meters.

Ecopilot® communicates with the existing BMS via BACNet, Modbus, or other common communication protocols, and interfaces with the BMS via the Ecopilot® **Secure Edge Gateway**. This is the preconfigured hardware unit installed onsite to create the encrypted outbound connection to the Ecopilot® Smart Cloud.

Ecopilot® does not replace a BMS; it works with it. Building operators and EcoPilot Canada technicians can turn-off the Ecopilot® system and revert to the original BMS control at the touch of a button.

Figure 2 Ecopilot® main dashboard displays real-time savings over 7 days, dynamic heat map and weather forecast.

SENSORS

Ecopilot® operates within pre-defined building zones and the parameters that uniquely impact comfort and energy demand within each zone. Ecopilot® considers real-time conditions, current and future weather, state of occupancy and the variables that impact that area, for instance, solar radiation. Each zone has its own schedule, its own exceptions, and its own personality and Ecopilot® responds accordingly.
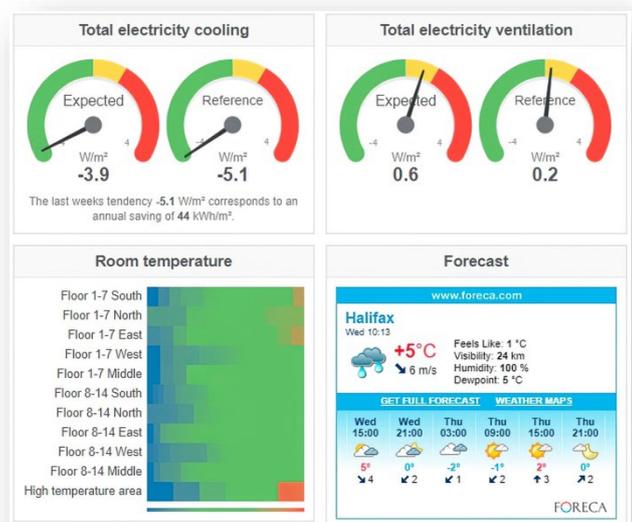
Occupant comfort is prioritized using real-time data from the temperature sensors. The sensor data is used by the software algorithm to ensure each space is within appropriate temperature ranges as defined by the end user, typically between 21-24 degrees Celcius | 70 -73 degrees Fahrenheit. At no time will Ecopilot® allow the building to deviate from client specified space temperature setpoints and limits in a manner that would negatively affect occupant experience. Tenant comfort, by sensor and zone, can be seen on the software's main dashboard. Easy to read heat maps provide operators with a snapshot of building conditions and temperature comfort ranges at-a-glance.

> "For us, this has been one of the easiest projects to implement, with the best ROI."
>
> **Pat Poirier**
> **Crombie REIT**

Ecopilot® aims to utilize all existing building assets, including temperature sensors. If a building is already equipped with temperature sensors read by the existing BMS, Ecopilot® will use those and add more, if required. For adequate coverage, it's generally recommended that the building be fitted with one sensor per 100 square meters.

Each building zone in scope is transposed and made visible in the Ecopilot® dashboard, annotated with the locations of each of the existing sensors that Ecopilot® will need to monitor. Here, you will be able to view the real-time readings of every relevant sensor, on every floor, as well as the ability to view this data in the form of a heat map, enabling the user to get a snapshot of the current internal climate.   The buildings' future requirements can be examined as well as an understanding of what Ecopilot® is doing to meet the current and future heating and cooling needs of the property.

ENERGY METERS

BTU, natural gas, and electricity meters are either integrated to Ecopilot® or added as part of a project for real-time analysis and visualization of savings. Meters are installed and integrated into the BMS for real-time reading and energy signature measurement and verification.

SOFTWARE / USER INTERFACE

Ecopilot® Secure Edge Gateway creates the outbound encrypted connection to the Ecopilot® Smart Cloud; which is the user interface that allows analysis and configuration of the Ecopilot® solution.

> "We're on track to exceed the estimated savings guaranteed by EcoPilot Canada and were pleasantly surprised that Ecopilot®'s AI was also able to identify system issues we weren't aware of, as well as recommendations for greater efficiencies, both that will result in additional energy savings."
>
> **Jeff Ransome**
> **Halifax Marriott Harbourfront**

Ecopilot®'s technical team prepares and designs the technical structure of the software solution including adaptation to the existing building management system which allows Ecopilot® to change set points for all relevant systems.

Ecopilot® is configured to offset supply temperature setpoints in centralized systems; boilers, chillers, heating loops, cooling loops, and air handling units, as well as start and stop of the heating and cooling systems when there is no long-term demand.

Ecopilot®'s software calculates a building's balance point temperature every two-minutes and trims the interaction of the various systems for optimization within specified zone temperature parameters, resulting in a new supply temperature for the systems.

The dashboard reports on:

- Real-time energy savings
- Building system conditions in real-time
- Tenant comfort in all zones
- Dynamic heat map
- Dynamic floor plans

Varying levels of access are provided based on end user role; from Level 1 Read Only Access to Level 4 Administrator.

Building Operators have the capability to view and track the history of changes made in the BMS by Ecopilot® in real-time. Operators have access to stored change history data that spans up to one-year of history. Backups of the entire system are conducted monthly.

Measurement and verification tools are also built right into the dashboard. Ecopilot® uses the Energy Signature method for normalization and verification of savings which has several advantages over other common methods, such as, Degree Day Compensation. Research has shown that the Energy Signature gives the most accurate monthly compensation over a range of building types and weather conditions.

> "Our commitment to delivering exceptional resident experiences, including their comfort, is a priority for us. Ecopilot® delivered a more balanced internal climate that contributed to energy and operating savings."
>
> **Jennifer Poirier Southwest Properties**

Peak Demand - Optional

Ecopilot®'s core offering is to lower consumption 24/7/365 – automatically and continuously but to enable customers to **access additional energy savings**, Ecopilot® has partnered with EnPowered Inc. to seamlessly automate HVAC response for peak demand reduction.

EnPowered's advanced algorithms use AI and game theory to accurately predict how the market will respond during Peak Events. When peak events are predicted, EnPowered sends a software signal to the Ecopilot® system to trigger HVAC curtailment. This merging will allow Ecopilot® and EnPowered to improve ROI, lower costs, reduce emissions automatically during peak events.

When peak demand events are predicted, Ecopilot® will prepare the space for upcoming dynamic effects and uses its thermal inertia to cushion against those dynamic effects, in turn, reducing cooling demand. This prediction feed is another input into Ecopilot®'s algorithm that will support planning for an event, and curtailment of systems, without dramatic impact on comfort. This could take the form of various scenarios, ranging from increasing water temperature set point from chillers, up to, and including, disabling the cooling system. How aggressively Ecopilot adjusts the building will depend on the building and operation requirements. Both solutions, Ecopilot® and EnPowered, have extensive product maturity and the alignment of their AI's is a unique tool to address the next level of peak demand response.

PROTOCOLS

Standard building automation system protocols such as BACnet and Modbus are used to communicate between Ecopilot Secure Edge Gateway and the pre-existing BAS.

MORE THAN JUST AN HVAC-AI.

Ecopilot®'s automatic and continuous control supports:
- Harnessing thermodynamics prioritizing the use of free energy before purchased
- Running systems when necessary; thereby reducing equipment run times
- Not overheating or overcooling; therefore, creating a more consistent indoor climate

Though Ecopilot® prioritizes comfort and energy efficiency, it's also a powerful ally in identifying HVAC system imbalances, failures, and flaws in connected systems.

Some of the common issues identified through Ecopilot® operation include:
- passing valves
- systems not meeting set points
- AHU's economizer failing to perform to spec
- forgotten manual overrides
- zones utilizing more energy than should be required

As part of Ecopilot®'s reporting services, energy engineers will also make further recommendations to support long term efficiency and maintenance plans, such as:
- system temperature range adjustments
- fine tuning of occupied and unoccupied space schedules
- adjustment to BAS programming

ECOPILOT® ALERTS.

Ecopilot® works 24/7/365 and will alert when too much energy is being consumed in a particular zone or system, when an override remains on, when communication is lost, or other alerts as identified with end user.

These alerts enable our dedicated energy managers to analyze and make recommendations on why events are happening and what measures should be taken to prevent them from happening in the future.

OUR TEAM IS YOUR TEAM.

Your project is backed by a dedicated technical team and energy manager who works to further identify additional HVAC savings opportunities based on the data provided via Ecopilot®. Consider them an extension of your building operations team.

Because with Ecopilot®, ENERGY SAVINGS ARE JUST THE BEGINNING.

> "From an energy management point of view, Ecopilot allows us to reduce the energy consumption of buildings; for instance, by reducing the overlap of when boilers and chillers operate automatically. In addition, the device allows us to go further and investigate the operation of the building as a whole. This remote visibility will allow us to optimise building energy consumption which will assist in Aberdeen Standard Investments' journey to Net Zero Carbon buildings."
>
> **Paul Miller**
> **KJ Tait Engineers**

Network Architecture