Intesis®
BY HMS NETWORKS

Reduce Energy Consumption in Buildings with AC Cloud Control

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Introduction

THE NEED TO SAVE ENERGY

The world according to most scientists is changing due to global warming, and they advise we must reduce CO2 emissions to slow down the rate of climate change. Increasingly governments around the world are putting into place strategies and legislation designed to minimise energy consumption and encourage a sustainable economy. Long-term targets for the EU are set by EU Directive 2018/844, which sets rules and obligations for achieving the EU's 2030 energy efficiency targets.

According to statistics from the European Union and the International Energy Agency, the building sector is the most energy-consuming vertical, more than industry or transportation. Within buildings, cooling is the fastest-growing application, especially in emerging countries like China, India, Indonesia, Mexico, and Brazil. Every year, over 100 million air conditioning units are installed worldwide. Unfortunately, air conditioning (AC) systems are typically the largest consumer of energy in a building. Commonly, they account for approximately 40% of the energy, while in areas such as the Middle East, it can be as much as 70% of the energy cost. To reduce overall energy consumption, AC systems are often looked at as the priority. With rising energy costs everywhere, raising the energy efficiency of air conditioning systems is critical.

> *"Every year, over 100 million air conditioning units are installed worldwide."*

An example of legislation to reduce energy consumption within buildings is the EU's Energy Performance of Buildings Directive (EPBD). This sets the legal requirements that commercial buildings must comply with to reduce their CO2 footprint. It requires that commercial buildings (offices, retail businesses, hotels, supermarkets, fashion stores etc.) with a rated output for an air conditioning system (or combined air conditioning and ventilation system) of more than 290 kW (80TR), must be equipped with building automation and control systems by the year 2025. If they are not, those buildings must undergo regular inspections that include an assessment of the efficiency and sizing of the air-conditioning system, compared with the cooling requirements of the building.

To give a perspective of energy used in typical buildings a lower limit of 290 kW is the nominal power used for an air conditioning system that corresponds approximately to a hotel with about 200 rooms, or office space of about 3,000 m2, or 300 employees.

Additional to EU regulations, in Spain in August 2022 the local government introduced a regulation to limit the temperature of AC systems. This was introduced to reduce the pressure on the national energy grid and of course to help with energy efficiency. In Spain, air conditioning cannot now be lowered below 27 deg C in summer, nor heating exceeds 19 deg C in winter, while shop fronts must also go dark by 10 PM. This example of the Spanish government will be surely followed by other countries keen to follow this example of reducing energy consumption.

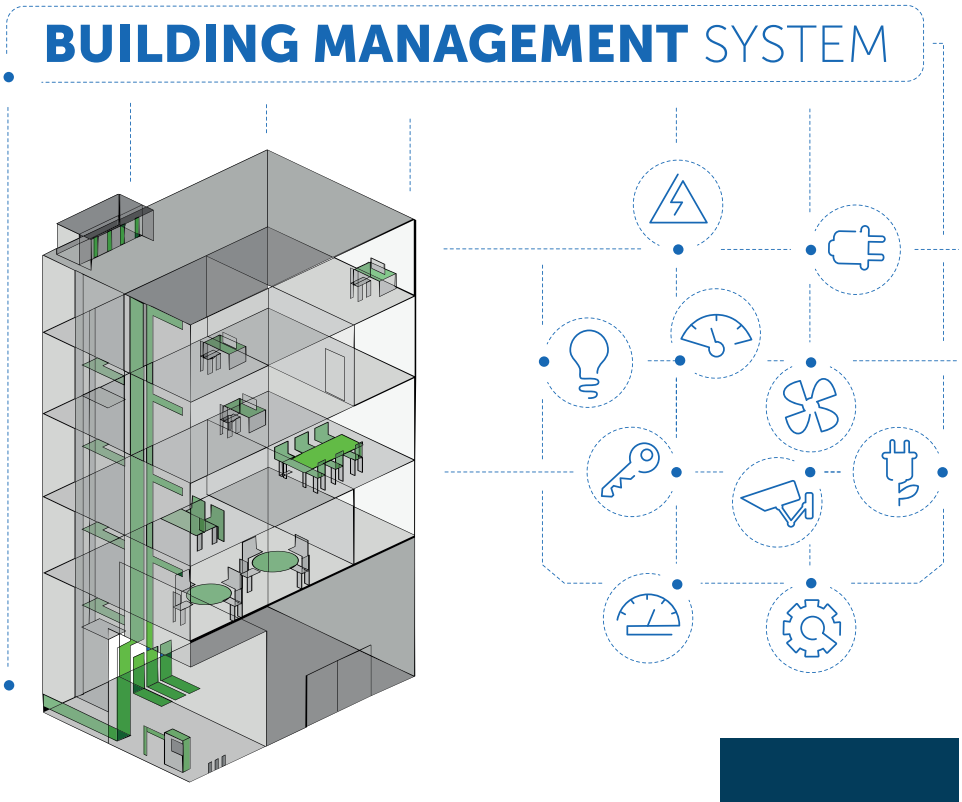
The role of Building Management Systems (BMS) in air-conditioning energy management

In commercial buildings, the Building Management System (BMS) must be capable of a variety of tasks including:

- Continuously monitoring building operations
- Logging energy use
- Analysing energy use
- Allowing for localised adjustment of energy use
- Benchmarking energy efficiency
- Detecting losses in the efficiency of technical building systems
- Inform the facilities manager about opportunities for energy efficiency improvement.

To do this the BMS must allow communication with connected technical building systems (HVAC, lighting, fire systems, etc.) and other appliances inside the building. So it must communicate across different types of proprietary protocols, devices, and manufacturers.

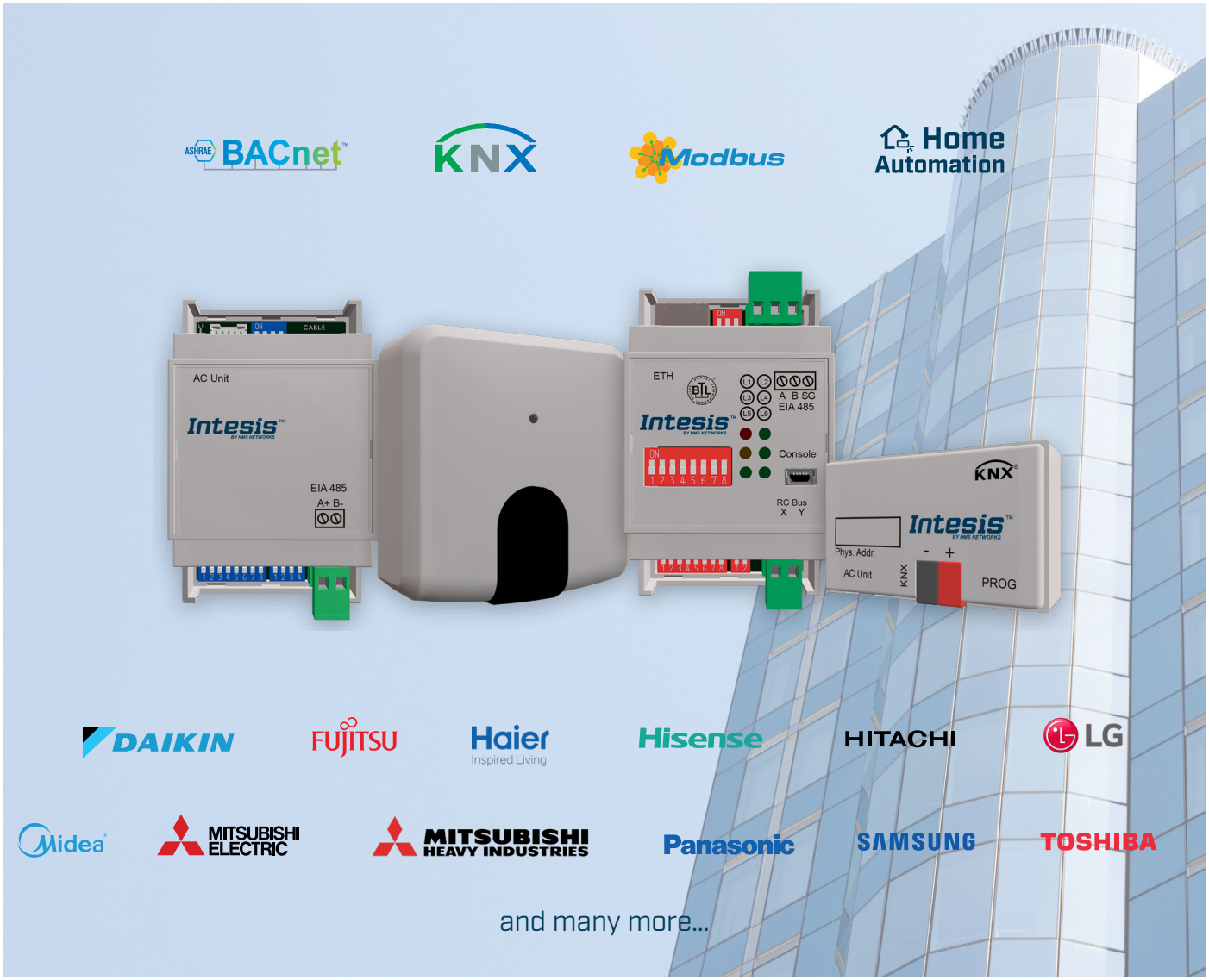
As an example, having communication between the AC system and the fire alarm system is highly desirable. In case of fire, a different European Directive on Building Safety requires that air conditioning systems must be switched off immediately. This is to prevent additional oxygen from being supplied to the fire via the air conditioning system.



Reduce Energy Consumption in Buildings with AC Cloud Control

The main challenge with integrating HVAC systems into a BMS is that the communications protocols are proprietary, so special devices are sometimes needed to allow this communication called gateways. These gateways are developed and validated in close collaboration with AC manufacturers. The most popular protocols used for communications between BMS and HVAC devices are networks such as BACnet, Modbus, and KNX.

One of the leading brands in BMS to HVAC gateways is Intesis. Since 2009 there have been over a million air conditioning units integrated into BMS systems using specialist AC interfaces from Intesis. By using Intesis gateways it is calculated that the energy saved is equivalent to the annual consumption of a city of 22,500 inhabitants, or CO2 absorbed by six million trees in one year, or the equivalent energy saving of 230,000 intercontinental flights between Barcelona and New York.



Retrofitting & upgrading existing AC systems

All over the world, there are many ageing buildings. Often the AC equipment within those buildings is also ageing and lacks the controls which maximise its energy efficiency.

Adding/retrofitting a dedicated building management system (BMS) to an existing building is often an expensive and complicated exercise. It requires introducing additional layers of controls and wiring to the infrastructure, which can be quite cumbersome, and require downtime to systems (such as HVAC, lighting, fire protection systems etc.) – that may not be allowed in certain types of buildings. Even in newer buildings, adding a dedicated BMS system to smaller/medium-sized buildings, just to monitor and control the AC systems is also very expensive, and does not make economic sense. BMS systems are often found in larger commercial/residential buildings and are meant to be installed for a robust overview and control of several other assets besides AC systems.

To avoid those complicated installations within retrofits and on smaller/medium-sized buildings is recommended to use more cost-efficient, and easier-to-install solutions such as cloud control solutions, that can also be done with minimal wiring and negligible downtime (if any).

One option is to replace the AC system in its entirety, but this is a costly investment and the return on investment could take many years to recoup even though it would achieve the desired improvements in efficiency and performance.

An alternative approach is to use smart technology to upgrade the air conditioning system already in place. Across many industrial sectors, adding smart technology to legacy equipment is becoming more common to extend machinery life and improve its efficiency. For example, remote sensing capability can be added to virtually any equipment to enable condition monitoring.

Upgrading an existing system is not only good for energy consumption, but it prolongs the lifetime of the installed equipment rather than using energy to manufacture and install a new one; which is also good for the environment and helps move in the right direction of achieving sustainability goals.

How AC Cloud Control can help reduce energy consumption within existing AC systems

An easy way to upgrade the air conditioning system is where devices like HMS' Intesis AC Cloud Control come in. Intesis' AC Cloud Control is a cloud-based remote-control system that allows comfortable and intuitive control of air conditioners and heat pumps. Based on a brand-agnostic cloud-based platform, it brings remotely accessible smart intelligent control to legacy installations which previously had zero or limited control capability.

To use Intesis' AC Cloud Control each indoor unit requires one AC Cloud Control device. The AC Cloud Control device connects to the indoor unit either via Infrared (for ACs that utilize or can utilize a wireless remote control), via a direct connector on the PCB unit, or via a bus connection port on the indoor unit PCB/wired remote control of the AC. Once connected with the AC, the AC Cloud Control device provides the ability to monitor and control the AC units via a local WI-FI network, then all variables are available for remote control and monitoring, providing control to previously uncontrolled ACs. With multi-brand, multi-site, and multi-user control available on a Web-based and App based UI, it creates a dedicated AC system control platform, with easy execution, especially on older buildings where doing wiring can be unfeasible and extremely cost inefficient.

Mulit-brand web and app control for Domestic, Commercial & VRF systems

Integration example

Functionality available within AC Cloud for energy optimization

With a centrally controlled air conditioning system, the reaction time can be quite slow, which is a big shortcoming. For example at a quality hotel, guests expect the air conditioning in the hotel room to react immediately when it is switched on or off. Local control allows individual users to instantly set the desired room temperature and operating mode (cooling, ventilation, dehumidification) and view the reaction happening on a near real time basis.

Using smart building controls allows simple actions that can have a big impact on energy consumption. Examples include:

1) The AC unit shutting down in the case of an open window or an empty room

2) Adding calendars that automatically turn the system on/off in line with the opening times or occupancy

3) Limiting the setpoint range to avoid users to set the temperature too cold in summer or too hot in winter.

In a hotel, check-in/check-out processes can be linked to the air conditioning system via the building management system, so that the hotelier can typically specify when the air conditioner is to start cooling, automatically on a guest's arrival day; similarly on the day of departure, the air conditioner will switch off automatically.

Operational parameters, such as fan speed and vane position can also be set via the AC interface, which also provides access to error codes and maintenance information.

Energy saving potential of AC Cloud Control solution

The energy savings potential through the AC Cloud Control solution is highly subjective to the building site, as it really comes down to the difference between a controlled and an uncontrolled air-conditioning system. It's also dependent on the usage hours, usage schedule, the energy consumption of the AC unit itself etc.

Therefore in order to define the energy savings created by bringing control to previously uncontrolled AC units, a following model can be considered:

To estimate the energy savings achieved with Intesis products, first, we take a common split unit as our reference model to represent all devices under control.

According to the AC industry benchmark, a standard split unit consumes 353 kWh per year in cool mode and 1,594 kWh in heat mode, resulting in total annual energy consumption of 1.947 kWh. Therefore, the whole installed base is responsible for 1.7 TWh of energy consumption.

Several HMS customers report energy savings between 20-45% using Intesis AC interfaces in the retail sector. Assuming an average of 30% energy savings across the different projects, Intesis AC interfaces help to save 509 GWh per year. According to statistics from the European Union, the current power mix of renewables, nuclear power, gas, and coal plants results in 295 grams of CO2 per generated kWh.

Within AC Cloud Control, we also have further control possibilities, that can enhance energy savings further, such as:

Temperature Limitation: Allows setting of a minimum and maximum temperature. The maximum temperature limitation ensures that we can maintain a more uniform comfort within the entire building and control humidity. While the minimum temperature setting allows for energy savings. As per industry standards, it is estimated that each temperature degree increase in the set-point allows for up to 5% energy savings.

Scheduling: This allows setting an Annual Calendar, of how the AC units in the building should be controlled. Ensuring that the AC is not operating during unoccupied hours and operates only when needed.

Scene Creation: Allows for control of multiple ACs in different zones, rooms and even sites to do a particular action. This allows for scheduling, plus temperature settings to occur. Allowing the user to specifically switch off any ACs not under use and switching those on that create the needed comfort within the space under use.

The importance of remote control to energy optimization

With modern smart building technologies, an installation can be controlled from anywhere in the world at any time or date. Quite often people forget to switch off an appliance when they leave the office or home. These vampire devices according to recent studies cost companies in a typical office building 170 Euros per employee per annum. For large offices, this figure for wasted energy starts to add up to considerable costs. Using a cloud-enabled device allows for appliances such as AC units to be checked remotely. These cloud-enabled devices even allow for alarms to be set up to notify staff that they have left the AC running and allow them to act accordingly to redress the situation.

Retrofit or replacement?

Installing and maintaining AC systems is an extremely price-sensitive area, meaning that retrofitting is a very attractive option in many cases, as an alternative to installing a new system. Some installations may feature more than one proprietary AC system, so linking them together with intelligent control is much more attractive. The approach is not exclusively limited to older buildings, but it can also be used when a new building is fitted with an AC system under centralised control.

Whether or not to retrofit is dependent on the individual circumstances; a new system could still be the right approach when the existing system is extremely old, regularly breaking down or largely beyond repair. It is also hard to estimate the exact energy savings which result from using AC Cloud Control because it depends on the user profile and the environmental conditions; however, it is believed to be around 30% on average.

While it is often thought that smart technology is a brand-new concept, solutions like the Intesis AC Cloud Control system have been on the market since 2012. This means that these products and associated technology are already extensively tried and tested and proven to be compatible with the AC systems of most manufacturers. With Intesis's universal version the knowledge that a single cloud solution works with virtually all manufacturers' AC portfolios and is a proven reliable technology removes any risk from implementing these energy-saving measures to existing or new AC units.

Demand response and AC Cloud

There are energy consumption peaks in the day that make energy distributors use different energy production alternatives and various energy tariffs, making energy even more expensive. To avoid peak hours, energy distributors encourage energy users to use demand response. The objective is to reduce energy consumption when the demand is high, taking the strain off national energy grids, and in return paying lower energy prices. This might be done, for example, by decreasing the temperature a few degrees in the buildings in winter at peak hours, so the HVAC systems consume less energy. Over many buildings, the energy consumption reduction is considerable.

The next step in the use of clouds for controlling energy consumption in AC devices will be in the area of demand response. Using cloud control to instantly manage assets such as AC units is already enabled in cloud solution like Intesis's cloud implementations and using these when notified of energy issues allows organisations to minimise their energy use and waste.

For AC units to respond to the demand in a reliable way through the cloud control solution, it is critical that the AC Interfaces used to enable cloud control, are certified to be used with the specific AC brand/unit. This ensures seamless connectivity with the AC unit and guarantees that the controls/ demand response will work as expected. If the interfacing with the AC units isn't achieved properly/the AC interface is not certified for seamless connectivity, the cloud controls can't be guaranteed to achieve the desired result. For larger companies buying energy from the energy stock marketplaces allows them instant remote control to shut down assets if the energy price is too high and switch them back on if the price drops. All these factors combine to allow AC Cloud Control to help mitigate energy waste.

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