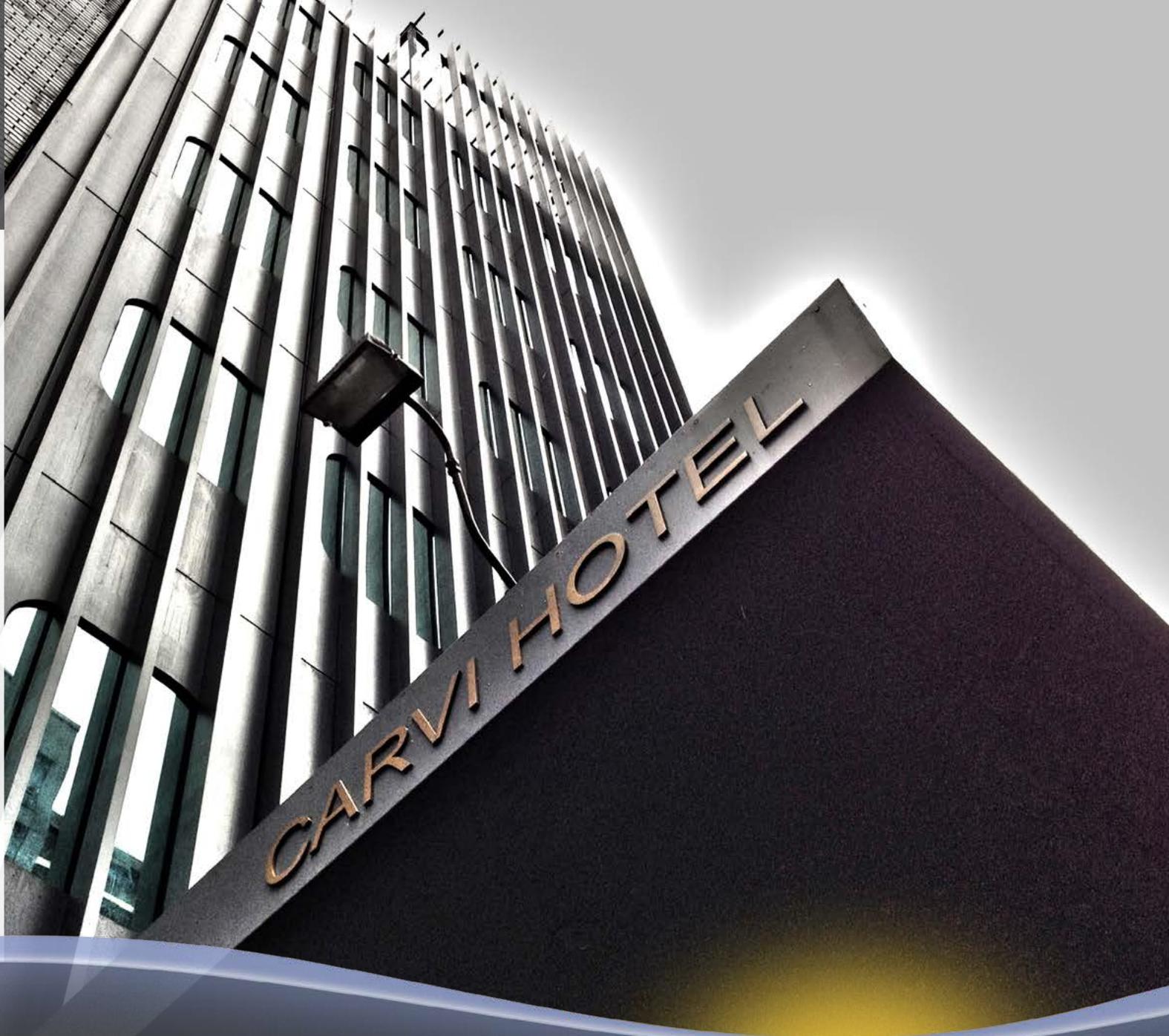


Carvi Hotel

New York, NY

Automated HVAC Energy Savings in Guestrooms

- ◆ Wireless, Self-powered Technology
 - ◇ Occupancy detected by self-powered motion & door sensors
- ◆ Fast & Non-invasive Installation
 - ◇ Despite maintaining a high occupancy rate (95%), no rooms were taken out of inventory during installation



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Wireless Technology Simplifies Automation Retrofit

Carvi Hotel undergoes 21st century technology makeover to reduce HVAC energy spending - without taking rooms out of inventory

Occupancy Detection

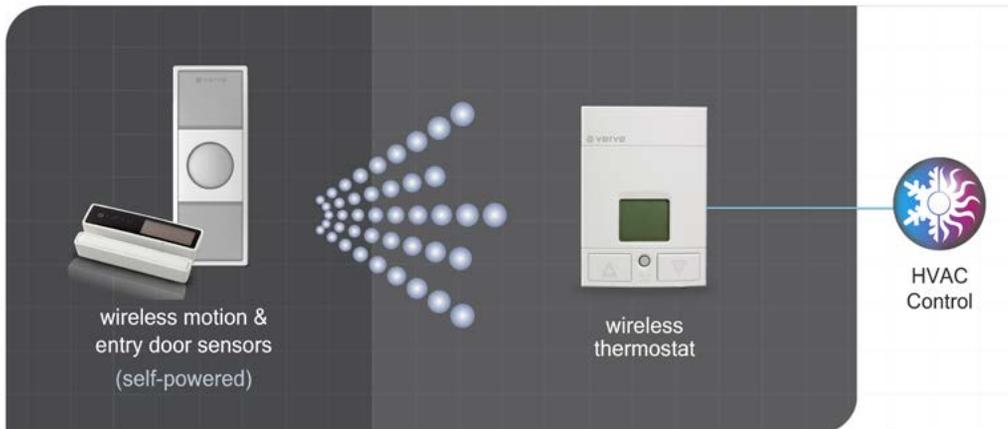
Despite operating at an astounding 95% occupancy rate; the Carvi Hotel was spending significant utility dollars heating and cooling unoccupied guestrooms. Even sold rooms are routinely left vacant. According to Lawrence Berkeley National Laboratory's report titled "Energy Saving Opportunities in Hotel Guest rooms", hotel guestrooms are left unoccupied 8-12 hours per day.

In order to reduce HVAC utility spending, Carvi Hotel installed pre-packaged Verve wireless control systems in each guestroom. Each control system consists of an entry door sensor, motion sensor and wireless thermostat.

Wireless Communications

Wireless communications between the in-room controls are based on the EnOcean Wireless Standard. By employing EnOcean energy harvesting and wireless technologies, the Verve sensors power themselves using an unlikely source - indoor light. The sensors capture ambient light and use it to power wireless communications between devices. Since there is an infinite amount of light available, the sensors do not require batteries or line-power.

System Diagram - as installed at Carvi Hotel



The in-room control system heats and cools the rooms according to guest preferences. When a sold or unsold room is left vacant, the system sets back the room's set point temperature as a simple way to save energy.

Sequence of Events

- ◆ Each time a guest opens or shuts the entry door to their room, the self-powered wireless entry door sensor transmits a radio signal.
- ◆ The radio signal alerts the wireless thermostat to monitor the occupancy status of the room by listening for data coming from the motion sensor.

Between the radio signals transmitted by the door and motion sensors, the wireless thermostat can discern whether or not the room is occupied and accordingly adjust setback temperatures. This system maintains the guests' expectations for comfort while optimizing the system for energy savings.

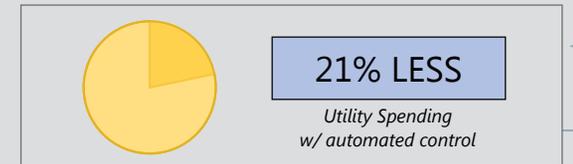
Payback & ROI Analysis



Cost of powering one guestroom (USA average, w/out automation controls)

Baseline: Annual power usage / Room ¹	2,850 kWh
Cost of electricity (peak, per kWh)	\$0.15
Yearly energy savings potential / room	\$427.50

Compare "with" versus "w/out" automated HVAC control



Automated Energy Savings

Energy savings potential / Room	\$427.50
Occupancy-driven energy savings	21%
Annual energy savings / Room / Yr.	\$89.78

Projected energy savings are based on the ROI impact variable values specific to this site location (HVAC system type, local climate, cost of electricity & occupancy rate)

¹ ACEEE (American Council for an Energy-Efficient Economy) "Emerging Energy Saving Practices"

