



# 1888 Historic Denver Dry Goods Building Retrofits with LONWORKS® Open, Interoperable Building Automation

The Denver Dry Goods Building in Colorado, USA, is a landmarked historic building in the center of Denver's popular 16th Street pedestrian shopping area. Built in 1888 as a dry goods store, the Denver Dry was closed down in 1987 when Denver's economy took a downturn.



Under threat of possible demolition, the Denver Urban Renewal Authority (DURA) purchased the building from the May Company and teamed up with New York developer Jonathan Rose. Under his leadership, an environmentally and socially responsible redevelopment helped revitalize this historic building making it into a viable model for sustainable redevelopment.

Between 1993 and 1999, the 350,000 square foot historic building was renovated into a multi-tenant, mixed-use building. The renovation consisted of 30,000 square feet of office space, 115,000 square feet of retail space, 47,235 square feet of affordable rental units (51 units) and 77,000 square feet of high-end condominiums for sale (63 units). Within the last three years it has undergone a tenant change converting the single use space of 38,738 square feet into six different spaces, 21,548 square feet for a two-story spa/salon and school, 5848 square feet for restaurant use, 1532 square feet for retail use and 5065 square feet of offices with the remaining space being designated as common areas.

## The Challenge

The nature of the building renovation from a single user to multi-users created a very complicated central heating and cooling system which had to adapt to and reuse the existing piping layout.

The new retrofitted system consists of the pre-existing steam plant, reusing city steam for heating and water, the addition of two rebuilt chillers (250 ton and 430 ton, respectively), a cooling tower, and two flat plates for cooling. The heating and cooling are dispersed via air handling units for the offices, commercial and common area spaces and these are controlled by FCU and VAV boxes. FCU and hot-water reheat are utilized for the condominium

units, and evaporative coolers and hot water reheat for the rental units.

Additionally, electric hot water heaters are used in the rental apartments, office restrooms, and retail spaces. The recent re-tenanted spaces have been fitted with fan-coil units, VAV's and VFD's and share the use of three pre-existing air handler units which served the previous, single tenant. The range of uses in the new space created a number of equipment challenges, which had to accommodate the zoning for retail space, a coffee shop, offices, a restaurant, and a teaching spa and salon in addition to the existing housing, office, and retail areas.

In 2003, building engineering company Stewart Boyer, Inc., recommended and installed a new, LONWORKS platform-based building automation system and new BTU meters to measure each space's energy use to better manage the HVAC system and more equitably allocate energy costs.

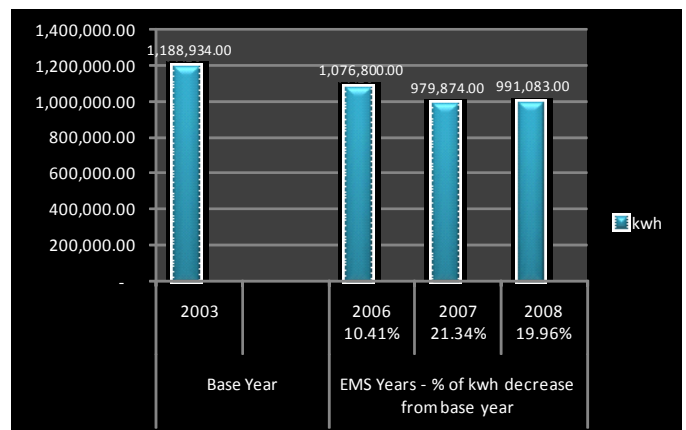


Fig. 1

Figure 1 uses year 2003 as a base year to show the decrease in total kWh use over the years. 2005 and 2006 begin to show the effects of equipment improvement and the installation of the LONWORKS platform-based EMS System.

Thanks to the flexibility and adaptability of the LONWORKS platform system, the building not only has the ability to monitor and tweak the central heating and cooling

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plant, but also is able to integrate into the monitoring system each individual space's equipment from various manufacturers allowing set-point adjustments for the various tenants and each of their unique heating and cooling needs.

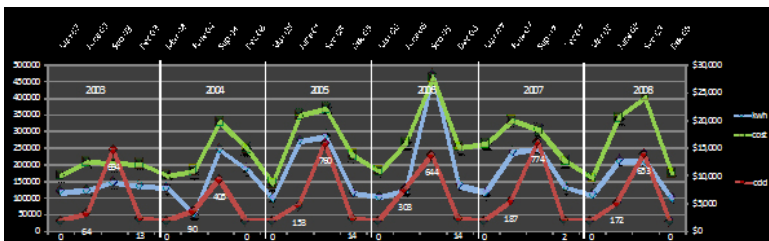
For example, on the top floor, the new salon includes a retail storefront and a client salon area, with 18 foot high ceilings. These two spaces have different operating hours than the classrooms and the massage spa located in the basement level. The basement zoning requirements include classroom use with large occupancy, therefore higher cooling demand and separate massage rooms where comfort is a priority, so this area needs to be warmer.

Located on the ground level is a restaurant with an open dining area with 18 foot ceilings and floor to ceiling wall-to-wall windows along the southwest side of the building. On the opposite side of the space is the kitchen area with ovens, refrigeration, and a dishwashing area. Due to use, occupancy trends, and the solar gain and loss from the wall of windows, this space experiences significant temperature fluctuations. The restaurant shares one air handling unit with a coffee shop and two additional retail spaces. In the basement area below the restaurant is an office space with shared bathrooms, kitchen, and office equipment areas.

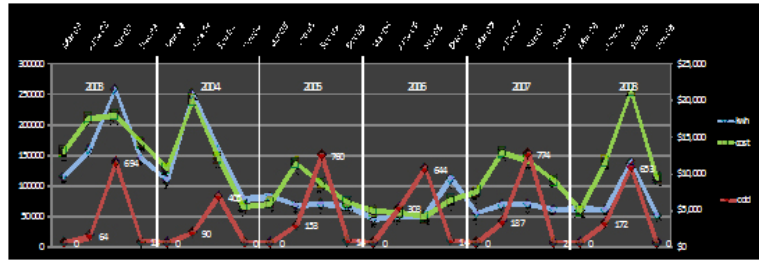
Unlike the upper floors with high ceilings and natural day-lighting, the basement has seven and half foot ceilings and no windows. Here the challenge is heat gain from occupancy, lighting and equipment combined with cool dampness from the subterranean basement location. This space shares the air handling unit with the spa and salon.

In addition to accommodating both the existing and multiple new equipment additions, the open, LONWORKS platform-based control system allows for easy programming of the complicated scheduling and zoning for the various uses and occupancy times as well as allowing for the re-use of the three existing air handler units which would have otherwise been expensive to replace.

### Trends in Energy Use and Costs Before and After LONWORKS Platform Install



Chiller #1 (240 ton) – efficiency temperature set points 65°F to 85°F



Chiller #3 (480 ton) – efficiency temperature set points 90°F and above

The charts above indicate a significant decrease in the use of chiller 3 over the period 2005-2006, largely due to the installation of the EMS system and the ability to finitely program the equipment (i.e. the LONWORKS platform-based controls system allows precise programming of equipment set-points and encodes them to react to the temperature fluctuations of the various spaces within the building).

Chiller 1 tracks much more closely with the cooling degree days than chiller 3 which does not react much to the outside temperature. This indicates that chiller 3 is only being utilized when outside air temperatures reach extreme highs and that the plant mostly relies on the smaller, more efficient and less expensive chiller 1.

### The Benefits

The new system delivered a 31% reduction in energy costs despite increased energy rates for each of the years. This was due to two things – first, the improved visibility, flexibility, and manageability of the LONWORKS platform-based control system, and second, due to repairs made to existing equipment.

Besides the ongoing energy savings via monitoring and adjustment of the numerous pieces of equipment, there is a significant cost savings advantage gained from specifying the LONWORKS system in the construction of new spaces and for future re-tenanting and renovations. LONWORKS technology eliminates proprietary situations in HVAC equipment which leads to competitive MEP construction bidding and it easily accommodates any future equipment additions.

Ultimately, the adaptability of the LONWORKS platform topology in building automation is a critical tool in property asset management, and allows property managers and owners to make cost-saving decisions in construction and repairs as well as permits continual tracking and analysis of the building energy use, all of which leads to satisfied tenants, lower energy use, and above all energy and equipment cost savings.

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