

CHAPTER/REGIONAL TECHNOLOGY AWARD - SHORT FORM

1. Category (Check one and indicate New or Existing, if applicable)

- | | | |
|---|---|--------------------------------|
| <input type="radio"/> Commercial Buildings | <input checked="" type="radio"/> New or | <input type="radio"/> Existing |
| Institutional Buildings: | | |
| <input type="radio"/> Educational Facilities | <input type="radio"/> New or | <input type="radio"/> Existing |
| <input type="radio"/> Other Institutional | <input type="radio"/> New or | <input type="radio"/> Existing |
| <input type="radio"/> Health Care Facilities | <input type="radio"/> New or | <input type="radio"/> Existing |
| <input type="radio"/> Industrial Facilities or Processes | <input type="radio"/> New or | <input type="radio"/> Existing |
| <input type="radio"/> Public Assembly | <input type="radio"/> New or | <input type="radio"/> Existing |
| <input type="radio"/> Residential (Single and Multi-Family) | | |

2. Name of building or project: Walgreens Store #15364 (Evanston Net Zero)
City/State: Evanston, IL

3. Project Description: Net-Zero Energy, All-Natural Refrigerant Retail Store
Project Study/Design Period: 07/2012 to 11/2013
Begin date (mm/yyyy) End date (mm/yyyy)
Percent Occupancy at time of submission: 0

4. Entrant (ASHRAE member with significant role in project):

a. Name: Skelton Benjamin A
Last First Middle

Membership Number: 05219191
Chapter: Illinois (049)
Region: VI

b. Address (including country): 1819 S. Michigan Ave, Unit 907
Chicago IL 60616 USA
City State Zip Country

c. Telephone: (O) 312.520.0025 d. Email: bskelton@cyclonegrp.com

e. Member's Role in Project: Commissioning Authority & Energy Analyst

f. Member's Signature: 

5. Engineer of Record: Steve Sovak (WMA Consulting Engineers, Ltd.)

By affixing my signature above, I certify that the information contained in this application is accurate to the best of my knowledge. In addition, I certify that I have discussed this entry with the owner and have received permission from the owner to submit this project to the ASHRAE Technology Awards Competition.



WALGREENS STORE #15364

2013 ASHRAE TECHNOLOGY AWARDS SUBMISSION

The Walgreens Company, a global retail pharmacy brand with over 8,000 stores, set out with a vision to create a showcase for innovative, sustainable, high-performance design at a retail location without altering the operational characteristics of the building in order to make it as highly-scalable as possible, and to share this information with the sustainability, architecture, and retail communities in a completely transparent fashion as a means of encouraging the adoption of green building practices wherever reasonably feasible.

The store is expected to achieve net-zero energy use by the U.S. Department of Energy's most stringent standard (building footprint) at 200,000 kWh consumed and 240,000 kWh produced. Additionally the project is on track to earn USGBC LEED Platinum, Green Globes, Living Building Challenge, and Green Chill Platinum.

Building Details

Gross Square Footage: 14,460 SF
Major Areas of Occupancy: Retail
Opening Date: 11.21.13

Design Team

Walgreens Company - Developer
Camburas + Theodore - Architect
GI Energy – Engineering / Geo
Energy Center of Wisconsin – Consultant
WMA Consulting Engineers – MEP/FP
Cyclone Energy Group - Commissioning

Energy Efficiency

Minimized Plug Loads

Special efforts were made to discourage plug-in parasitic loads to allow for smaller HVAC equipment and minimized off-hour energy consumption. Walgreens incorporated over a dozen specialty time-of-day schedules into the power and lighting systems to de-energize when not needed.

All LED Lighting & Daylighting

Specialty LED fixtures were designed that provided a perfect light distribution across shelving. The final designed building has an installed wattage of 0.89 W/SF compared to a typical store of 1.40 W/SF. Daylight sensing zones were laid out in the general sales area allowing lighting to fluctuate between 100% and 20% power. Lighting systems consume 40% less energy annually than a typical store.

Automatic Shade Controls

Curtainwall on the West façade creates an open feel and a more transparent experience for customers. Automated shade controls were incorporated into the lower 16' of fenestration which react automatically to solar flux. The shades reduce HVAC peak loads and eliminate glare while allowing for a comfortable, diffuse lighting level.

Enhanced Envelope & Light Redirecting Glass

The prototypical store façade design was used to maintain brand but was provided with additional insulation levels. Walls are R-20 and the roof is R-30. High-performance curtainwall systems with a center-of-glass performance of U-0.31 and SHGC-0.26 was incorporated. Curtainwall glazing above 16' has specialty light redirecting film applied. The film redirects 80% of direct visible light up towards the ceiling and 20% towards the floor. The film eliminates glare as well as redirects direct radiation to the stratified plenum zone.

Single-zone VAV Air Handling Units

A four-pipe VAV dedicated outside air system (DOAS) and seven (7) 4-pipe single-zone VAV air handling units were sized based on the reduced building load. The DOAS unit provides ventilation to each space and allows for the single-zone VAV systems to modulate between 100% speed and 0% speed depending on space demand. The DOAS also modulates ventilation to the retail space based on occupancy levels.

Triple-temp CO₂ Heat Pump

The design team considered many cooling and heating plant options and ultimately settled on a triple-temperature CO₂ heat pump system that allowed refrigeration heat to be reclaimed for use by building HVAC and domestic hot water systems. The single-package heat pump system serves the freezer, cooler and provides both heating and chilled water to the store HVAC systems. Waste heat from the system also feeds a pre-heat tank for domestic hot water. The system has a refrigeration gas-cooler but also uses eight (8) 500-foot deep geo-exchange wells to store heat for use during heating season. The project has heating water, chilled water, condenser water and geo-exchange systems. All systems have pumps with variable speed drives.

Energy Consumption

All of these energy efficiency measures yield a store that consumes a projected 200,000 kWh of electricity annually, a 51% improvement over a store built to ASHRAE Standard 90.1-2007.

Indoor Air Quality

Natural Ventilation

The three-tiered roof incorporates operable clearstory glazing at each tier. All operable glass has motorized actuators to allow for natural ventilation. The operable windows can also be used for heat relief and pre-conditioning.

Innovation

Triple-temp CO₂ Heat Pump

The triple-temp CO₂ heat pump system allows the store to use only natural refrigerants. The design team had to go to Sweden to find equipment that could support the store loads. Walgreens and the design team worked with the Swedish manufacture to customize the design of the system to support the store and the manufacture had to perform special UL certification to meet local codes.

Light Redirecting Film

Light redirecting film allows for 80% of direct daylight and radiation to be redirected to the stratified plenum space, saving HVAC energy, reducing glare and enhancing natural daylight penetration further into the store. The remaining 20% continues on the original direct path.

Other Innovations

- 256 kW Solar Photovoltaic Array (entire roof area)
- Two vertical wind turbines
- Car charging stations

Operation & Maintenance

Measurement & Verification

A networked building automation system has been installed to allow for remote control and monitoring by operations and maintenance personnel. Because of the research oriented nature of the project, a highly detailed measurement & verification plan was designed to collect data once operational. Electrical sub-metering was installed on all plug, lighting, HVAC and other systems. Data will be gathered throughout the project and compared to modeled energy performance. The data will be used to make adjustments necessary to ensure net-zero operation. Furthermore, the data will serve as a tool when designing future stores.

Commissioning

Commissioning was incorporated early in planning and design of the project. An Owner's Project Requirements document served as a tool to keep the design team focused on the primary objective of the project: *Net-Zero Energy Performance*. As a check, energy modeling updates were performed throughout the project, including start-up, functional testing and operation.

Cost Effectiveness

The project, being a research project and living laboratory for the retail design and operations community, incorporates innovating and cutting edge technology. While the budget of the project is confidential, Walgreens has shared that it used a strategy of using marketing funds to offset the some of the additional construction costs. As far as store operation, being net-zero energy, it is expected to be revenue generating.

Environmental Impact

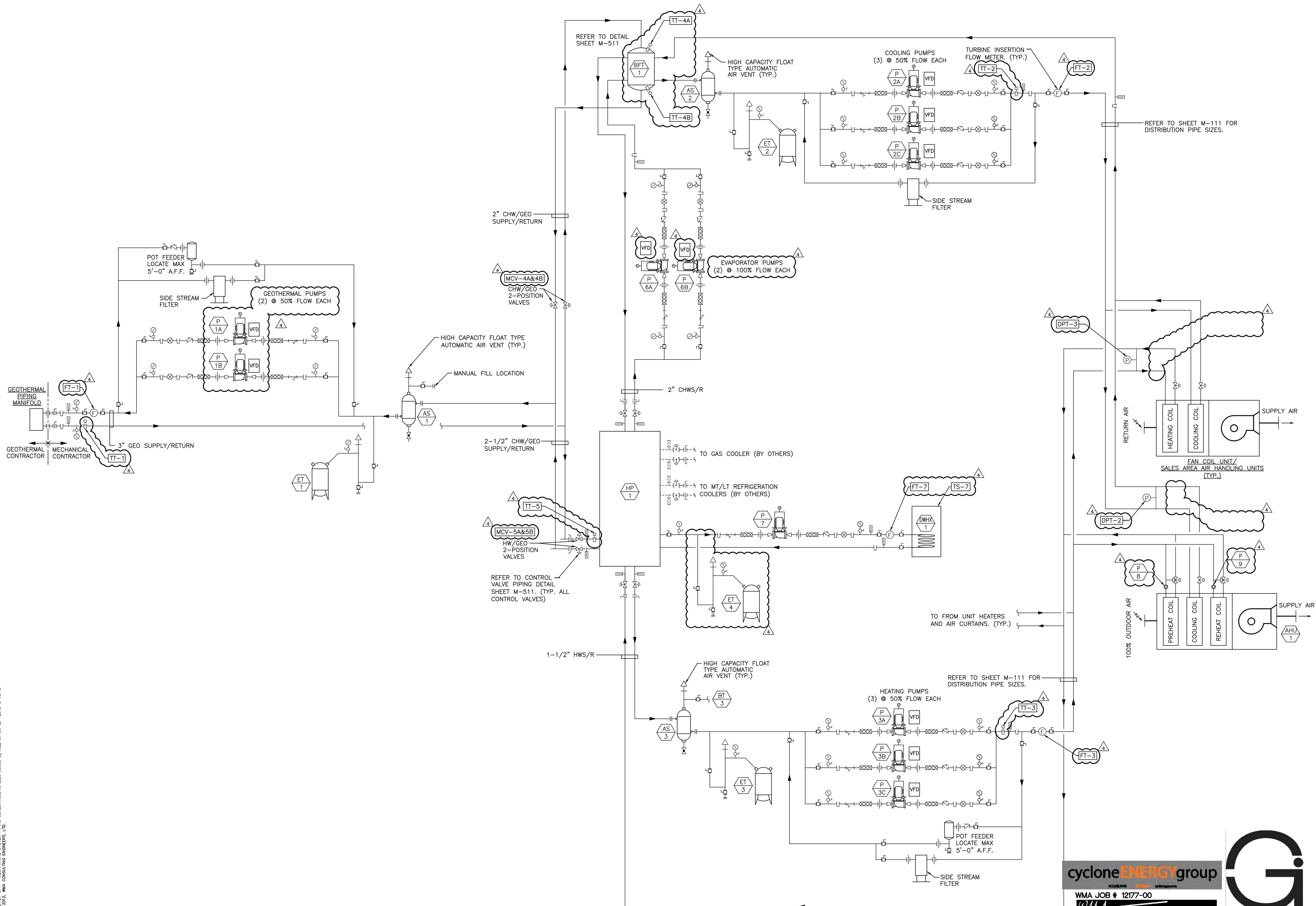
ENERGY STAR Target Finder reports the store, without on-site generation, will have a site energy use intensity of 52 kBtu/ft²/yr and produces a total of 157 MtCO₂e, over 55% better than the median retail store.

With solar photovoltaic and on-site wind generation, the store is expected to surpass net-zero energy performance.

Annual Energy Use:	200,000 kWh
Onsite Renewable Generation:	240,000 kWh
Total:	- 40,000 kWh

One of the secondary goals of the project was to use all-natural refrigerants. The triple-temp CO₂ system achieves that goal and sets will provide an important benchmark for future retail stores.

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DRAWING TITLE: MECHANICAL SYSTEM PIPING SCHEMATIC

SCALE: NO SCALE

DRAWN BY: WALGREENS

DATE: NEC OF CHICAGO AVE & KEENEY ST. EVANSTON, IL

REVIEWED:

NO.	DATE	BY	DESCRIPTION
7	06/12/13	WMA	ISSUED FOR CONSTRUCTION
6	03/25/13	WMA	VALUE ENGINEERING REVISIONS
5	01/21/13	WMA	ADDENDUM #2
4	01/07/13	WMA	PERMIT REVISIONS
3	12/20/12	WMA	ADDENDUM #1
1	11/26/12	WMA	ISSUED FOR PERMIT

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