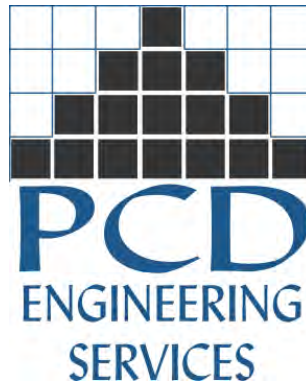




Case Study in Commercial Near Net-Zero LEED Design

*Peter C. D'Antonio, LEED AP, PE
President - PCD Engineering Services, Inc.*



Mapleleaf Orthopedics

- ◆ 8,000 SF medical office, completed Dec 2007
- ◆ Southern Colorado's 1st LEED Building – *LEED 2.2 Gold*
- ◆ CRES award winner
www.cres.org



Project Team

Owner: Dr. Ken Danylchuck
Sustainability Consultants: Sustainable Building Concepts
Mechanical Engineer: AE Associates
Electrical Engineer: Kohnert Engineering
Energy Consultant: PCD Engineering
Commissioning Agent: PCD Engineering



First LEED project for
owner and A/E team



Costs



201 \$/SF (total project cost)
12% LEED Related Costs (% of total project cost)



Project Goals



Design a 'green' facility
with a 'healthy' environment

Site & Water

- ◆ Building oriented South to harvest solar
- ◆ Pervious paving
- ◆ Low water landscaping
- ◆ Generous open space
- ◆ Low flow fixtures



Energy

- ◆ 30kW Photovoltaic (PV) system
 - meets 90%+ of energy needs
- ◆ Ground source heat pumps (GSHP)
 - 350%+ heating efficiency
 - 23 EER cooling
- ◆ Energy recovery ventilator (ERV)
 - reduces ventilation load by 75%



GSHP



ERV

PV Costs

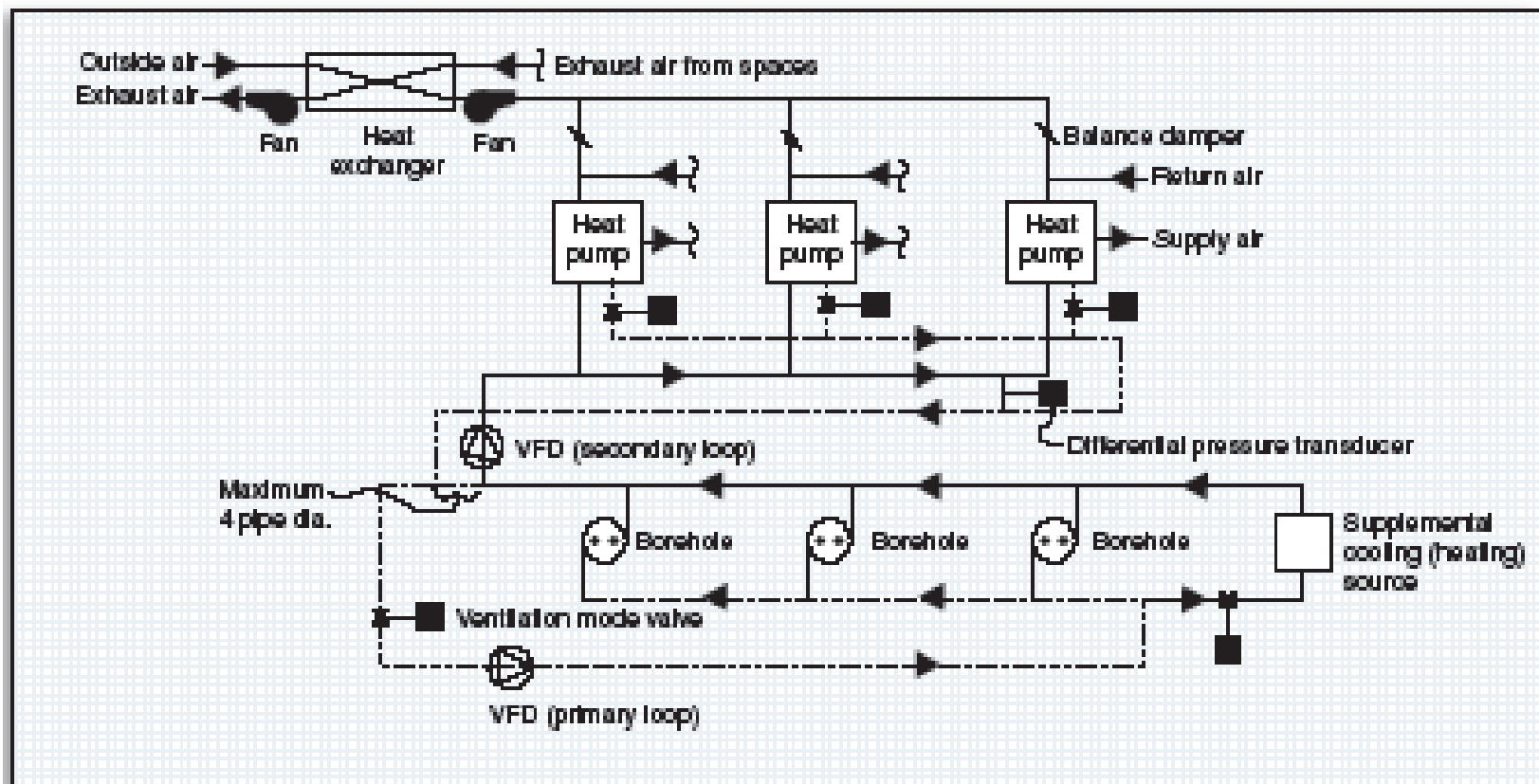
Cost	Description
\$244,800	Installed Cost
(\$171,264)	Utility Rebate (CO Amendment 37)
(\$22,061)	Federal Tax Credit
\$51,475	Net Cost
\$4,020	Annual Energy Savings
7.8%	ROI

Lighting

- ◆ 90% of spaces are daylit
- ◆ Dimming and occupancy based lighting controls

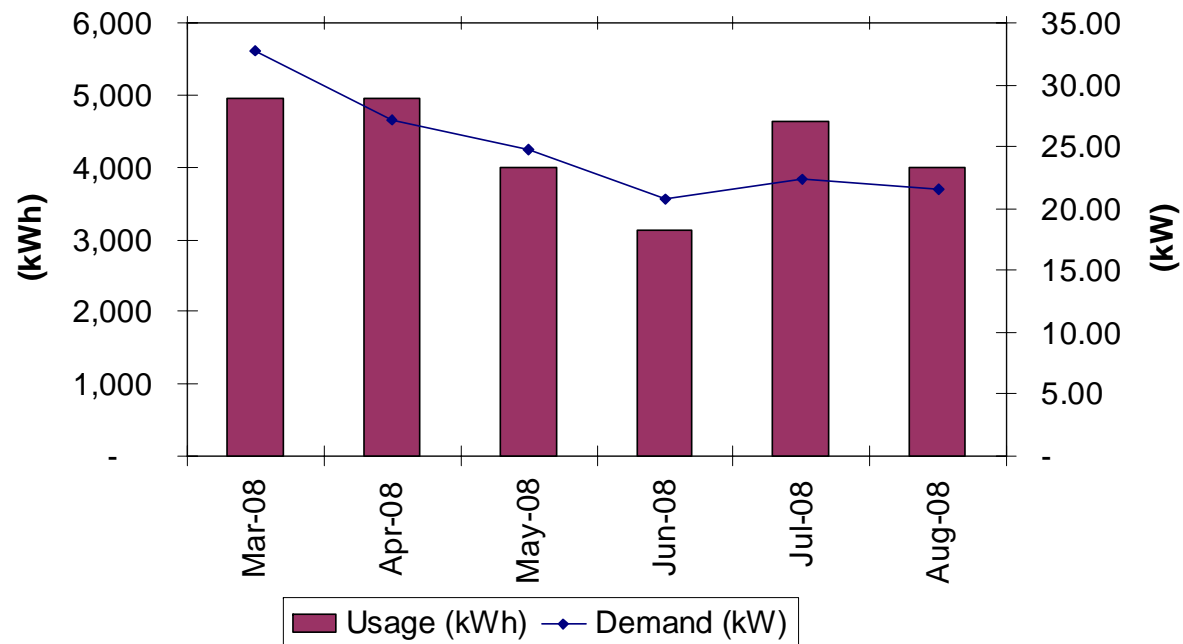


HVAC



Energy Profile

Electric Usage and Demand



Performance Metrics

Period March 2008 - August 2008 Extrapolated	
kWh Used/Year	51,360
kWh Produced/Year	47,854
Net kWh Used/Year	3,506
Energy Use Intensity (Btu/Square Foot/Year)	16.5
CBECS: Office US 1990-2003*	88.0
CBECS: West Mountain Region 1990-2003*	81.2
Mapleleaf Orthopedics Performs 80% Better Than a Typical Building	
\$/Year	\$ 5,187
\$/SF/Yr	\$ 0.65

Source: EIA CBECS 2003: Table C.12 Consumption and Gross Energy Intensity by Year Constructed for Sum of Major Fuels for Non-Mall Buildings, 2003

Materials & Indoor Environment

- ◆ Healthy, low/no VOC carpet & flooring that is recyclable or biodegradable
- ◆ No VOC paints & stains
- ◆ Wheat board cabinets
- ◆ Sustainable lumber
- ◆ Construction waste recycling
- ◆ Recycled content products
- ◆ Regional materials





Exemplary Performance



- ◆ EAc2 - Exceed % of building energy cost met by PV System (80% above highest LEED requirement)
- ◆ Exemplary lighting design – auxiliary lighting system
- ◆ WEc3 - Exemplary plumbing design – 59% reduction in water use from baseline (29% above highest LEED requirement)
- ◆ SSc5.2 - Vegetated open space exceeds local zoning requirements by 516% (491% above LEED requirement)



Lessons Learned – LEED

- ◆ Set LEED goals early
- ◆ Get team members on board early with respect to LEED, and schedule progress meetings
- ◆ Budget time for credit documentation and compliance
- ◆ Value experience
- ◆ Seek out exemplary projects and lessons learned

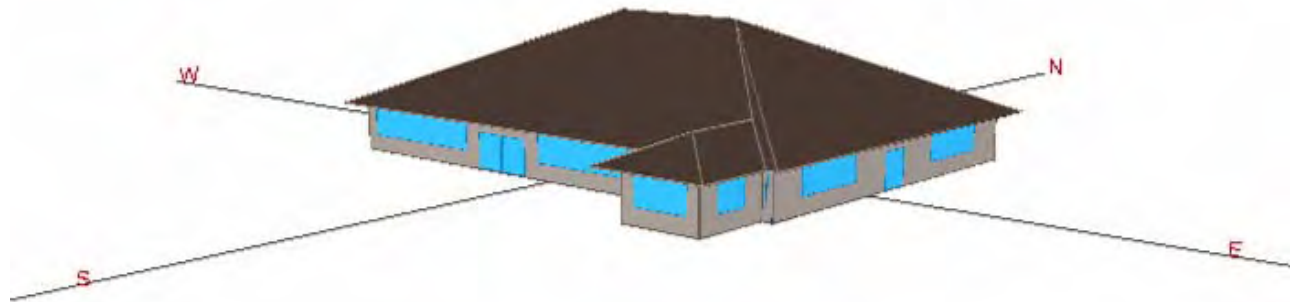


Lessons Learned – High Performance Design

- ◆ Well written Owner Requirements and Basis of Engineering Design are key
- ◆ Best results are achieved when risk is shared by a committed team
- ◆ A building is not a thing – It's a collaboration – Be involved
- ◆ Reduce loads – Harvest passive and renewable energy sources
- ◆ Track VE efforts and changes back to Basis of Design and Owner Requirements. Resist temptation to peel-off efficiency add-alternates
- ◆ LEED Checklist actively maintained (even if LEED not a goal)

Lessons Learned – Energy Modeling

- ◆ Establish measurable goals and stick to them
- ◆ Use modeling to inform the design
- ◆ Complete modeling throughout the process = best value
- ◆ Monitor and verify performance



Lessons Learned – Design Phase Cx

- ◆ Need clear Owner's Requirements & Basis of Design
- ◆ High performance and LEED breed complexity
- ◆ Be an O&M advocate
 - Access, Service, Controlability, Training
- ◆ Insure requirements (including LEED) are represented in construction documents
- ◆ Design review integrates Cx agent and builds relationships



Lessons Learned – Construction Phase Cx

- ◆ Don't believe it until you see it
- ◆ Frequent communications with team facilitates teamwork
- ◆ Objective is the value of the Cx process, not merely documentation
- ◆ Cx raises subcontractor level of performance and compliance
- ◆ Maintain deficiency log and follow through





Challenges and Keys

- ◆ Establish reasonable expectations
- ◆ Focus on the Value (ROI & OPR)
- ◆ Apply appropriate technologies for the facility type
- ◆ Bring team up to speed on high performance design requirements
- ◆ Achieve goals within budget
- ◆ Manage Risk



Feedback

- ◆ Owner is thrilled with utility cost and increased exposure for the facility
- ◆ Inspiration for the community
- ◆ Gold Rating exceeded team's expectation
- ◆ LEED not black and white – there is flexibility
- ◆ LEED is time consuming, “cumbersome”
- ◆ LEED not that stringent with respect to energy
- ◆ A/E fees must be higher
- ◆ All would do/are doing LEED again

Thank you!

Peter C. D'Antonio, PE, LEED AP
PCD Engineering Services, Inc.
peter@pcdengineering.com (303) 678-1108

Tom Corlett
Sustainable Building Concepts, (719) 330-3360

