

Case Study: A Green Data Center

How a building that consumes
energy like a Data Center can be
LEED® rated



Dental



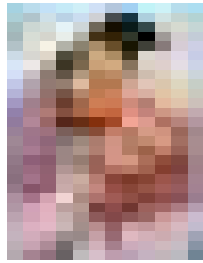
Vision



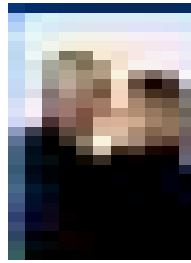
Specialty Drug



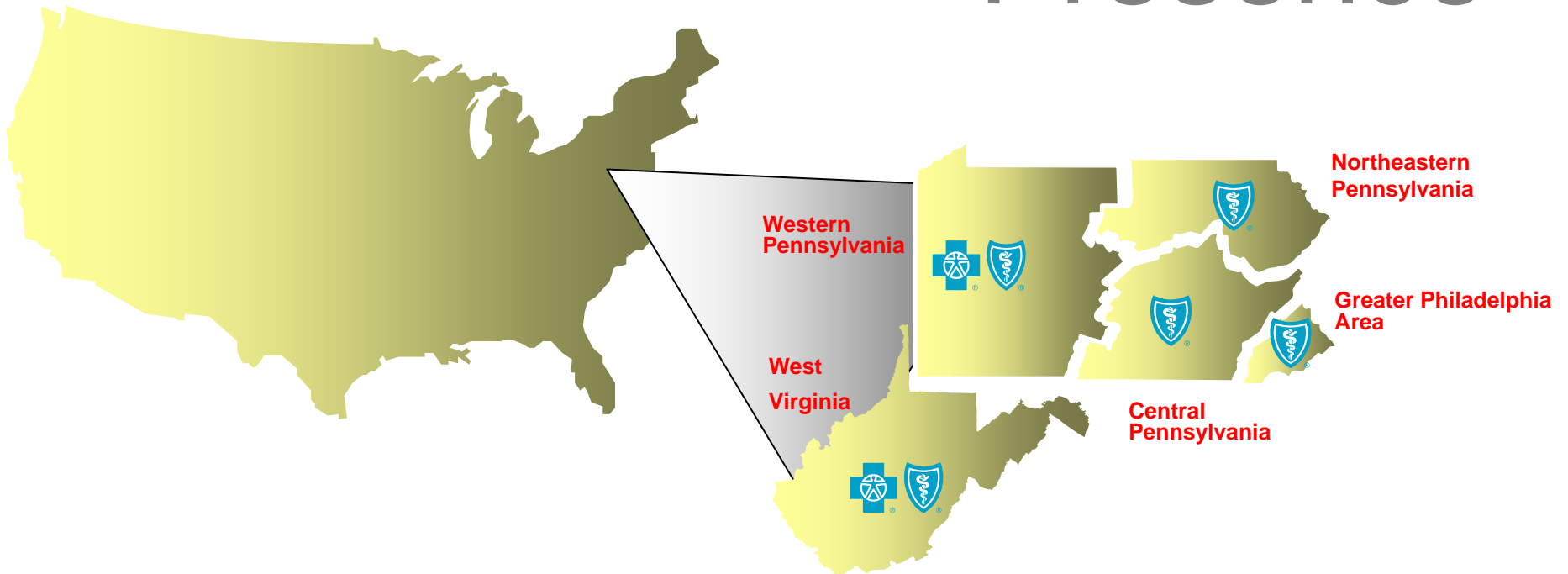
Life



Medicare



Regional Missions with National Presence





Highmark's Longstanding Mission

- Provide access to affordable, quality health care enabling individuals to live longer, healthier lives.



Snapshot of Highmark

- Pennsylvania Office Locations: Pittsburgh, Camp Hill, Johnstown, Erie, Williamsport, and Allentown
- 11,000 employees
- Total enrollment in all products and markets: 28 million
- 2005 Revenues: \$10 billion
- 2005 community reinvestment: \$156 million



What is Green Design

Design and construction practices that significantly reduce or eliminate the negative impact of buildings on the environment and occupants in five key areas:

Sustainable site planning

Safeguarding water and water efficiency

Energy efficiency and renewable energy

Conservation of materials and resources

Indoor environmental quality



*ne design and
f buildings that are
ly responsible, profitable,
aces to live and work.”*

LEED® Program

Leadership in Energy and Environmental Design

- The Green design program administered by the U.S. Green Building Council
- “Market-driven building rating system based on existing, proven practices to measure resource conservation and energy efficiency
- Standards apply to entire lifecycle of a building, from design to construction
- Encourages collaboration between designers, engineers, builders, and owners
- Promotes healthier, more productive employees

from the *LEED Reference Guide*, Version 2.0





LEED® Program

Continued ..

- USGBC has created several LEED Programs. The LEED-NC (Leadership in Energy and Environmental Design - New Construction) program was the best fit for the Highmark Data Center.
- Accreditation is based on a points system (63 total possible points)
 - Certified 26-32 points
 - Silver 33-38 points
 - Gold 39-51 points
 - Platinum 52+ points
- LEED has increasingly become the standard for local, state and national building projects



mark Data Center



Project's Mission:

Four primary business drivers for the design and construction of the new data center:

- 1. To improve reliability*
- 2. To improve security*
- 3. To demonstrate technology as a differentiator in the market*
- 4. To display Highmark's commitment to being a good neighbor*



Project Team

Bring together:

- Nationally recognized consultants known for designing reliable innovative Data Centers
- Local site design familiar with the site and local jurisdictions
- Strong project management team able to keep the budget and
- Contractor with extensive experience in Data Center construction
- LEED professional with knowledge of the LEED process



CSTechnology[®]
The Clarity of Experience

RTKL



Building Program

- 87,000 gsf new Data Center on 11.3 acre remote site
- 28,000 sf raised floor monitored by a state of the art Operation
- Space for redundant electrical and mechanical systems including
- Office space for IS, helpdesk staff, and vendors
- Defined spaces for loading, burn-in, security and storage
- Fitness center, café space, and outdoor terrace
- Security stand-off and other appropriate measures

chedule



Schedule

- November 2003 - Project Interview
- December 2003 - Project Kick-off
- January 2004 - Basis of Design Completed
- February 2004 - 100% Design Completed
- March 2004 - Construction Documentation Begun
- May 2004 - Permit Approved by West Hanover Township
- June 2004 - Sitework Begun / CA started
- August 2004 - Precast Erected / Final Documentation
- July 2005 - Substantial Completion

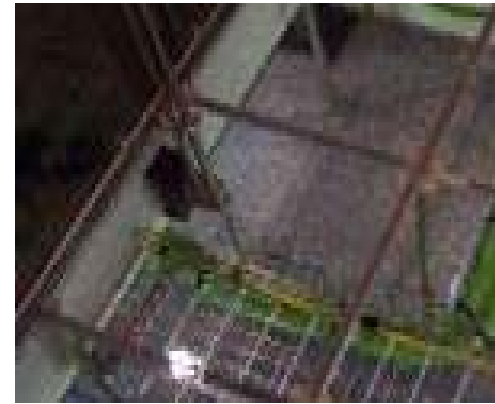


Building Design

- Unique two-story solution benched into the rolling hills of Centra
- Expandable design / Upgradeable design
 - Removable rear wall for future expansion
 - Space built day-one for more electrical and mechanical gear to increase reliability
- Emphasis on architectural design to showcase Highmark's cutting-edge technology



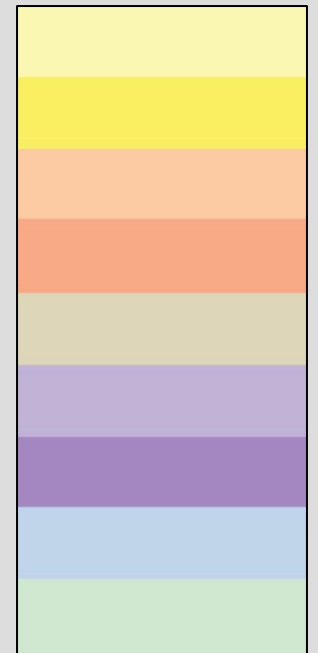
Tour Aisle



- Provide a complete tour of the Data Center
- Maintain security
- Catered to client audit process
- Showcase Highmark's technology



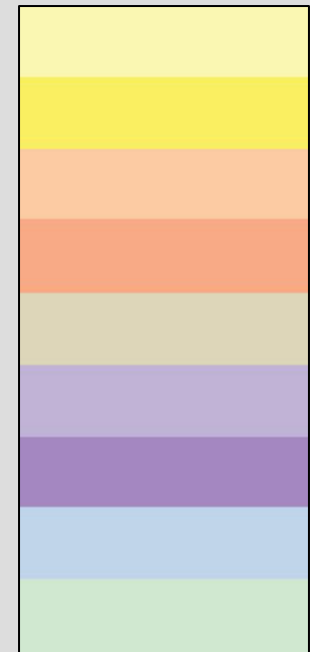
Level 2
At Grade



- Circul
- Vertic
- Office
- Office
- Stora
- Data c
- MDF
- Electr
- Mech



Level 1
Partially below grade



- Circul
- Vertic
- Office
- Office
- Stora
- Data
- MDF
- Electr
- Mech



Why do a LEED® Data Center?

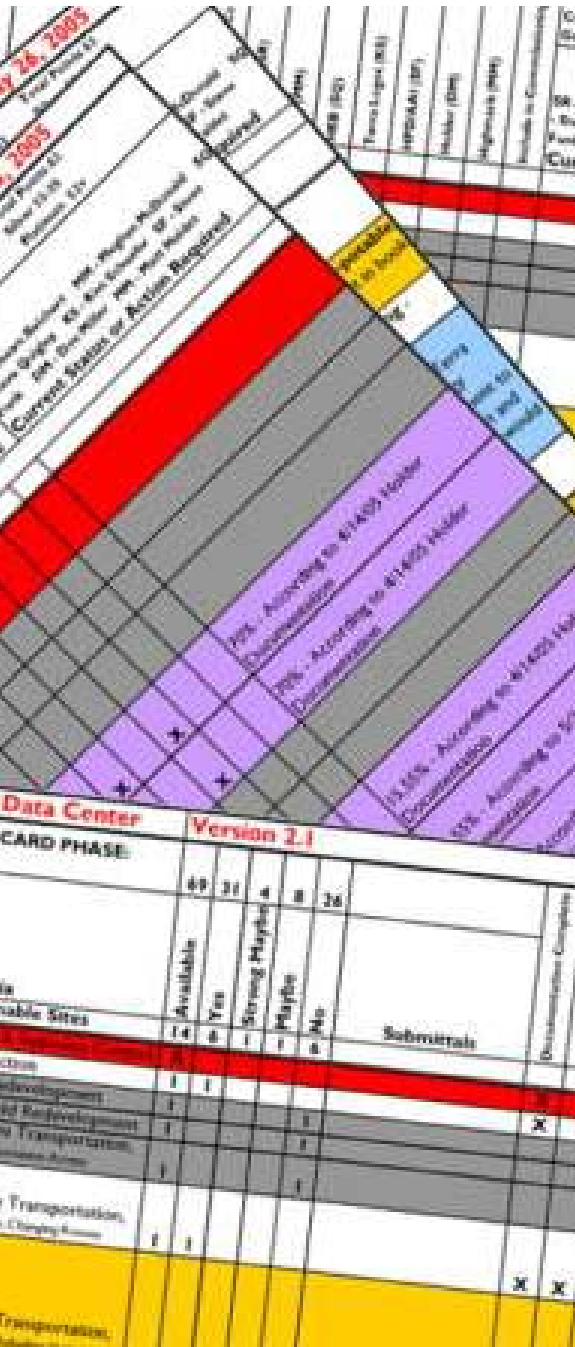
- LEED goals coordinate with Highmark's corporate philosophy of environment, employee wellness, and employee satisfaction
- LEED criteria helped the Data Center be a better neighbor
- Highmark felt that a LEED facility would be a positive marketing when dealing with state and federal clients
- Energy and resource conservations makes economic sense who pays the electric bill



LEED® Process

From the beginning or don't bother

- In order to get the best result, Highmark start thinking about LEED architectural firm interviews forward
- Every LEED point and prerequisite has design implications
- The documentation process for LEED is a huge challenge for e
- Every point would be discussed at great length
- The costs and benefits of every point was being debated from through construction
- Point goals where established and point where being swapped entire process



LEED® Documents

Encyclopaedia or Set of LEED Binders

- Every point has a series of forms and supporting documents that are collected into the binder
- The contractor was made to keep detailed quantity documents
- Every scrap of trash, piece of wood, and truck load of dirt was documented
- Highmark also had to produce a series of memos documenting the building policy that would govern the building, i.e. smoking



LEED® Costs?

Hard Costs

- More expensive efficient MEP equipment
- Energy star roofing
- MEP monitoring points
- Grey water system
- Added insulation and windows
- Storm water infiltration systems

Most of these have long term pay offs



LEED® Costs?

Soft Costs

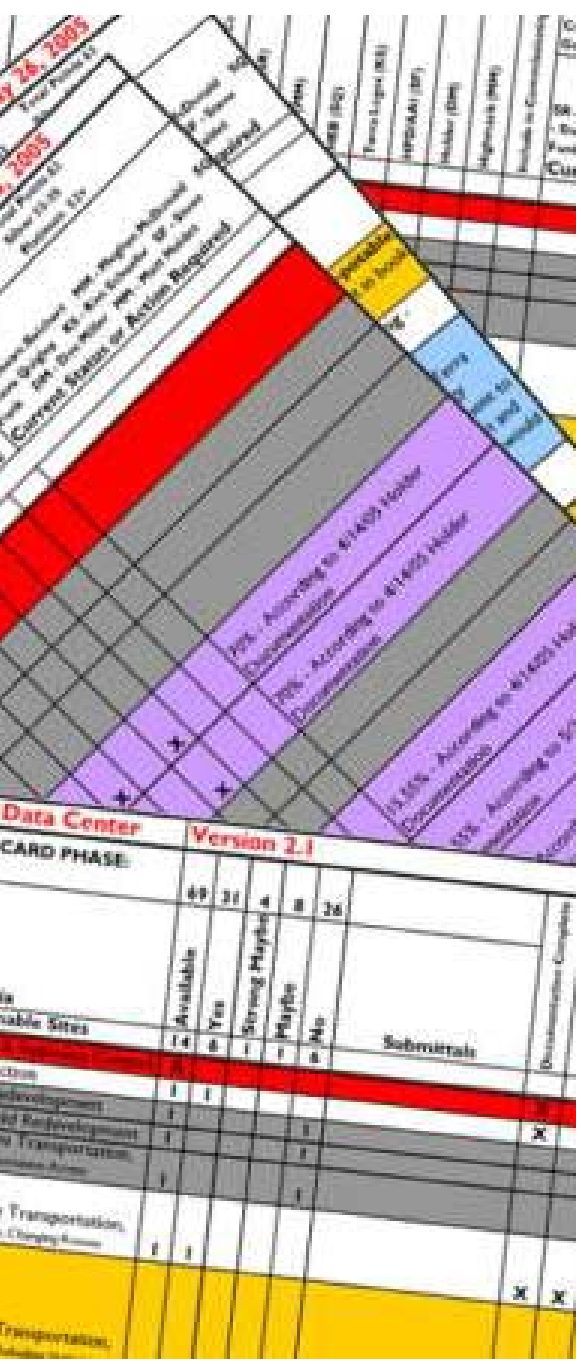
- Fees for LEED design and documentation
- Increased general conditions cost from contractor
- Fees and time spent by the project management team to administer LEED process



LEED® Costs?

Continuing Costs

- Added maintenance for heat exchangers, grey water system, and mechanical filters
- As materials wear out and need to be replaced there may be costs in keeping LEED compliant
- LEED is discussing recertification requirements that may be in the future



6 Point Categories

Highmark's Point Total: 35 Points for Silver

Category	Possible	Awarded
▪ Sustainable Sites	14	9
▪ Water Efficiency	5	5
▪ Energy & Atmosphere	17	4
▪ Materials & Resources	13	5
▪ Indoor Environmental Quality	15	9
▪ Innovation & Design Process	5	3



Sustainable Sites

Prerequisite: Erosion and Sedimentation Control – swales, silt fence

Credits:

- Site Selection - did not develop on prime farm land or endanger
- Alternative Transportation – provided bike racks, parking for all carpooling vehicles

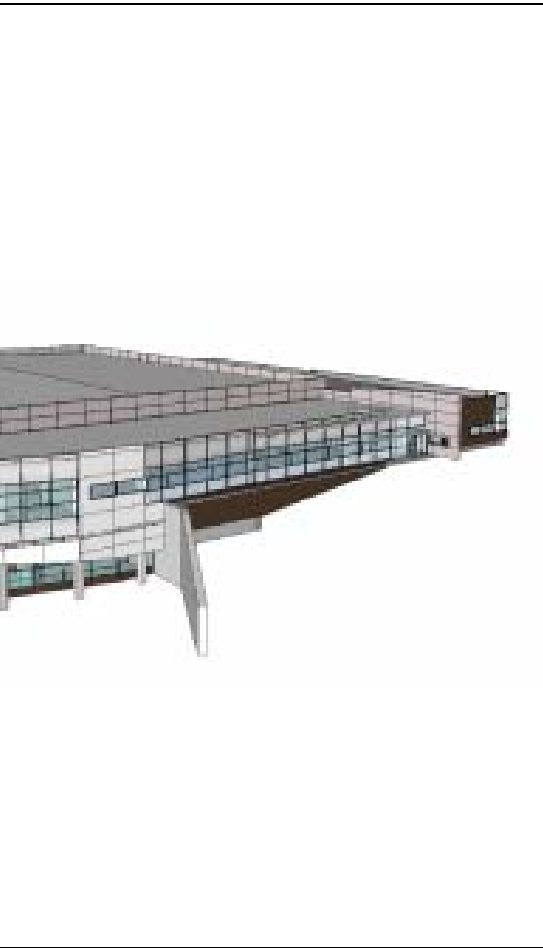


Sustainable Sites

...continuu

Credits:

- Reduced Site Disturbance – smaller footprint through unique 2 and reduced parking
- Storm Water Management – swales, detention basin, infiltration rainwater collection / grey-water system



Documentation including:

Site Plans, Local
Open Space Letter form

LEED® Point in Detail - Sustainable Sites

Credit 5.2 Reduced Site Disturbance - Development Footprint

The Design team used two main strategies to achieve this point:

1. The typical Data Center is a one story box that covers a huge footprint. Because the Data Center was able to be two-stories tall without some of the typical drawbacks. At grade access was available on both levels limited the need stairs and elevators. This solution had other benefits for maintenance because all the piping and conduit types were now hung in the ceiling of level 1. This allowed for easy access and shorter runs.
2. The other strategy was to reduce the parking count. By local code a building this tall required much more parking. We were able to convince local officials that the parking need was less for a Data Center. This allowed us to pave less space and reduce the development footprint.



Water Efficiency

Credits:

- Water Efficient Landscaping – hardy, native plants and no irrigation
- Innovative Wastewater Technologies – rainwater and make-up water for cooling towers collected for non-potable uses
- Water Use Reduction – reuse of rainwater and reduction in amount used by cooling towers



LEED® Point in Detail – Water Efficiency

Credit 1.2 Water Efficient Landscaping, No Potable Use or No Irrigation

The Landscape Design team choose to integrate native plants and drought hearty plants planting. This strategy allowed us to eliminate the need for irrigation.

Instead of planting traditional grass, a mixed blend of native wildflowers / meadow grass large portions of the open space of the site.

Documentation including:

Planting Plans, Planting Schedule



Energy & Atmosphere

Prerequisites:

- Fundamental Building Systems Commissioning – commissioning ensured building systems work properly
- Minimum Energy Performance – building complies with ASHRAE
- CFC Reduction in HVAC&R Equipment – no CFCs in air conditioning



Energy & Atmosphere

Credits:

- Optimize Energy Performance – efficient HVAC system, increase insulation in walls and roof, low-e glass, reduced artificial lighting
- Additional Commissioning – post-occupancy evaluations
- Ozone Depletion – no HCFC's or halon in HVAC or fire suppression



Implementation including:

...tions, and Energy

LEED® Point in Detail – Energy & Atmosphere

Credit 1.1 Optimize Energy Performance

By saving 29% compared to the baseline ASHRAE simulation the project was able to earn 2 points.

Several strategies allowed us to achieve this savings:

1. Under Floor Air allowed the office mechanical system to be very efficient by operating at higher return temperatures and delivering the air directly to the work station
2. High Delta T Cooling of the Data Center space in conjunction with precision cooling reduced the energy. By operating the CRAC units at higher return temperatures and supplying air directly to the cabinets several CRAC units can be eliminated. This allowed the data center to reduce 15KW of connected fan power.
3. The R value for the exterior wall was increased from R-5.7 to R-18.61 while the roof was increased from R-10 to R-31.74.
4. Low E glazing reduced the heat load while still allowing natural light which saves on the lighting side of the equation.
5. Lighting controls were added that switched off lights in unoccupied spaces.



Materials & Resources

Prerequisites:

- Storage & Collection of Recyclables – built-in bins for cans, paper, metal

Credits:

- Construction Waste Management – 67% reduction of landfill waste
- Recycled Content – recycled materials account for 24.7% of materials
- Local/Regional Materials – used materials that are manufactured or extracted within a 500-mile radius of site



Documentation including:

Locations, Database of Materials,
Manufacturer Locations.

LEED® Point in Detail – Materials & Resources

Credit 5.1 Regional Materials

Through the careful selection and specification of construction materials the design was able to earn this credit. This credit requires that 20% of the construction materials be locally produced. Here are some examples:

The building structure and a large portion of the skin is an insulated precast concrete panel.

The brick for the job was produced in Pennsylvania.

The CMU for the job was produced in Pennsylvania.

The raised access floor for the job was produced in Maryland.

The gypsum board was produced in Ohio.



Indoor Environmental Quality

Prerequisites:

- Minimum IAQ Performance – HVAC air intakes >25' from pollutants
- Tobacco Smoke Control – designated outdoor smoking areas

Credits:

- Carbon Dioxide Monitoring – CO₂ sensors installed on HVAC
- Increased Ventilation Effectiveness – under-floor air distribution
- Post-Construction IAQ Management – building air flushed before occupancy



Indoor Environmental Qu

...continued

Credits:

- Low Emitting Materials – sealants, paints and carpets have low
- Chemical Pollutant Source Control – deck-to-deck rated walls a
mechanical and janitorial rooms, recessed walk-off mats at ent
- Thermal Comfort – monitoring to maintain productive and health
- Daylight and Views – 93% of occupied areas have access to v
natural light



LEED® Point in Detail – Indoor Environmental Quality

Credit 2 – Increased Ventilation Effectiveness

The office portions of the Data Center are designed around an open office plan which makes an underfloor air system viable. Highmark already was in favor of a raised access floor for cable management. The decision was made to design a system that supplied the HVAC through the raised floor. The areas of the Highmark building are supplied using an underfloor HVAC system, air conditioning units (ACUs), and fan coil units (FCUs). In this project, heat is supplied to the exterior zones by baseboard radiation. The zone air distribution effectiveness is equivalent to ASHRAE 12. The zone air distribution effectiveness (ACE). The average air change effectiveness in cooling for the building was determined to be 1.0 and in heating the average air change effectiveness was determined to be 0.923. The calculated values are greater than the 0.9 air change effectiveness required to achieve this credit.

Documentation including:

• Air Change Calculations



Innovation & Design Proc

Credits:

- Water Recycling – collected rainwater used for air-conditioning
- Computer Tape and Battery Recycling Program
- LEED Accredited Professional – Kim Schaefer, from Consultan



Implementation including:

ations

LEED® Point in Detail – Innovation & Design Process

Credit 1.2 – Rain Water Recycling

Various strategies and uses of captured rainwater have been designed and implemented at this Data Center to help offset substantially high potable water uses for facilities of this size. Data centers consume large quantities of water for the air conditioning process. For a baseline comparison this project's process load will consume 16,556,400 gallons per year.

1. The design approach will recycle approximately 35% of the water that drains from the roof. This represents approximately 624,902 gallons of water per year (gpy). The primary use of the recycled water will be the operation of the water closets and urinals. The total plumbing demand on the municipal systems reduced by 18%. All available recycled rainwater that required by the plumbing fixtures will be dedicated for the air conditioning process and cooling tower make-up, thereby reducing that demand.
2. The underground storage tank used to store the rain water will also serve as a reserve water supply should the city water supply be interrupted. A 100,000 gallon underground storage tank that will always maintain at least 50,000 gallons in case of water service interruption.
3. The design includes the use of a water softener that, based upon a water analysis, will allow the cooling tower to run at a concentration of 5.8 cycles. This will reduce the cooling tower water consumption from 10.5 gallons per minute to 2.2 gallons per minute.

The total water savings for the process water is 4,945,334 gallons per year, a reduction of 30%.



LEED® Challenges

- LEED NC is written around Office Space not Data Centers. Most Data Center inhabitation (computers) do not want natural light, fresh air, or daylight.
- Data Centers with no office spaces may be difficult to achieve LEED certification.
- Data Centers consume much more power, water and resources than office buildings.
- Data Centers are often designed and built in a very short period of time, making the LEED process more difficult.



LEED® Synergies

- Commissioning is a common step for Data Center construction and can help get a LEED point
- MEP Monitoring occurs in most Data Centers can help get a LEED point
- Raised Access floor can help get a LEED point for ventilation efficiency
- Data Center typically have extensive control systems which can help get LEED points
- Electric and water efficiency is critical to the economics of a Data Center. Efforts to be more efficient than minimum ASHRAE standards can help get LEED points



Lessons Learned

- Start to think about LEED before site selection or budgets are set
- Choose LEED points to chase based on the benefits to the Project
- Recognize the long term effort the LEED process will take
- Find positive benefits for your company that will come with a LEED



Recognition

- Silver LEED-NC v2 from USGBC
- Tier III from Up-Time Institute
- 2006 Best in Class Award from PCI
- 2006 Best All Precast Award from PCI
- 2006 Sustainable Design Award from PCI
- 2006 Highmark Information Services Group Team Excellence Award

Highmark Data Center is one of the only standalone Data Centers to achieve both Tier III and LEED Silver status



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