U.S. GREEN BUILDING COUNCIL

USGBC®

USGBC/LEED Stats

- LEED is "officially" touching 4+ billion SF
  - 36,000+ commercial projects
    - ~30,000 D&C
    - ~6,000 EB O&M
    - Average project ~ 110,000 SF
  - 12,500+ residential projects
- 175,000 LEED APs
- USGBC ~19,000 Member Companies

BUILDING CODES and **LEED**

- Standard 189.1 released January 2010
- IGCC v1.0 released March 2010
- Unified advocacy platform
- Future LEED versions
    - Seek additional harmonization between 189.1/IGCC
    - Floor/Ceiling approach

USGBC Building Performance Partnership

- How are LEED projects performing?
  - Energy
  - Water
  - Comfort
    - IAQ – health
    - Productivity

- If they are performing, what can we learn from them to replicate in the future?

- If they aren't performing, what can we learn from them to avoid in the future?

The Origins of BPP

http://www.usablebuildings.co.uk

probe 2

1 Aldermanbury Square

Mark Standeven, Robert Cohen and Bill Bordass report on how 1 Aldermanbury Square, the second building in our post-occupancy review series, has performed since completion.

To understand the building's detailed design readers must refer to the original article "Melting away the costs", which appeared in the April 1990 issue of *Building Services*.

The second PROBE investigation has focused on the true performance of c
storage systems. This example, 1 Aldermanbury Square, was the first speci
building in the UK to feature the installation of an ice storage system[1].

1 Aldermanbury Square is a nine storey office building of 6 100 m^2 net letta
(8000 m^2 gross, 7000 m^2 treated). The floor plan is roughly rectangular at 4
m, and partly joined to a newer, neighbouring building on the south side whi
overshadows all windows on that elevation.
The building was commissioned by the developers, and after a period of no
it was let to Standard Chartered Bank (SCB) in 1990 as headquarters accor
under a full repairing lease. The Bank commissioned an initial fit-out (not by

probe 4

Queens Building

Roland Asbridge and Robert Cohen report on how de Montfort University's Queens Building has performed since its completion. To understand the building's detailed design readers should refer to the original building analysis 'Learning curve' which appeared in the October 1993 issue of *Building Services Journal*.

The fourth article in the PROBE series revisits the Queens Building the award winning School of Engineering and Manufacture completed in 1993 for de Montfort University in Leicester. Today the building represents a benchmark in natural ventilation, daylighting and passive solar design.
The original brief called for an innovative solution to reflect the creative nature of the new university. Designed by architect Short Ford Associates with Max Fordham Associates as the services consultant, the Queens Building provides academic facilities for 1500 full-time students. Predominantly naturally ventilated, the whole building is characterised by the exposure of its thermally-massive structure with fair-faced brick and blockwork walls, and exposed soffits to the concrete floor slabs.

The 10 000 m^2 structure comprises the central building, the mechanical laboratories and the electrical laboratories. A full-height concourse in the central building acts as a light well and thermal buffer zone for adjoining spaces.
The mechanical laboratories are flanked on the western facade by a two-storey block of mechanically-ventilated specialist laboratories. The electrical laboratories are housed in two shallow plan, four-storey wings, either side of a narrow courtyard which forms the

ENERGY AND ENGINEERING PROBE TECHNICAL REVIEW

PROBE 9

benchmarks for better buildings

Eight buildings were studied under the PROBE research project – four offices and four non-commercial buildings. In the penultimate article in this PROBE series, we focus on the engineering and energy issues of all the study buildings to draw some conclusions on building performance. How well do lighting controls work? Are energy efficiency targets being met, and how important is the quality of construction to delivering good comfort conditions?

BY BILL BORDASS, ROBERT COHEN AND MARK STANDEVEN

THE NON-OFFICE BUILDINGS

Three of the non-commercial buildings in the PROBE survey can loosely be defined as educational buildings, although they differ markedly in many respects[1,2,3]. The fourth building is a small medical centre[4].

The award-winning School of Engineering and Manufacture at De Montfort University in Leicester was completed in 1993. Named the Queens Building, the thermally massive building is mostly naturally ventilated.

The Cable & Wireless (C&W) Training College was completed in 1993 on the outskirts of Coventry, and won a Building of the Year Award in 1994. Three separate low-rise buildings provide high-quality teaching and residential accommodation for long and short-term courses in technology, management, sales and account management.

Woodhouse Medical Centre was built in 1989 by the 'green' architects Brenda and Robert Vale. It is occupied by two general practices and one dentist. Anglia Polytechnic University's Learning Resource Centre (also called the Queens Building, but hereafter referred to as APU) is a low energy, naturally ventilated building.

Hours of occupancy vary markedly for each building, although they all have longer hours of occupancy than most office buildings. C&W, for example, operates an intensive eight-hour day, while the dentist at Woodhouse Medical Centre provides evening surgeries.

Services performance: heating

All the buildings are heated by gas-fired boilers, although De Montfort has a sequence of combined heat and power, a condensing boiler and a high efficiency boiler. C&W has high efficiency boilers, while APU and Woodhouse both have condensing boilers.

The comparatively low installed boiler power for APU and Woodhouse (66 W/m^2 and 42 W/m^2 respectively) reflects the low heat losses from two very well insulated buildings. However, APU has experienced underheating in the north zone owing to insufficiently sized perimeter heating which was not resized following a cost-saving change from triple to double-glazing in that zone. This was exacerbated by the external temperature sensor being located on a west-facing wall.

The medical centre avoids hws pipework by using point-of-use electric undersink storage heaters. Standing losses from these units are high, accounting for perhaps half the building's 50 kWh/m^2/y electricity consumption.

Services performance: ventilation

All four buildings have a range of ventilation control strategies, from Woodhouse Medical Centre's very simple manual window opening to the mixture of manual and automatic systems at De Montfort and APU.

At APU, the atrium vents and window toplights in open-plan areas open automatically according to zone CO_2 and temperature sensors. There is no manual override, which has proven to be an occasional irritation owing to cold draughts on very sunny but cold winter days, outside noise and traffic fumes.

There is a self-learning night cooling algorithm, but this has suffered a few commissioning difficulties and at the time of the survey had not operated as intended.

The medical centre has a mechanical ventilation and heat recovery system (mvhr), intended to reduce heat loss during the heating season. The system has no time control and relies on manual switching. Its fan energy would be significantly reduced if it were switched off outside occupancy.

The mvhr system cannot be used for overnight cooling in summer because the heat recovery element cannot be bypassed. In practice, the system was not understood and has been out of use for several years. Indeed, one doctor's practice has installed split dx room air conditioners.

The medical centre's trickle vents have been varnished over. Ventilation now relies almost totally on manual window opening, as the roof Velux windows are not accessible.

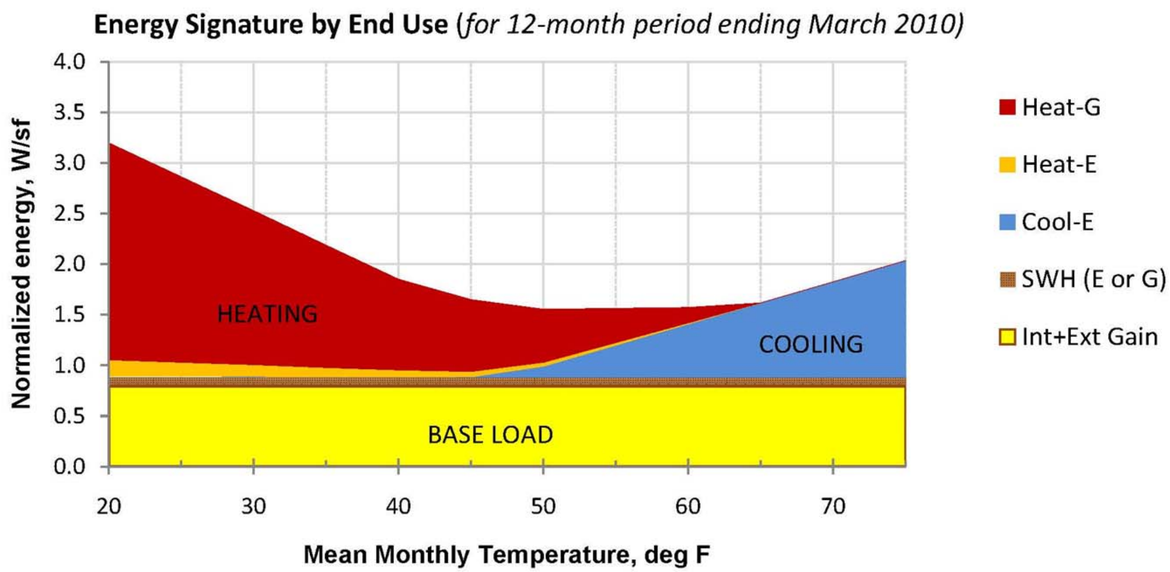
BUILDING SERVICES JOURNAL APRIL 1997 E21

BPP – Energy, Water, IEQ data collection

- BPP views data as a continuum
- Phase I – whole building energy and water
- Phase II
  - Submetered energy and water
  - IEQ
- Phase III – "real time" energy, water IEQ

BPP – Phase I Reports

Energy Signature analysis performed by: New Buildings Institute, Vancouver, WA

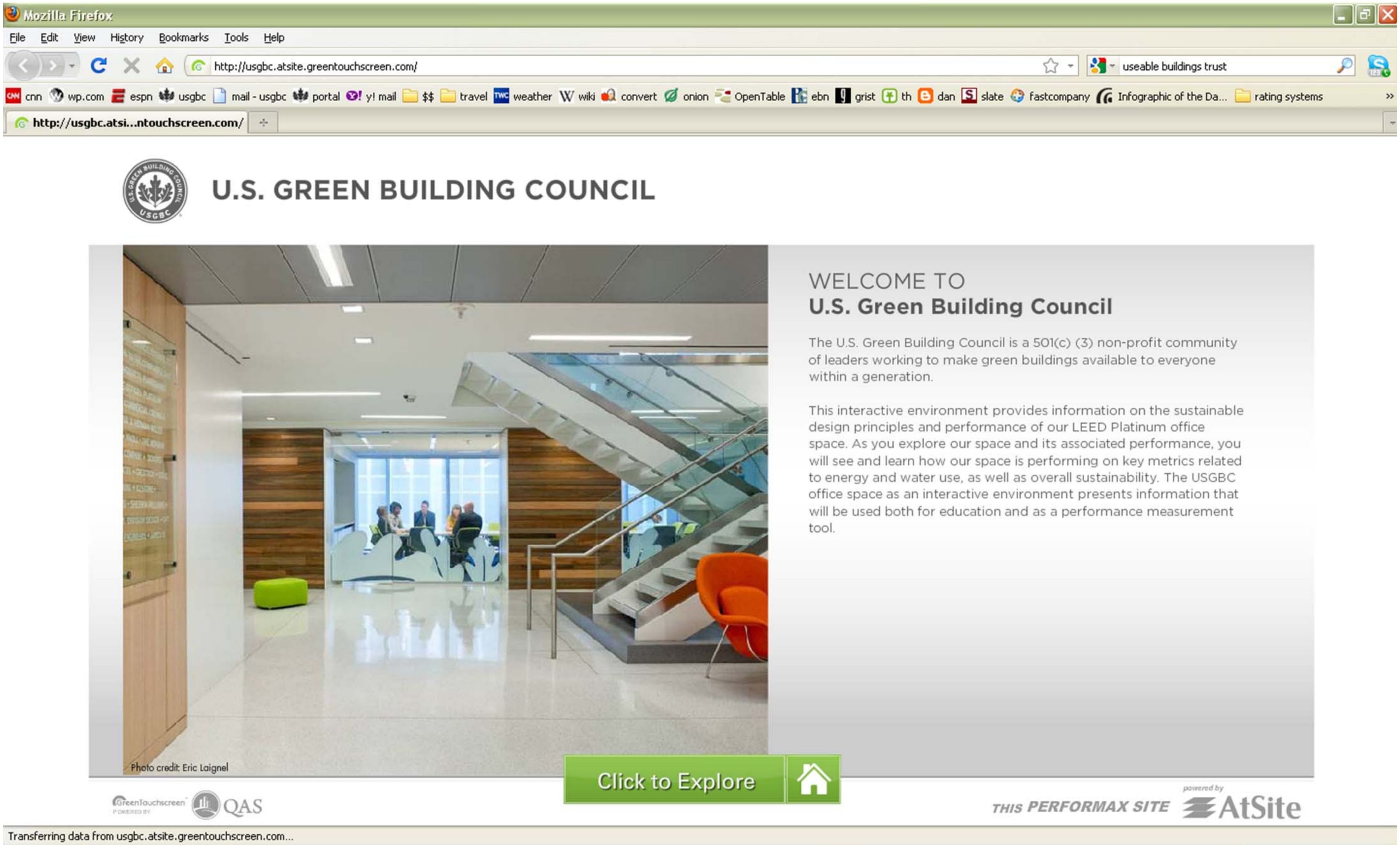


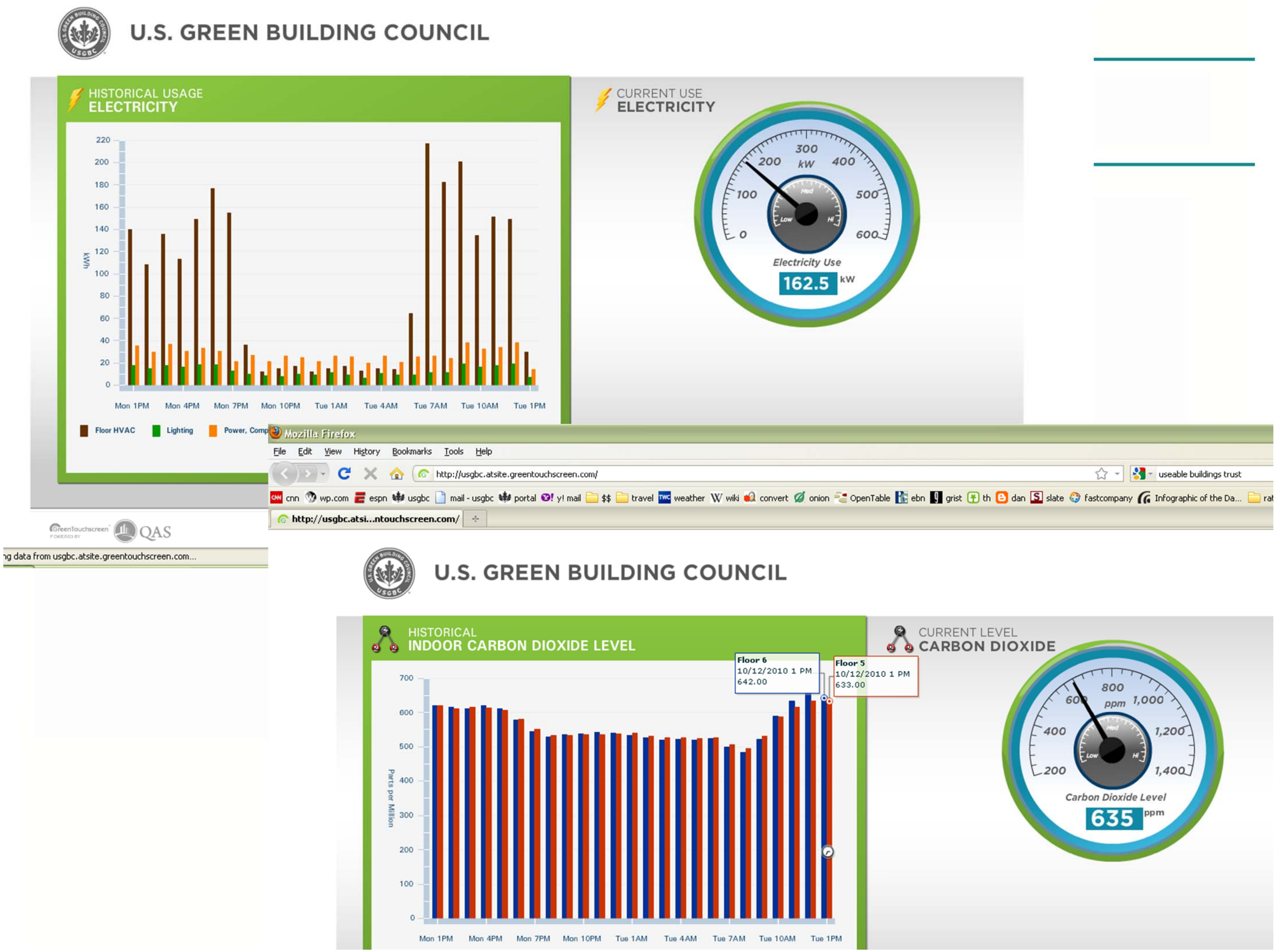
Energy Signature Results

The Energy Signature analysis shows good overall performance

Low cooling efficiency. [This building has demonstration-level ice-storage, which could be a factor here. Some implementations may be effective at shifting peak demand even though not reducing total energy use.] (227)

USGBC Performance Dashboard




U.S. GREEN BUILDING COUNCIL
HISTORICAL USAGE
ELECTRICITY
kWh
220
200
180
160
140
120
100
80
60
40
20
0
Mon 1PM
Mon 4PM
Mon 7PM
Mon 10PM
Tue 1AM
Tue 4AM
Tue 7AM
Tue 10AM
Tue 1PM
Floor HVAC
Lighting
Power, Comp
CURRENT USE
ELECTRICITY
0
100
200
300
kW
400
500
600
Low
Med
Hi
Electricity Use
162.5
kW
QAS
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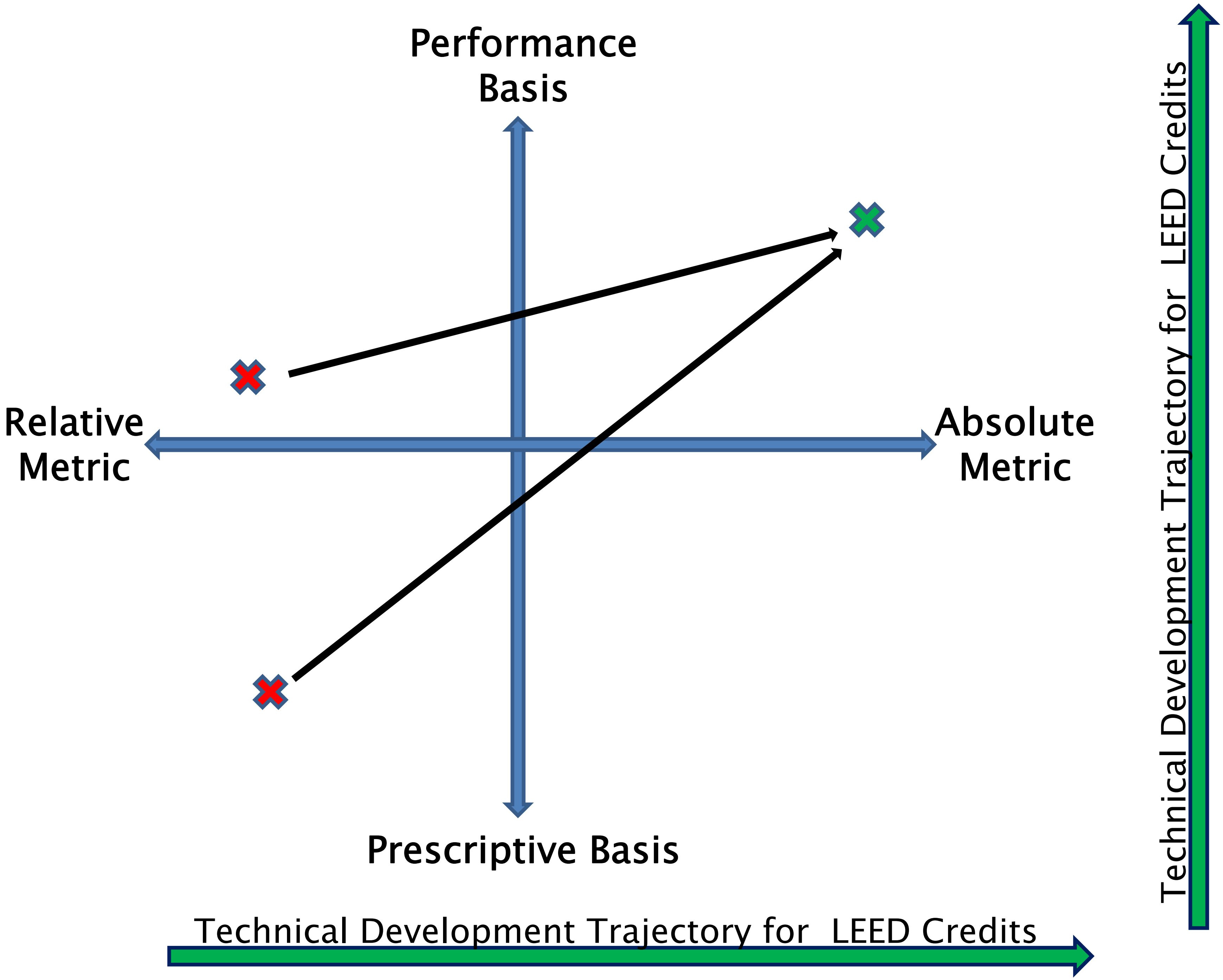
U.S. GREEN BUILDING COUNCIL
HISTORICAL
INDOOR CARBON DIOXIDE LEVEL
Parts per Million
700
600
500
400
300
200
100
0
Floor 6
10/12/2010 1 PM
642.00
Floor 5
10/12/2010 1 PM
633.00
Mon 1PM
Mon 4PM
Mon 7PM
Mon 10PM
Tue 1AM
Tue 4AM
Tue 7AM
Tue 10AM
Tue 1PM
CURRENT LEVEL
CARBON DIOXIDE
200
400
600
800
ppm
1,000
1,200
1,400
Low
Med
Hi
Carbon Dioxide Level
635
ppm

BPP – Feedback Loops

- Inform LEED rating system development
- Reinforce value proposition for green buildings
- Educate buildings inhabitants
- Demand/Grid Response
- *Improve building performance* (it's what this whole LEED thing was about from the start)


Performance
Basis
Relative
Metric
Absolute
Metric
Prescriptive Basis
Technical Development Trajectory for LEED Credits
Technical Development Trajectory for LEED Credits

Pilot Credit: Demand Response

- **Intent**:
  - To reduce regional carbon emissions and improve and enhance the optimization of electric generation, transmission and distribution resources.
- Requirements: Option 1.
  - Demand Response Program – Incorporate the capability to participate in a demand response program by a local utility, Independent System Operator, Curtailment Service Provider, or other recognized entity that provides, manages or services a demand response program into the design of the project.
  - Demonstrate that the design measures implemented qualify the project for participation in an active Demand Response program.

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