Clark County School District
Case History

Moving Through the Gx Learning Curve

Salt Lake City, Utah
April 30, 2009
Eric Heinicke, PE, CEM
Mech. Engineering Manager
Clark County School District
Las Vegas, Nevada
eaheinicke@interact.ccsd.net
My summer vacation

- A slide show of our family trip to Utah
CCSD’s First Gx Project

Northwest Career & Technical Academy
NW CTA
Implementing a New Technology Planning & Development Process

- Award Winning Architectural Design Planning Process
- Leed Silver
- Gx Consultant
- District Planning & Design Review
- District PM & Inspection
- District hired 3rd Party TAB & Cx
- 80/20 Hybrid System
- Energy Usage Goal
Then what happened???

• Time to call AAA
Energy Usage Goal

• 39 kBtu/sf/Yr
• Combined Power & Gas
• Electrical Usage Only

<table>
<thead>
<tr>
<th>Month</th>
<th>kBtu/sf</th>
<th>kBtu/sf/Yr</th>
</tr>
</thead>
<tbody>
<tr>
<td>Jul-07</td>
<td>7.85</td>
<td>47.11</td>
</tr>
<tr>
<td>Aug-07</td>
<td>6.64</td>
<td>57.97</td>
</tr>
<tr>
<td>Sep-07</td>
<td>4.28</td>
<td>51.35</td>
</tr>
<tr>
<td>Oct-07</td>
<td>3.95</td>
<td>49.40</td>
</tr>
<tr>
<td>Nov-07</td>
<td>3.93</td>
<td>48.63</td>
</tr>
<tr>
<td>Dec-07</td>
<td>3.36</td>
<td>46.54</td>
</tr>
</tbody>
</table>
Gx in Las Vegas
How did CCSD get here?

- Over 340 facilities using $60M expenditure for energy - all fossil fuels
- Growing interest in sustainable/green design
- LEED Certification Points
# The Learning Curve for the Gx Application Process

<table>
<thead>
<tr>
<th>What it’s not</th>
<th>What it is</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Not just a Pre-construction Planning Process</td>
<td>• An Ongoing Process – through the life of the building</td>
</tr>
<tr>
<td>• Not an “apply it &amp; forget it” technology</td>
<td>• Never stop learning &amp; improving</td>
</tr>
<tr>
<td>• Not conventional or common</td>
<td>• Show &amp; Tell</td>
</tr>
</tbody>
</table>
NW CTA

- ~217,000 sqft
- 650 tons cooling
- 420 Wells x 400 ft Depth
- 80% - 20% Hybrid Gx System
TYPICAL HYBRID SYSTEM

Fluid Circulation Pump - 1

Diverter-1

T-pie e-1

Ground Loop Heat Exchangers

To/From Conditioned Space

Heat Pump

Cooling Tower

Plate Heat Exchanger

Fluid Circulation Pump - 2
Other CCSD Gx Projects

- NW CTA
- Burkholder MS Replacement
- East CTA
- Vegas PBS – Ch 10
- SW CTA
- Central CTA
- West CTA
- Total – over 1.3 Million sf
<table>
<thead>
<tr>
<th></th>
<th>Design Base</th>
<th>Bundle 1</th>
<th>Bundle 2</th>
<th>Bundle 3</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Envelope</strong></td>
<td></td>
<td>Code level roof insulation</td>
<td>Code level roof insulation</td>
<td>Code level roof insulation</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Aggressive roof insulation</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Daylighting</strong></td>
<td></td>
<td>Solatube Skylights</td>
<td>Solatube Skylights</td>
<td>Solatube Skylights</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Dimming daylighting controls</td>
<td>Dimming daylighting controls</td>
<td>Dimming daylighting controls</td>
</tr>
<tr>
<td><strong>Lighting Controls</strong></td>
<td></td>
<td>Occupancy sensors</td>
<td>Occupancy sensors</td>
<td>Occupancy sensors</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Dual level control</td>
<td>Dual level control</td>
<td>Dual level control</td>
</tr>
<tr>
<td><strong>Lighting Design</strong></td>
<td></td>
<td>Direct system at 50 fc minimum</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Direct system at 50 fc min w/ super T8 lamps</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>HVAC System</strong></td>
<td>2-Deck Multizone</td>
<td>Packaged rooftop units</td>
<td></td>
<td>Ground Source Heat Pump</td>
</tr>
<tr>
<td><strong>HVAC Controls &amp; other strategies</strong></td>
<td></td>
<td>Outside Air Controls</td>
<td>Outside Air Controls</td>
<td>Outside Air Controls</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Efficient DHW</td>
<td>Efficient DHW</td>
<td>DHW with heat pump</td>
</tr>
</tbody>
</table>

The Planning...
The Planning Results....
Best Lit School at Night

The Reality....
Automotive Shop
Egress lighting
Security Camera Monitor
It’s Midnight….16 nicely lit spaces
Planning Lessons Learned:

Need to get your engineering community to overcome the doubt:

- Study the technology.
- Study Gx applications in your area or similar climates.
- Retain a qualified Gx consultant.

Present your findings to your peers:

- Evaluate your upcoming projects to select a prime candidate for Gx.
- Conduct TC testing – evaluate drilling conditions at various sites.
Design Lessons Learned:

Pre-plan to avoid common pitfalls
- GX Consultant – KLVX, clustering Hp’s – small mech pods vs. overhead heat pumps
- Peer review of design from an Architectural, Mechanical & Gx standpoint

Plan for Maintenance -
- Filter access; RA filter grills
- HP Access; Suspended Ceiling Access door, avoid interferences from plumbing and conduit
- HP location
- Consider HP Pods – small mechanical rooms

Address OA & Energy Recovery
Contracting Lessons Learned:

Cost reduction measures
  Break-out bore field contracts from General Contracting

Need to pursue Gx drilling Contractors – consider issuing an RFQ

Package multiple loop field projects into a single contract

Fast track your project by starting loop field & civil work prior to design completion
Construction Lessons Learned:

This may be new to some folks – Education is the key:

- GC – education Coordination – loop damage/heavy equip.
- Inspector Education
- Mechanical & Control contractors, Comx Agents
- Craft coordination-interferences, bore field protection
Operating Lessons Learned:

Optimization

Look at it – Troubleshoot it & make adjustments

Find Piping errors, control system errors, etc.
Controls – SOC – Is the SOC correct? Is it programmed as designed?

Cooling Tower operation

Crossover piping location

Training for O&M personnel

Feedback to owner, designer, maintenance –
Conduct Pow Wows –
within organization,
between organization,
contractor debriefing,
tours
M&V Lessons Learned:

Perform a detailed M&V program

Retain GX or Energy consultant,
Continue to work with you’re A/E’s & contractors as applicable

Study operational sequence variables

Conduct data evaluations and make your system better,
Trend your variables and plot them against related variables
Give yourself enough data storage that you can see long term trends

Finally:

Optimize the system for additional energy savings.
Use the data to improve future project designs.
Find Partners

• NV Energy SureBet Program
• Consultants, Design Community
• In-house personnel
• Contractors
• Outside funding sources
• Information resources
LV Valley Ground Temps & Water Depths
Educate and Partner with Contractors
Some closing clichés

Things are not always as they may first appear
Gotta have a sense of humor
Roll with the punches

A New Partner to help us find the watermelons
Until Next Year

Driving into the Sunset