WHY ENERGY EFFICIENT DESIGN?

1. PERSONNEL

2. COST OF ENERGY

HIGHEST OPERATING COSTS

SPEAKERS

WHY ENERGY EFFICIENT DESIGN?

1. PERSONNEL

2. COST OF ENERGY

HIGHEST OPERATING COSTS
WHY ENERGY EFFICIENT DESIGN?

COST SAVINGS

Operational Costs

CODE COMPLIANCE

ASHRAE 90.1

International Building Code

International Energy Conservation Code

VOLUNTARY CERTIFICATIONS

LEED

TX-CHPS

HOW?

Effective use of bond dollars in new construction and renovation provides for greatest impact on energy savings over the life of the project.

ENERGY REDUCTION STRATEGIES
WHICH SYSTEM IS BEST?

- Energy Modeling
- Close Collaboration
- Efficient Building Envelopes
- Low Maintenance Materials and Systems

ADDITIONAL STRATEGIES

- Building Orientation
- Mechanical Systems

STRATEGIES

- Site Selection
- Building Orientation
- Efficient Systems

EASY TO MAINTAIN
ENERGY EFFICIENT
FITS SITE RESTRAINTS
MEETS BUDGET LIMITATIONS
US GROUND TEMPERATURES

30-40% ENERGY COST SAVINGS

GEOTHERMAL HVAC SYSTEMS

US GROUND TEMPERATURES
Typical Maintenance Costs

<table>
<thead>
<tr>
<th>Equipment Type</th>
<th>2017 Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>WSHP Compressor</td>
<td>$10,000</td>
</tr>
<tr>
<td>Chiller Compressor</td>
<td>$850</td>
</tr>
<tr>
<td>Water Treatment</td>
<td></td>
</tr>
<tr>
<td>Geothermal Loop</td>
<td>$0.00</td>
</tr>
<tr>
<td>Central Plant</td>
<td>$6,500</td>
</tr>
<tr>
<td>Water Pump</td>
<td></td>
</tr>
<tr>
<td>Geothermal</td>
<td>$560</td>
</tr>
<tr>
<td>Central Plant</td>
<td>$4,000 to 6,000</td>
</tr>
</tbody>
</table>

**GEOTHERMAL HVAC BENEFITS**

**SYSTEMS OPERATION CONTROL**

Operations are controlled and monitored at a district wide level in a central location. Scheduling overrides and monitoring can be done on individual rooms.

**Building Utility Type 2016 2017**

**Borchardt Elementary**

<table>
<thead>
<tr>
<th>Utility Type</th>
<th>2016 Cost</th>
<th>2017 Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>Electric (KWH)</td>
<td>329,360 KWH</td>
<td>251,760 KWH</td>
</tr>
<tr>
<td>Natural Gas (CCF)</td>
<td>740 CCF</td>
<td>420 CCF</td>
</tr>
</tbody>
</table>

**Borchardt Elementary Subtotal**

|$34,101.88$ | $22,022.26$

**Bright Elementary**

<table>
<thead>
<tr>
<th>Utility Type</th>
<th>2016 Cost</th>
<th>2017 Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>Electric (KWH)</td>
<td>312,000 KWH</td>
<td>226,400 KWH</td>
</tr>
<tr>
<td>Natural Gas (CCF)</td>
<td>517 CCF</td>
<td>460 CCF</td>
</tr>
</tbody>
</table>

**Bright Elementary Subtotal**

|$33,158.12$ | $24,214.34$

**Fisher Elementary**

<table>
<thead>
<tr>
<th>Utility Type</th>
<th>2016 Cost</th>
<th>2017 Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>Electric (KWH)</td>
<td>272,480 KWH</td>
<td>245,680 KWH</td>
</tr>
<tr>
<td>Natural Gas (CCF)</td>
<td>372 CCF</td>
<td>318 CCF</td>
</tr>
</tbody>
</table>

**Fisher Elementary Subtotal**

|$26,265.38$ | $20,349.38$

**$26,839 Savings in four months (July, August, September and October)**

In the summer of 2016 three elementary schools were converted from a central plant to geothermal systems.
CAREFUL CONSIDERATION OF A COMBINATION OF ARTIFICIAL AND NATURAL LIGHTING

SEEING THE LIGHT

- **ARTIFICIAL LIGHTING**
  - CLASSROOM: 0.963 W/SF
  - TYPICAL LED LIGHT: 0.513 W/SF

- **NATURAL LIGHTING**
  - WITH SQUARE FOOT: 0.14 W/SF

25% ARTIFICIAL LIGHTING

**TOTAL LIGHTING:** 0.513 W/SF
After lighting, mechanical systems account for the most energy usage of buildings.

High-quality indoor air quality has a great effect on student performance and attendance.

BUILDING ENVELOPE

- Insulated Concrete Forms
- Energy Star Rated Roof
- Insulated Concrete Forms
- Building Envelope

FEEL THE COMFORT

- High-quality indoor air quality
- System to enhance student performance
- New lighting mechanisms
Net Zero

CUMULATIVE CASH FLOW COMPARISON

1 Kwh = 3,410 Btu's

1 Thermal = 100,000 Btu's

BUI = TOTAL BTU/BLDG SQ FT

BUI = TOTAL BTU/100,000 Btu's

1 Thermal = 2.4 to 3 Btu/kwh

1 Kwh = 2.4 to 3 Thermal

BUILDING UTILIZATION INDEX (BUI)

YEAR

CUMULATIVE CASH FLOW COMPARISON

NET ZERO PROJECTIONS IISD AVERAGE TEXAS AVERAGE

NET ZERO

BUILDING UTILIZATION INDEX (BUI)
• U.S. GREEN BUILDING COUNCIL

Buildings in the U.S. account for:

- Electrical Consumption: 72% of energy use
- Carbon Dioxide Emissions: 39%
- Waste Output: 25%
- Raw Materials Used: 15%
- Potable Water Consumption: 9%
• District standards in collaboration with staff
• Energy management plan
• Clear goals and baseline analysis to assess savings
• Community and student involvement for representation energy data
• Systematic energy audits for control of energy costs
• Paying attention of the energy bill

IT TAKES A VILLAGE
COLLABORATION

Education is key to empowering maintenance staff. Understand that after all engineers and contractors are gone, they are the ones that have to take care of the building.

- Jerry Palermo, Energy Manager, Grand Prairie ISD

CASE STUDIES
FRISCO ISD
DISTRICT OVERVIEW
50 BUILDINGS
$840,000 COST
$340,000 REBATES BY ELECTRIC PROVIDERS
$147,514 PROJECTED SAVINGS PER YEAR WITH 3 YEAR PAYBACK
$450,000 ACTUAL SAVINGS IN FIRST YEAR

VS.
MAINTENANCE IS KEY

Assessment of needs during Bond projects

Accurate and accessible as-built documents, product manuals and warranties for troubleshooting and maintenance schedules.

Grants and incentives: SECO grant, energy rebates

42 YEARS AVERAGE SCHOOL AGE

LADY BIRD JOHNSON MIDDLE SCHOOL LADY BIRD JOHNSON MIDDLE SCHOOL

SCHOOL WEB ACCESS

- Teacher's Desk
- Electronic Record
- Class Announcement
- Student Access
- Student Grade Report
- Program Status
- Program Privacy
COMMUNICATION ABOUT BUILDING USE

DIFFICULT CONVERSATIONS

You cannot discuss how the building will be efficiently designed without talking about how the building will be efficiently used.

Energy efficient design can have a truly positive effect on our schools. In these times of increased financial scarcity and scrutiny, thoughtful approaches to energy savings can help direct resources back to personnel and students creating a meaningful impact on students, schools, districts and communities.

NOW THE FUN BEGINS...

GROUP ACTIVITY

GROUND RULES

• Small groups
• Chime in
• Solutions should be within budget
• Be ready to present!
• Choose your scenario & budget
• Select appropriate strategies from the provided list
• Briefly explain your choices

INCREASED WALL PERFORMANCE
SOLAR SHADING
SOLAR ENERGY
WIND ENERGY
GEOTHERMAL
NATIVE PLANTING AND DRIP IRRIGATION
DAYLIGHTING
COOL ROOF
COMMUNITY CONNECTION
HIGH EFFICIENCY LIGHTING
NO-WAX FLOOR
HIGH-RECYCLE CONTENT
WATER COLLECTION FOR IRRIGATION
BUILDING AUTOMATION AND MONITORING SYSTEM
WATER CONSERVATION

COMMUNICATION ABOUT BUILDING USE

Evaluating design criteria and communicating evaluated ideas to clients or web developers requires a meaningful platform. When designing ideas for the building's facade, you must incorporate the principles of efficiency and sustainability, ensuring a harmonious blend of aesthetics and function. This phase of design involves coordinating with architects, engineers, and other stakeholders, ensuring every aspect of the project aligns with the project's vision.

DIFFICULT CONVERSATIONS

Talking about how the building will be efficiently designed will be difficult. Why should I design the building to be efficient? How do I convince my stakeholders to support efficiency over other design principles? The key is to communicate the value of efficiency, highlighting cost savings, environmental benefits, and the long-term impact on the building's performance. By focusing on these aspects, you can effectively advocate for efficiency in your project.
SCENARIO 1
• Elementary school open 9 months/8 hours a day, sub-urban setting, replacement school, courtyard plan

SCENARIO 2
• Middle school open throughout the year, urban setting, limited site area, extensive after hour use by the community, adjacent to a flood plain

SCENARIO 3
• High school campus in a rural setting, used throughout the year by the district and community, extensive topographic variations, adjacent to farm land

SCENARIO 4
• STEM academy in an existing elementary campus in a suburban setting, building will be a teaching tool and renovations to be scheduled over the summer break.

Budgets:
$5,000 - $10,000

THANK YOU!