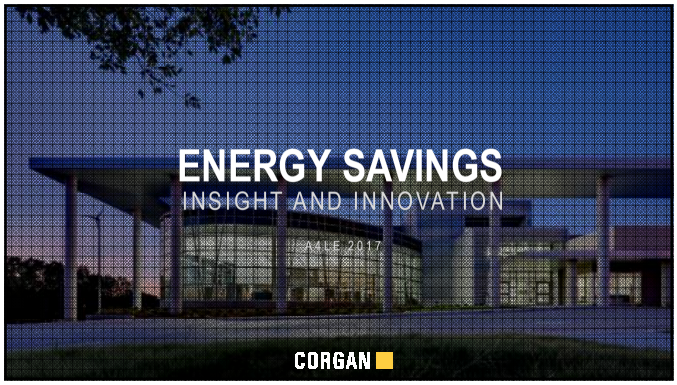


SANGEETHA KARTHIK
VICE PRESIDENT
CORGAN

RICHARD WILKINSON
EDUCATION SUPPORT SPECIALIST
CORGAN

BRANDON BOYTER
EXECUTIVE DIRECTOR OF FACILITIES
ALLEN ISD

SPEAKERS

WHY ENERGY EFFICIENT DESIGN?

HIGHEST OPERATING COSTS

1. PERSONNEL

2. COST OF ENERGY

WHY ENERGY EFFICIENT DESIGN?

CODE COMPLIANCE
ASHRAE 90.1
International Building Code
International Energy Conservation Code

COST SAVINGS
Operational Costs

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

STRATEGIES

SITE SELECTION

BUILDING ORIENTATION

MECHANICAL SYSTEMS

EFFICIENT BUILDING ENVELOPES

LOW MAINTENANCE MATERIALS AND SYSTEMS

ADDITIONAL STRATEGIES

ENERGY MODELING

CLOSE COLLABORATION

DESIGN & CONSTRUCTION TEAM, OWNER & END USER

WHICH SYSTEM IS BEST?

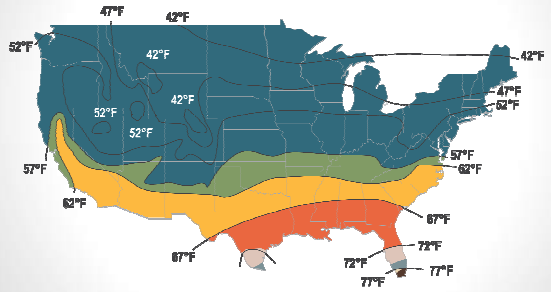
EASY TO MAINTAIN

ENERGY EFFICIENT

FITS SITE RESTRAINTS

MEETS BUDGET LIMITATIONS

US GROUND TEMPERATURES

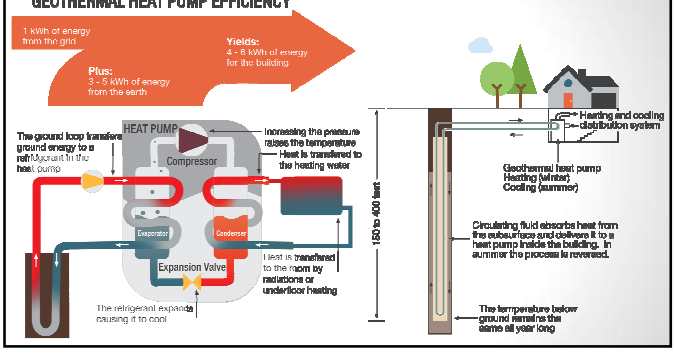


GEOTHERMAL HVAC SYSTEMS

30-40%

ENERGY COST SAVINGS

GEOTHERMAL HEAT PUMP EFFICIENCY



GEOTHERMAL HVAC BENEFITS

Typical Maintenance Costs

Compressors
- WSHP Compressor $850
- Chiller Compressor $10,000

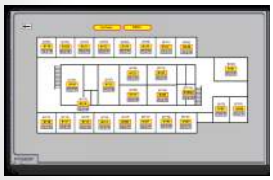
Water Treatment
- Geothermal Loop $0.00
- Central Plant $ 6,500

Water Pump
- Geothermal $560
- Central Plant $4,000 to 6,000

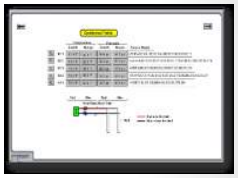
Equipment Lasts Longer- Not on the roof

SYSTEMS OPERATION CONTROL

Scheduling overrides and monitoring can be done on individual rooms.



Operations are controlled and monitored at a district wide level in a central location.



In the summer of 2016 three elementary schools were converted from a central plant to geothermal.

Building	Utility Type		2016		2017
Borchardt Elementary	Electric (KWH)	329,360 KWH	$33,381.22	251,760 KWH	$21,537.59
	Natural Gas (CCF)	740 CCF	$720.66	420 CCF	$484.67
Borchardt Elementary Subtotal			$34,101.88		$22,022.26
Bright Elementary	Electric (KWH)	312,000 KWH	$32,665.46	226,400 KWH	$23,705.60
	Natural Gas (CCF)	517 CCF	$492.66	460 CCF	$508.74
Bright Elementary Subtotal			$33,158.12		$24,214.34
Fisher Elementary	Electric (KWH)	272,480 KWH	$25,846.60	245,680 KWH	$19,962.79
	Natural Gas (CCF)	372 CCF	$418.78	318 CCF	$386.59
Fisher Elementary Subtotal			$26,265.38		$20,349.38

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


GEOTHERMAL HVAC


GEOTHERMAL HVAC
3.25"


GEOTHERMAL HVAC

25% ARTIFICIAL LIGHTING CONSUMPTION OF SCHOOL'S TOTAL ENERGY

AUTOMATIC DAYLIGHT HARVESTING

VACANCY SENSORS

DUAL CONTROLS

LED LIGHTING

NATURAL LIGHTING

SEEING THE LIGHT

CAREFUL CONSIDERATION OF A COMBINATION OF ARTIFICIAL AND NATURAL LIGHTING

TYPICAL LED LIGHT CLASSROOM

WITH SQUARE FOOT: 0.513 W/SF

TYPICAL FLUORESCENT CLASSROOM

WITH SQUARE FOOT: 0.963 W/SF

SEEING THE LIGHT

CAREFUL CONSIDERATION OF A COMBINATION OF ARTIFICIAL AND NATURAL LIGHTING

- 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

FEEL THE COMFORT

SPRAY FOAM INSULATION

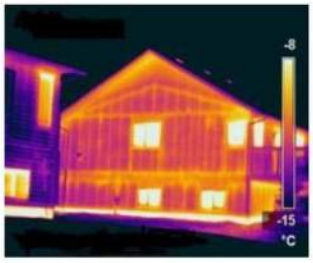
ENERGY STAR RATED ROOF

INSULATED CONCRETE FORMS

BUILDING ENVELOPE

INSULATED CONCRETE FORMS

2 X 6 Framed Wall with R-19 Batt



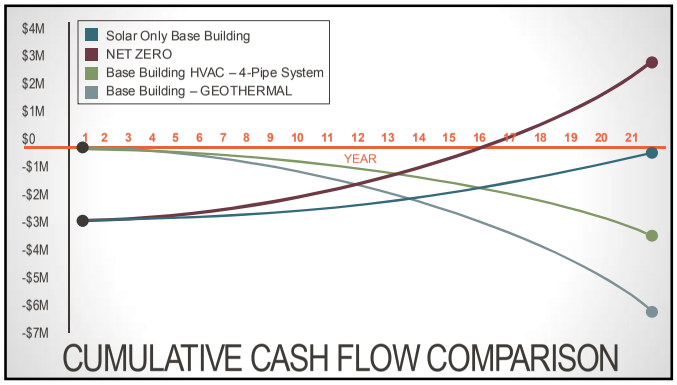
ICF Wall

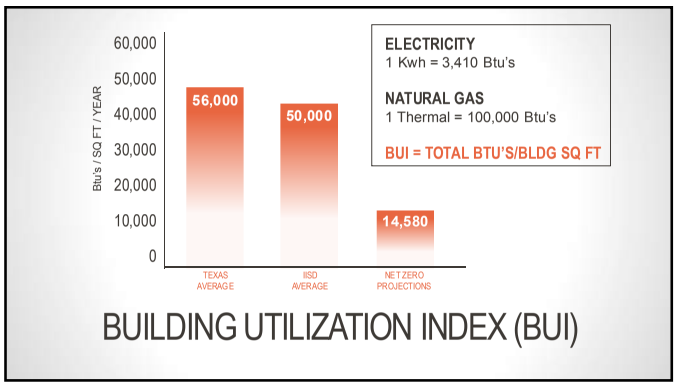

INSULATED CONCRETE FORMS

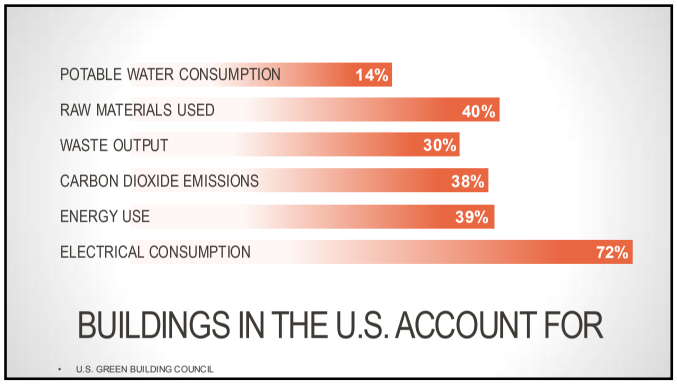

INSULATED CONCRETE FORMS

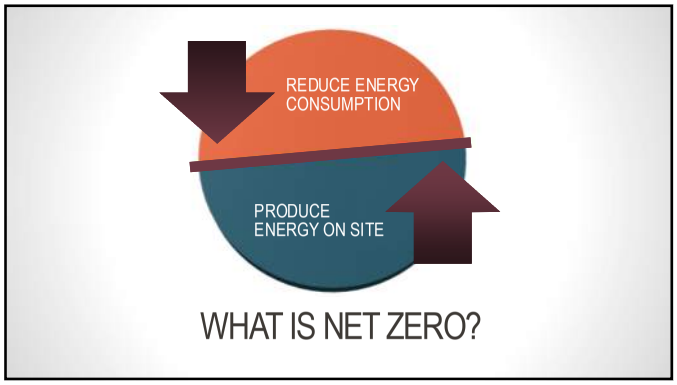

INSULATED CONCRETE FORMS

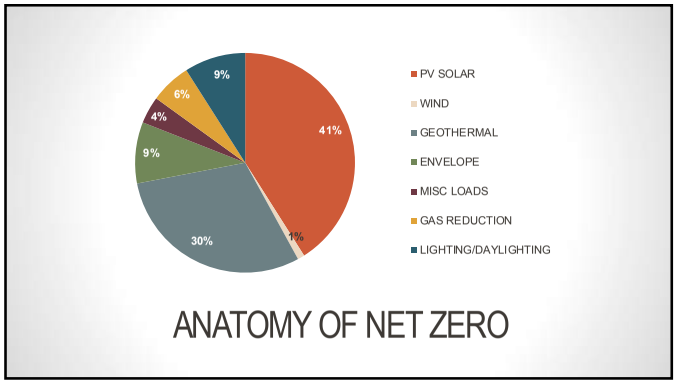

NET ZERO


$4M
$3M
$2M
$1M
$0
-$1M
-$2M
-$3M
-$4M
-$5M
-$6M
-$7M
Solar Only Base Building
NET ZERO
Base Building HVAC – 4-Pipe System
Base Building – GEOTHERMAL
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21
YEAR
CUMULATIVE CASH FLOW COMPARISON


60,000
50,000
40,000
30,000
20,000
10,000
0
Btu's / SQ FT / YEAR
56,000
50,000
14,580
TEXAS AVERAGE
IISD AVERAGE
NETZERO PROJECTIONS
ELECTRICITY
1 Kwh = 3,410 Btu's
NATURAL GAS
1 Thermal = 100,000 Btu's
BUI = TOTAL BTU'S/BLDG SQ FT
BUILDING UTILIZATION INDEX (BUI)


POTABLE WATER CONSUMPTION 14%
RAW MATERIALS USED 40%
WASTE OUTPUT 30%
CARBON DIOXIDE EMISSIONS 38%
ENERGY USE 39%
ELECTRICAL CONSUMPTION 72%
BUILDINGS IN THE U.S. ACCOUNT FOR
U.S. GREEN BUILDING COUNCIL


REDUCE ENERGY CONSUMPTION
PRODUCE ENERGY ON SITE
WHAT IS NET ZERO?


41%
1%
30%
9%
4%
6%
9%
PV SOLAR
WIND
GEOTHERMAL
ENVELOPE
MISC LOADS
GAS REDUCTION
LIGHTING/DAYLIGHTING
ANATOMY OF NET ZERO

- 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

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

IT TAKES A VILLAGE

COLLABORATION

50
BUILDINGS

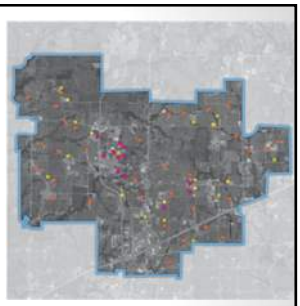
$840,000
COST

$340,000
REBATES BY ELECTRIC PROVIDERS

$147,514 VS. $450,000

PROJECTED SAVINGS PER YEAR WITH 3 YEAR PAYBACK

ACTUAL SAVINGS IN FIRST YEAR



FRISCO ISD

DISTRICT OVERVIEW

2,100 STUDENTS
COMPREHENSIVE HIGH SCHOOL

WALL CONSTRUCTION **ICF**

GEOTHERMAL HEATING & COOLING
LED LIGHTING
CAREFUL BUILDING LAYOUT AND SITING

COMPARED TO DISTRICT'S OTHER HIGH SCHOOL **50%** LESS ENERGY

FRISCO ISD
INDEPENDENCE HIGH SCHOOL

9
ADDITIONAL ICF SCHOOLS SINCE 2014

4
ADDITIONAL ICF SCHOOLS UNDER CONSTRUCTION

NELSON
MIDDLE SCHOOL

PEARSON
MIDDLE SCHOOL

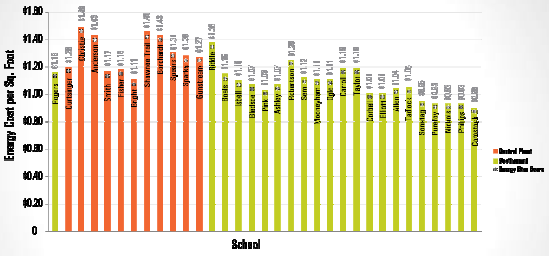
VAUGHN
ELEMENTARY SCHOOL

MILLER
ELEMENTARY SCHOOL

FRISCO ISD
INDEPENDENCE HIGH SCHOOL

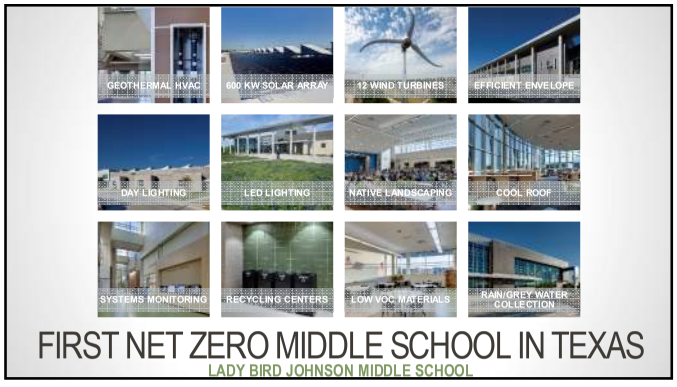
ROBERTSON ELEMENTARY SCHOOL **ROGERS ELEMENTARY SCHOOL**
SONNTAG ELEMENTARY SCHOOL SEM ELEMENTARY SCHOOL
TADLOCK ELEMENTARY SCHOOL TAYLOR ELEMENTARY SCHOOL
RIDDLE ELEMENTARY SCHOOL **BOALS ELEMENTARY SCHOOL**
COBB MIDDLE SCHOOL **FOWLER MIDDLE SCHOOL**
GRIFFIN MIDDLE SCHOOL HUNT MIDDLE SCHOOL
MAUS MIDDLE SCHOOL ROACH MIDDLE SCHOOL
SCOGGINS MIDDLE SCHOOL **STAFFORD MIDDLE SCHOOL**
ALLEN ELEMENTARY SCHOOL **ASHLEY ELEMENTARY SCHOOL**
BLEDSOE ELEMENTARY SCHOOL CORBELL ELEMENTARY SCHOOL
CARROLL ELEMENTARY SCHOOL ELLIOT ELEMENTARY SCHOOL
ISBELL ELEMENTARY SCHOOL **MOONEYHAM ELEMENTARY SCHOOL**
OGLE ELEMENTARY SCHOOL **PINK ELEMENTARY SCHOOL**
PUREFOY ELEMENTARY SCHOOL

GEOTHERMAL SCHOOLS
FRISCO ISD



ENERGY USAGE BY CAMPUS

2012-2013



FIRST NET ZERO MIDDLE SCHOOL IN TEXAS

LADY BIRD JOHNSON MIDDLE SCHOOL

PROJECT BASED LEARNING SCHOOL-WIDE

- Problem Solving
- Rubrics
- Scaffolding Activities
- Project Share – Electronic Portfolios
- Global Awareness Units – **Green Energy**
- Technology Focus
- Interactive Notebook

SCHOOL WEB ACCESS

42 YEARS
AVERAGE SCHOOL AGE

- Assessment of needs during Bond projects
- Grants and incentives: SECO grant, energy rebates
- Accurate and accessible as-built documents, product manuals and warranties for trouble shooting and maintenance schedules.
- Record keeping

MAINTENANCE IS KEY

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.

COMMUNICATION ABOUT BUILDING USE

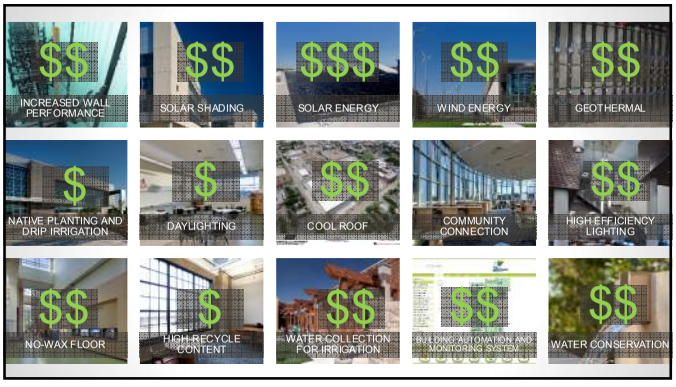
- Choose your scenario & budget
- Select appropriate strategies from the provided list
- Briefly explain your choices

GROUND RULES

- *Small groups*
- *Chime in*
- *Solutions should be within budget*
- *Be ready to present!*

NOW THE FUN BEGINS….

GROUP ACTIVITY



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 sub-urban setting, building will be teaching tool and renovations to be scheduled over the summer break.

Budgets: $$$$$ $$$- $$$$$ $$$$$ $$