



N O R T H C A R O L I N A

A S S O C I A T I O N O F C O U N T Y C O M M I S S I O N E R S

From Net Zero to Energy Positive

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“Learning and innovation go hand in hand. The arrogance of success is to think that what you did yesterday will be sufficient for tomorrow.”

William Pollard



What's wrong with the way we have done buildings in the past?

Construction times are being reduced

- Market Conditions

Quality of construction is suffering

- Labor Shortages for Skilled Workers
- Craftsmanship

Total Cost of Ownership is increasing

- Rising utility costs/operating costs
- Rising construction costs (first cost)

Aesthetics are suffering

- Buildings are getting uglier

Financing tools obsolete

- Bonds discourage LCC analysis
- Bonds limit flexibility

Safety/Security

- Child safety
- Intruders
- Fire/Code

Owners are focused on first cost not operating cost

- Political pressure
- Financing tools (bonds) limit flexibility

Environmental Concerns

- Indoor Air Quality
- Global Warming
- Etc.

Education Delivery is suffering



Case Studies: "A journey not an end product"

1st generation



2nd generation



3rd generation



4th generation



5th generation





 dragonfly™
FIRSTFLOOR

“Dragonfly” Prototype Elementary School

Goals

- To provide a high performance facility with the lowest TCO possible
 - **First cost efficiency**
 - efficient design-reduce unprogrammed space
 - efficient construction delivery
 - **Operating efficiency**
 - reduce energy & water use
 - reduce maintenance cost
 - eliminate electrical cost
 - **High performance educational environment**
 - increase attendance
 - increase test scores
 - increase graduation rates
- To provide facilities faster
 - **Awards**
 - AIA
 - CEFPI
 - LEED® Platinum

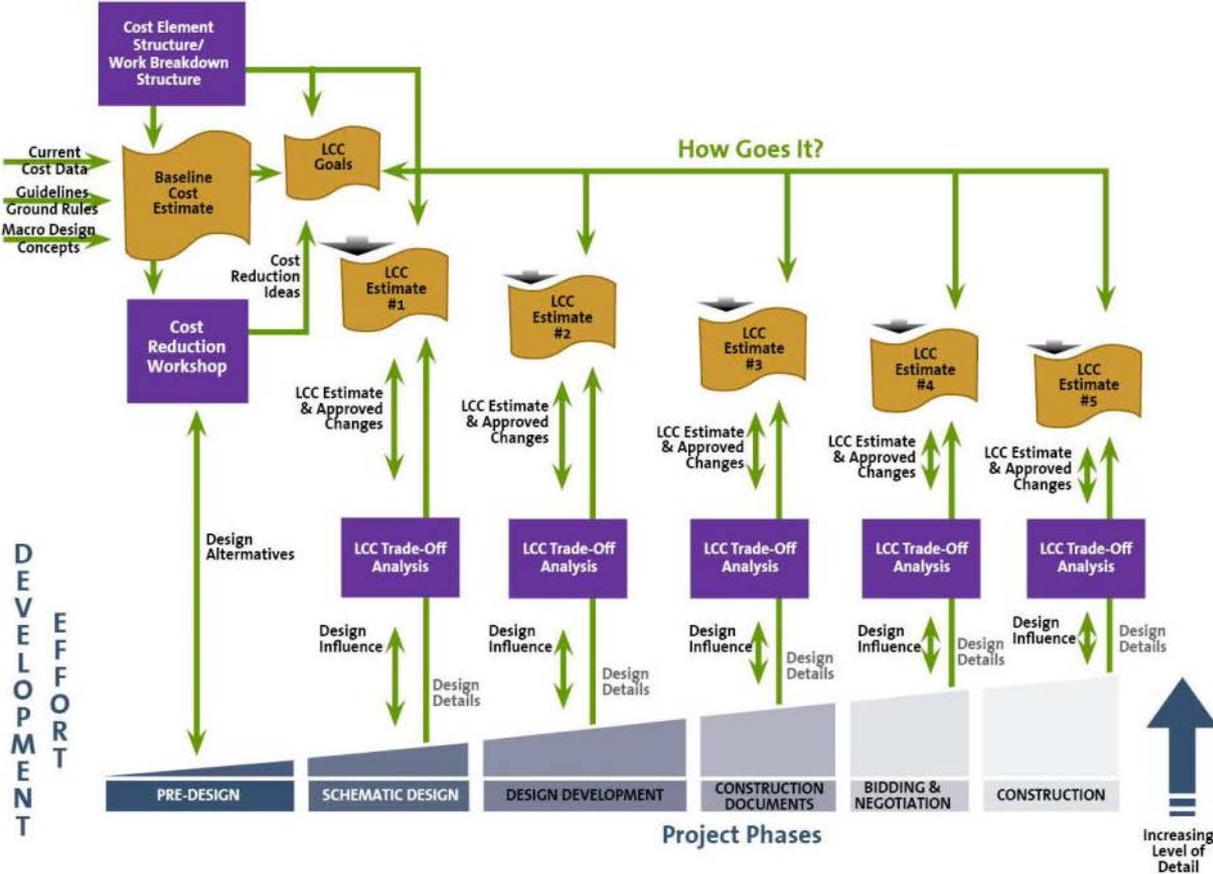




Design Process



Life Cycle Cost Analysis Process



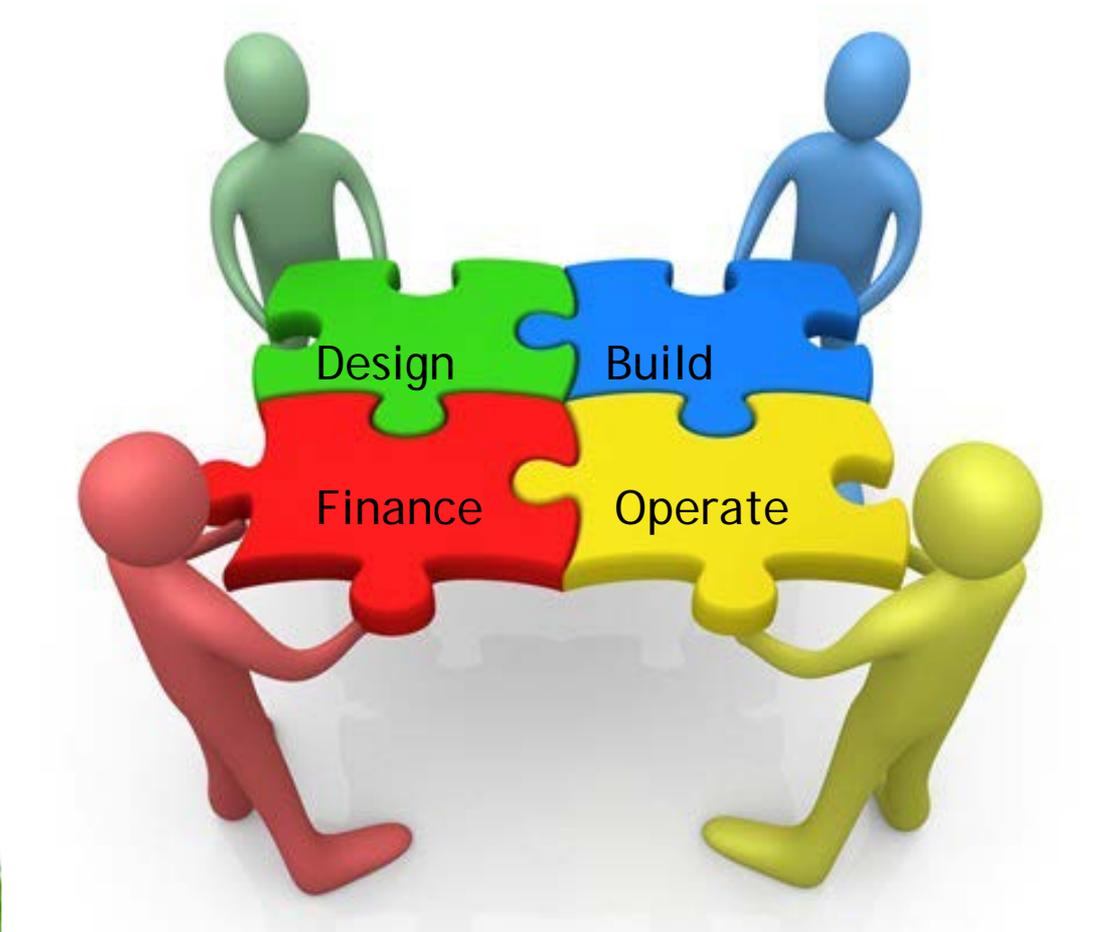
Life Cycle Cost Analysis Process

SYSTEMS EVALUATED

Super Structure	*21 systems evaluated
Roof Systems	20 systems evaluated
Mechanical Systems	7 systems evaluated
Urinals	3 systems evaluated
Lighting (Interior)	4 systems evaluated
Rainwater Storage	3 systems evaluated
Interior Walls	3 systems evaluated
Flooring	27 systems evaluated
Lighting (Site)	2 systems evaluated
Kitchen Equipment	13 pieces of equipment evaluated "all electric"

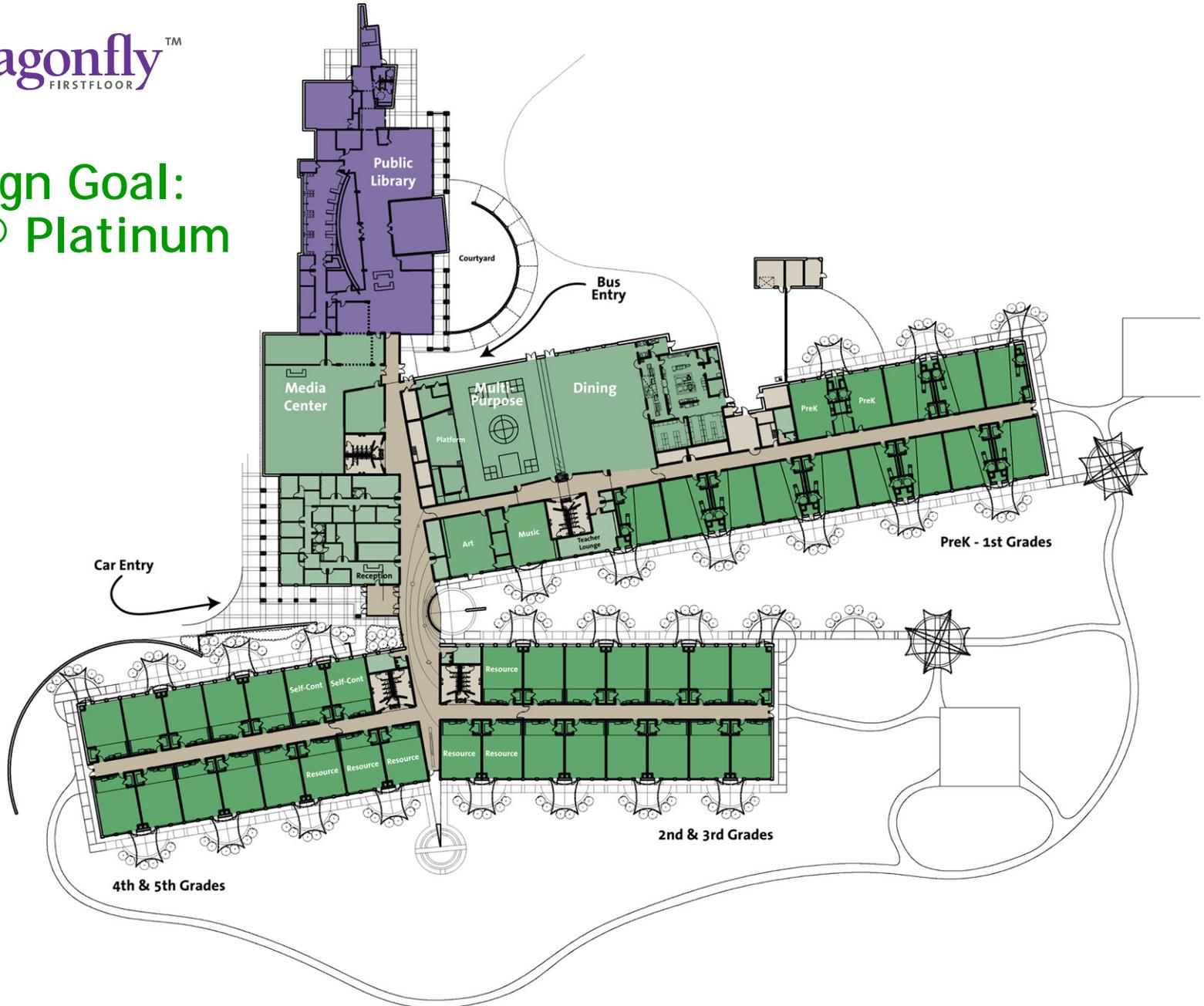


Integrated Design, Build, Finance, Operate Solutions Provide the Greatest Value.





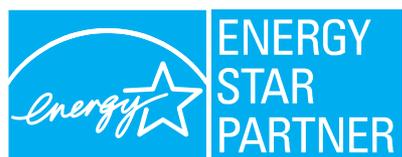
Design Goal: LEED® Platinum





Designed to be a net zero energy building!

EUI: 35.81 (2008)





North Elevation



South Elevation

Sandy Grove Middle School



- Began design in 2007/Project re-started in 2010
- Needed a new school building
- Typical school costs \$1,500,000; They could afford \$450,000/year
- Modified traditional design and started integrated project delivery approach

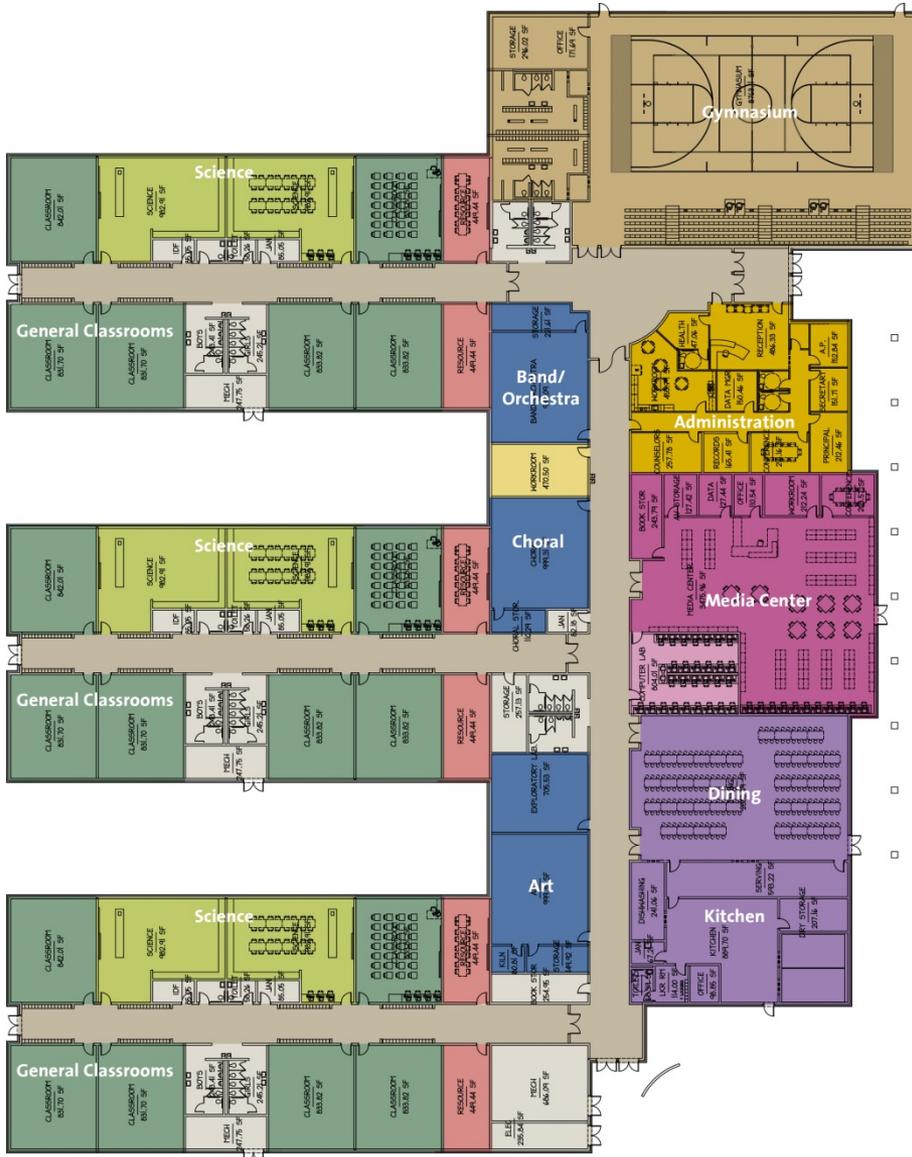
Sandy Grove Middle School



- Energy Positive: Generates 40% more electricity than it consumes
- Designed to LEED Platinum Standards
- Reduce the total cost of ownership by approximately 75%
 - Construction, interest and energy

Sandy Grove Middle School

EUI: 17
EUI: -7
with Solar
Contribution



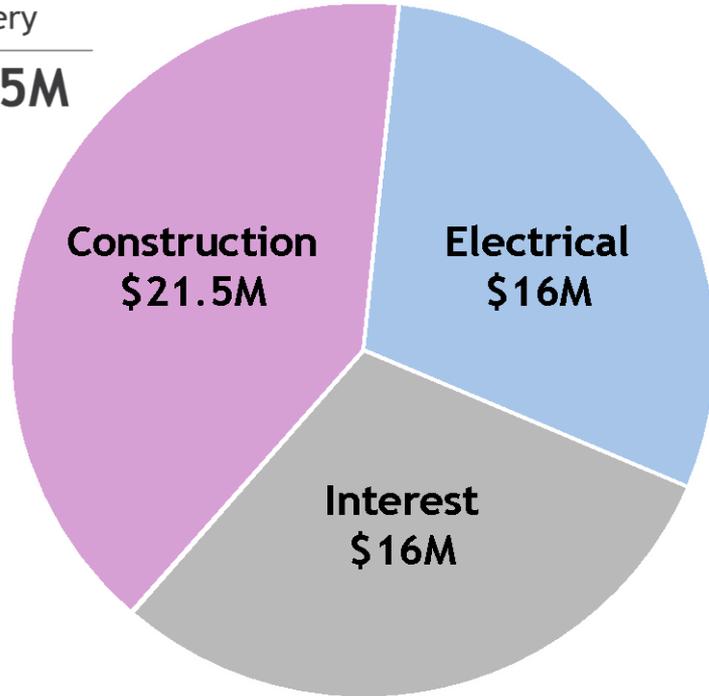
High Performance Systems

- Ground Source Geothermal
- LED Lighting
- Load Bearing Masonry
- Enhanced Building Automation System
- Solar PV (589 kW)
- Indoor Air Quality Monitoring

Sandy Grove Middle School

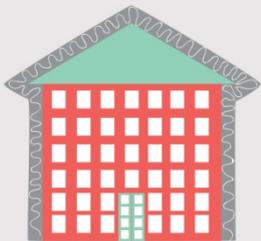
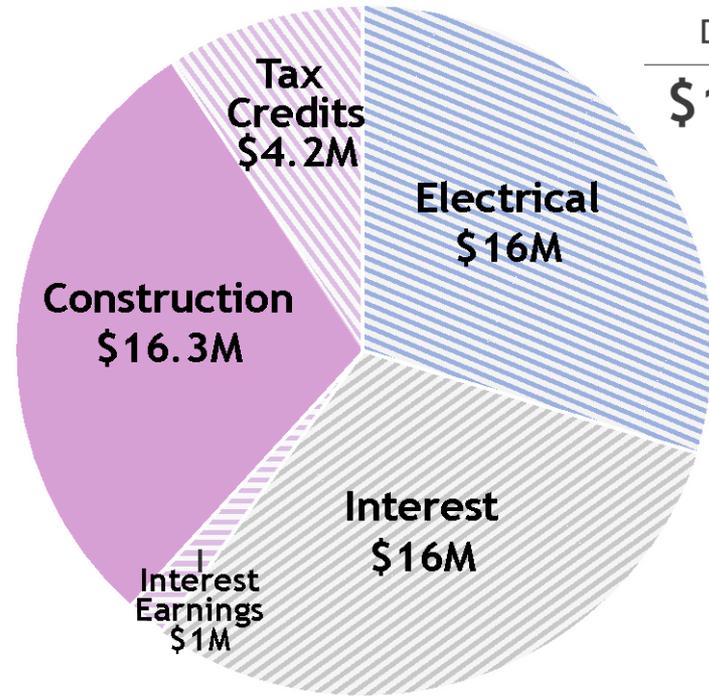
Traditional Delivery

\$53.5M

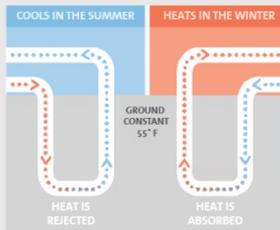


Leased Delivery

\$16.3M



Enhanced Building Envelope



Energy Efficient Geothermal HVAC Design



LED Lighting



Photovoltaic Installation



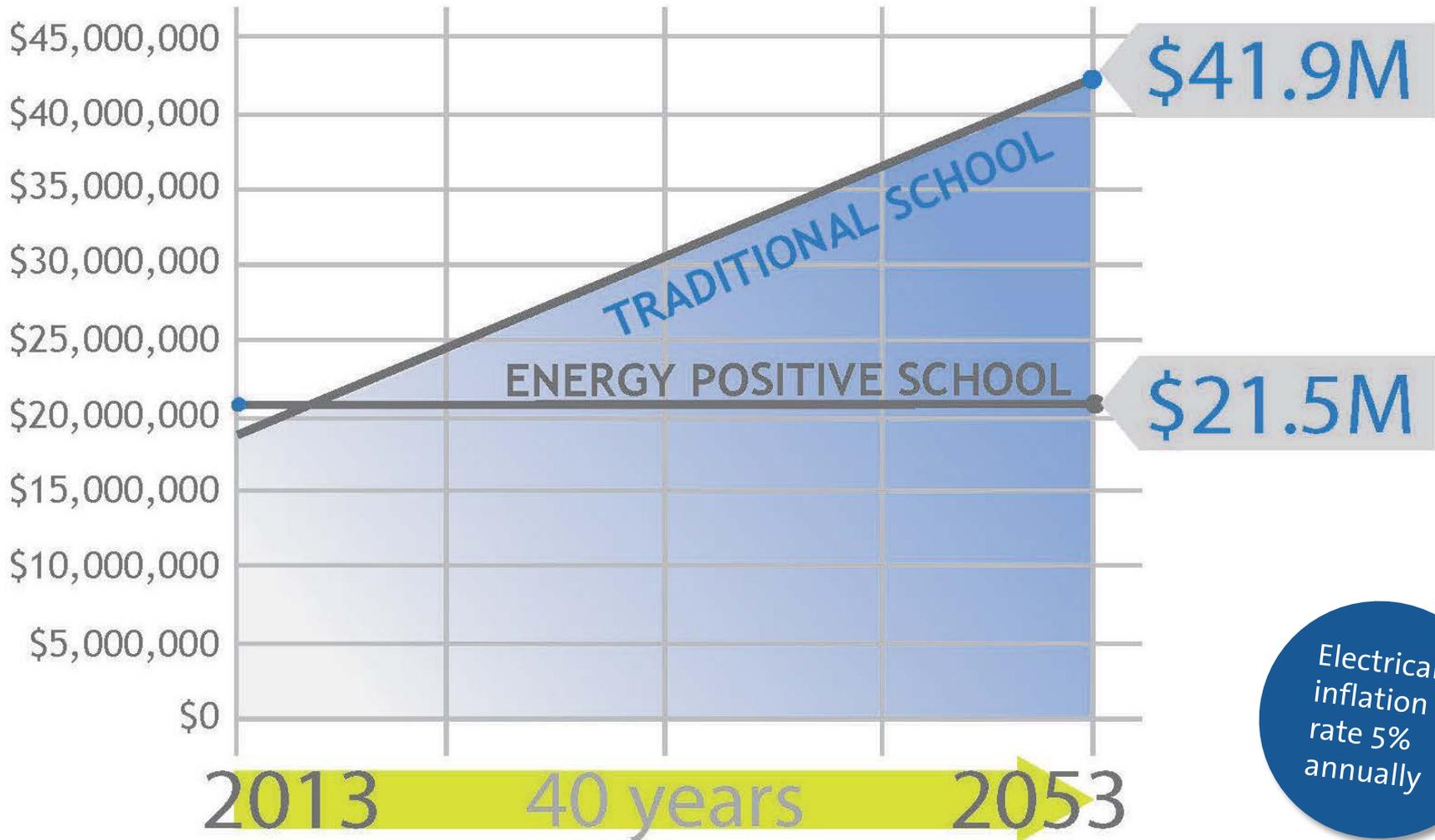
Energy Star Equipment



Sandy Grove Middle School

Leasing Energy Positive Schools

Energy Positive vs Traditional Schools



Sandy Grove Middle School



Sandy Grove Middle School



Sandy Grove Middle School

buildingdashboard 
by lucid

<http://buildingdashboard.com/clients/hcs/sandygrove/>

Solar Photovoltaic Electricity Production

Kilowatt-hours of electricity produced last year



Total Production

768,972

Kilowatt-hours



Total Use

541,136

Kilowatt-hours



Select a Timescale

Select a Unit Equivalent

Learn More



Introduction



Electricity



Wings



Solar Electric



Water



Geothermal



Comparisons



Green Tips



Green Features



Competition



Weather

Sandy Grove Middle School

Lesson Example: 1.75 Years of Hairdryer Use

Putting Electricity Consumption in Perspective
From the Lovett School

Using Building Dashboard Kiosk, students at The Lovett School used Building Dashboard Kiosk to examine electricity used Building Dashboard Kiosk to examine the school's Portman building. Students easily graphed the



Students could see that the building consumes mean? Students then clicked the "Select a mean?" Students then clicked the "Select a mean?" Students then clicked the "Select a mean?"



They then looked at hairdryer-hours:



So, last week's electricity consumption is equal calculation) 644 days or 1.75 years!
The amount of electricity now means much more as running a hairdryer for almost 2 years. But w



721.98 dollars!
The Unit Equivalent tool in Building Dashboard provides discussion points for students. The ab displayed.

Lesson Example: Explaining Variations in Solar Production

From Sidwell Friends School

Middle school science teachers at Sidwell Friends School in Washington, D.C. asked their students to develop possible explanations for variations in photovoltaic production during the second semester of the 2010/11 school year. Students used the Graphing tool to create a bar graph of PV production for their building using monthly resolution data:



Students also used the Layers tool to plot data from the 2009/10 year on the same graph:



This provided discussion points for the class and challenged students to make more complex connections within the data. Although relatively simple in presentation, the Graphing tool can be used to effectively introduce students to reasonably complex data interpretation.

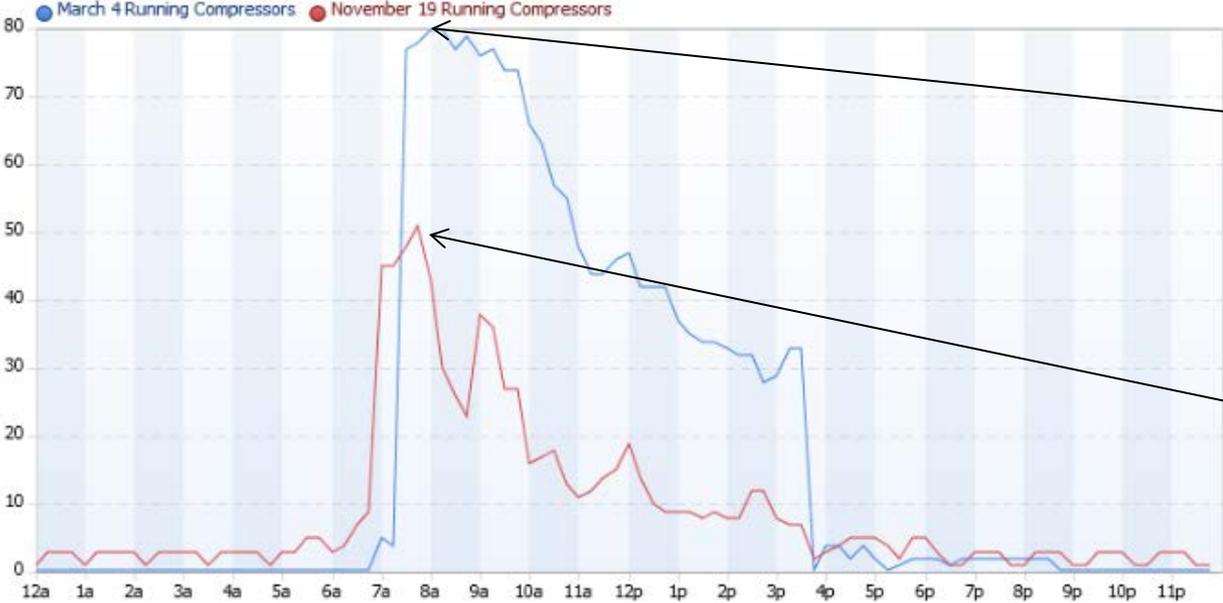
Sandy Grove Middle School



Operations Team



Schedule Optimization



BEFORE

Over 80 compressors starting at one time

AFTER

Under 50 compressors starting at one time

NOVEMBER 19, 2014

*Record setting cold day

Lessons learned



- It takes 2-5 years to optimize building performance.

Grantham & Spring Creek Middle Schools

- Reduced unprogrammed space
- Advanced Geothermal HVAC
- Superior building envelope
- Solar panels
- LED lighting
- Energy Star kitchen equipment
- Advanced building automation systems
- Onsite renewable energy
- PM&E Commissioning
- Long term energy optimization and performance contracts

GRANTHAM MS: Modeled
EUI of 27.2.

SPRING CREEK MS:
Modeled EUI of 25.9

GRANTHAM & SPRING
CREEK MIDDLE SCHOOLS
EUI IS ESTIMATED TO BE
10-12 AFTER
OPTIMIZATION!



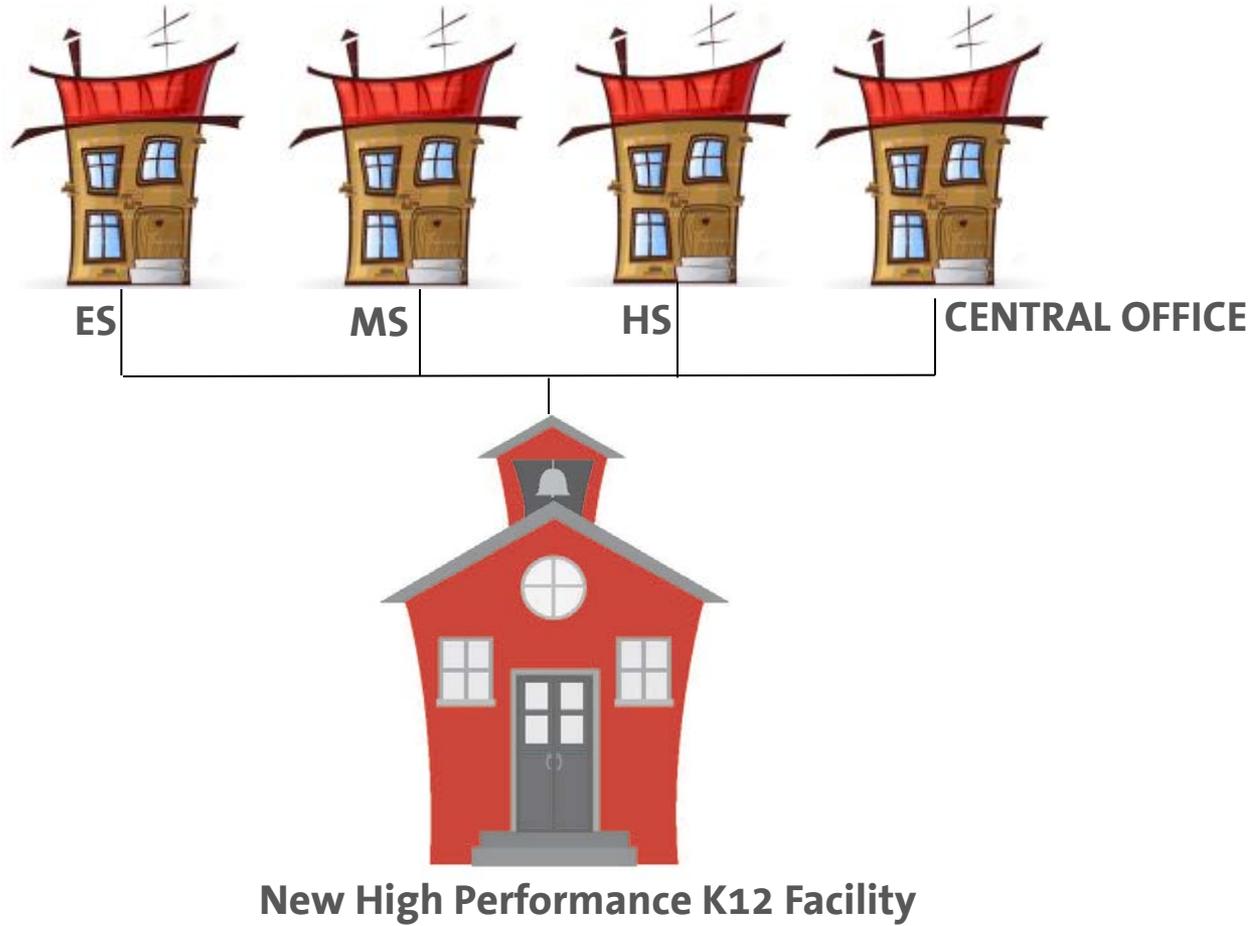
Spring Creek Middle School



Grantham Middle School



Denmark-Olar PK-12



Denmark-Olar PK-12

Estimated
EUI:
10-12



- Reduced unprogrammed space
- Advanced Geothermal HVAC (4th Generation)
- Superior building envelope
- Solar panels
- LED lighting
- Energy Star kitchen equipment
- Advanced building automation systems
- Onsite renewable energy
- PM&E Commissioning
- Long term energy optimization and performance contracts

Denmark-Olar PK-12



Site Plan

Lumbee River EMC North Center

Estimated
EUI:
18-22



Lumbee River EMC North Center



- Geothermal HVAC
- Superior building envelope
- Solar panels (414 panels, 110 kW DC, 70 kW AC)
- LED lighting
- Advanced building automation systems
- PM&E Commissioning
- Long term energy optimization and performance contracts
- Battery/generator
- Emergency ready

Integrated Design, Build, Finance, Operate Solutions Provide the Greatest Value.

