Empower your Team

Build your organization’s capacity

Identify and conduct needed research
Evaluate available delivery method options for best likely ZNE result
Explore alternative financing approaches to help offset costs
Develop project financial model
Use integrated development process
Empower your Team

- Conduct Educational Workshops
- Utilize Case Study
- Leverage Technical & Planning Guides
- Review Technical White Papers
- Hold Planning and Project Charrettes
- Tours ZNE Facilities
Pilot your Approach

Choose an upcoming project to pilot your ZNE approach

- Explore proven and new technologies and strategies
- Develop financial model to evaluate costs/benefits
- Document the project and process, bring team together to discuss lessons learned
Iterate for Continuous Improvement

- Build on success and lessons learned
- Refine next steps for your team
- Explore opportunities for scaling campus and district
- Embed practices in policies and procedures
Path to 0 net Energy Schoolhouses

RI School Building Authority

Joseph da Silva, Ph.D., AIA

Rhode Island Department of Elementary and Secondary Education
What We Did

- Surveyed 307 Schools
- 24.435 million ft²
- Derived Utility Cost Data from UCOA Data
- Benchmarked Energy Use for each school
- Assessed the Condition of Energy Consuming Equipment

- Identified Energy Conservation Measures
- Defined Action Plans to Achieve Net Zero Energy for Each School
- Identified Funding Sources & Execution Strategies
Why We Did This

• Significantly Reduce Energy $
• Net Zero Energy Schools
• Avoid Energy Volatility $
• Reduce O&M Costs
• Improve Cognitive Performance
• Improve Student Learning
• Create Living Laboratories
• Demonstrate Institutional Values
• Preserve Current Staff & Academic Programs
How Did We Do It

- 5 Teams Assessed 307 Schools
- Entered Conditions Data into MAPPS® via Handheld PC
- 4 Energy Engineers Filtered UCOA Utility Data
- Utility Consumption Derived from Cost Data based on Assumptions
- Calculated EUI & $/ft^2 for each School

- Identified Energy Conservation Measures
- Defined Action Plans to Achieve Net Zero Energy
- Estimated Costs, Savings & simple payback period
- Utilized Potential Contractors
- Solicited Incentives & Funding Sources
Findings

- Rhode Island 4th highest AVG. Electric Rate in US 18.69 cents/kWh
- Avg. EUI 45.2 - 60.7 vs. US Avg. 58.2
- Energy Costs $33.6 Million
- Avg. Age of School 62 Years +/- 30
- Avg. School Energy Cost $1.48/ft²
RI Public Schools Energy Cost ($/SF by LEA)
<table>
<thead>
<tr>
<th>Energy Conservation Measure</th>
<th>Cost to Implement</th>
<th>Annual Savings (Estimate)</th>
<th>Simple Payback (Years)</th>
<th>System Size</th>
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<tbody>
<tr>
<td>Building Automation System</td>
<td>$4,830,000</td>
<td>$149,920</td>
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<td>ERVs/DOAS</td>
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<td>Solar Photovoltaics</td>
<td>$246,916,430</td>
<td>$13,527,620</td>
<td>18.25</td>
<td>125MW Array generating 150,000 MWH/year</td>
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<td>$64,121,905</td>
<td>$2,796,098</td>
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<tr>
<td>Heat Pumps (Geo)</td>
<td>$389,677,907</td>
<td>$20,186,799</td>
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<td>87,000 Tons of geothermal heat pump</td>
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</table>
Total Need PV Solar Needed

- Enough to generate 106 million +/- kWh/year
- App. 70-80 Megawatts of PV arrays
- Approximate Cost $300 Million (before incentives)
- Annual Savings – App. $15.9 Million/Year
- Simple Payback period 9-18 years (depending on incentives)
Steps Toward Net Zero

- ASHRAE Level 2 & 3 Audits
- Bundle ECMs
  - Building Automation System
  - Energy Recovery Ventilation
  - LED Lighting Retrofits
- Bundle Net Zero Energy Measures
  - Solar Assisted Domestic Hot Water Heaters
  - Geothermal Heat Pumps
  - Solar PV
- Utilize RIIB Efficient Buildings Fund
- Prepare RFQs
- Get Projects Shovel Ready
- Prepare RFPs
- Obtain Approvals
- Execute, Monitor, Inspect, Cx, Train
Next Gen Energy Conservation Measures

- Broader Benefits
- Better for Student Learning
- Longer Pay Back Periods
- Building Automation Systems
- Energy Recovery Ventilation
- LED Lighting Retrofit
- Solar Assisted Domestic Hot Water
Understanding Financing & Incentive Options

- Federal Incentives
- State Incentives & Financing
- Utility Incentives & Financing
- Other Public Financing (Bonds)
- Qualified Energy Conservation Bonds (QECBs)
- Tax Except Lease - Purchase
- Third Party Ownership (PPA)
- Private Financing Options (Bond-PPA Hybrid)
- ESPCs (Energy Service Performance Contracts)
- Renewable Energy Credits (RECs)
- National Grid Energy Efficiency Rebates & Incentives

**Funding 0\textsubscript{net} Energy**

Establish a revolving loan fund

LEAs Borrow from fund to implement Net Zero Action Plant

Derived savings repay the loan fund
Broader Benefits
Better for Student Learning
Longer Pay Back Periods
Building Automation Systems
Energy Recovery Ventilation
LED Lighting Retrofit
Solar Assisted Domestic Hot Water
Energy Conservation Projects

**LED Lighting Retrofits:**
- Reduce Lighting Electricity by 30%
- Takes Advantage of Existing Lighting Controls
- Optimizes the use of natural daylight

**Building Automation:**
- Reduces heating energy by up to 10%
- Turns unnecessary equipment off
- Turns thermostats down when unoccupied
- Allows scheduling for vacations and holidays
- Reduces associated electrical energy by 5%
Coaborne Pell Elementary (ZE Capable)
Newport, RI

General Information
Location: 35 Dexter Street Newport, RI 02840
Scope: 105,565 gross square feet of new construction
Cost: $28 million
Completion: 2013
Enrollment: 865 PK-4th graders

Architect: HMFH Architects, Inc.
Engineer: Garcia Galuska Desousa Engineers Inc.
Certification: NE-CHPS Verified;
US Department of Education Green Ribbon School

- 35 EUI
- $116,855 annual energy savings
- 80%+ construction waste was recycled
- 40% reduction in potable water
- 77% of classrooms utilize daylight and photosensors/occupancy sensors to maintain adequate lighting while conserving energy
La Escualita Education Center

- Oakland USD
- Public School
- First CHPS® Verified Leader School in CA
- NBI Emerging ZNE School
Sacred Heart Elementary School - Stevens Library

- Library: 6,300 sf
- Low energy at budget Y2009 - 300/sf
- Grounded: 9 mo. - 14 mo.
- Construction
- Building envelope – Net Zero
- Platinum LEED
- Vision
- LEED Pilot Project
- Monograph with Ed Dean
Greywater added approximately 3000 kWh to the actual metering data – not originally expected

EUI of 16.1 or 13.2 if not including greywater

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How can you make a school a teaching tool?