2018 Winter Conference ✱ Chicago, IL

Seminar 49
The Owner's Perspective: Making Zero Energy Happen

John C. Chadwick, AIA
Arlington Public Schools, VA
john.chadwick@apsva.us
703.228.6600

Learning Objectives Seminar 49

After attending this seminar, the attendees will be able to:

- **Describe a process for creating a zero energy school**
- **Apply a set of Energy Use Intensity targets to achieve a zero energy school**
- **Provide an overview of the Advanced Energy Design Guide for Zero Energy Schools**
- **Describe the interactions between envelope, lighting, plug loads and HVAC design and the integrated roles that architects and engineers should follow to achieve low-energy design**

Learning Objectives This Segment

After attending this seminar, the attendees will be able to:

- **Collaborate with architects and other team members to create integrated designs to achieve Zero Energy on a reasonable budget**
- **Collaborate with owners and other design team members to achieve culture change around zero energy**
- **Use Zero Energy as a catalyst to integrate teaching, learning, design, sustainability and environmental stewardship**

AIA/CSI is a Registered Provider with The American Institute of Architects Continuing Education Systems. Credit earned on completion of this program will be reported to AIA/CSI Records for AIA members. Certificates of Completion for non-AIA members are available on request.

This program is registered with the AIA/CSI for continuing professional education. As such, it does not include content that may be deemed or construed to be an approval or endorsement by the AIA of any material of construction or any method or manner of handling, using, distributing, or dealing in any material or product. Questions related to specific materials, methods, and services will be addressed at the conclusion of this presentation.

GOAL

To create a learning environment inside, outside and beyond the school, in which teaching, learning, design, sustainability and environmental stewardship are integrated to a new level.

*VMDO Architects proposed **Zero Energy** as a catalyst and collaborated with CMTA Engineers to achieve it.*

NOT NEGOTIABLE

- Thermal comfort
- Air quality
- Acoustics
- Daylight and views
- Transparency
- Technology
- Universal design
- Short-term agility
- Long-term adaptability
- Community use

Teaching and learning must not be compromised to achieve Zero Energy.

INTEGRATED DESIGN TEAM

- Write ZE specific RFPs.
- Hire passionate, expert, tenacious A/E team.
- Hire dedicated construction team that understands quality needed to achieve ZE.
- Integrate owner, A/E, construction team.
- Design for full building utilization.
- Budget for ZE from outset.
- Schedule time for additional QA/QC and commissioning.

Removing or altering any one component of an integrated ZE school threatens achieving and maintaining ZE performance.

SIMULATION / MODELING

IDENTIFY KEY MEASURABLE PERFORMANCE PARAMETERS FOR SYSTEMS AND COMPONENTS IN OWNER'S PROJECT REQUIREMENTS

- Simulate/model everything
- Create utilization model
- Use energy model iteratively
- Commission everything
- Measure and verify performance

Never stop measuring and verifying!

INTEGRATED LUNCHROOM

HEAVILY REGULATED THROUGH NATIONAL SCHOOL LUNCH PROGRAM, WHICH SPECIFIES TYPES OF FOOD AND SERVING PORTIONS:

- Baked goods and cereal for breakfast.
- Simple baked or pre-cooked entrées, salads and fruit for lunch.
- More fresh fruits and vegetables; farm to table; school produce garden.

INTEGRATION WITH ZE:

- No fried foods, no deep fat fryers.
- Electric kettle for sauces and soups.
- Walk-in refrigerator and freezer connected to geothermal system.

OPERATIONS AND ENERGY

- Embed zero energy in school culture
- Use energy dashboard data for learning and operations
- Make systems as straightforward and simple to operate as possible

PRE-SOLAR

- 50% less energy consumed per square foot compared to average Arlington elementary school (72 kBTU/sf)
- 33% less energy consumed per square foot compared to next most efficient elementary school (43 kBTU/sf)

ENERGY PERFORMANCE

PREDICTED

EUI:	21.1 kBTU/sf*yr
Generation:	21.5 kBTU/sf*yr
Net EUI:	-0.4 kBTU/sf*yr

ACTUAL

EUI:	15.8 kBTU/sf*yr
Generation:	19.0 kBTU/sf*yr
Net EUI:	-3.1 kBTU/sf*yr

EPA Energy Star Certification Score: 100 out of 100

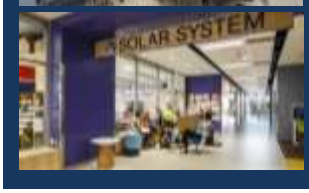
Estimated annual energy cost avoidance: $100,000

UTILITY CHALLENGES

- **No incentives for solar energy in Virginia**
- **Net metering maximum of 500 kW (now 1,000 kW) in Virginia**
- **Minimum standby service charge: $1,060/month**

No one had done this before in Virginia!

THE LEARNING EXPERIENCE



FIND A CHAMPION

- Collaborated with design team from outset.
- Graphics, signage, wayfinding and colors integrated with Standards of Learning by grade.
- Solar laboratory, bioretention gardens and solar calendar.
- National Wildlife Federation's Eco-Schools USA program: student-led project to reduce lunch waste; uneaten food saved and donated every Friday; students weigh total school lunch trash.
- Paper*light* school with fewer copiers and printers and more digital work.
- Students track transportation modes and give building tours.

Dr. Erin Russo
Principal

EXPLORERS

CULTURE CHANGE

- Integrate zero energy with teaching, learning and student success
- Focus on how students, teachers and staff contribute to low EUI without diminishing teaching and learning

Students, teachers, staff, parents, even neighbors, all come to understand how they each contribute to achieving and maintaining ZE.

ZERO ENERGY CULTURE

SPHERE / ENERGY DASHBOARD

WHAT WE LEARNED

- Vision and goals should be established before design team is selected.
- Design team should share vision and goals and have expertise and tenacity to achieve them.
- A zero energy building is an integrated system from which no major element may be omitted or changed.
- Reducing utility costs should not be sole reason for seeking zero energy
- Maintaining zero energy should be a commitment for the life of the building.

WHAT WE ACHIEVED

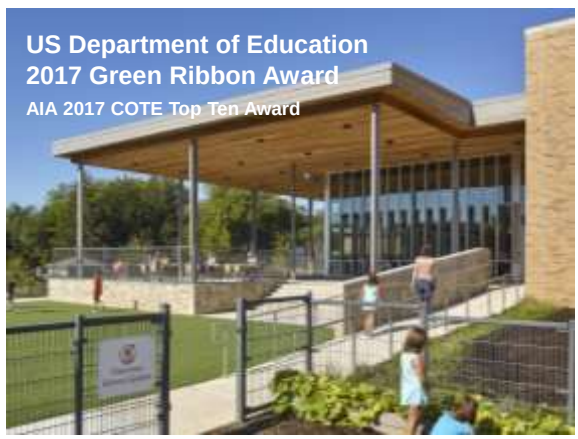
- Zero energy on a reasonable budget
- Integrated teaching, learning, design, sustainability and environmental stewardship
- Culture change among all stakeholders
- Schools where students love to be and love to learn.

We achieved zero energy the first year; now we have to maintain it year after year!

SUCCESS

US Department of Education 2017 Green Ribbon Award

AIA 2017 COTE Top Ten Award



Conclusions

- A Zero Energy school can be achieved on a reasonable budget through integration of design team efforts to reduce energy consumption as possible without compromising teaching, learning and community use of the school.
- If the solar installation itself exceeds the budget, owners may still use a solar power purchase agreement to achieve Zero Energy.
- A Zero Energy school can become a catalyst for culture change to integrate teaching, learning, design, sustainability and environmental stewardship.
- Any member of the owner/design/contractor can a champion for Zero Energy.

Questions

John C. Chadwick, AIA
john.chadwick@apsva.us