

Appalachian Energy Summit

APPALACHIAN STATE UNIVERSITY
The University of North Carolina Energy Leadership Challenge
Breakout Session Notes

Designing and Constructing a Net-Zero Energy Building

Discussion Leaders: Robert Powell, NC A&T Assistant Professor, Energy and Building
Jeffrey Tiller, Appalachian State Department Chairperson, Technology and
Environmental Design

Please provide notes that are clear, concise, high level, and actionable. These notes will be initially forwarded to discussion leaders for final editing before publishing to all participants with the objective of providing them with good ideas and helpful contacts.

Pam Metcalf-Community CPCC

Timothy McCullen – University Architect and Director of Design and Construction Services – 6 project managers

Tom Flood

Ondin Mihalcescu NCCU

Energy Features that make a building cost effective

What is the definition of “net zero”

How net zero building operates with the central utility plan

Jeff’s Intro –

Killing a little time while waiting for co-presenter.

Zero Energy Building Example – currently building a zero energy building to compete internationally in France in 2014

Must design the building, build it, disassemble then rebuild it in the location of the competition

Points for being above net zero w/ a 5KW inverter limit

80% of load is when you’re not supposed to pull anything from the grid

Bob’s presentation

Today we will ask questions

-Where are you on the path to net zero?

Where do you want to be?

How will you get there?

Minimum building code isn’t net zero.

Consider getting a campus “district” or neighborhood to be net zero, rather than just individual buildings.

DEFINE Net zero-

Over a year's time, the building uses the same amount of energy that it produces.

The balance is about zero –or +/- 10%

Typically these are grid connected buildings.

What are things we should attack first to get to net zero

-Building orientation to be passive solar

-Building on the envelope

-Daylighting

-Controls

-the efficiency of the equipment, computer systems, etc.

ASHRAE Advanced Energy Design Guides

-Free, very helpful, being used in classrooms

-prescriptive, cookbook guide to get you to 25% to 50% net zero level

Are you aware of 2012 Energy Code?

Mixed response from audience

Breaks US into zones with new requirements for envelope section so buildings are encapsulated

Max of 30% of wall can be windows

Occupancy sensors required

Ventilation controls required

Requirement for a systems completion statement from an engineer (or commissioning agent)

Random question: where does the road to net zero building intersect with a carbon neutral building??

Missing programming – huge piece, more potential there than anything else, space utilization

Second piece- what are we going to do about piping, envelope materials, what are our building materials constructed from?

Answer: Good question, but that's part of a much bigger session.

Jeff Demonstrates features of the Pasiv Haus in Vienna

12" concrete walls for insulation

Skylights and floor "skylights" to allow sunlight to permeate lower floors

Central light shafts with room windows facing the light shafts

Airflow is in issue

How do they exhaust bathroom /kitchen moisture? Yes w/ heat recovery

What is typical cost premium for doing passive? Jeff thinks it's in the range of 2%-3% but it depends on the building. That's a guess. Will vary quite a bit. You're saving on HVAC but spending on insulation.

Operable shutters for shuttering on hot summer day or winter.

What can we do to an office building that's already built. (refer to Jeff's slide 32)

New Buildings Institute – looks specifically at commercial buildings and recommends improvements.

The institute provides case studies.

It also lists items to consider that will effect the costs of the improvements

Graph demonstrates no real correlation between cost to build a regular building and an energy efficient building, so although it's intuitively more expensive to build a Leed efficient building, the graph demonstrates it's not prohibitive compared to other design choices that can be more expensive.

Payback on PV array for Bowling Green KY was 14 years.

Dave Robertson points out that cost to build per sf at \$196 seems like recession numbers.

Center for Design Innovation used as a case study.

Will be built in Winston Salem

Attendee in room, Jim, acted as an unpaid consultant.

CDI to be used as a place to do design research, doing advanced stuff with photography and motion capture.

Looked at total site and included roof garden as part of the design

Living wall for air filtration

Had hoped to take advantage of recession pricing, but b/c design process took a long time (innovation takes time), missed the window

Watchword was "good bones" so it could be taken to the next level as more funding becomes available

In range of \$195 p/sf

Living building looks at embodied carbon

How do you integrate into the community?

Leed checklist is a great place to start, but we really need a living breathing matrix that looks at how the building functions in the community, and how does it track over time as to how it fits in to the community.

Stop doing it the way we've always built it.

Project ZED

Bob: Now the questions isn't the building as an individual unit, but as part of a district.

Colorado has "Fort ZED"

- City of Fort Collins

- CO State University

- County

- Businesses

They got stimulus money, grants, and their plan is to establish a net zero district.

Goal is to get to net zero by cutting using and generating power:

- solar pv

- natural gas and biogas generators

- Thermal energy\Whole point is that although we've been talking about buildings, we should build the ring one cycle bigger, for example, look at the whole campus or try and net zero an area.

Forecast is .50 cents a watt for PV modules- cost is dropping

4.5 hours of sun requires 53 modules to match the load and 12,000 SF

System cost \$375-\$752k

Rate of return could be 6% -14%

Conclusion: PV is becoming affordable,

Group Discussion –What projects does audience have going?

225,000 sf New construction in UNC G (Fred)

Student Rec center w/ pool

Where is this in Net Zero progression?

Will try and just get good bones, has a lot of flat roof so PV array would be good later.

Working w/ daylighting

Solar heating a possibility

Challenge is customer doesn't want to give up space for programming

Student funded

Attendee 2: We had success w/ solar heating combined w/ steam hot water exchanger

Carole: We used a student fund to help pay for energy efficient construction

Dave: Although you don't have one, students are supportive and will vote to create a fund.

Carole: It has to be approved through the BOG, but at least it's a way to get it started.

Just finished a student rec center- UNC Wilmington

We put some solar thermal for heating the outdoor pool, but at UNC Wilmington we don't have any projects left in the pipeline. We scraped together all the money we had to do a refurb, looking into chilled beam.

We're most interested in doing a leak test so we can plug holes before we put the finishes back on the buildings.

Bob: We won't have new construction so much a "deep retrofit" in our futures. We need to look at how we can do integrated design w/ these refurbs.