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## Towards Zero Energy Homes

T49: Building Science = Green

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## Objectives for this afternoon

- Give context for “green” building
- Discuss overlap between building science approach and green building
- Convey strategies for green residential construction
- Help you understand options and then prioritize efforts, reach goals

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## GREEN & BUILDING SCIENCE FUNDAMENTALS

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## Fundamental Questions

- Is what we are doing having an impact? i.e., is it effective?
- Of the range of techniques and technologies that are available, which ones should be applied?
- What is “green”? What is “sustainable”?

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## “Green” and “Sustainable”

- terms ‘green’ and ‘sustainable’ are often used interchangeably

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## “Green” and “Sustainable”

- ‘green building’ is a label for the process of design and construction which aims to produce buildings that are less damaging to the environment—and the people that use them—than most buildings currently built today.

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**bsc** “Green” and “Sustainable”

- ‘Sustainable building’ refers more precisely to the goal of designing and constructing buildings that have no net impact on the environment, such that a total built environment composed of similar buildings could co-exist with the world’s ecological balance indefinitely.

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**bsc** Sustainability is HARD

- Global consensus but unknowns exist:
  - the extent of the damage caused by our actions
  - the length of time the world will support our society
  - the most equitable relationship between peoples
  - the acceptable balance between present and future needs
  - we don’t know what a sustainable society will be like
- to be effective, solutions must address these unknowns

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**bsc** “Green” Characteristics

- Grows out of common practice . . .
  - builds on, innovates, revolutionizes, etc.
- Improvement is measurable
- Improvement is significant
  - understanding of end goals
- Group learning part of the process
- Awareness of both success and failure
  - esp. that is openly acknowledged

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Environmental Concern	Scale of Effect	Timeframe	Building-related Issues	Concerned Groups
Climate Change	Global, Regional	Centuries	-Global Ecological Impact -Energy Efficiency -Land Use -Materials and Resource Efficiency -Social Transformation	Widespread
Loss of Biodiversity	Global, Regional, Local	Years, Centuries	-Land Use -Water Management -Global Ecological Impact -Social Transformation	Municipalities, Individuals
Habitat Destruction, Aesthetic Impact	Regional, Local	Years	-Land Use -Water Management -Materials and Resource Efficiency -Community Development -Social Transformation	Municipalities, Individuals
Depletion of Non-renewable Resources	Global, Regional, Local	Centuries, Years	-Durability -Materials and Resource Efficiency -Energy Efficiency -Social Transformation	National Level, Industry
Pollution of Air, Earth and Water	Regional, Local	Years, Days	-Design and Delivery Process -Land Use -Durability -Indoor Environmental Quality -Water Management -Materials and Resource Efficiency -Social Transformation	Municipalities, Individuals
Poverty	Global, Regional, Local	Years, Days	-Affordability -Design and Delivery Process -Durability -Energy Efficiency -Community Development	Widespread

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**bsc** Partial List of Green Issues

- Land Use
- Social Transformation
- Global Ecological Impact
- Design and Delivery Process
- Durability
- Energy Efficiency
- Materials and Resource Efficiency
- Indoor Environmental Quality
- Water Management
- Affordability
- Community Development

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**bsc** “Core” Green Building Issues

- Land Use
- Social Transformation
- Global Ecological Impact
- Design and Delivery Process
- Durability
- Energy Efficiency
- Materials and Resource Efficiency
- Indoor Environmental Quality
- Water Management
- Affordability
- Community Development

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**bsc** Buildings and the Environment

- Largest single global industry
- Hence, buildings consume resources
  - Lots of materials
  - Lots of energy
  - Lots of money
  - Pollute, displace, and destroy habitats
- Last a long time: A “durable good”
  - Running shoe (1 yr), car (10 yr), bldg (100yr?)
- Hence - more careful long-term design
  - i.e. societal involvement is justified

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**bsc** Building Science and Green

- Durability
- Energy Efficiency
- Indoor Air Quality
- Materials and Resource Efficiency
- Affordability
- Social Transformation

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- Durability
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Heat, Air and Moisture

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**bsc** Building Science Fundamentals

- Understanding how things work enables the design and construction of energy efficient, durable enclosures that provide healthy indoor air quality.
- Setting goals allows us to test to see if the goals are met.
- The house is a highly interconnected system. The systems approach to design underlines discussions of:
  - mold and moisture control
  - air, vapor and weather barriers
  - insulations effectiveness
  - foundations;
  - framing for energy efficiency
  - windows
  - air sealing details
  - indoor air quality and mechanical ventilation
  - mechanical equipment and distribution systems

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**bsc** Do it Right! Green Fundamentals

- Green building addresses a range of environmental concerns:
  - Resource and Energy use
  - Climate Change
  - Land Use
  - Construction Waste Management
  - Homeowner Awareness
- Cost of energy use over a building’s lifetime can exceed first cost
- Buildings have a significant environmental impact and are a major social investment
  - and therefore must be built to last . . .

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**bsc** Is it Green? Learning to count

- Depends on answers to:
  - Does it use less non renewable energy to operate?
  - Will it last longer? (less life-cycle resources)
  - Does it use fewer non renewable resources to build?
  - Does it pollute less?
- Compared to what?:
  - Zero (sustainable)
  - Better than average (move forward, “green”)
    - What is average?

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**bsc** Green Buildings are Energy Efficient

- Current Buildings
  - Vast majority of damage done by energy consumption *during operation*
  - As energy consumption drops, the energy and resources in the construction itself becomes important
- Energy consumption reduction is key
- Material choices less significant
  - Nice to choose lower energy lower polluting alternatives

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**bsc** Common Pitfalls

- Focus on materials, not systems
- Focus on recycling, not durability/performance
- Same process, just add more
- Unwilling to choose performance
- Follow the points, not performance
- Design process, too quick, not enough \$

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**OVERVIEW OF HEAT, AIR AND MOISTURE**

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