Joseph T. Wunderlich PhD

Lecture Notes

EGR 343 Green Architectural Engineering

This is a required course for:
- BS Engineering - Sustainable Design
- Architectural Studies Minor

Course Text:
- "Heating, Cooling, and Lighting for Sustainable Design" by N. Lechner (2009)
- Read all 500+ pages!
- >50% of lecture material from this text
- LEED reading material
- AIA "Graphics Standards"
- Many notes from my 14 international trips
- Notes from my B.S. Architectural Engineering (U. Texas, Austin 1984)
- Notes from 2 years (39 credits) of Environmental Design and Planning at U. California, San Diego
- Case studies from projects I worked on (Austin, TX; San Diego, CA; San Francisco, CA, Southeastern & Central Pennsylvania)

Revit Software:
- Installed on all computers in E273 Design + Technology-Transfer Studio

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EARTH POPULATION AND RESOURCES CH 1 AND 2

> YOUTUBE: "NOAA EARTH ON A SPHERE - WORLD AT NIGHT"

> 7.0 BILLION PEOPLE
  - CHINA 1.3 B
  - INDIA 1.2 B
  - AFRICA 1.0 B
  - U.S. 0.3 B (~5%)
  - EUROPE 0.7 B

> WE (U.S.) ARE 5% OF POPULATION,
  BUT CREATE ~30% OF GREENHOUSE GASES BECAUSE
  ① WE ARE ONE OF THE MOST DEVELOPED,
      PRODUCTIVE NATIONS (GOOD)
  ② WE ARE NOT YET ONE OF THE MOST
      "GREEN" NATIONS

> FOSSIL FUELS (COAL, OIL, GAS)
  - HUNDREDS OF MILLIONS OF YEARS TO
    MAKE (DECOMPOSING PLANTS + ANIMALS)
  - WE STARTED USING IT IN THE
    MIDS 1800'S (INDUSTRIAL REVOLUTION)
  - IT WILL RUN OUT!
    - AT BEST, A COUPLE HUNDRED YEARS LEFT
    - BUT IT WILL BE IN
      MUCH SHORTER SUPPLY
      IN YOUR LIFETIME!

> PRESENTLY 85% OF U.S.
  ENERGY CONSUMPTION IS FOSSIL FUELS
  OTHER
  ① 6% NUCLEAR
  ② 8% RENEWABLES

> BURNING FOSSIL FUELS POLLUTES
  - SMOG
    - CH₄ (METHANE)
    - O₃ (OZONE)
    - OZONE ALERT DAYS IN LA
  - NO₂
    - BROWN AIR IN LA
  - SO₂
    - COMBINES WITH H₂O TO MAKE HYDROCHLORIC ACID
    - ACID RAIN
ACID RAIN LEACHES HEAVY METALS OUT OF SOIL (LEAD, MERCURY)
- Gets into food supply
- Fish become toxic
- PA Gaming Commission recommends eating caught fish only once or twice a week
- Variables by PA region and water use

Global Warming
- Dependence on oil has serious geopolitical ramifications
- Wars
- Pipeline battles
- "Oil Embargo" 1973
- OPEC countries exploiting
- Gas lines in US only can be used off certain days

Nuclear Energy
- Fission (split atom) yields energy
- Most common
- Fusion (combine 2 atoms of hydrogen into helium)
- Problems controlling
- 70% of US energy
- Radiation is a serious concern
- Chernobyl (Soviet Union 30+ years ago)
- Containment built, roof blown off
- Nobody can live in region for many lifetimes
- Fukushima (Japan a few years ago)

Earthquake in Dallas
- Containment branches
→ THREE MILE ISLAND (1978)
  → PARTIAL MELT-DOWN DUE TO LOSS OF COOLING
  → SMALL RELEASE OF RADIOACTIVITY
  → RADIOACTIVE PLUME WENT TOWARDS HERSE
  → NOW ONE OF THE SAFEST NUCLEAR POWER PLANTS ON EARTH

→ SOME COUNTRIES (E.g., GERMANY) DEDICATED TO COMPLETELY ELIMINATING NUCLEAR FUEL
RENEWABLE ENERGIES

Presently only 7% of U.S. energy usage

1. Solar
   - Passive
   - Active

2. Wind

3. Hydro
   - Hydro-electric
   - Dams
   - Tidal
   - Wave
   - Geothermal
   - Steam

4. Ocean
   - Thermal
   - Waves
   - Tidal
   - Use temp variations in Earth's surface

5. Biomass
   - Biofuels
   - Methane digesters
   - Septic systems
   - Landfill gases
   - Compost pile

A few good green behaviors relating to buildings

- Grow gardens
- Recycle + use recycled building materials
- Buy less packaging (and local produce + building materials)
- Green transportation behavior
  - Car pool
  - Public transportation
  - Walk
  - Use less petroleum products
  - Paper bags instead of plastic
  - Wood products in buildings instead of plastics
  - Use less electricity
  - Low-energy appliances
  - Energy-saving on computers
  - Zoned + programmed heating/cooling
  - Off-peak use

See pics on Dr. W. website

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(e.g., Condominium Complexes)
In Eugene Developments
by Homeowners' Associations
- Cools Air Established...

- C + R Est. restaurants
- To Alleviate This
- Promote C + R's
- Design Parking + Balconies
- Air-Play Clothes, etc.

- Popular
- Northwest
- Popular

- Green Behaviors/Design (CoT)