

27. ENERGY CONSERVATION

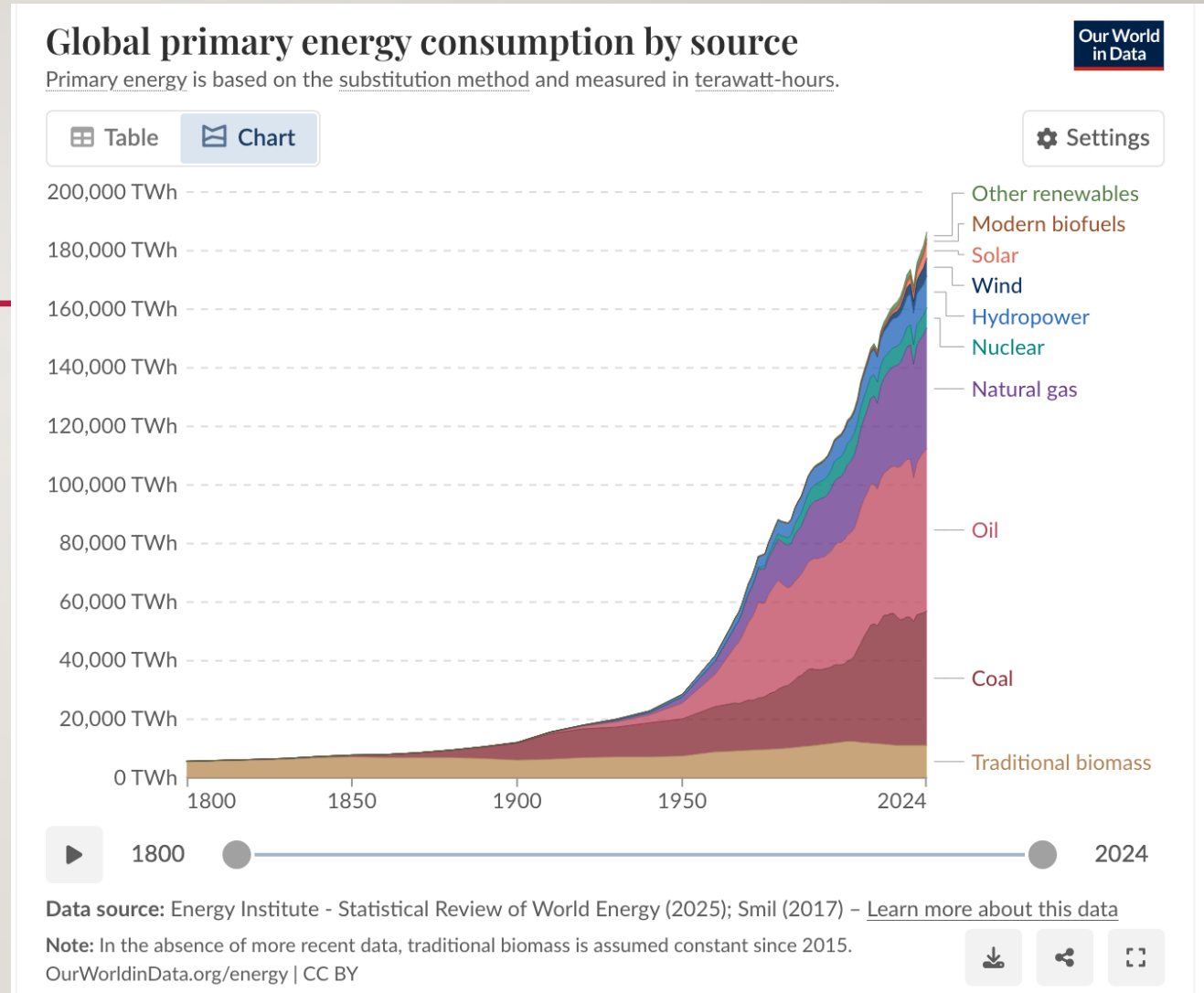
EGY 105 – WILKES UNIVERSITY

KENNETH M. KLEMOW, PH.D.



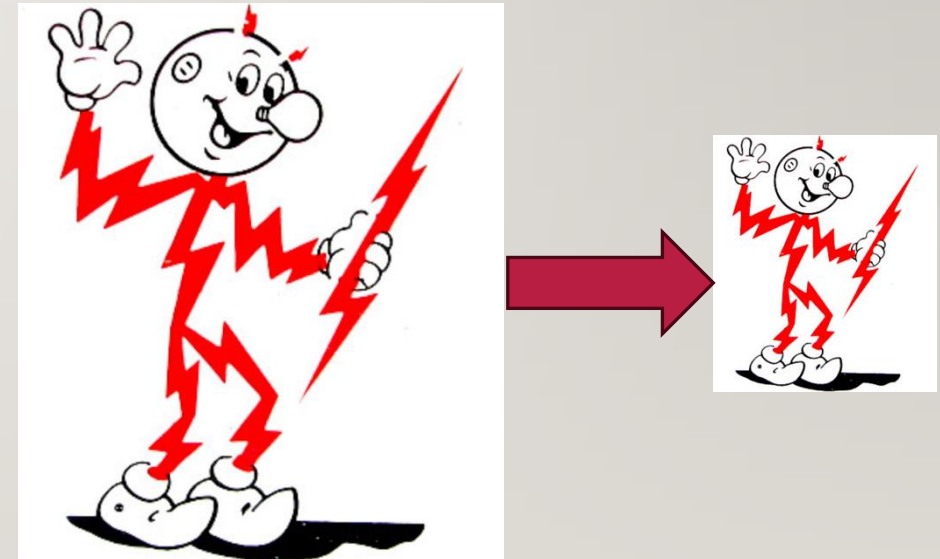
WORLD ENERGY USE

- Global energy use has increased
- Data in terawatt hours (10^{12} TWh)
 - 1830 - 6,000
 - 1912 - 12,000 82
 - 1940 - 23,000 28
 - 1965 - 46,000 25
 - 1986 - 92,000 21
 - 2024 - 186,000 38
- Question about sustainability – can we keep doubling every 20-40 years?



WHAT IS ENERGY CONSERVATION?

- Reducing energy use at personal, household, community, state, national levels.
- Achieved by:
 - Modifying human behavior to use less energy
 - Using energy efficient devices



WHY CONSERVE ENERGY?

- Lower costs for consumers
- Reduce greenhouse gas emissions
- Make energy supplies last longer
- Improve personal and community health
- Reduce ecological damage caused by extraction and waste
- Conserve water used for processing energy
- Promote energy security



<https://healtheplanet.com/100-ways-to-heal-the-planet/energy-conservation>



IMPORTANT DISTINCTION:

- **Energy Conservation**

- Achieved by change in human behavior
- Affected by education, motivation, need

- **Energy Efficiency**

- Achieved by technological improvements

- Two can be interactive

- People can decide to replace wasteful incandescent bulbs with efficient LED bulbs



ARGUMENTS AGAINST CONSERVING

- Cost of implementation
- Perception that being energy efficient requires sacrifices
 - Comfort
 - Freedom
 - Status
- Don't see the need
 - Cornucopian philosophy
 - Resistance to government mandates
 - Past predictions of energy shortages have been proven wrong
 - Drawbacks of different forms of energy are overblown



A BIT OF HISTORY

- Pre-industrial times
 - Conservation necessary because energy sources were limited
 - Took effort to prepare firewood
 - Hydropower limited to areas near rivers
 - Coal, petroleum, natural gas not commonly available
- Industrial revolution to early 20th Century
 - Conservation less important because coal and electricity were abundant
 - Conversely many low-income families could not afford energy
 - Scavenged wood and coal for heating and cooking purposes
- World War II
 - Strict rationing of gasoline



A BIT MORE HISTORY

- Post World War II – 1970s
 - Conservation less important, era of abundant energy
 - People conserved energy mainly to save money
 - Coal extraction for electricity production
 - Railroads switched to petroleum
- 1970s – 1980s
 - Conservation became important again
 - Oil embargos and nuclear accident led to search for alternatives
 - Concerns over sustainability of supplies
- 1990s - present
 - Debates about conservation
 - Concerns over climate change drive many conservation efforts.



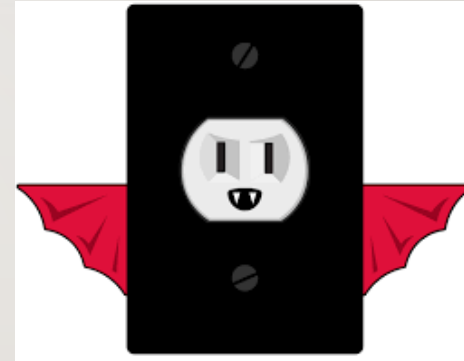
Lesson Plan: Climate and Energy Conservation

Constellation
An Exelon Company



TOP PRACTICES FOR ENERGY CONSERVATION – HOME AND OFFICE

- Turn off energy-using devices when not using them
 - Be wary of “energy vampires”
- Reduce need for water heating (short showers, cool water when washing clothes)
- Run energy consuming appliances at night (dishwasher, washing machine, dryer)
- Home heating and cooling
 - Reduce heating in winter, cooling in the summer
 - Insulate walls & ceiling; seal windows and doors



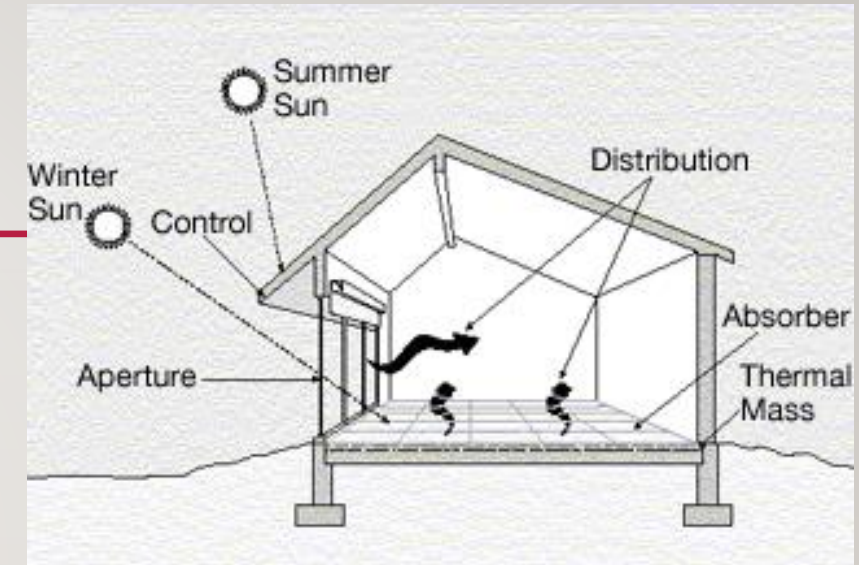
TOP PRACTICES FOR ENERGY CONSERVATION - TRANSPORTATION

- Use mass transit when feasible
- For your car
 - Buy high gas mileage / hybrid / electric car
 - Combine trips
 - Keep tires inflated
 - Avoid fast starts, sudden stops
- Walk or use bicycles, scooters.



ENERGY EFFICIENT BUILDINGS

- Insulate and fix leaks
- Use natural lighting
- Use light-colored paint for warmer climates
- Position windows to maximize insolation in winter, shading in the summer
- Ceiling fans instead of air conditioning
- Optimize landscaping reduce wind, improve shade
- Install heat pumps



SMART HOMES / BUILDINGS

- Occupancy sensors
- Remote controlled devices to improve energy efficiency
 - Thermostats
 - Lighting
 - Appliances
- Energy monitoring devices
- Energy Star appliances



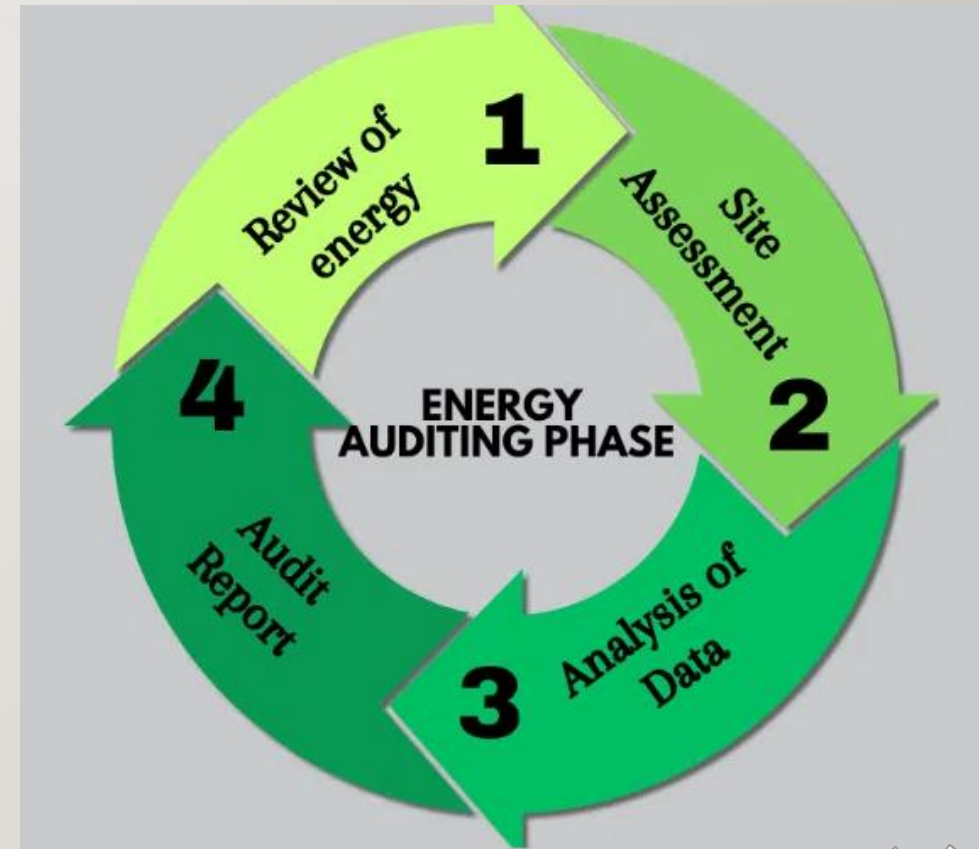
WHAT CAN CITIES DO TO SAVE ENERGY?

- Provide mass transit for residents
- Cluster residences and businesses around mass transit stops
- Line streets with trees
- Use energy-saving lighting
- Create safe travel lanes for pedestrians, bicycles and scooters
- Retrofit buildings to use energy-saving devices
- Maximize renewable energy in buildings, parking areas, airports



ENERGY AUDITS

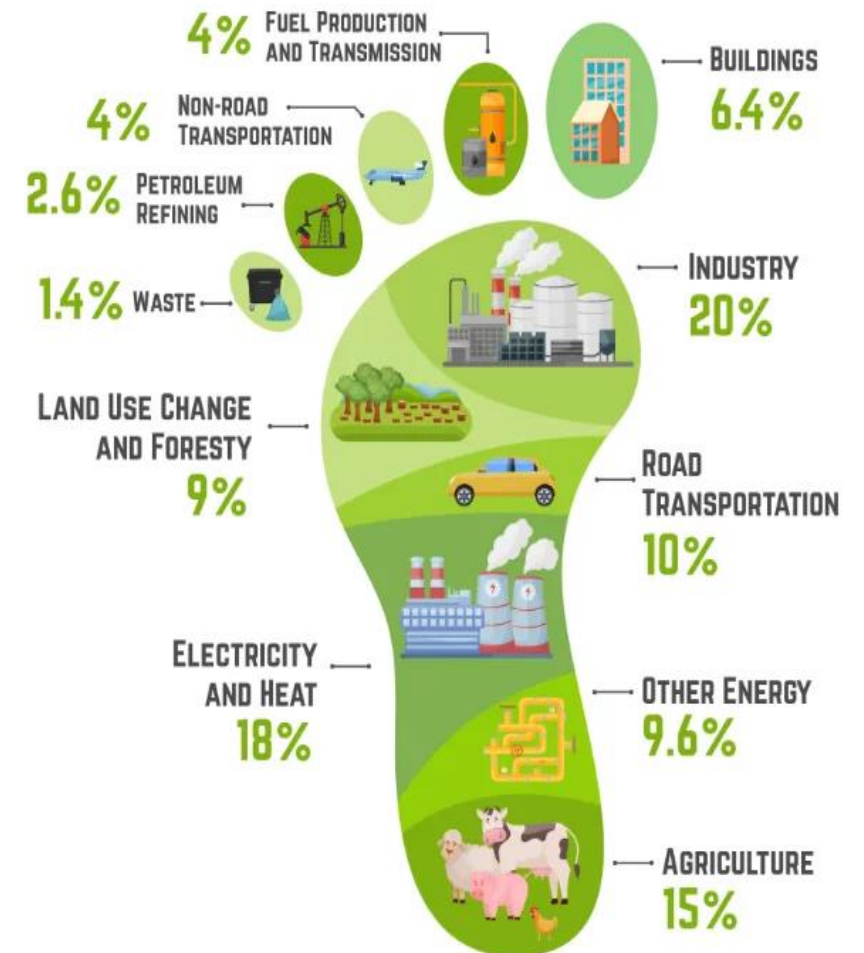
- Examine energy consumption patterns in home or business
- Look at sources of energy loss (leakage, wasteful appliances)
- Look at energy-consumption habits of occupants
- Balance energy use against comfort
- Performed by trained professionals using specialized equipment
- Energy auditor is an in-demand profession.



CARBON FOOTPRINT

- Determine total CO₂ production
 - Can be done for individuals, homes, businesses, cities
 - Direct use of energy in home, business, school, transportation
 - Individual car more energy intensive than public transit or bicycle
 - Indirect use of energy in terms of food, clothing, other goods purchased
 - Cotton shirt has many steps that produce greenhouse gases
 - Meat more energy intensive than plant derived foods
 - Expressed in tons of CO₂ equivalents per year
 - Can be calculated online or using apps
 - <https://www.nature.org/en-us/get-involved/how-to-help/carbon-footprint-calculator/>

CARBON FOOTPRINT



PROGRAMS TO CONSERVE ENERGY

- Government programs
 - Energy Star – for appliances
 - Weatherization Assistance Program
 - Low income homes
 - Energy Efficiency & Conservation Loan Program
 - Rural areas
 - PA Alternative and Clean Energy Program
- Utility Programs (e.g., PPL, UGI)
 - Rebates for purchasing energy-saving items
 - Education programs





THAT'S IT!

GOOD LUCK FOR THE END OF THE
SEMESTER!

