314: FUELS

FEBRUARY 2020

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AIA INFORMATION

Credit(s) earned on completion of this course will be reported to American Institute of Architects (AIA) Continuing Education Session (CES) for AIA members.

Certificates of Completion for both AIA members and non-AIA members are available upon request.

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Questions related to specific materials, methods, and services will be addressed at the conclusion of this presentation.

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COURSE DESCRIPTION

Universities and colleges have many options when it comes to selecting the primary fuel sources for their utility operations. Fuels are usually the single largest expense in utility budgets. Thus, active fuel management is an essential component of providing reliable and affordable utilities to campus. This course provides a comparison of the primary fuels and the various advantages and disadvantages of each. The comparison includes traditional hydrocarbon fuels and renewable fuels. You will also learn about the factors that drive prices up and down as well as recent trends in fuel supply and demand. The course concludes with a discussion on strategies to reduce the costs and risks associated with fuel procurement.

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LEARNING OUTCOMES

- Learning Objective 1:
  Discuss the many options to selecting the primary fuel sources for utility operations.
- Learning Objective 2:
  Discuss how management of the fuel source is an essential component for providing reliable and affordable utilities to the campus.
- Learning Objective 3:
  Discuss the comparison of traditional hydrocarbon fuels and renewable fuels.
- Learning Objective 4:
  Learn about the factors that drive prices as well as recent trends in fuel supply and demand.

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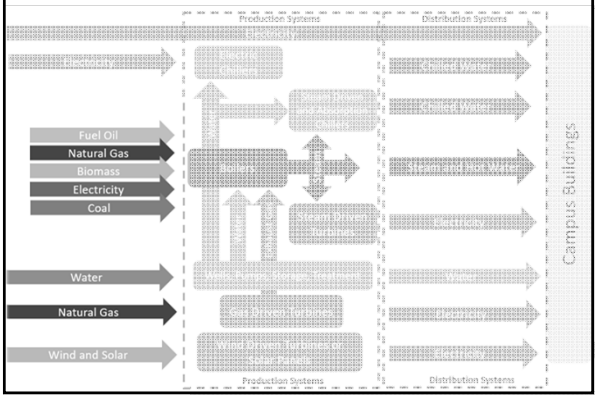
FUELS



COURSE OVERVIEW

- Fuel terms and concepts
- Primary fuels
  - Natural Gas
  - Coal
  - Oil
  - Renewables (sun, wind, & biofuels)

COURSE OVERVIEW

Common issues for each fuel type:

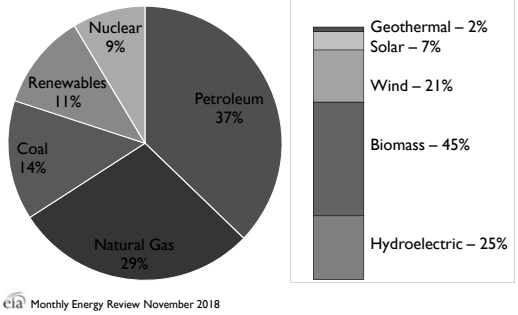
- Emissions
- Reliability
- Flexibility
- Costs – capital and O&M
  - Volatility/risk
  - Purchasing Strategies

CAMPUS FUEL USE

- Space heating
- Autoclaves, sterilization
- Domestic hot water
- Cooking
- Other processes
- Generate electricity (Cogeneration)
- Absorption Chillers

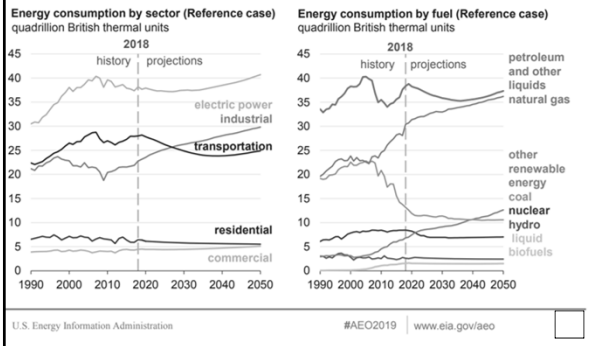
U.S. ENERGY CONSUMPTION

97.9 quadrillion British thermal units (Btu)



eia Monthly Energy Review November 2018

U.S. ENERGY CONSUMPTION



U.S. Energy Information Administration #AEO2019 www.eia.gov/aeo

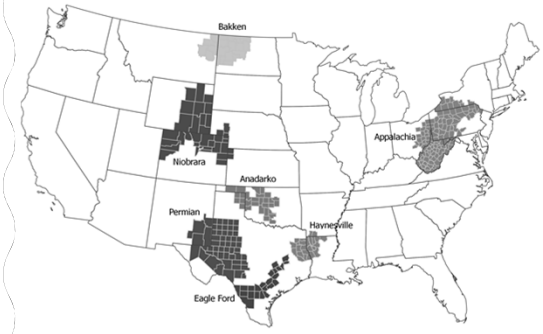
Colorless and odorless gas

NATURAL GAS

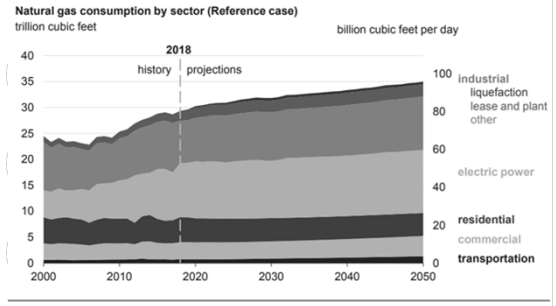
94% - Methane (CH_4)
4% Ethane (C_2H_6)
1% - Propane (C_3H_8)
1% - Nitrogen

Transported via pipeline and ship

WHERE IS THE NATURAL GAS?



U.S. NATURAL GAS USAGE

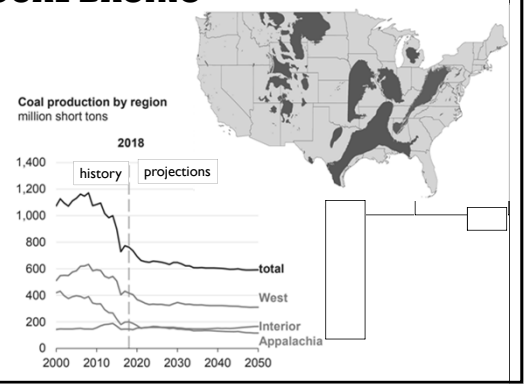


COAL

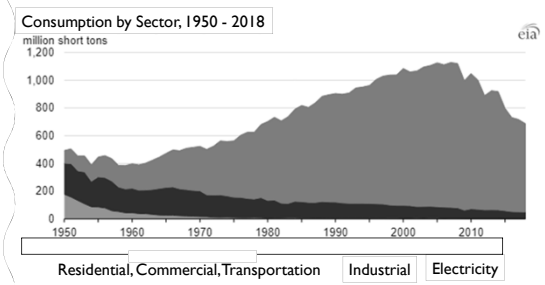
Solid – fossilized plant matter

- Carbon
  - sulfur
  - hydrogen
  - nitrogen
  - oxygen
- Transported via rail or truck

COAL BASINS



U.S. COAL USAGE



Liquid – fossilized plants and animals

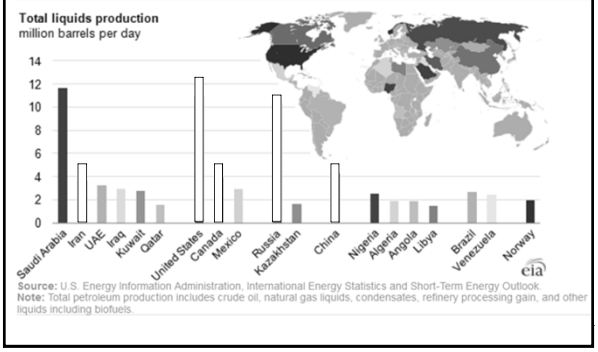
FUEL OIL

Distilled from Crude Oil

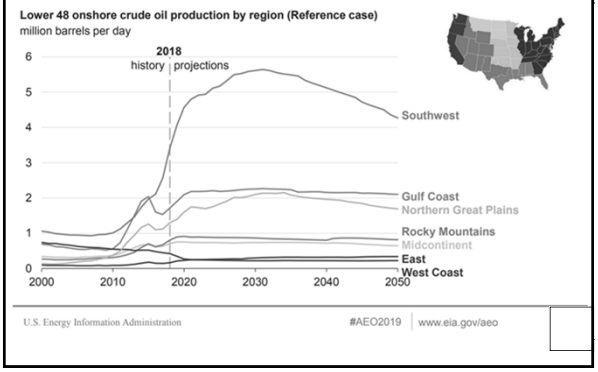
- 86% - carbon
- 12% - hydrogen
- 1% - sulfur
- 0.5% - nitrogen
- 0.5% - oxygen

Transported via rail, pipeline, or truck

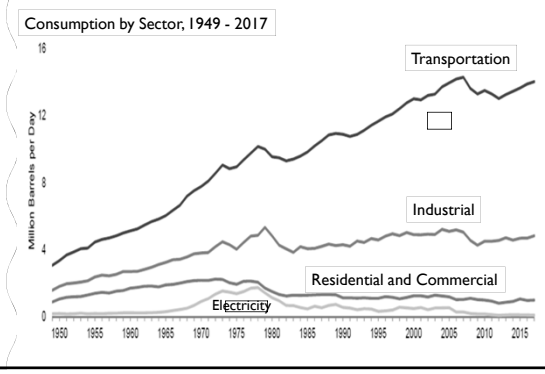
WHERE IS THE OIL?



US TOTAL CRUDE OIL PRODUCTION

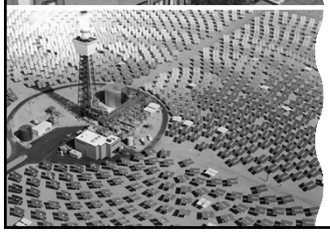


U.S. OIL USAGE



RENEWABLES

- Solar
- Wind
- Biofuels/Biomass

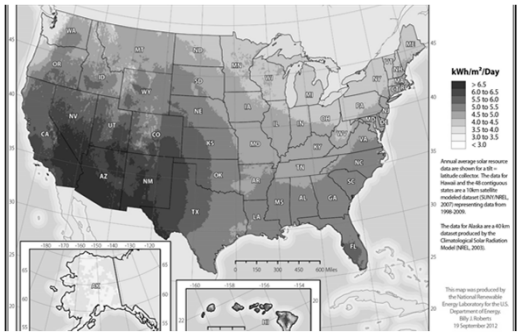


SOLAR

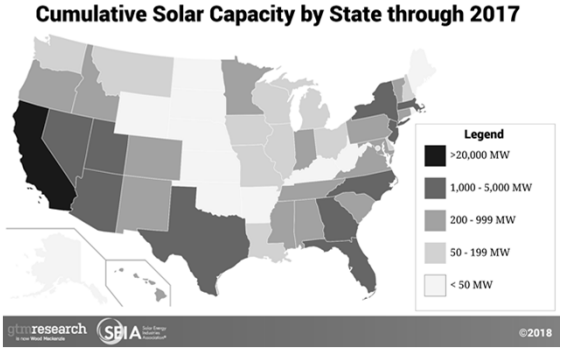
Photovoltaic

Concentrated Solar

POTENTIAL SOLAR ENERGY



INSTALLED SOLAR ENERGY



INSTALLED SOLAR ENERGY

SOLAR PV COST

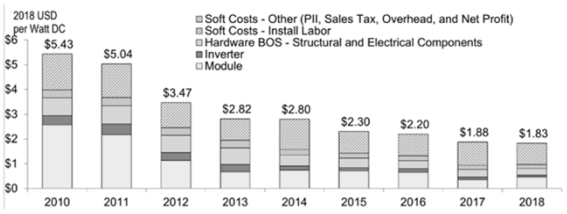


Figure 22. NREL commercial PV system cost benchmark summary (inflation adjusted), 2010–2018

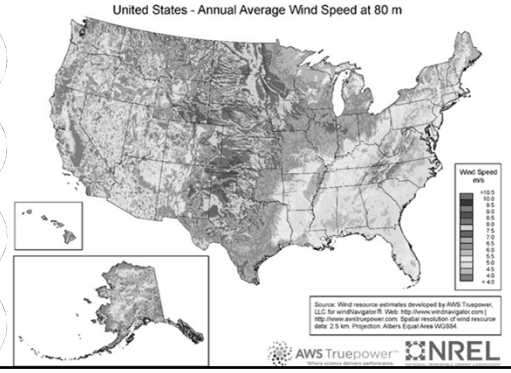
WIND

Wind Farm - PPA

On Campus

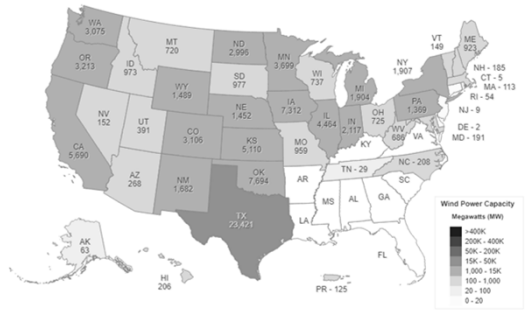
POTENTIAL WIND ENERGY

United States - Annual Average Wind Speed at 80 m



INSTALLED WIND ENERGY

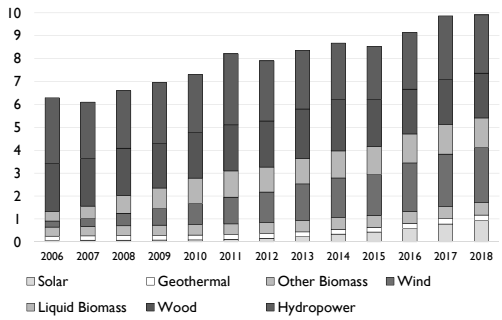
Q3 2018 Installed Wind Power Capacity (MW)



Total Installed Wind Capacity: 90,550 MW

Source: American Wind Energy Association Market Report

RENEWABLE ENERGY USE



All Economic Sectors (quadrillion Btu)

COMPARE

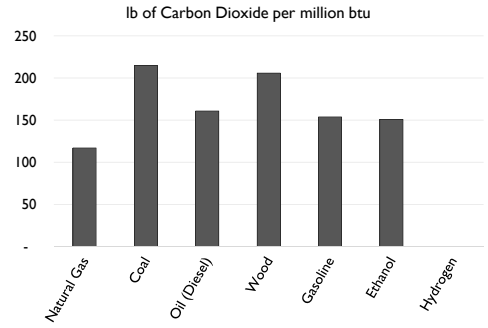
Greenhouse Gases

Pollutants

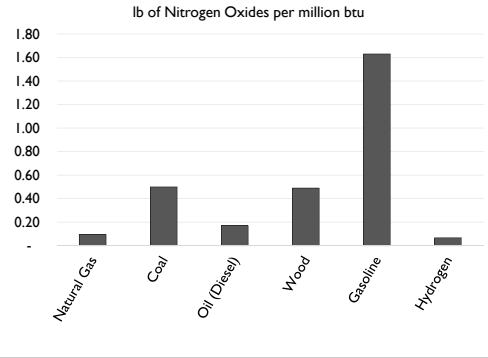
Energy Density

Price Factors

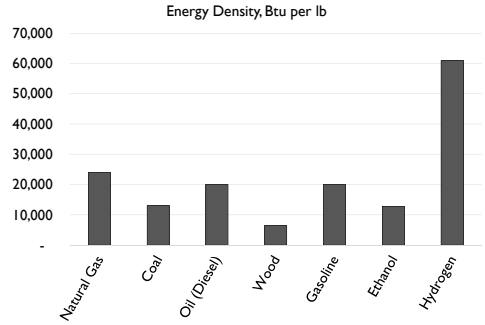
EMISSIONS – CARBON



EMISSIONS – NO_X



ENERGY DENSITY



NATURAL GAS PRICE FACTORS

- Distance from wells
- Pipeline proximity and capacity
- Load profile
- Local costs - distribution, taxes, other
- State regulations
- Competing suppliers

COAL PRICE FACTORS

- Transportation - train, barge, truck
- Sulfur content
  - Sulfur dioxide causes "acid rain"
- Surface coal is cheaper than underground coal
- Government regulations

FUEL OIL PRICE FACTORS

- Crude oil price
- Storage space
- Delivery costs
- Demand

SOLAR/WIND VALUE FACTORS

- "Transportation" – geographical
- Linked to local rates
- Availability varies based on local laws/regulations
- Requires connection to local utility

VOLATILITY AND RISK

- Commodity Markets
  - Natural Gas
  - Coal
  - Crude Oil
- Transportation and Storage
  - Increases volatility and risk
- Procurement/Contracting Process
  - Take or pay requirements
  - Balancing issues

COST/RISK MANAGEMENT STRATEGIES

- Hedging or Futures Options
- Ability to Switch Fuels
- Demand Management/Peak Shaving
- Thermal Energy Storage
- Combined Heat & Power
- Customer Incentives
- Renewables

MORE INFORMATION

- U.S. Energy Information Administration
  www.eia.gov
- National Renewable Energy Laboratory
  www.nrel.gov

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