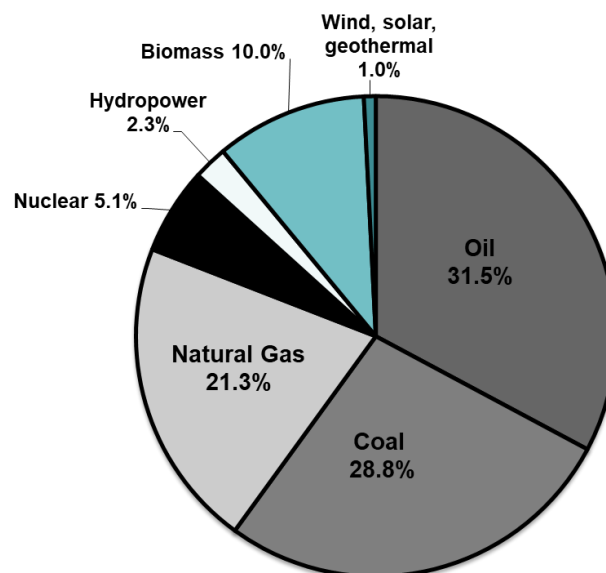


# ENE 101 – Introduction to Energy Engineering

## WEEK 4

### Energy Economics:

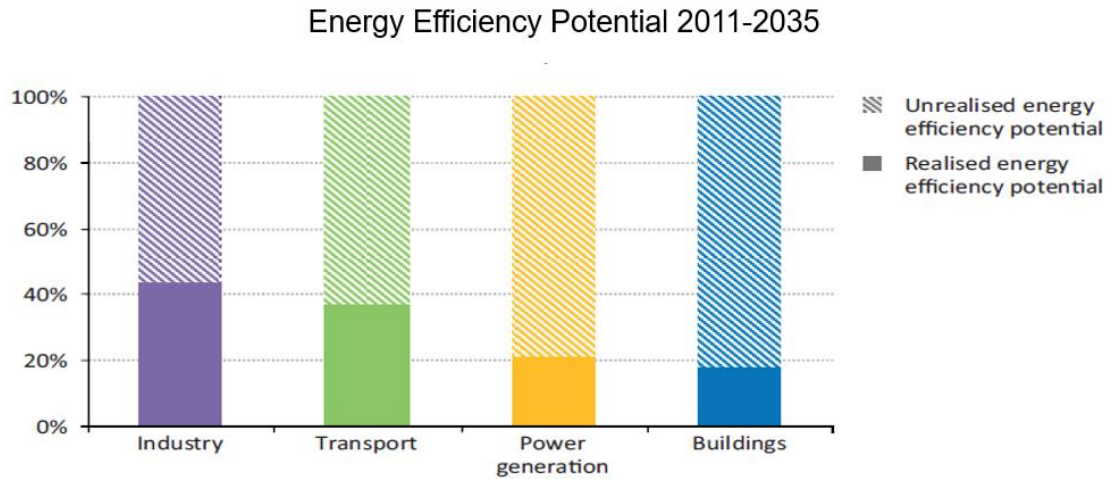
- **Energy economics** is a broad scientific subject area, which includes topics related to supply and use of energy in societies.
- **Energy economics** is the application of economics to energy issues. Central concerns in energy economics include the supply and demand for each of the main fuels in widespread use, competition among those fuels, the role of public policy, and environmental impacts.
- **Global Energy Consumption by Source, 2012:** The population is growing every day. The energy demand is skyrocketing. The energy resources are depleting. Therefore, the efficient usage of energy resources is a vital factor to provide life sustainability. Future energy needs are growing. In 2002, we needed about 412 Quadrillion British Units. By 2025, it will go up to at least 645, whether it is in Mature Market like the U.S., Transitional like Mexico, or Emerging like Nigeria.



Source: International Energy Agency (IEA 2013)

- **How efficient we utilize the energy? *Energy Efficiency***

Buildings have the highest level of energy loss

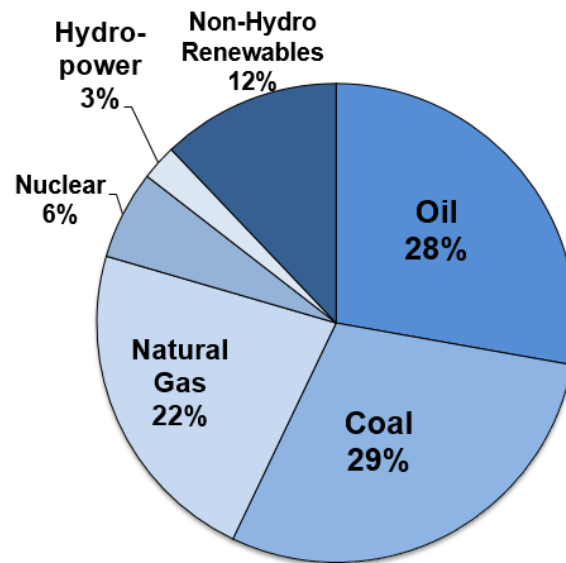


Source: World Energy Outlook 2012, International Energy Agency

- **Energy Efficiency**

Efficient energy use, sometimes simply called energy efficiency, is the goal to reduce the amount of energy required to provide products and services. Efficient energy use, sometimes simply called energy efficiency, is the goal to reduce the amount of energy required to provide products and services. For example, insulating a home allows a building to use less heating and cooling energy to achieve and maintain a comfortable temperature. Installing fluorescent lights, LED lights or natural skylights reduces the amount of energy required to attain the same level of illumination compared with using traditional incandescent light bulbs. Improvements in energy efficiency are generally achieved by adopting a more efficient technology or production process.

## Projected 2035 Global Energy Demand



Source: International Energy Agency, 2011.

- **Cost of Energy Production**

- ✚ Photovoltaic cells: \$0.20-0.40 per kW-hr
- ✚ Wind turbines: \$0.04-0.05 per kW-hr
- ✚ Gas: \$0.02-\$0.03 per kW-hr
- ✚ Coal: < \$0.03 per kW-hr

- **Energy Efficiency Improvement**

Several efforts have been applied in different sectors (residential, commercial/institution, transportation, industrial) to increase energy usage efficiency and to reduce energy loss. Each sector has energy efficiency gains between the years 1990-2010.

- **Energy Availability**

- ✚ Together with energy efficiency, another important factor in energy economics is energy availability.
- ✚ Considering the fact that in the near future, the fossil fuels are going to be depleted, this factor is more important for nonrenewable energy sources.
- ✚ This availability should be evaluated in Likely-Developable Locations.

**Table 1.** Energy Availability of Renewable Resources

<b>Energy Source</b>	<b>Total Global Availability (trillion watts)</b>	<b>Availability in Likely-Developable Locations (trillion watts)</b>
Wind	1700	40 – 85
Wave	> 2.7	0.5
Geothermal	45	0.07 – 0.14
Hydroelectric	1.9	1.6
Tidal	3.7	0.02
Solar photovoltaic	6500	340
Concentrated solar power	4600	240

Source: Jacobson and Delucchi (2011); U.S. Energy Information Administration

- **PV Economics Basics**

- ✚ Solar Photovoltaic Cells convert sunlight directly into electricity

- ✚ They are sold on a \$/Wp basis or \$/power

- ✚ Wp is the power in Watts for Peak sun hours -- the equivalent number of hours per day, with solar irradiance equaling 1,000 W/m<sup>2</sup>, that gives the same energy received from sunrise to sundown.

- ✚ To convert power to energy simply multiply by the amount of time that the cell is illuminated

$$W * hr = 1 \text{ W-hr}$$

- ✚ Electricity (energy) is normally billed \$/kW-hr

## References:

1. International Energy Agency (IEA 2013).
2. "Electrical Energy." The New Book of Popular Science. 2000 edition. Grolier Incorporated, 1998.
3. Source: Barbose, G., S. Weaver and N. Darghouth. 2014. Tracking the Sun VII: an historical summary of the installed price of photovoltaics in the United States from 1998 to 2013. SunShot Initiative, U.S. Department of Energy.
4. US Energy Information Administration (EIA), 2011.
5. Source: Blok et al. (2008) Global status report on energy efficiency 2008. Renewable Energy and Energy Efficiency Partnerships. [www.reeep.org](http://www.reeep.org)