# Nuclear Power

- Fusion
- Fission

$$1 MeV = 4.44 \times 10^{-20} kWh$$

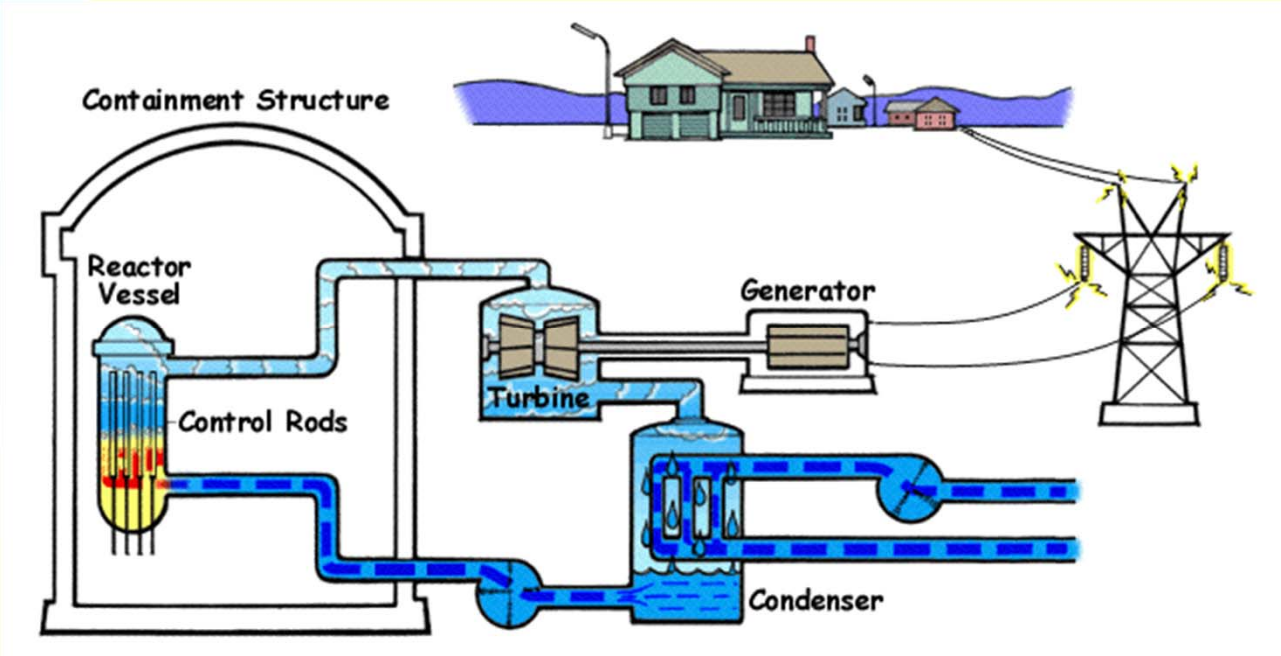
**Nuclear Fusion:**

$$D + D \rightarrow T + p + 4 Mev$$

# Nuclear Fission:

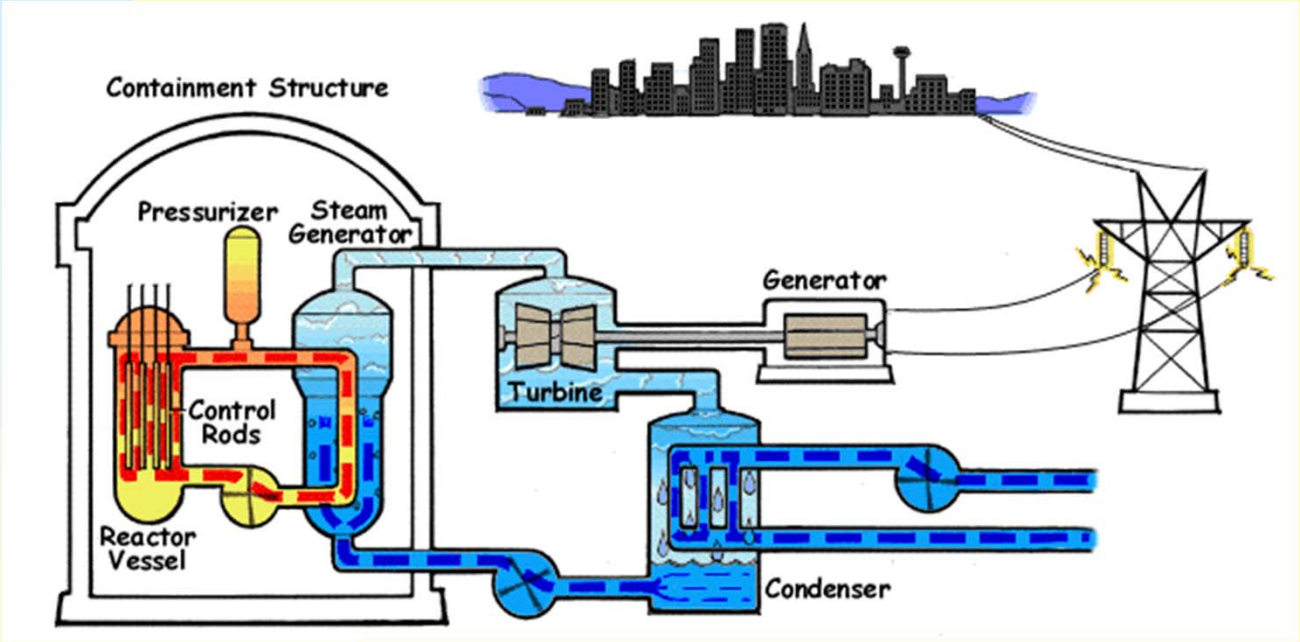
$$_{92}U^{235} + {}_{0}n^{1} \rightarrow {}_{54}Xe^{140} + {}_{38}Sr^{94} + 2\,{}_{0}n^{1} + 196\ Mev$$

# Nuclear Power Plant
# Type: BWR



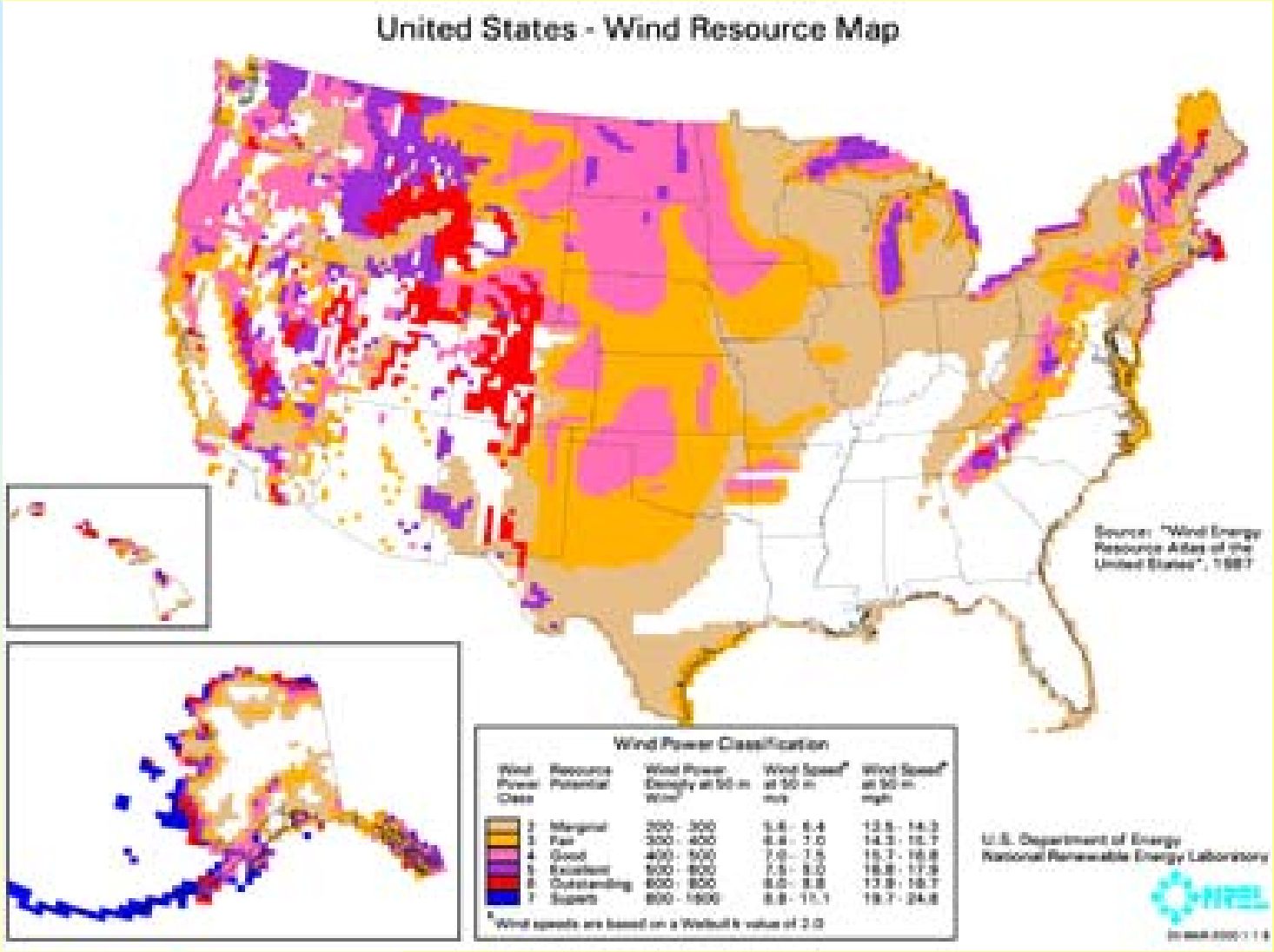

BWR: http://www.nrc.gov/reading-rm/basic-ref/students/animated-bwr.html

# Nuclear Power Plant
# Type: PWR



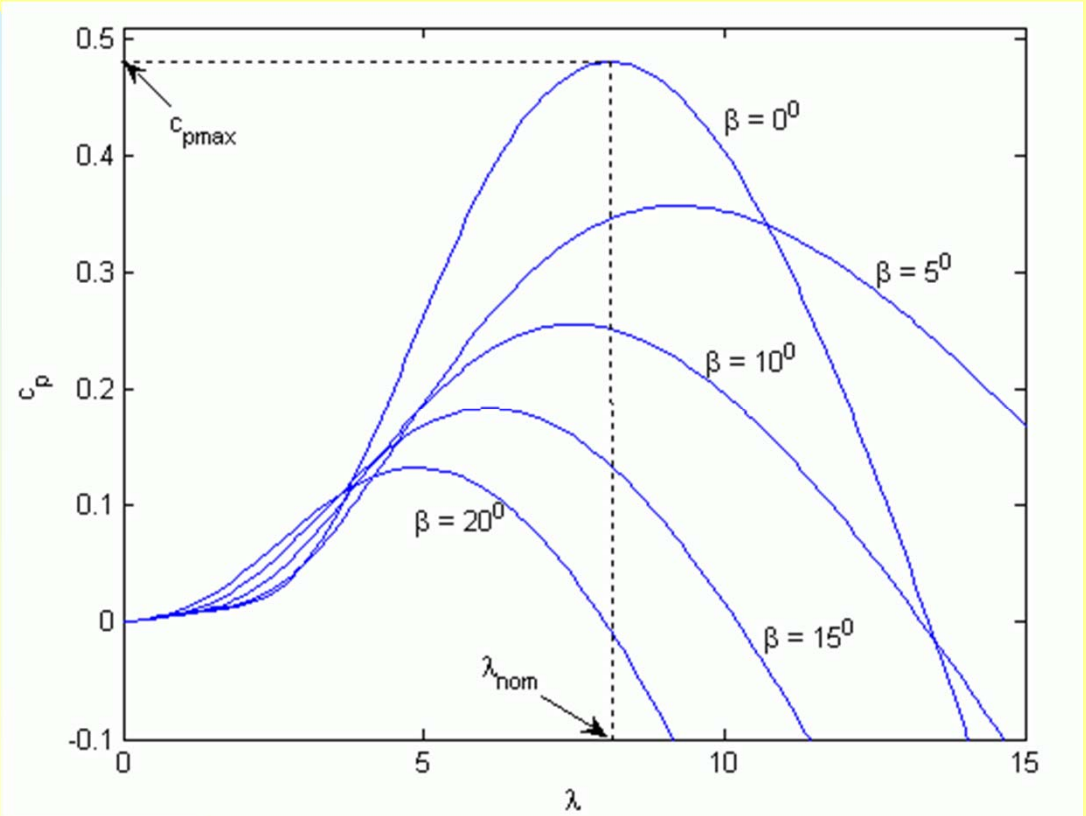

PWR: http://www.nrc.gov/reading-rm/basic-ref/students/animated-pwr.html

# Wind Resources in the U.S.



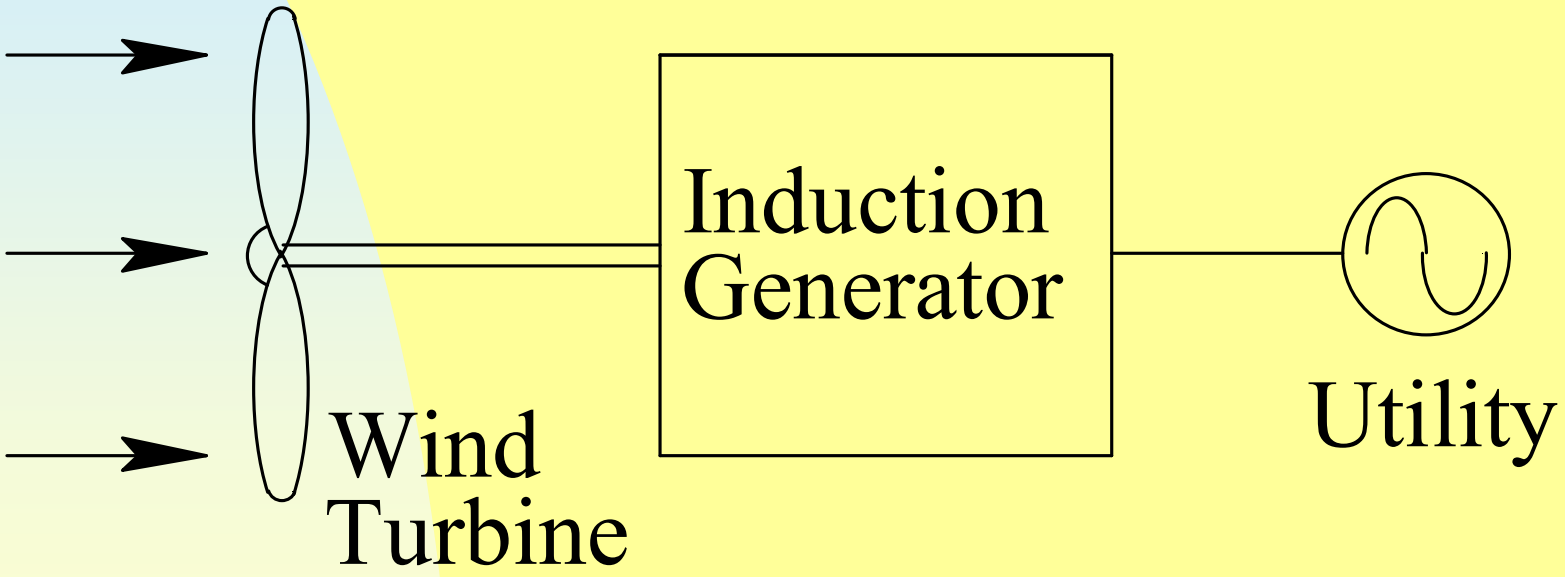
# Coefficient of Performance:

$$P_w = C_p\left(\frac{1}{2}\rho A V^3\right)$$

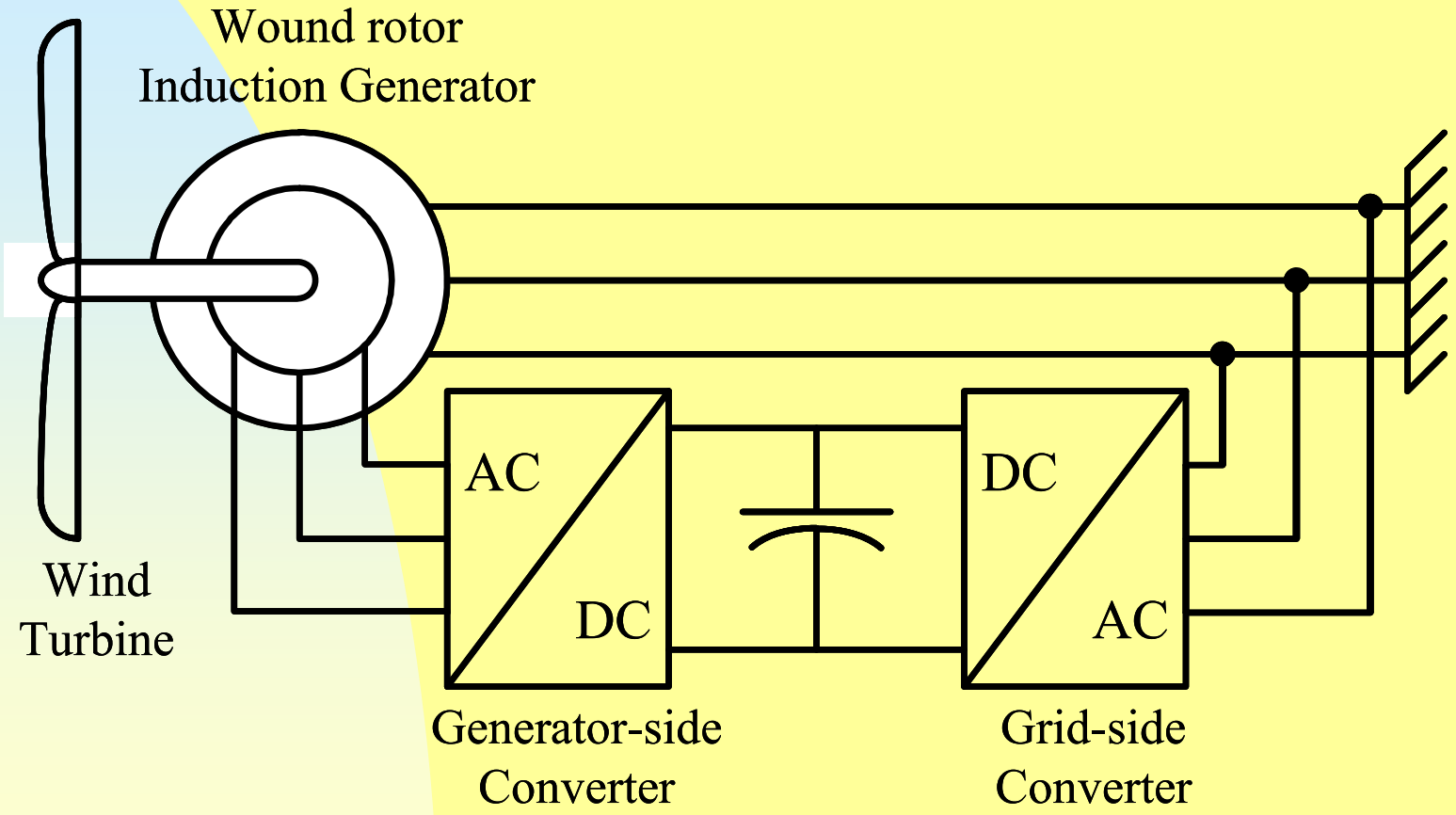



$$\lambda = \frac{\omega_m r}{V}$$

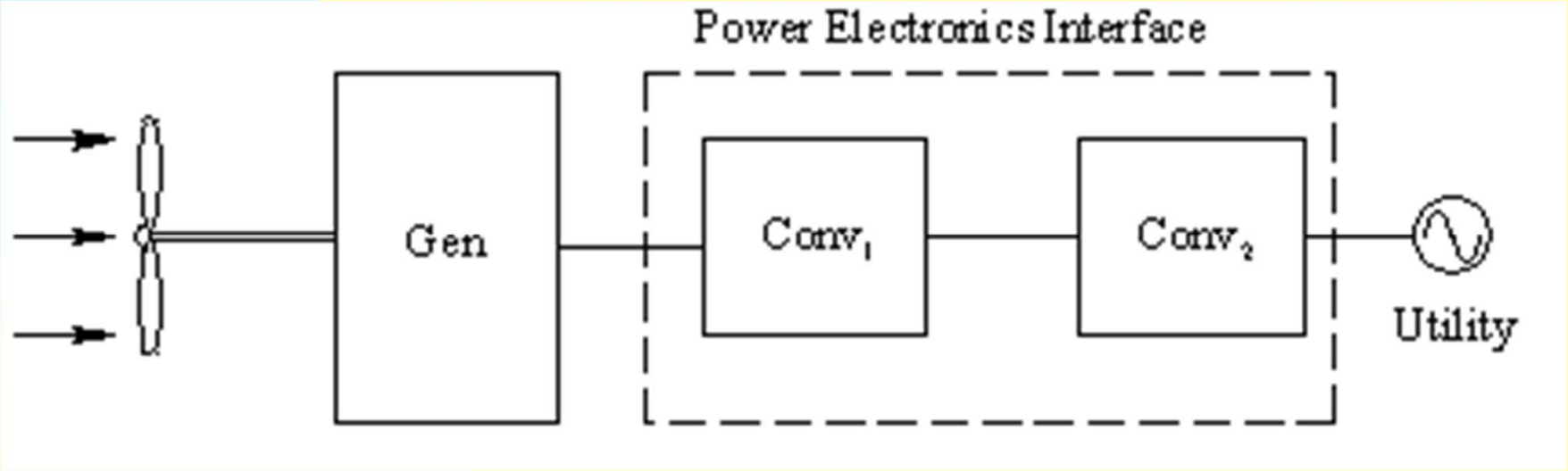
# Wind Generation using an Induction Generator Connected Directly to the AC Grid



# Wind Generation using a Doubly-Fed Induction Generator

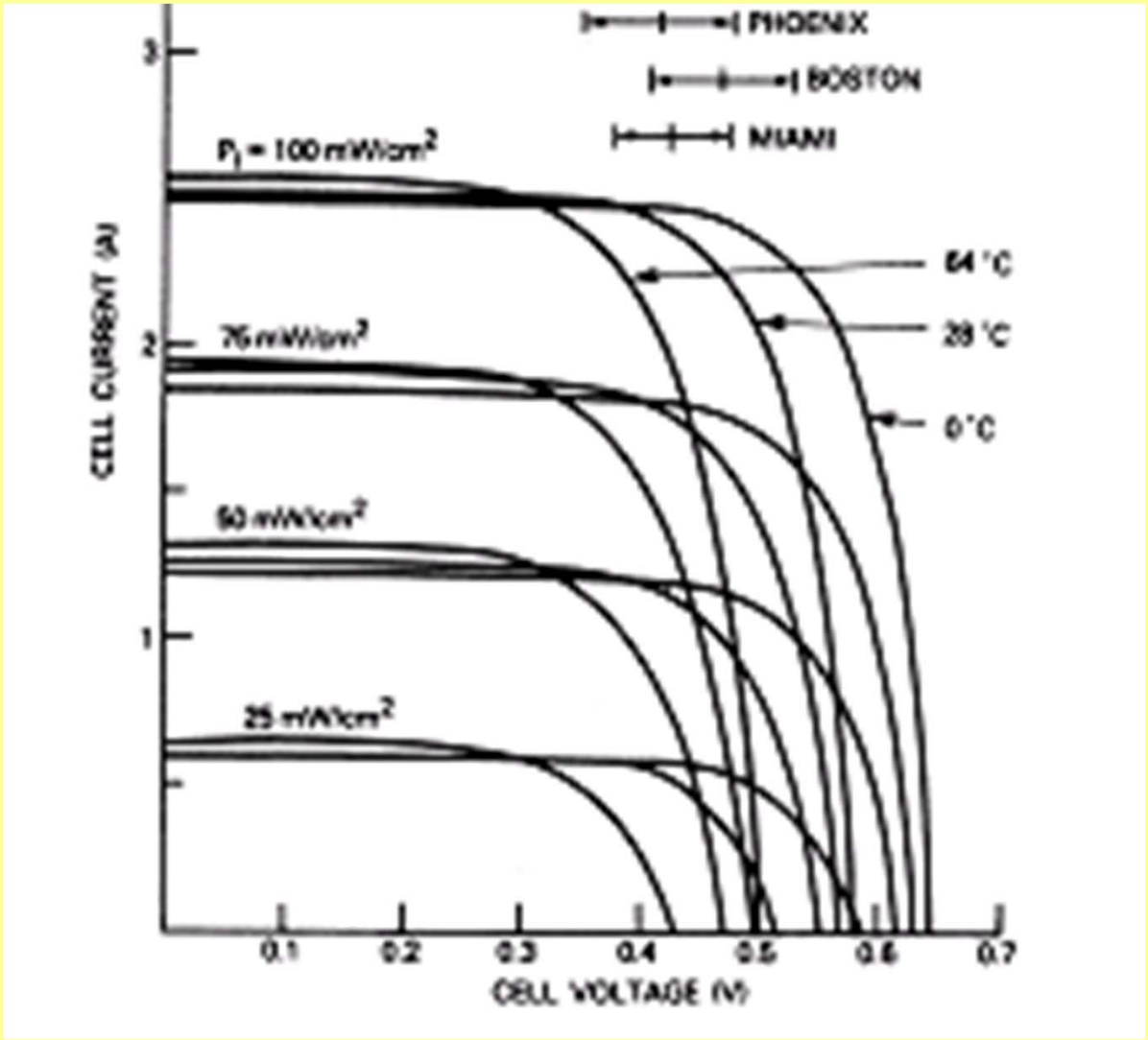


# Wind Generation using an AC Generator Connected through Power Electronics

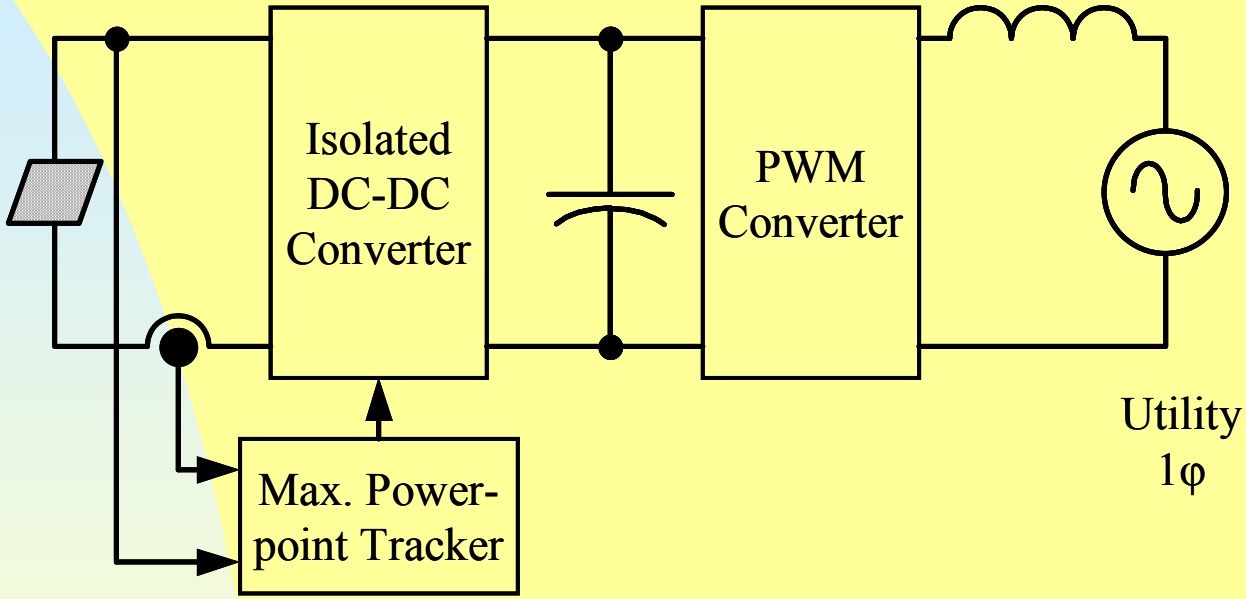


# Photovoltaics

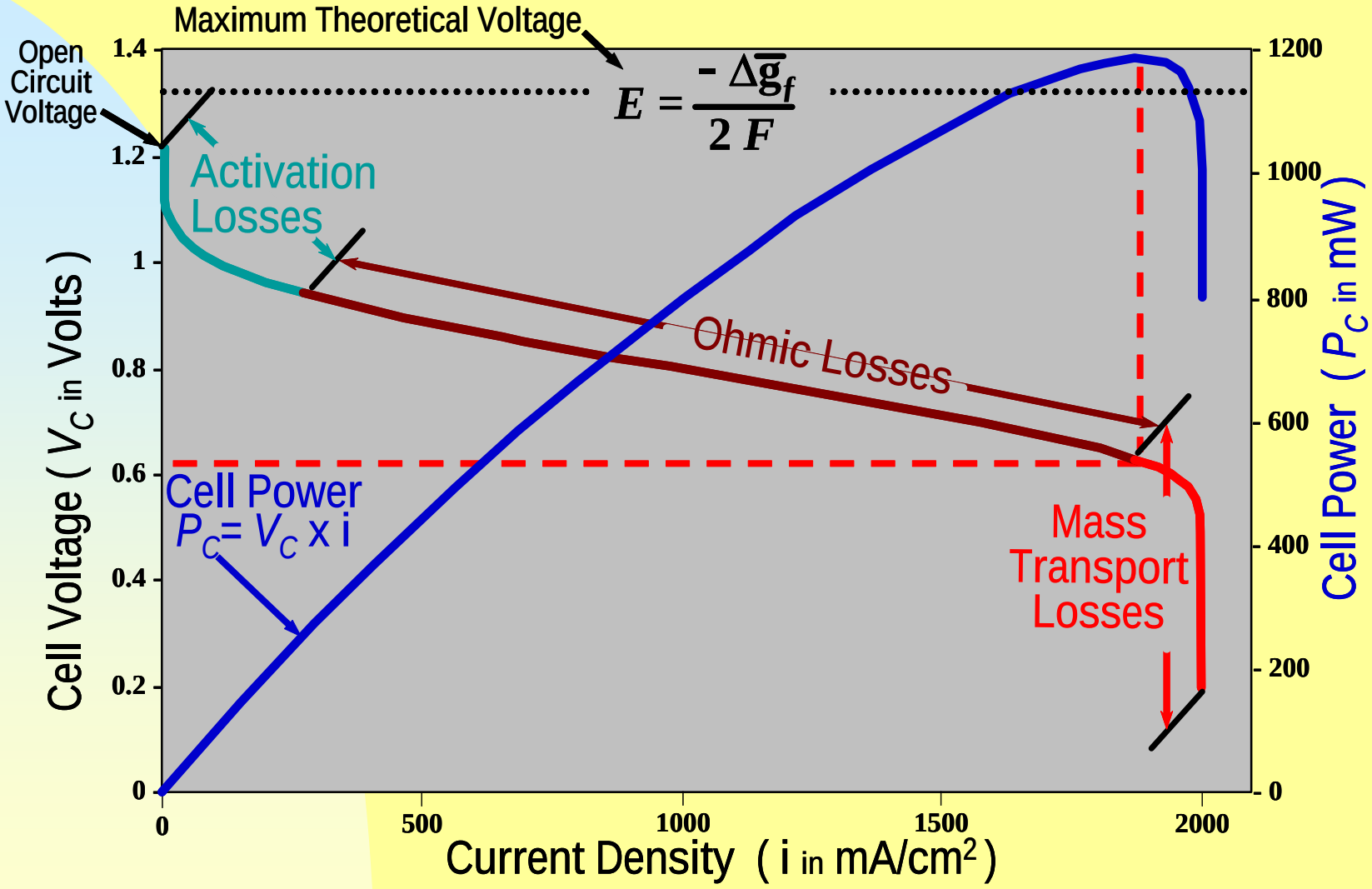
# Photovoltaic Cells



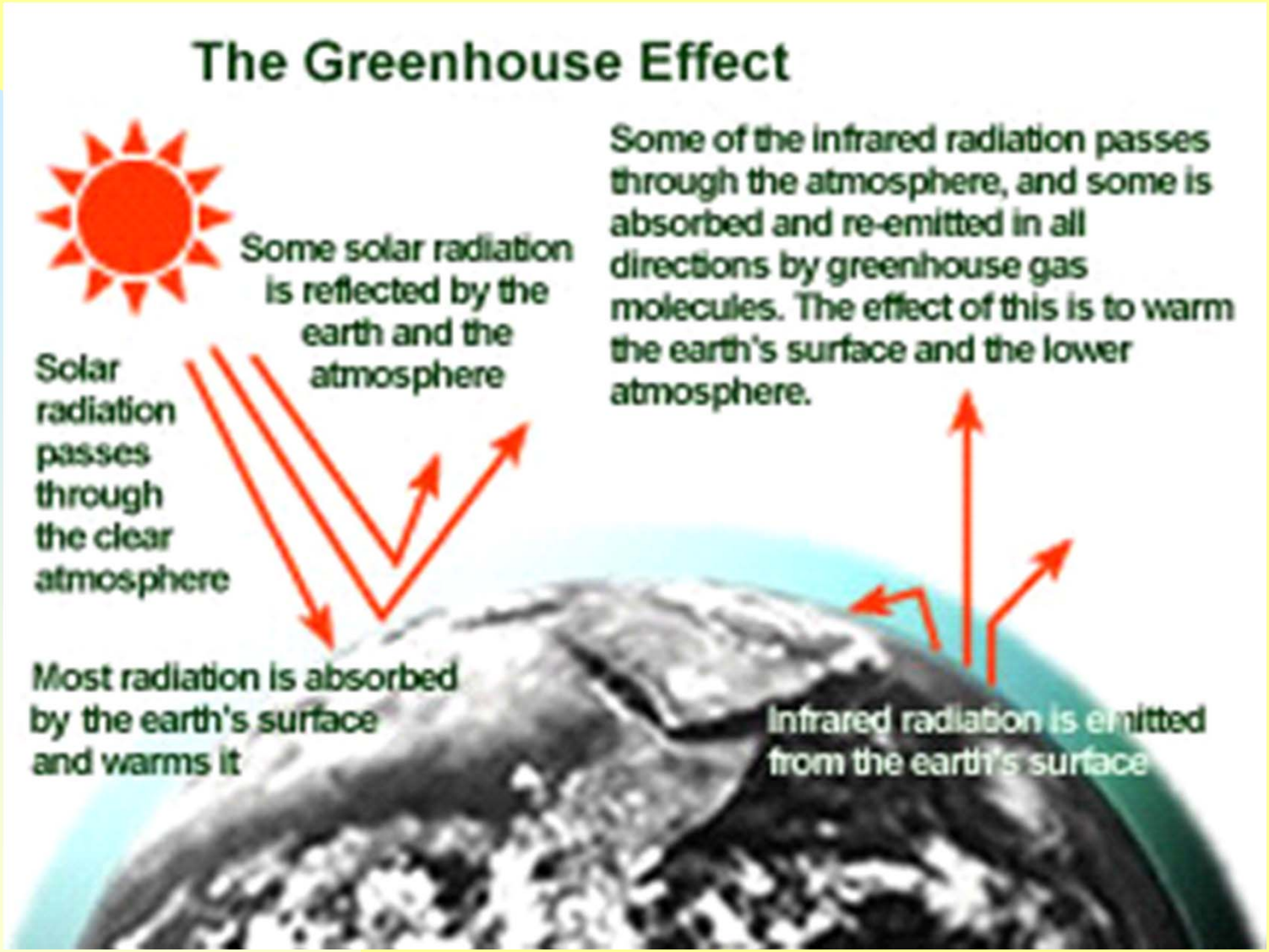
# Interfacing PV with AC Grid



# Fuel Cells

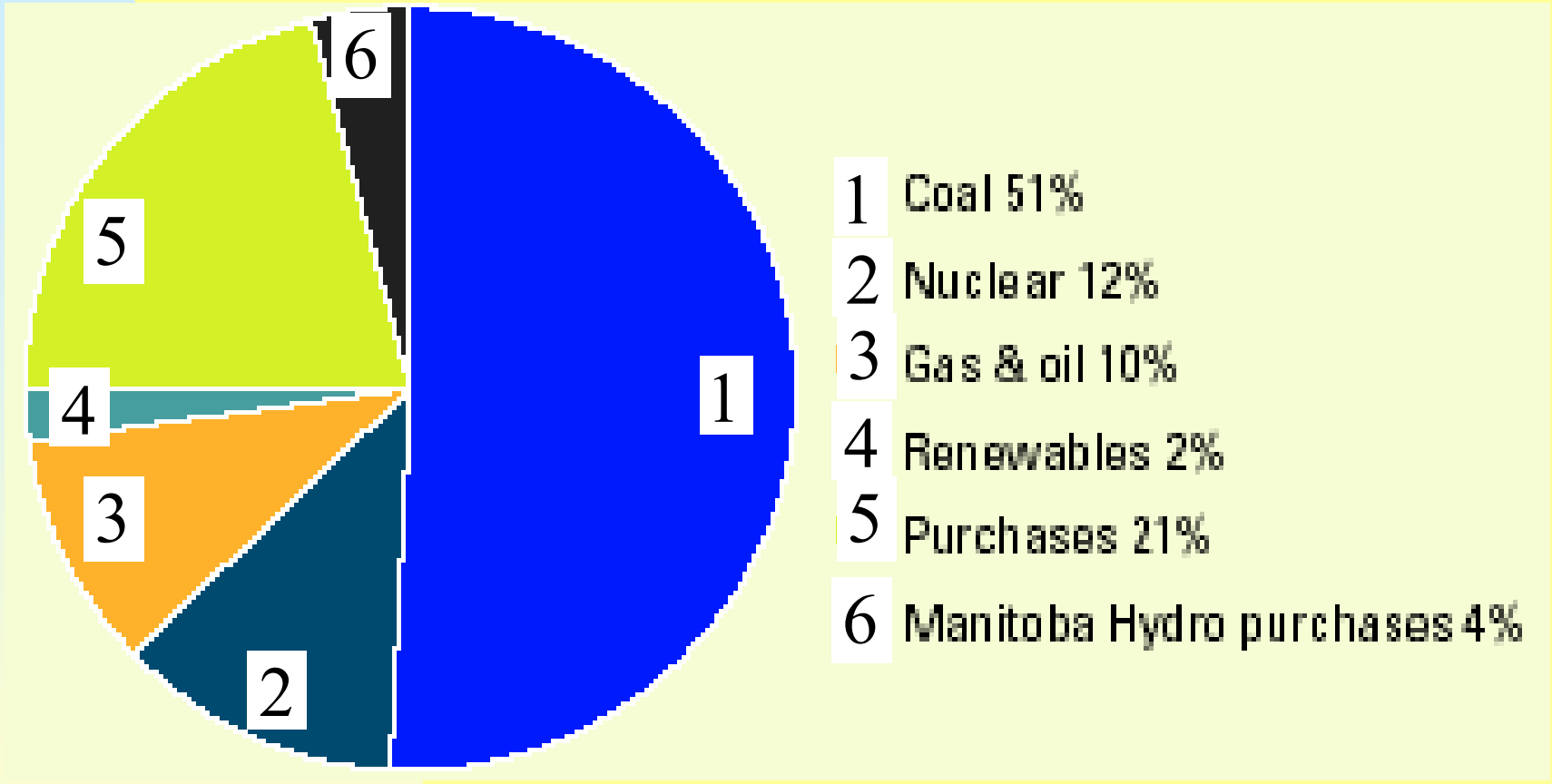


# Greenhouse Effect




www.epa.gov/globalwarming/kids/greenhouse.html

# Resource mix at XcelEnergy



# Cost of Electricity:

- Coal Plants
- Single-Cycle Gas Plants
- Combined-Cycle Gas Plants
- Wind Turbines
- Photovoltaics

# Summary

- Energy Production and Consumption
- Choices
- Consequences
- Cost of Electricity