U.S.NRC
United States Nuclear Regulatory Commission
Protecting People and the Environment

Importance of Science Literacy in Policy-Making

Union College
October 21, 2010

Commissioner William Ostendorff
US Nuclear Regulatory Commission

What do the following questions have in common?

Are genetically modified foods a solution to world hunger or a risk to our food supply?

Should childhood vaccinations be required?

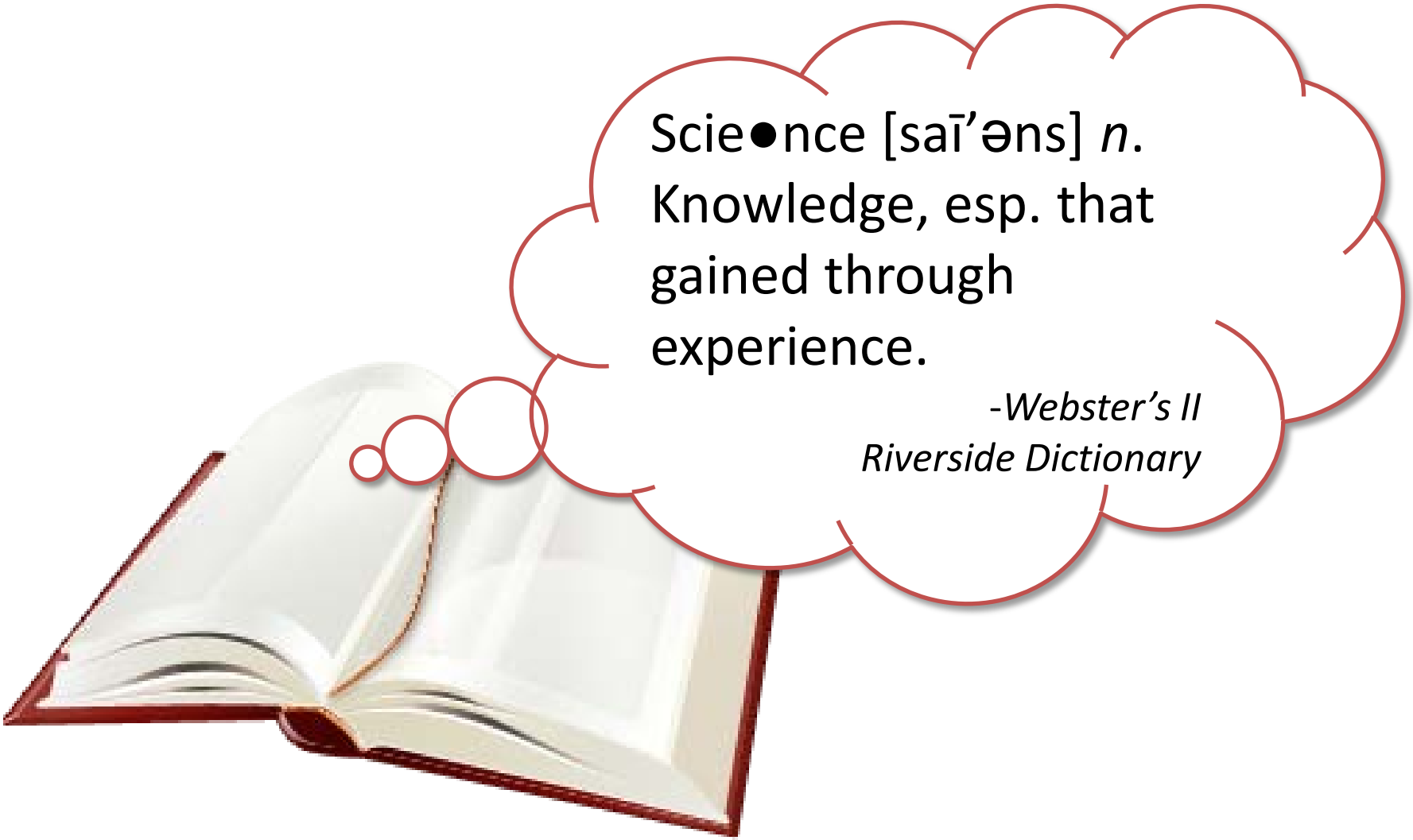
How should we use and protect personal genetic information?

Are biofuels “green”?

So, what do the following questions have in common?

SCIENCE IS NEEDED TO HELP INFORM THE ANSWERS

What is Science?



Science is Powerful

- Scientific knowledge creates power
- Power allows for the application of science

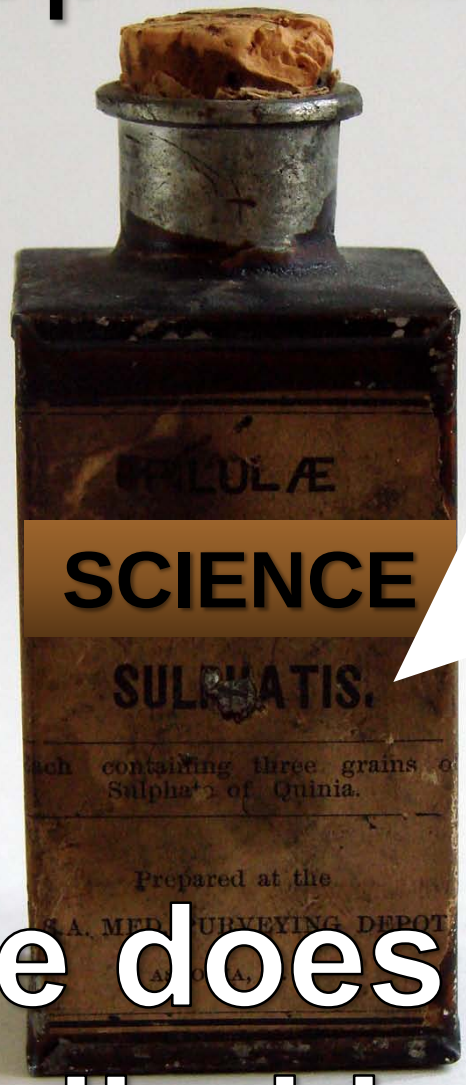
Science ≠ Certainty

- "Scientific knowledge is a body of statements of varying degrees of certainty – some are mostly unsure, some nearly sure, none are *absolutely* certain."

  - Richard Feynman, Nobel Physicist

Photo of Deep-Space from Infrared Telescope

Keep in mind...

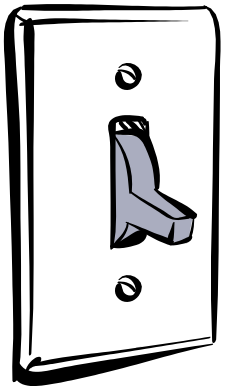


Directions For Use:
(1) Question; (2) Research; (3) Hypothesize; (4) Experiment; (5) Analyze and Interpret; (6) Communicate ; and (7) Repeat

Caution: Application will most likely lead to more questions!

...science does not come with detailed instructions

Scientific Method in Everyday Life



You arrive home and flip the switch

- Is the power out?
- If power out, neighborhood dark
- Look outside
- No lights.
- Ok, but what if coincidence?
- Try another lamp
- Is bulb out… lamp plugged in?

Results often lead to more questions

Importance of Science Education

…demonstrate ***problem-solving methods*** in science and technology

…be able to ***reason quantitatively***

…evaluate evidence, results, and claims related to the natural sciences or technology and understand their ***impact on broader human or societal issues***

…be able to ***think logically***, solve problems that require multiple steps

…promote ***critical thinking***

Case Study: Deforestation

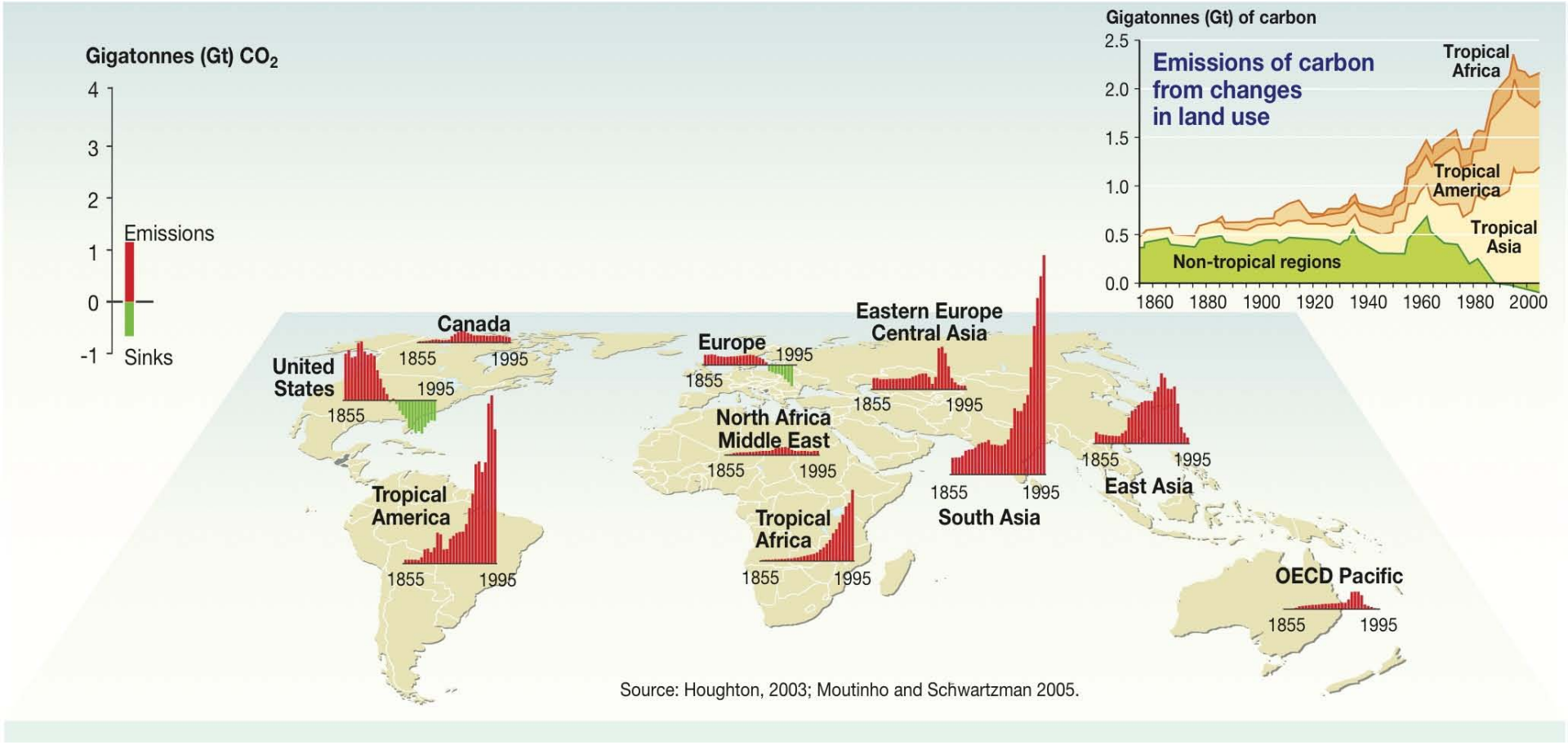
POLICY

- Carbon Credits
- Water Scarcity
- Land-use
- Endangered Species
- Conservation
- Developing Countries
- Farming Subsidies

SCIENCE

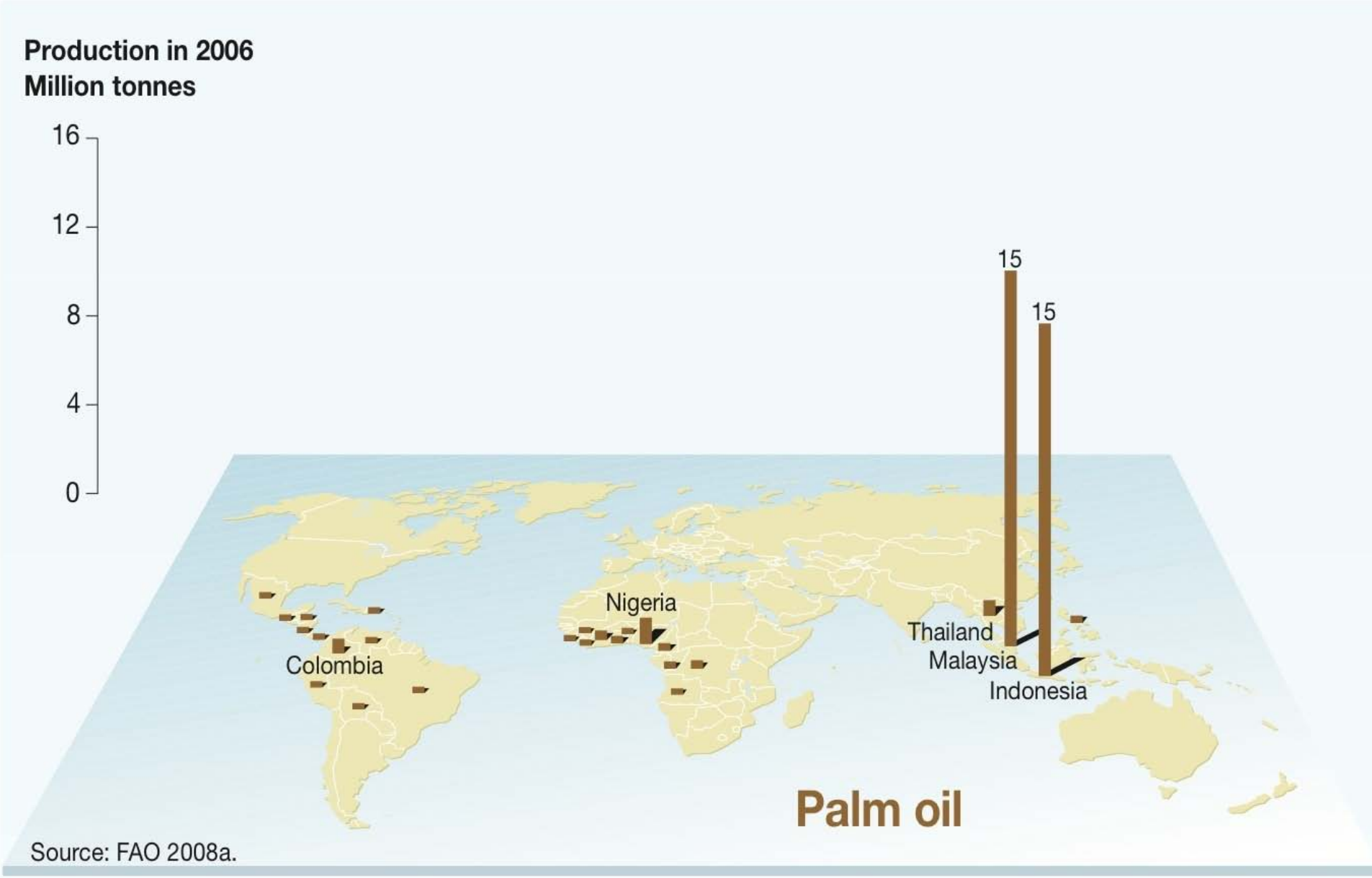
- Photosynthesis
- Thermodynamics
- Agriculture Science
- Biology
- Forestry Ecology
- Population Statistics
- Economics

Historical Forest Carbon Balance 1855-1995

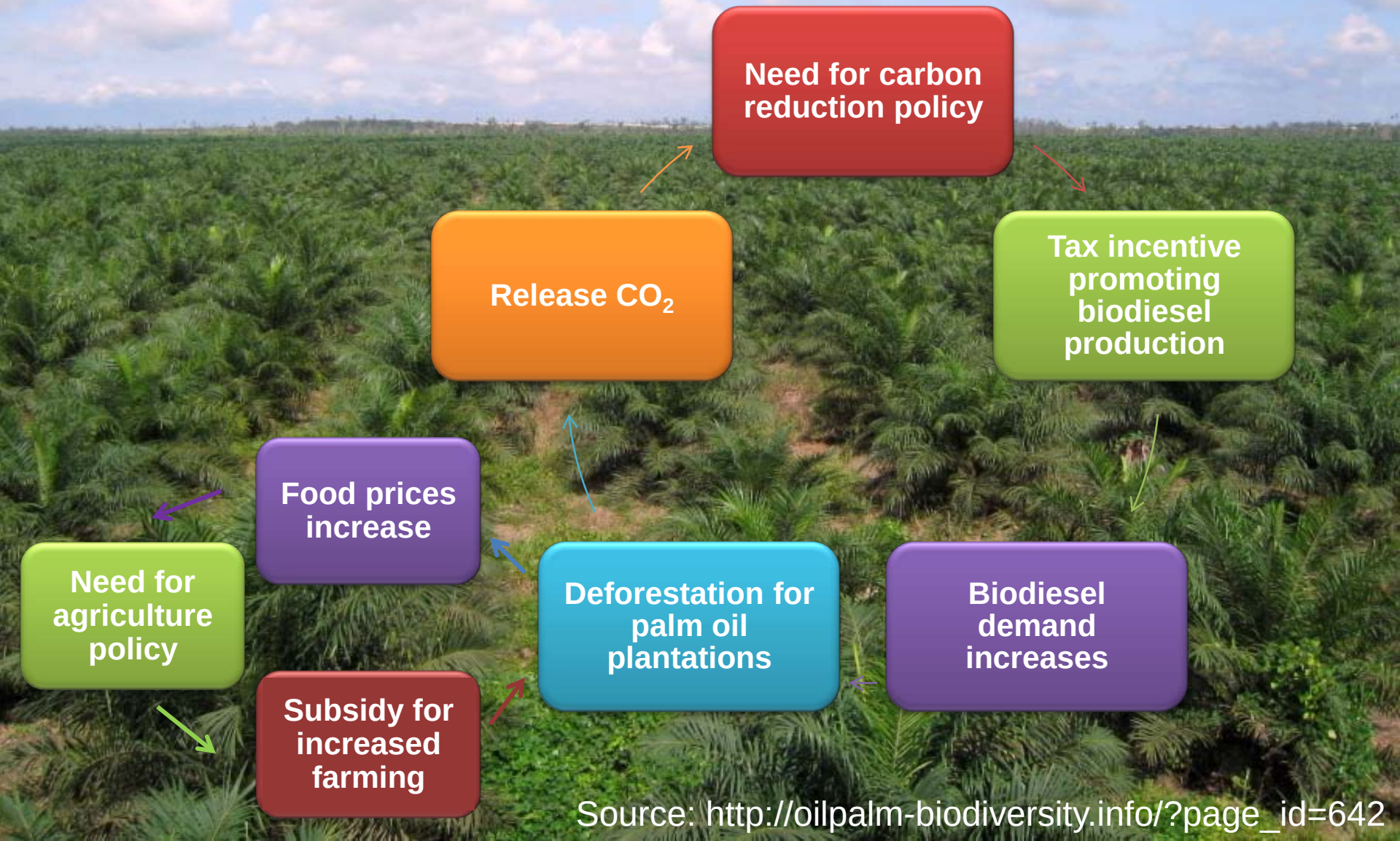


Source: United Nations Environment Program, http://maps.grida.no/go/graphic/historical-forest-carbon-balance-1855-1995

Major Producers of Palm Oil



Science and Policy Intersection



Source: http://oilpalm-biodiversity.info/?page_id=642

Case Study: Energy Policy

POLICY

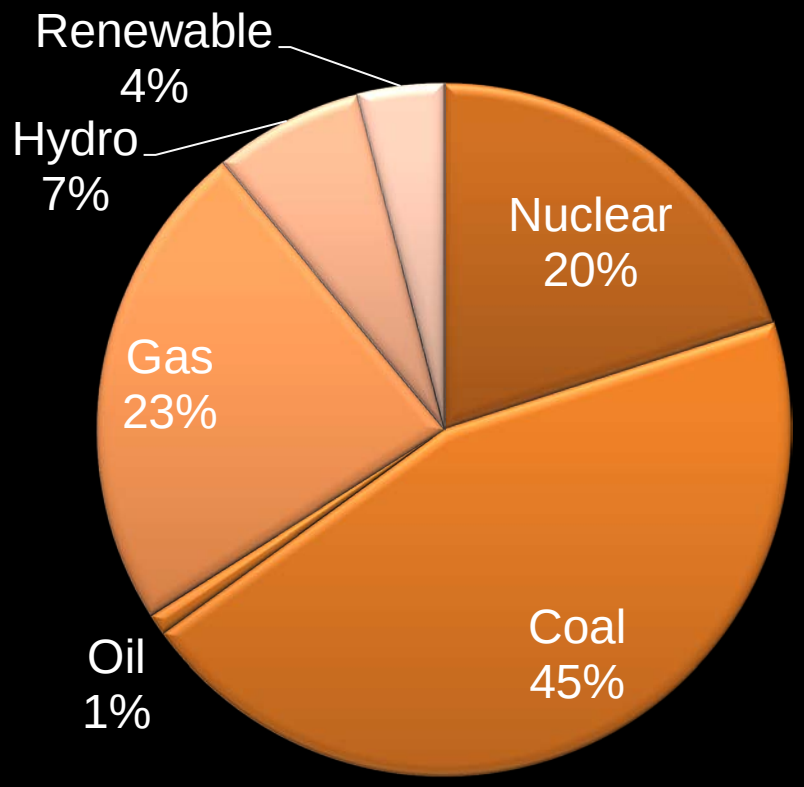
- Reliable Base-load Power
- Land-use and Waste
- Subsidies & Loan Guarantees
- Carbon Tax
- Pollution and Contamination

SCIENCE

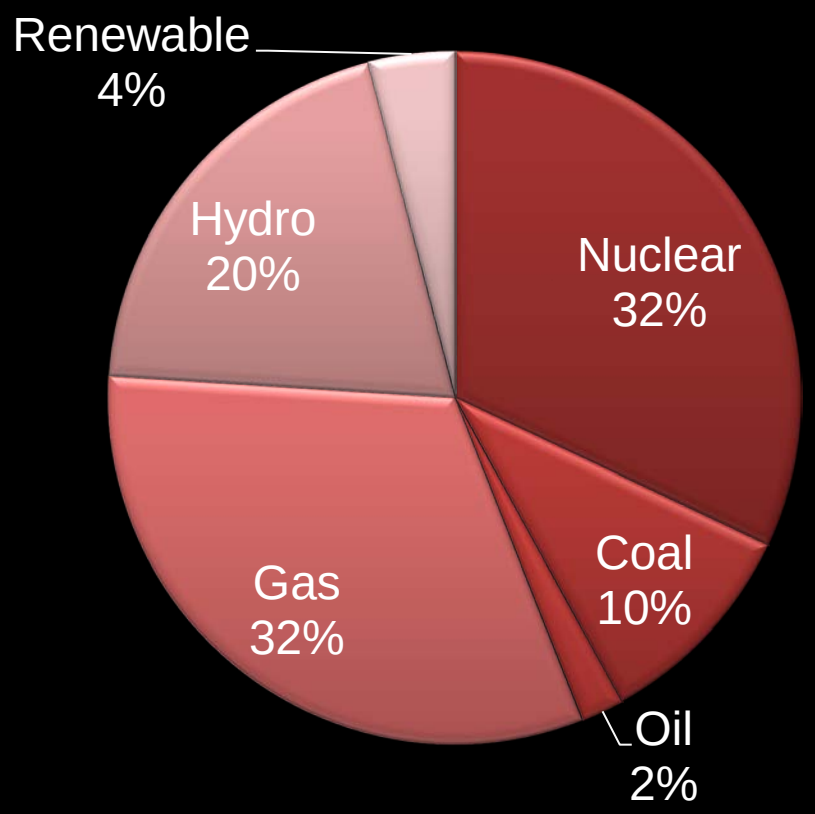
- Physics & Geography
- Energy Density
- Economics & Mathematics
- Climate Science
- Health Physics & Radiation

US and New York Electricity Sources

US Electricity Sources

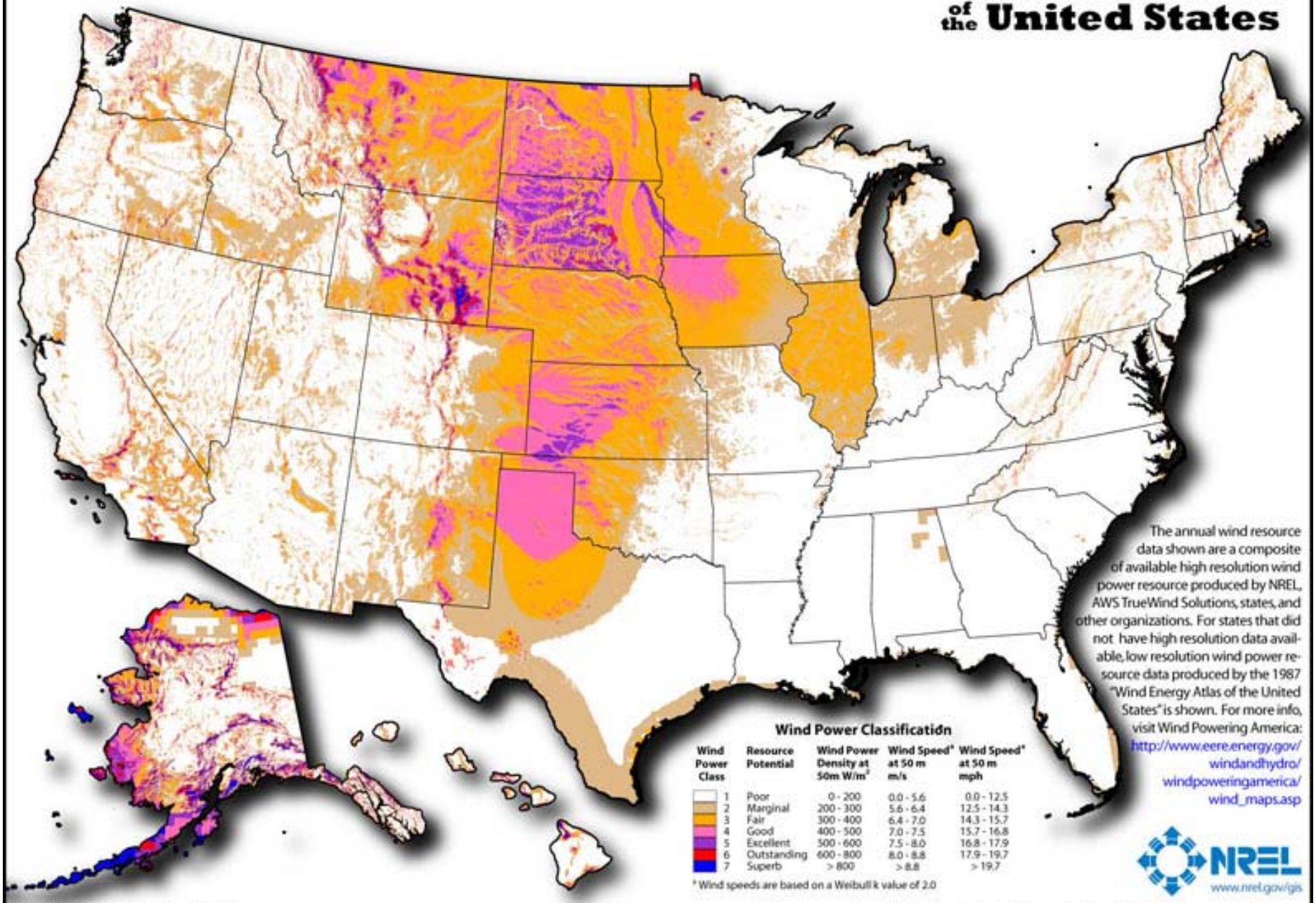


New York Electricity Sources



Source: U.S. Energy Information Administration (EIA), 2009

Wind Resource (50m) of the United States



The annual wind resource data shown are a composite of available high resolution wind power resource produced by NREL, AWS TrueWind Solutions, states, and other organizations. For states that did not have high resolution data available, low resolution wind power resource data produced by the 1987 "Wind Energy Atlas of the United States" is shown. For more info, visit Wind Powering America: http://www.eere.energy.gov/windandhydro/windpoweringamerica/wind_maps.asp

Wind Power Classification

Wind Power Class	Resource Potential	Wind Power Density at 50m W/m²	Wind Speed* at 50 m m/s	Wind Speed* at 50 m mph
1	Poor	0 - 200	0.0 - 5.6	0.0 - 12.5
2	Marginal	200 - 300	5.6 - 6.4	12.5 - 14.3
3	Fair	300 - 400	6.4 - 7.0	14.3 - 15.7
4	Good	400 - 500	7.0 - 7.5	15.7 - 16.8
5	Excellent	500 - 600	7.5 - 8.0	16.8 - 17.9
6	Outstanding	600 - 800	8.0 - 8.8	17.9 - 19.7
7	Superb	> 800	> 8.8	> 19.7

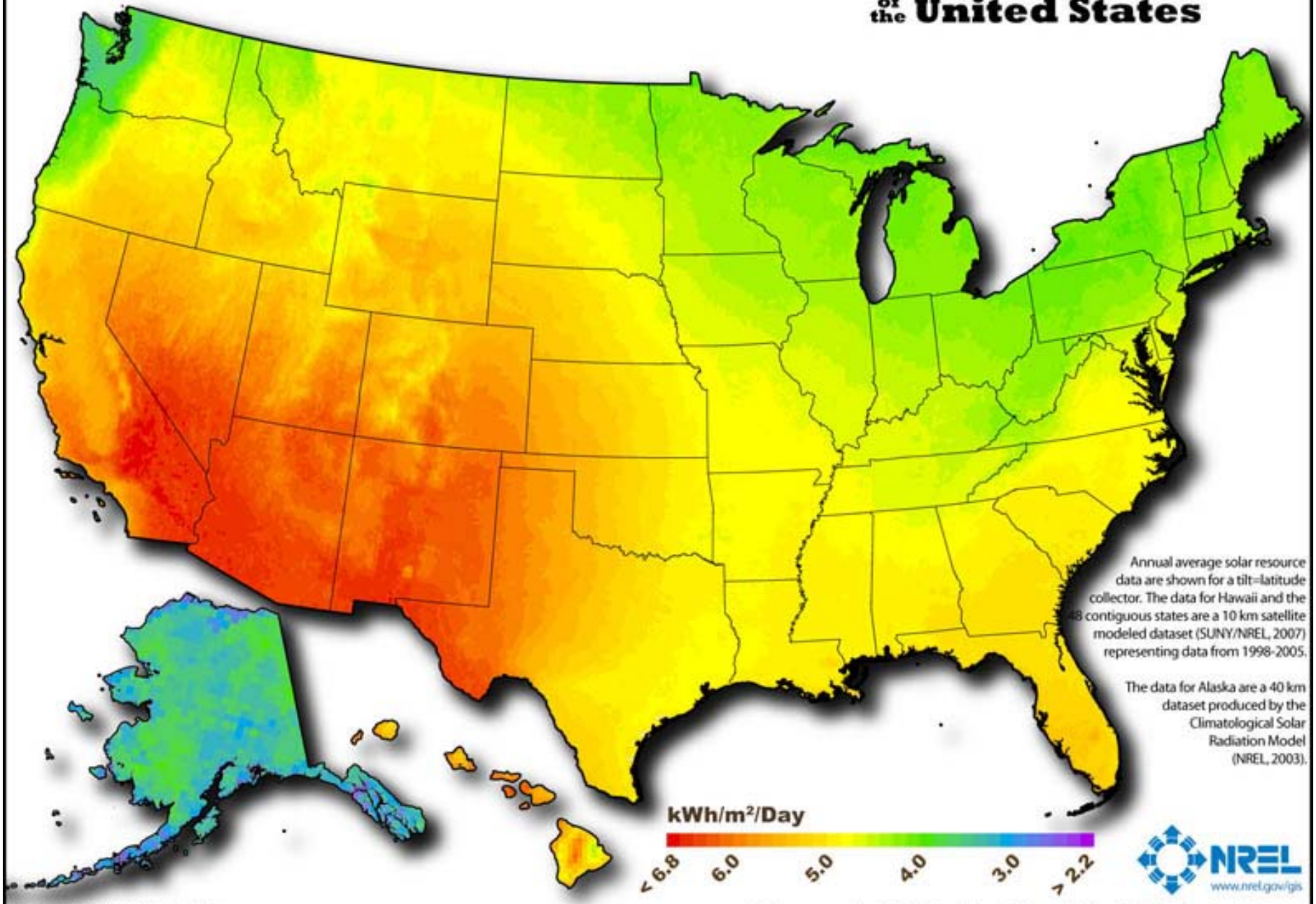
* Wind speeds are based on a Weibull k value of 2.0

NREL
www.nrel.gov/gis

Author : Billy Roberts - December 12, 2008

This map was produced by the National Renewable Energy Laboratory for the U.S. Department of Energy.

Photovoltaic Solar Resource of the United States



Annual average solar resource data are shown for a tilt=latitude collector. The data for Hawaii and the 48 contiguous states are a 10 km satellite modeled dataset (SUNY/NREL, 2007) representing data from 1998-2005.

The data for Alaska are a 40 km dataset produced by the Climatological Solar Radiation Model (NREL, 2003).

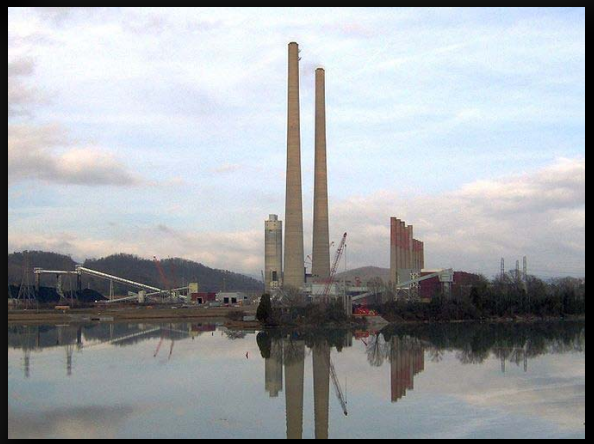
Author : Billy Roberts - October 20, 2008

This map was produced by the National Renewable Energy Laboratory for the U.S. Department of Energy.

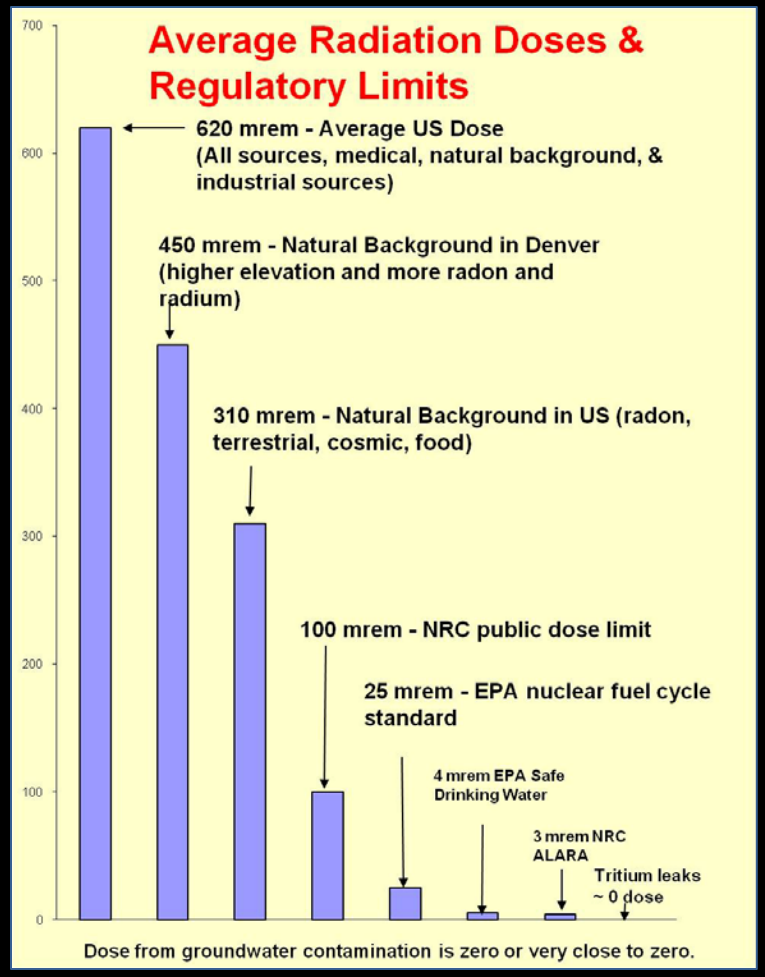
Converting Sun Energy to Area Solar Panel Required

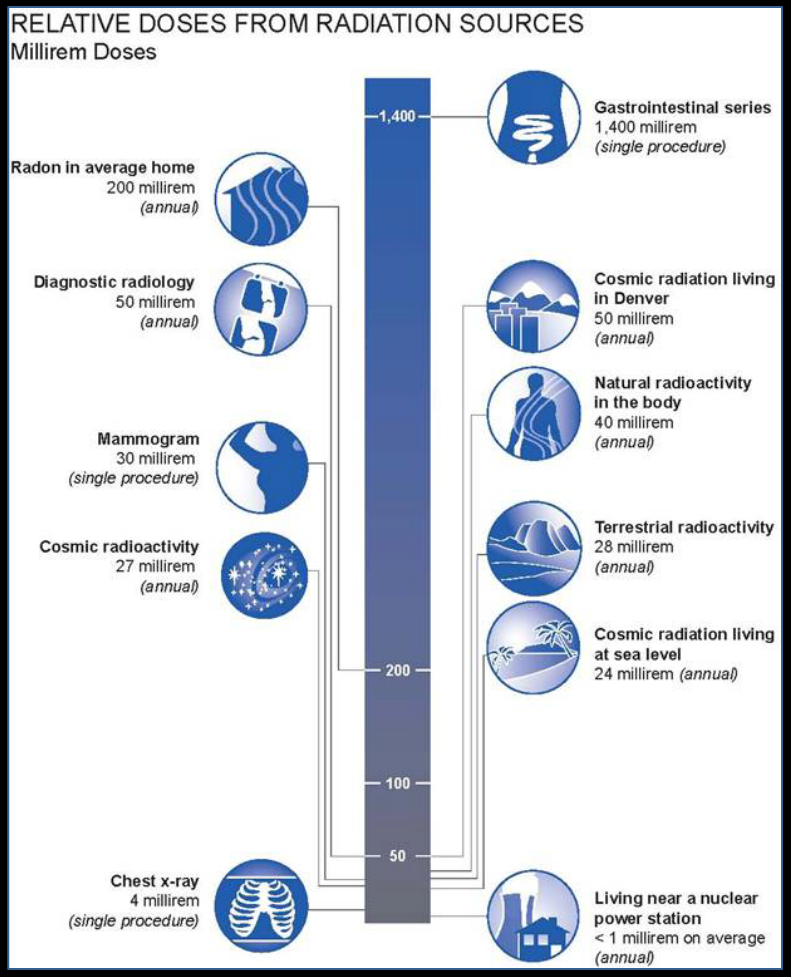
- 6.7 kWh for 1 year
  - 2450 kWhrs/m^2
- 12,000 kWh/yr per person
  - 5m^2 of sunlight
- 15% efficiency
  - 33m^2 of panels
- 0.5 min to avg ratio
  - 66m^2 of panels
- 15% capacity margin
  - 75m^2 of panels

Nuclear Power and Energy Mix in the New Millennium



Radiation and Groundwater



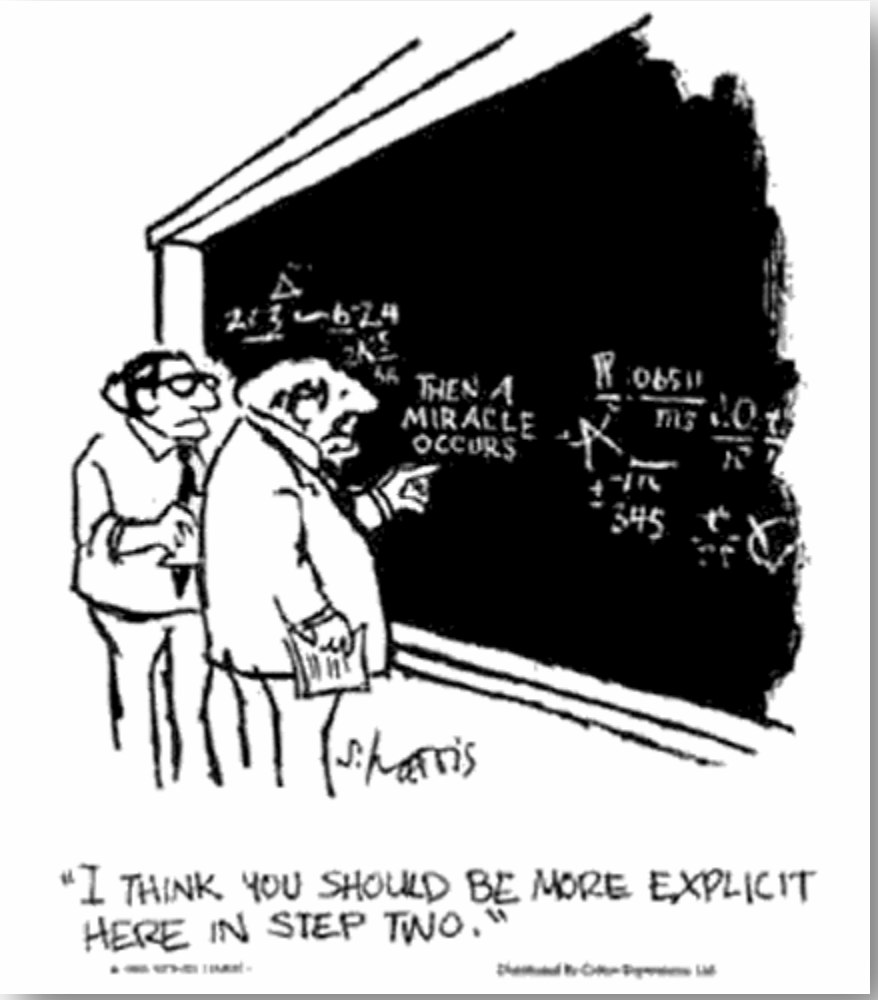


Concluding Thoughts

- Scientific knowledge is powerful in that it enables the use of technology.
- Scientific understanding does not equal consensus.
- There is potential for the misapplication of science.
- A better-informed public leads to better public policy.

"WHAT IT COMES DOWN TO IS THE GOVERNMENT WANTS TO KNOW HOW $\frac{K}{4}\sqrt{3^n}-T$ WILL HELP AMERICA."

QUESTIONS?


THEN A MIRACLE OCCURS
"I THINK YOU SHOULD BE MORE EXPLICIT HERE IN STEP TWO."