

The Future of Energy: Toward the 21st Century Energy System We Need (With an Eye on the Rear View Mirror)

Sue Tierney

Analysis Group, Boston, MA

Department of Energy “Energy All Stars” Day, Washington, D.C. – January 19, 2013





My story: Redlands, CA, c.1955 – at the foot of 11,500' mountains

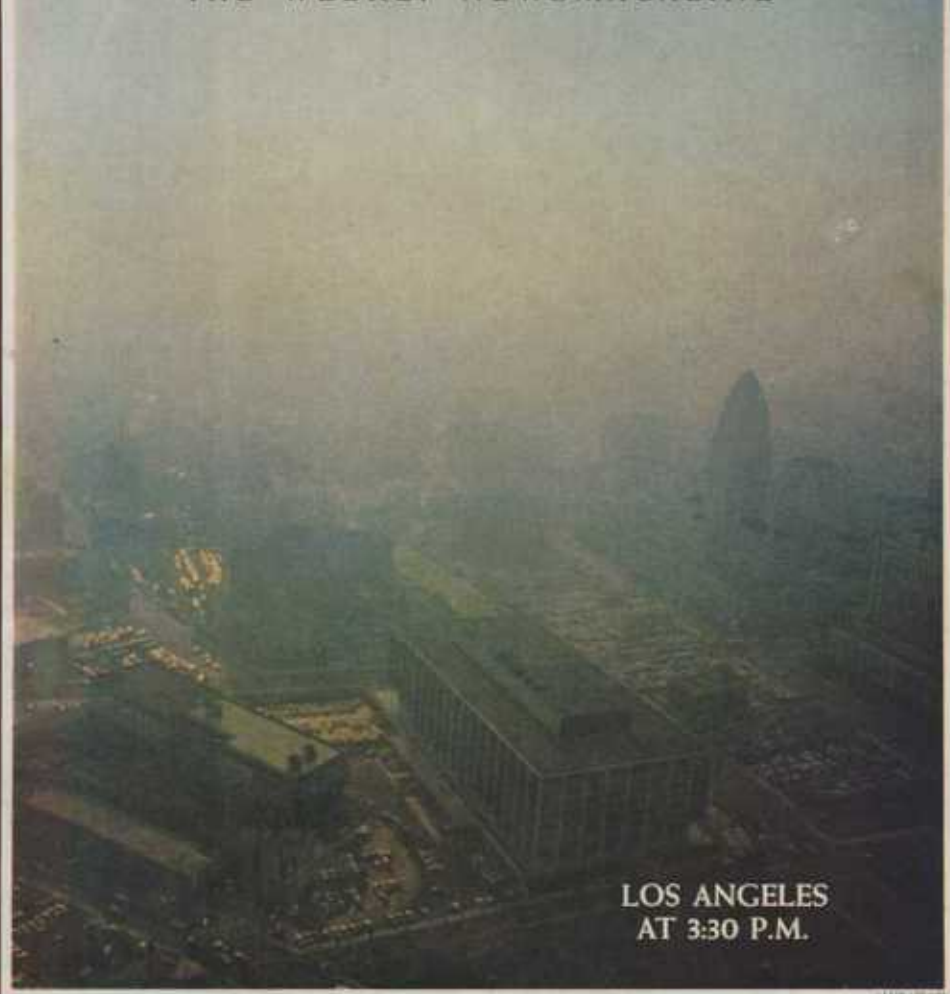
FIFTY CENTS

JANUARY 27, 1967

TIME

THE WEEKLY NEWSMAGAZINE

THE POLLUTED AIR



LOS ANGELES
AT 3:30 P.M.

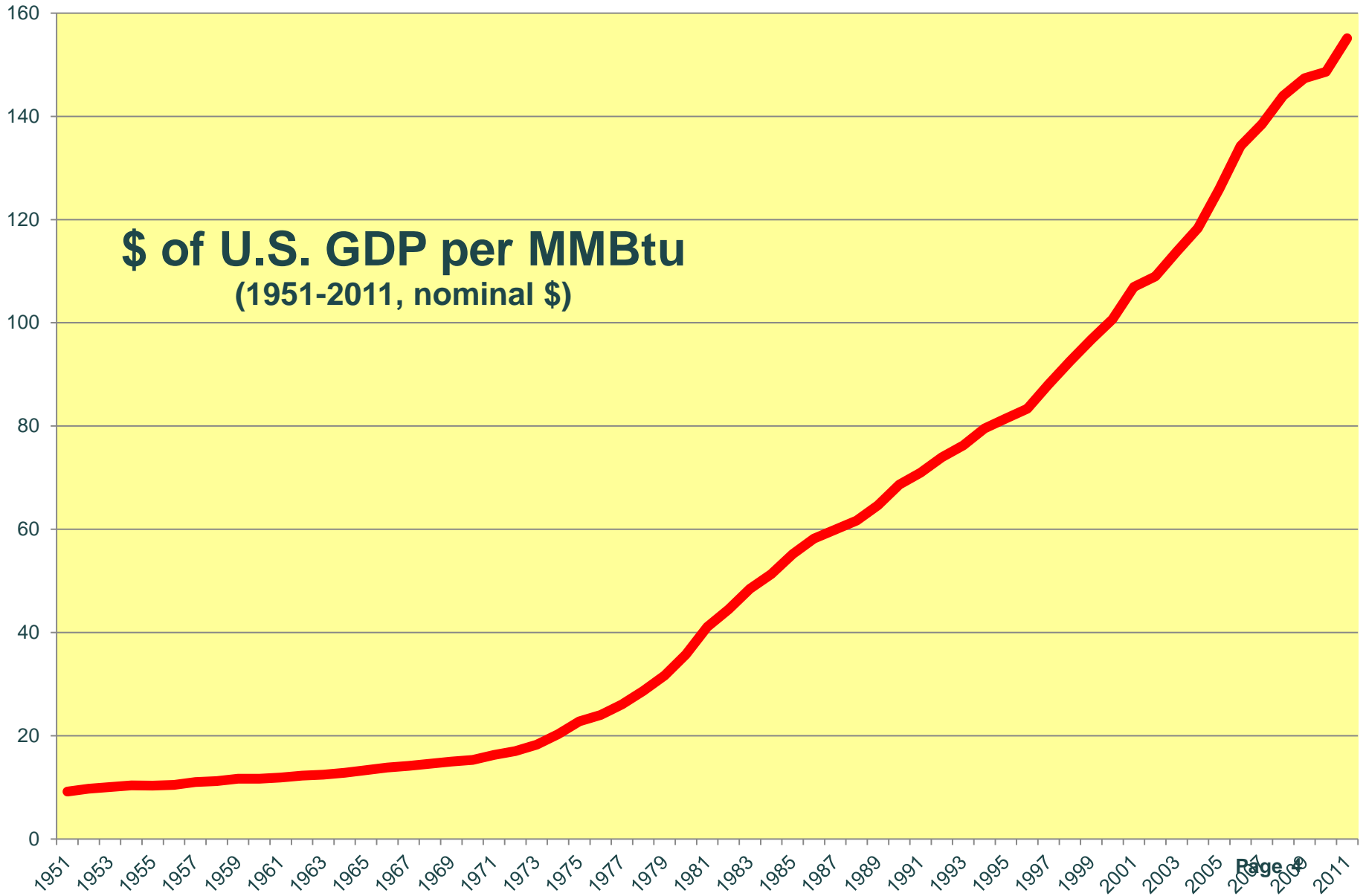
VOL. 89 NO. 4



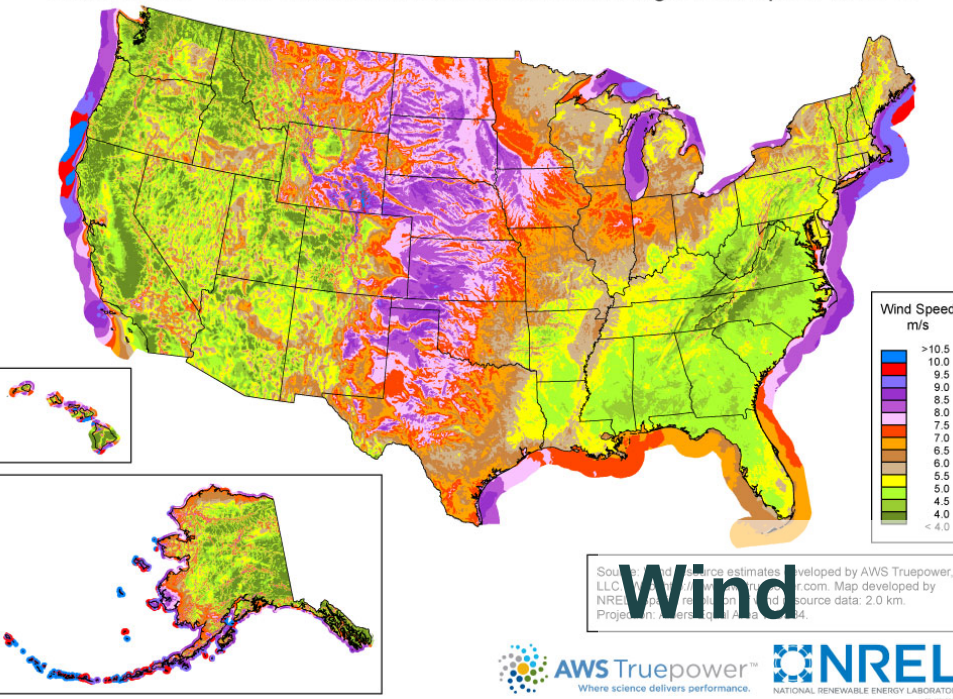
Los Angeles, 1967

Getting more bang out of the energy we use

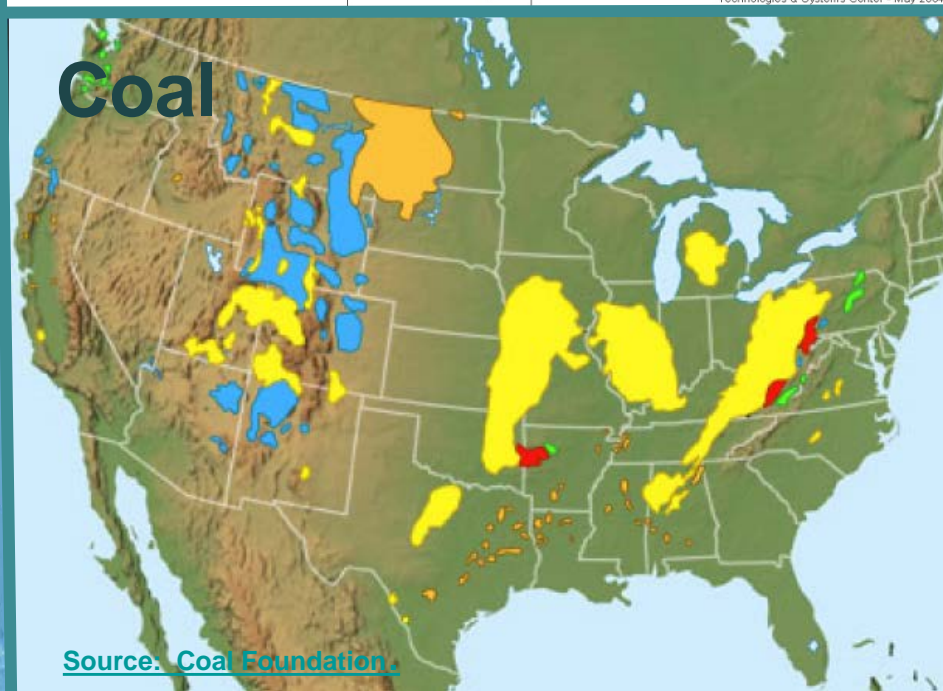
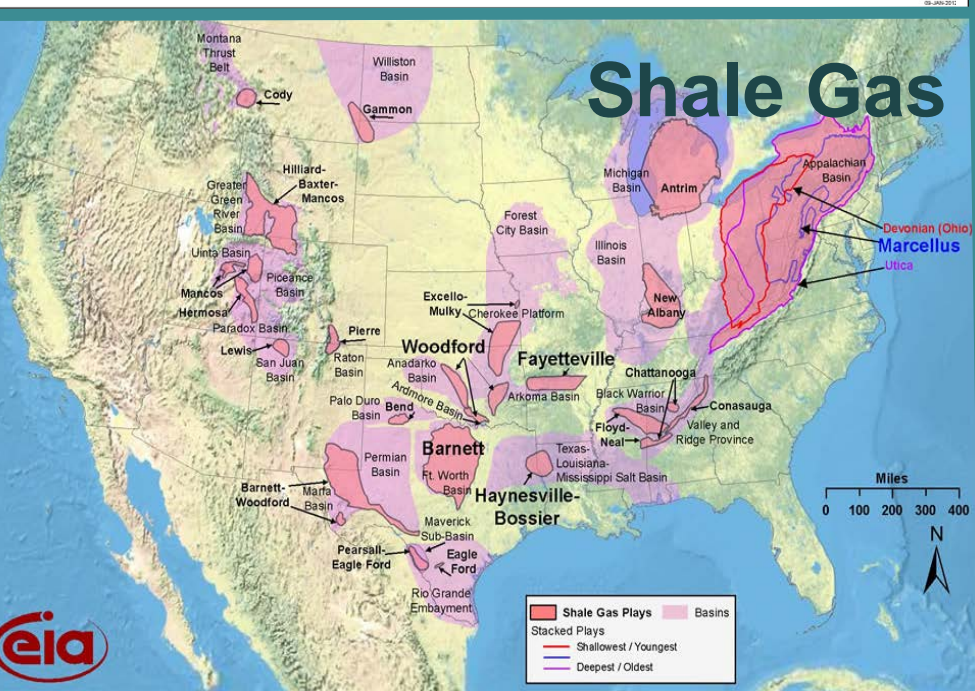
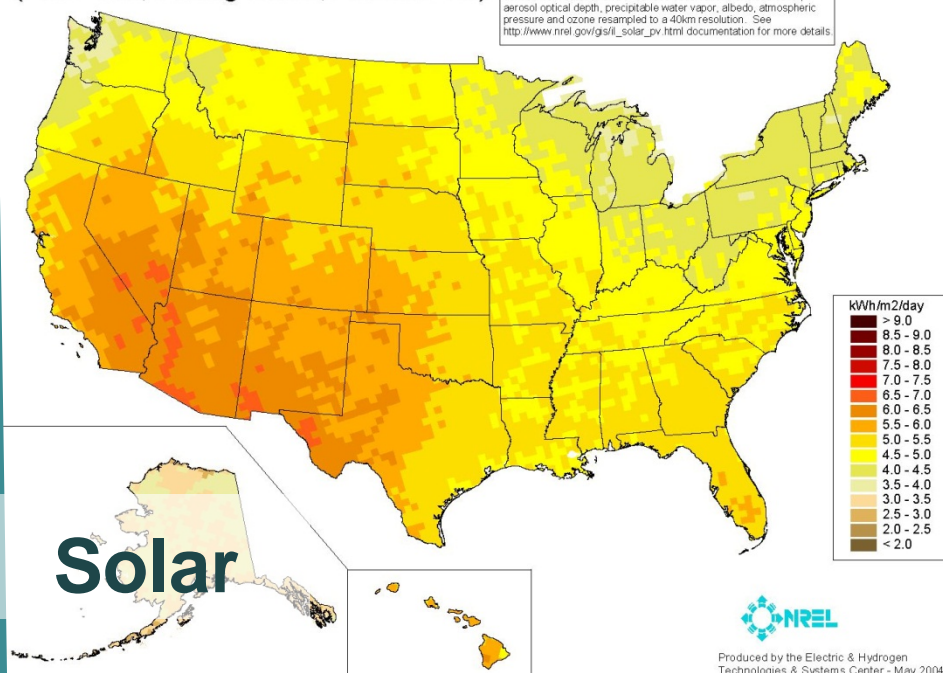
\$ of U.S. GDP per MMBtu
(1951-2011, nominal \$)

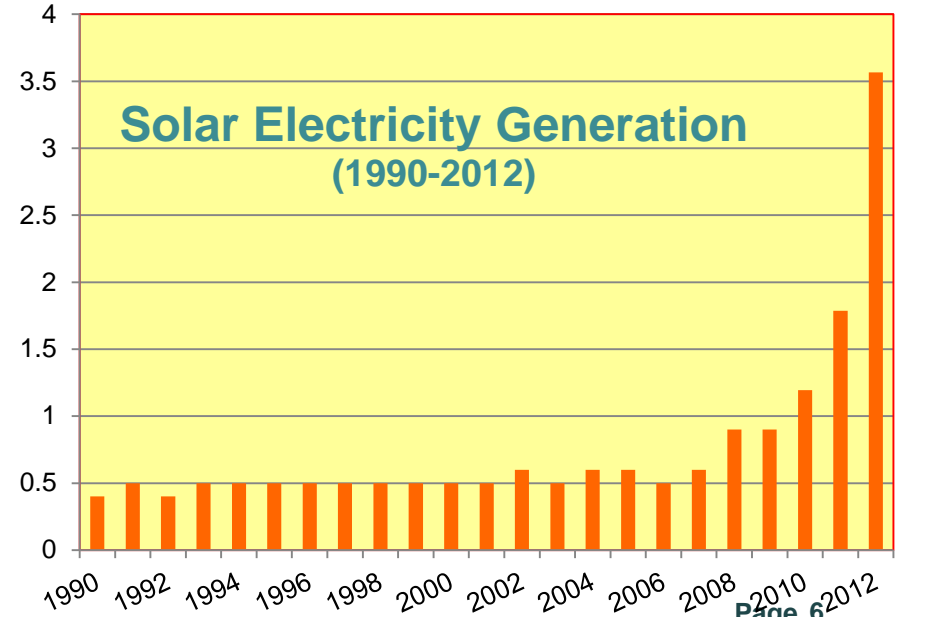
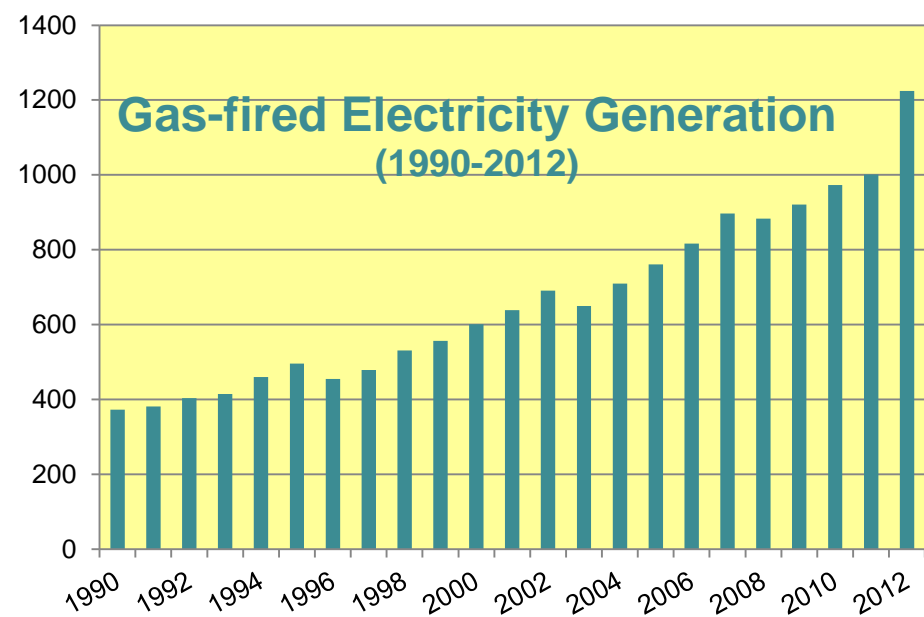
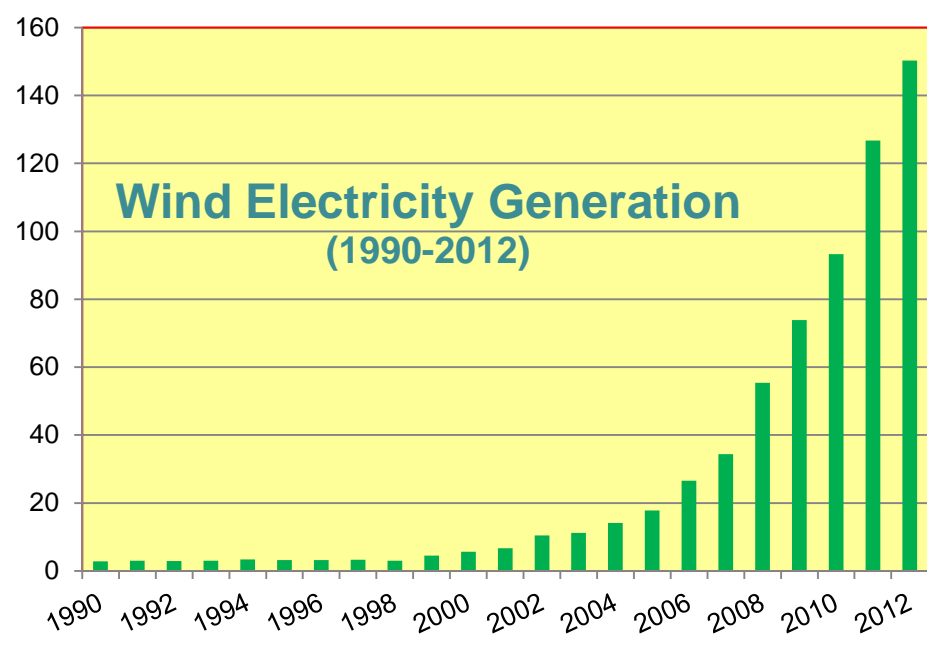
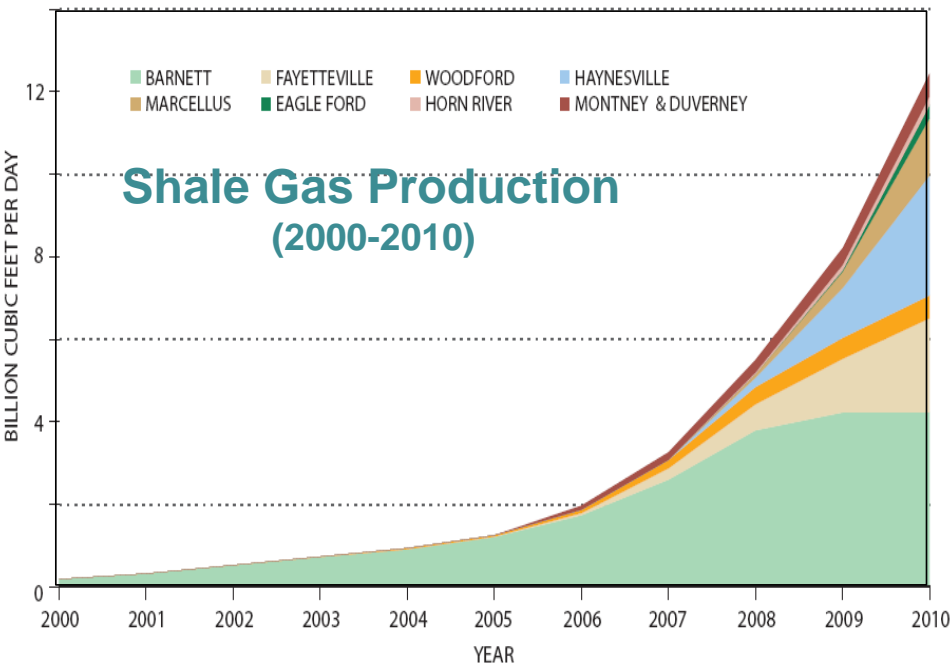


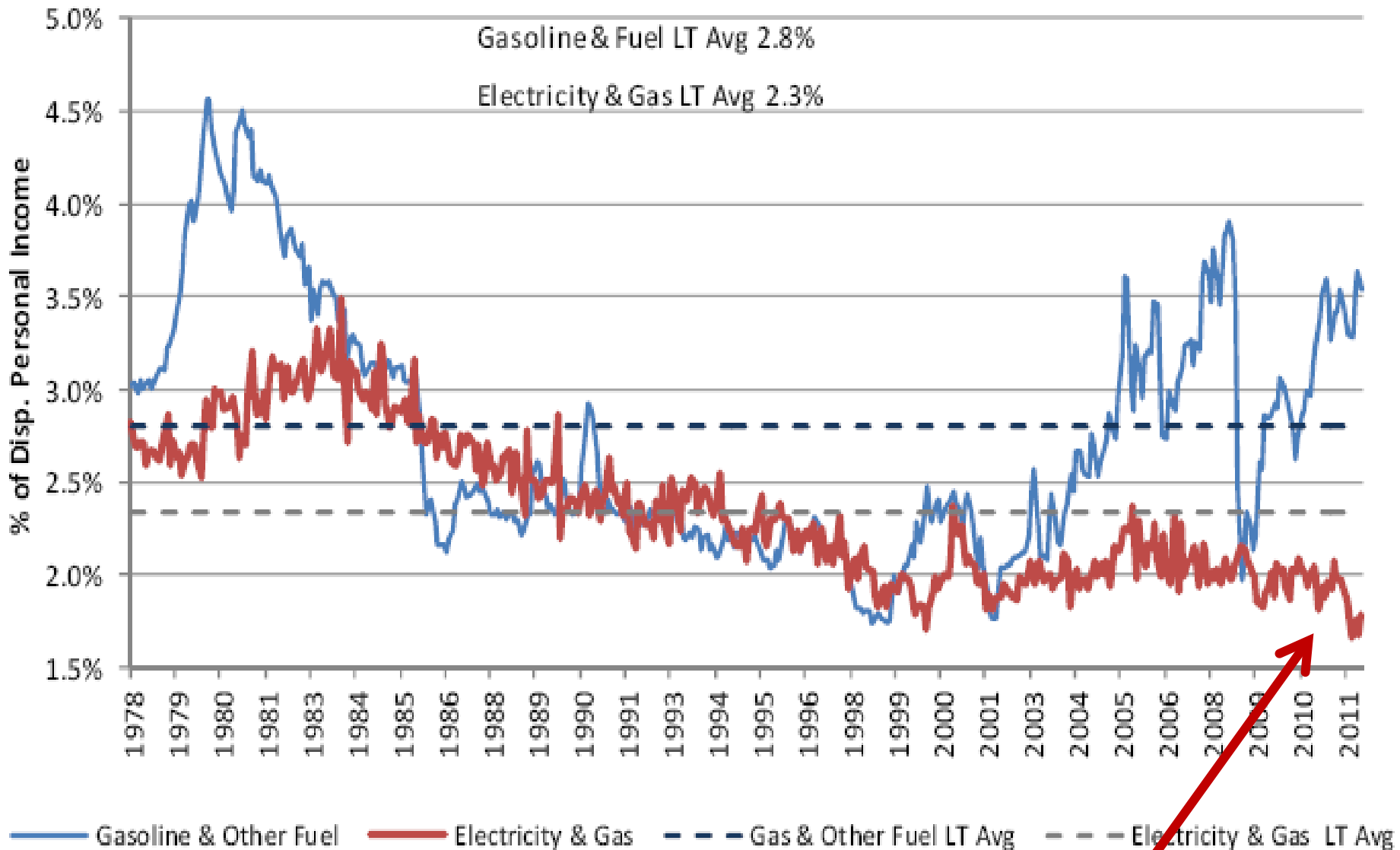
United States - Land-Based and Offshore Annual Average Wind Speed at 80 m



PV Solar Radiation (Flat Plate, Facing South, Latitude Tilt)







**Electricity and Gas as Percent of Disposable Personal Income
(1978-2011)**

Daily Peak Combined AQI

Saturday, July 07, 2012



Smog Advisories:
1977: 184 days
Recently: 0-3/year

South Coast Air Quality Management District

Legend for AQI levels:

- Good (Green)
- Moderate (Yellow)
- Unhealthy Sensitive (Orange)
- Unhealthy (Red)
- Very Unhealthy (Dark Red)
- Hazardous (Dark Purple)
- Action Day (Red with exclamation mark)

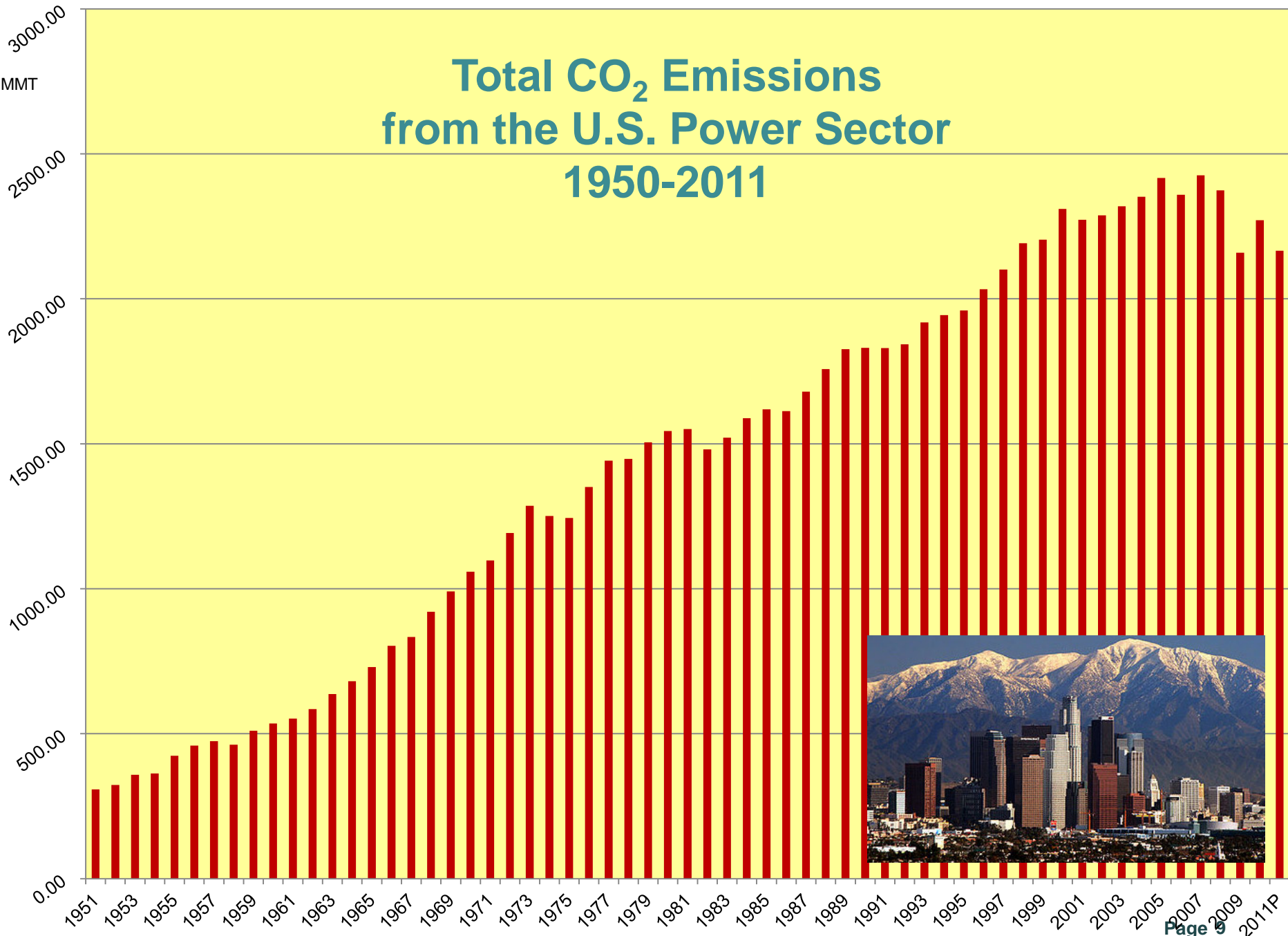
0 4.5 9 18 Miles

<http://www.webmd.com/asthma/ss/slideshow-worst-smog-cities>; http://www.airnow.gov/index.cfm?action=airnow_locof_city

<http://thegoodhuman.com/2012/03/04/smog-in-los-angeles/>

Generated on 2012-07-07 13:49:10Z

Total CO₂ Emissions from the U.S. Power Sector 1950-2011

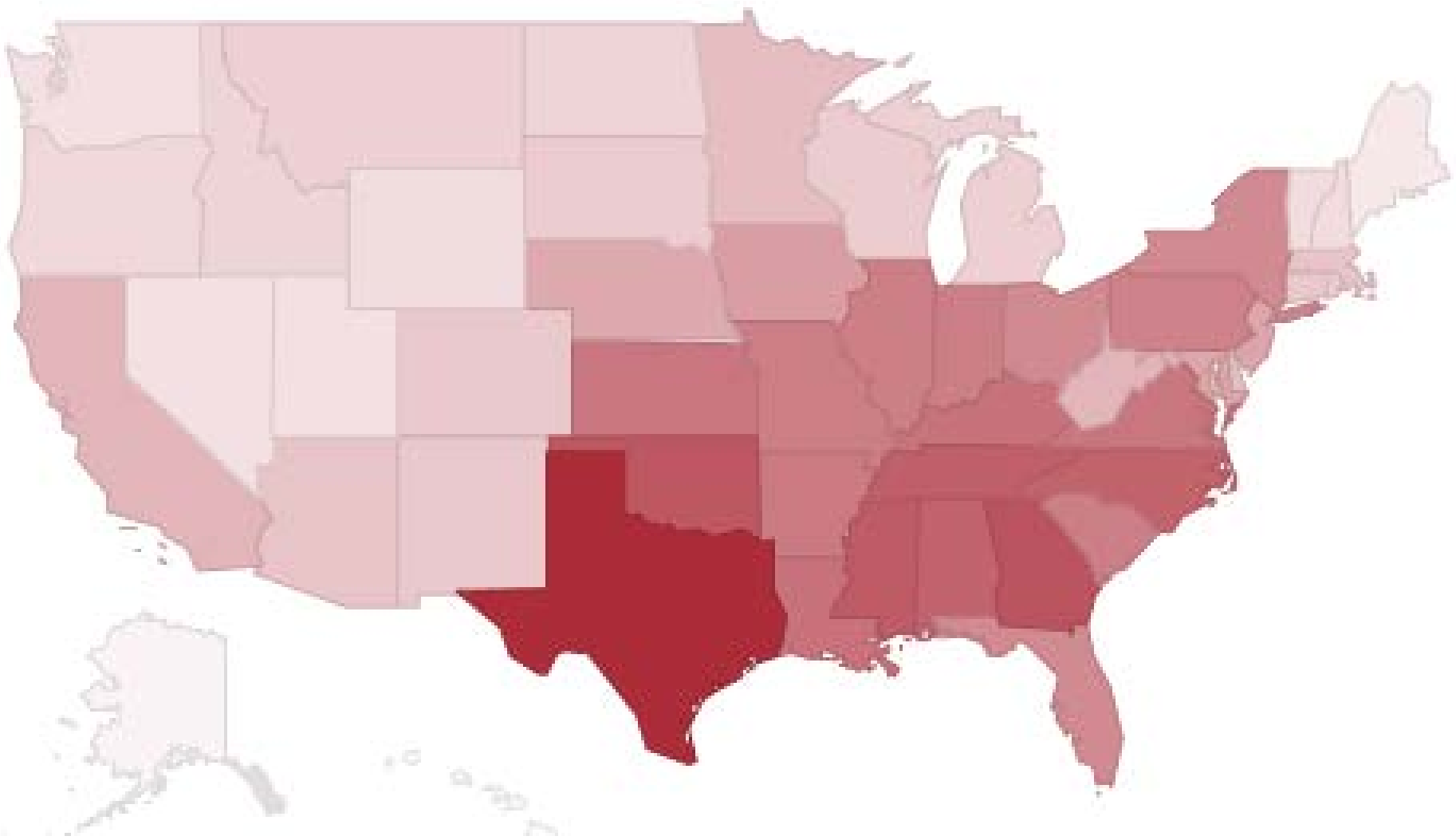


CO₂ Emissions by Country: Total emissions from 1950-2005 (billion tons)



Graphic from: Michael Glantz, "What Makes Good Climates Go Bad? ... and ... "Why Care?" USAEE/IAEE Meeting, 9-19-05.

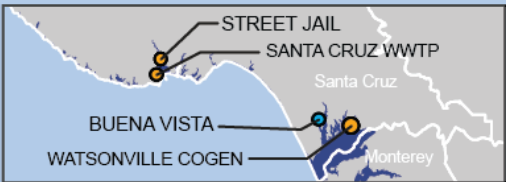
Billion-Dollar Weather/Climate Disasters (1980-2012, CPI-Adjusted)



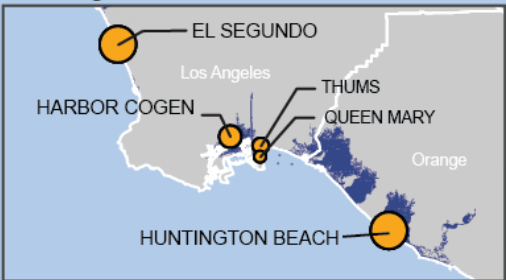
San Francisco Bay Area



Santa Cruz Area



Los Angeles Area



Megawatts

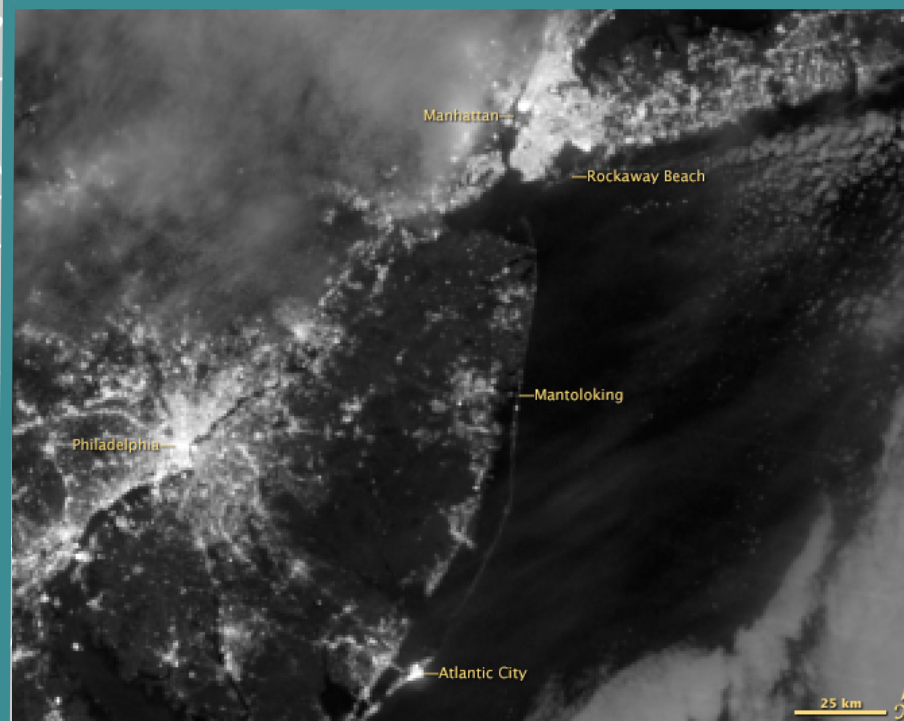
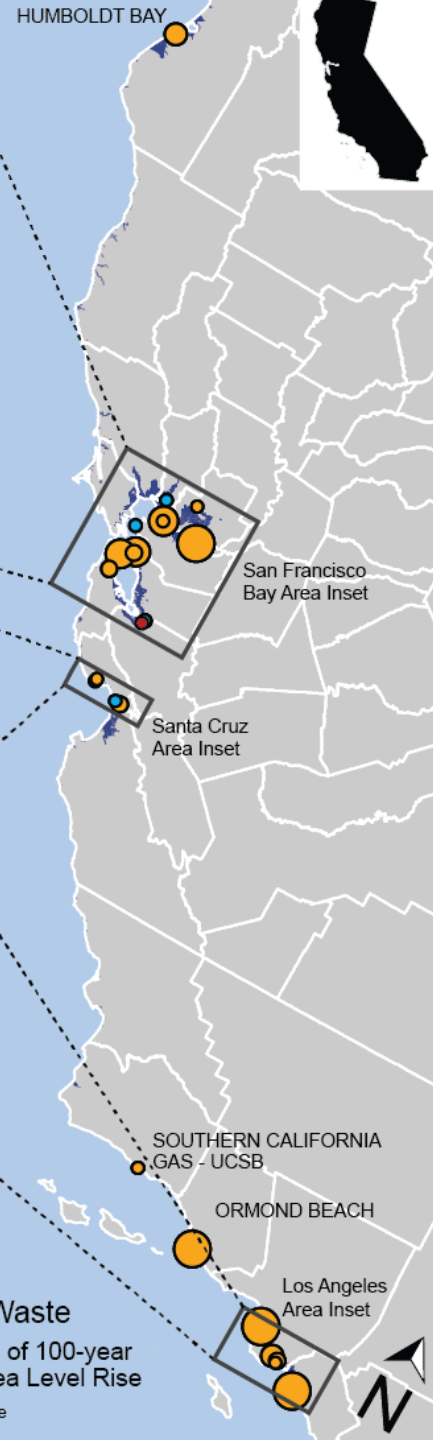
- 0-10
- 11-50
- 51-150
- 151-250
- 251-2000

Source: CEC

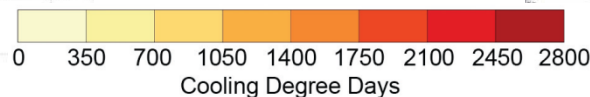
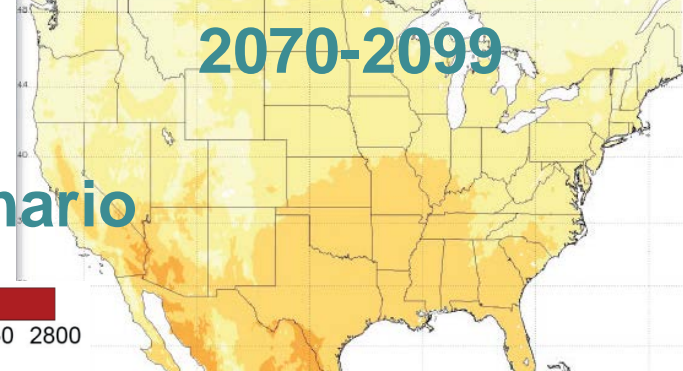
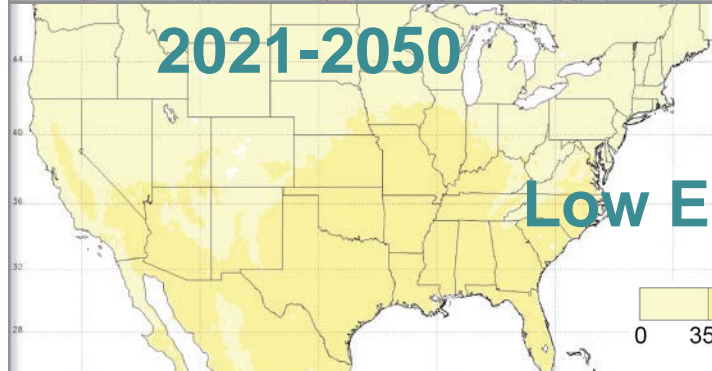
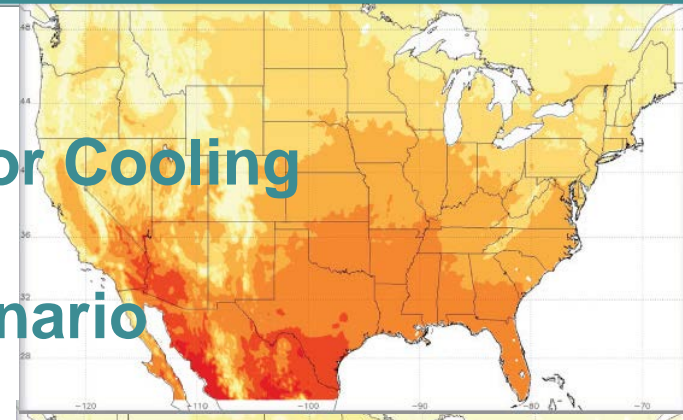
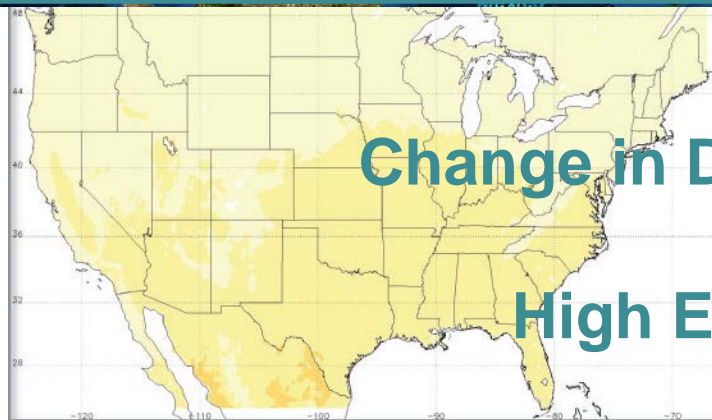
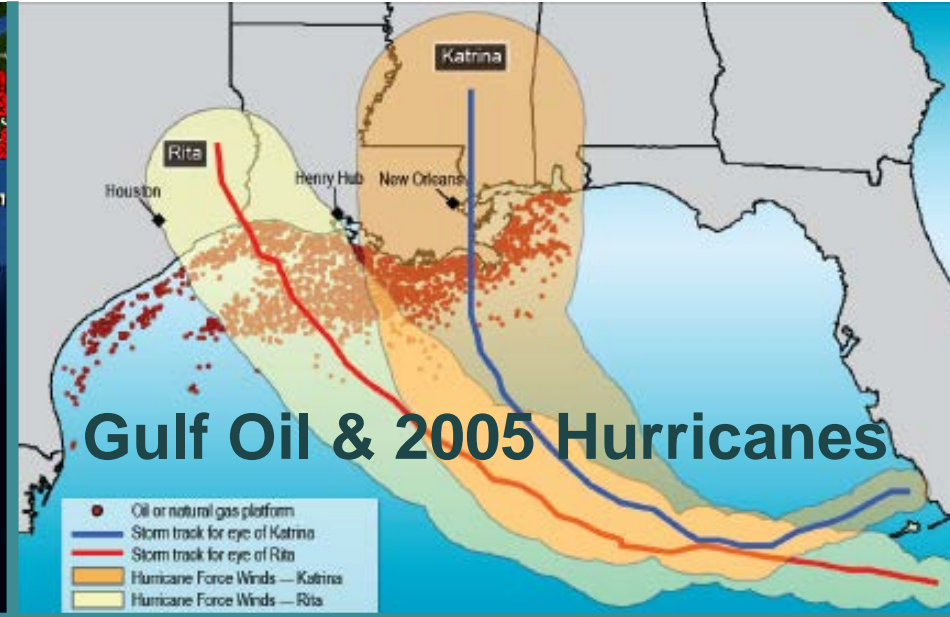
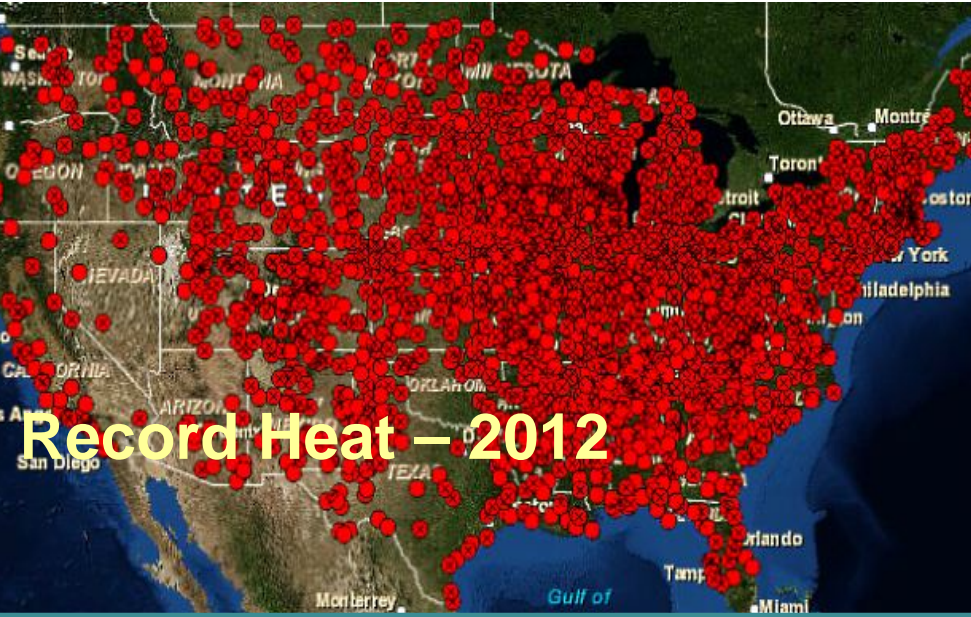
Fuel

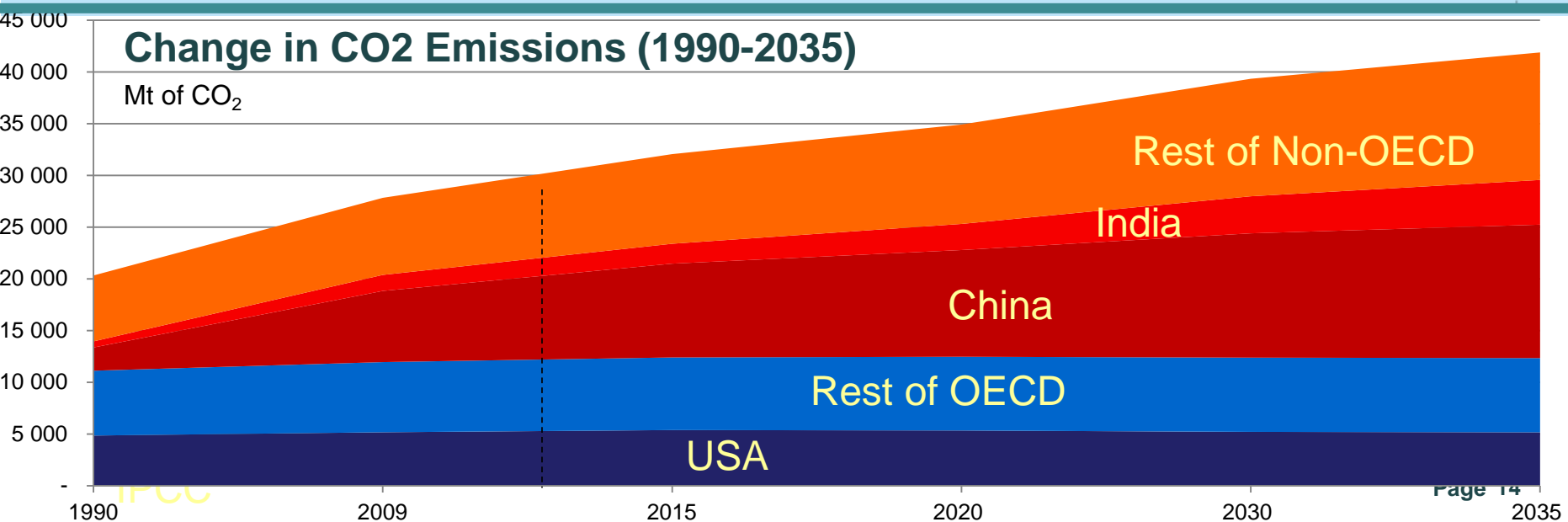
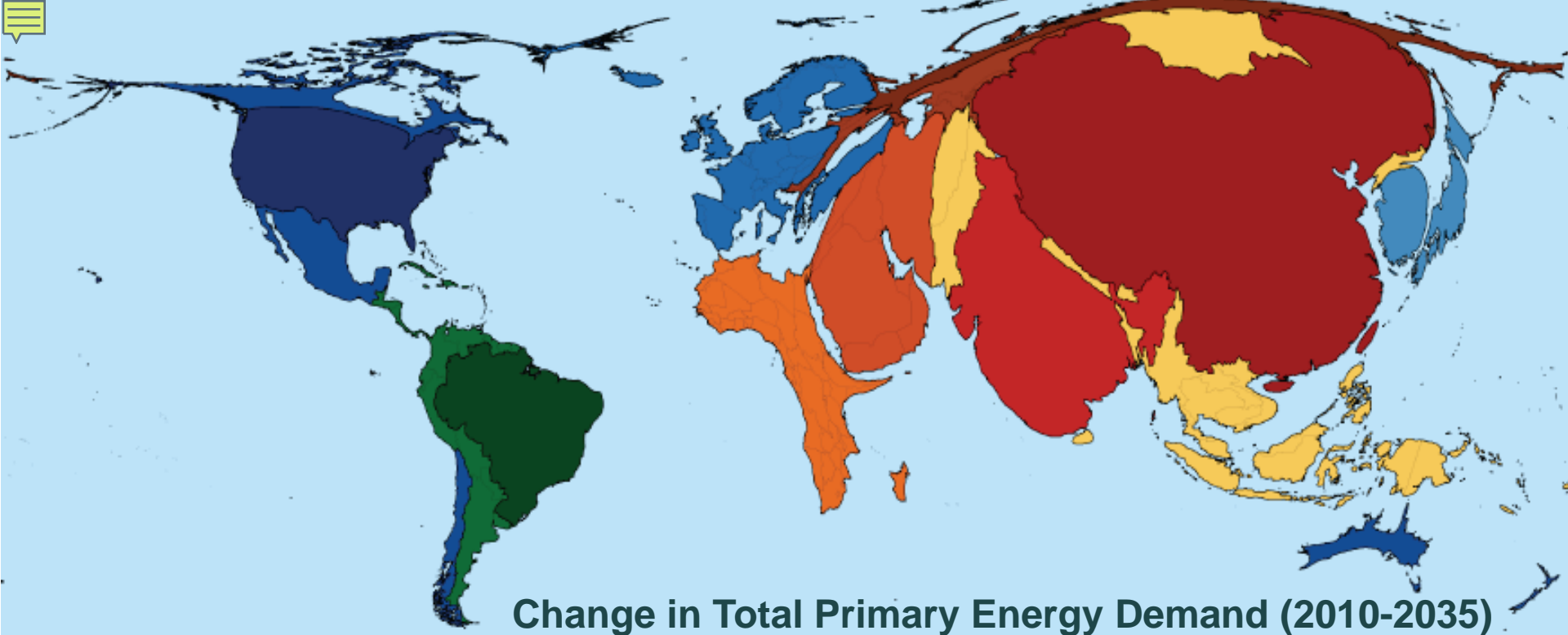
- Oil/Gas
- Landfill Gas
- Municipal Solid Waste
- Predicted inundation of 100-year flood with 4.6 feet Sea Level Rise

Source: Pacific Institute



Draft National Climate Assessment, 2013 (Ch. 4 Energy Production and Use, citing J. Sathya et al., 2011: Estimating Risk 36 to California Energy Infrastructure from Projected Climate Change 37; <http://www.earthobservatory.nasa.gov/IOTD/view.php%3Fid%3D7958>; http://www.google.com/search?num=10&hl=en&site=imghp&tbm=isch&source=hp&biw=1366&bih=566&q=hurricane+sandy&oq=hurricane&gs_l=img.1.0.010.1493.3126.0.6016.8.8.0.0.0.153.777.6j2.8.0.epsugrpq2high..0.0...1.1.cDtG_xO9POk







SPECIAL REPORT GLOBAL WARMING

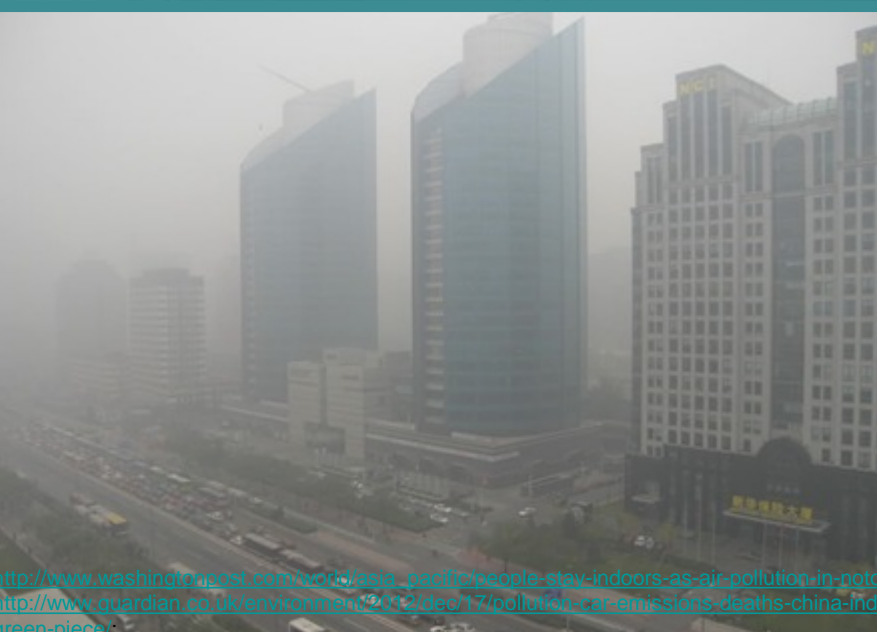
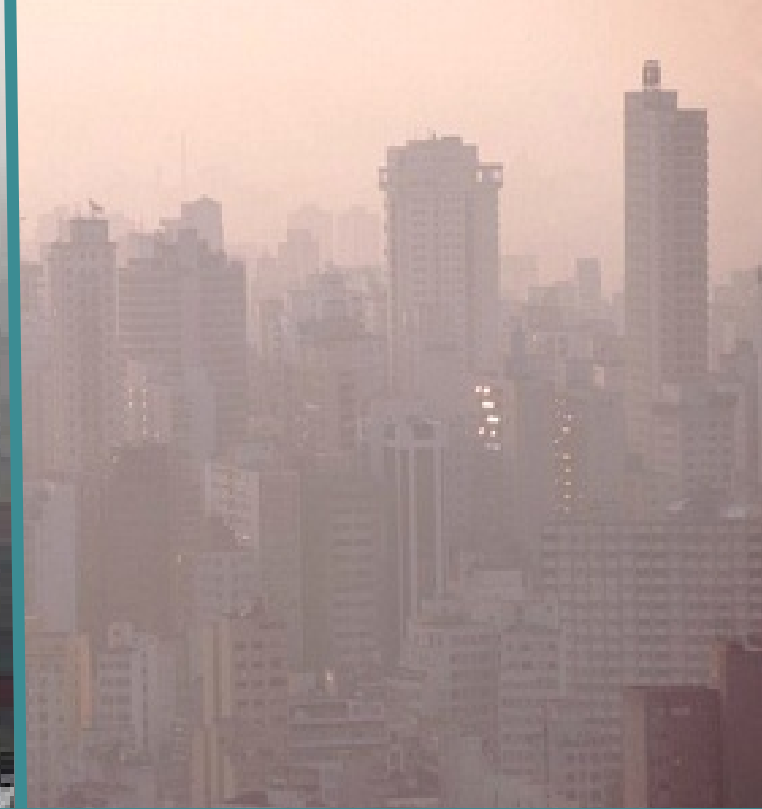
TIME

**BE WORRIED.
BE *VERY* WORRIED.**

Climate change isn't some vague future problem—it's already damaging the planet at an alarming pace. Here's how it affects you, your kids and their kids as well.

- EARTH AT THE TIPPING POINT**
- HOW IT THREATENS YOUR HEALTH**
- HOW CHINA & INDIA CAN HELP SAVE THE WORLD—OR DESTROY IT**
- THE CLIMATE CRUSADERS**

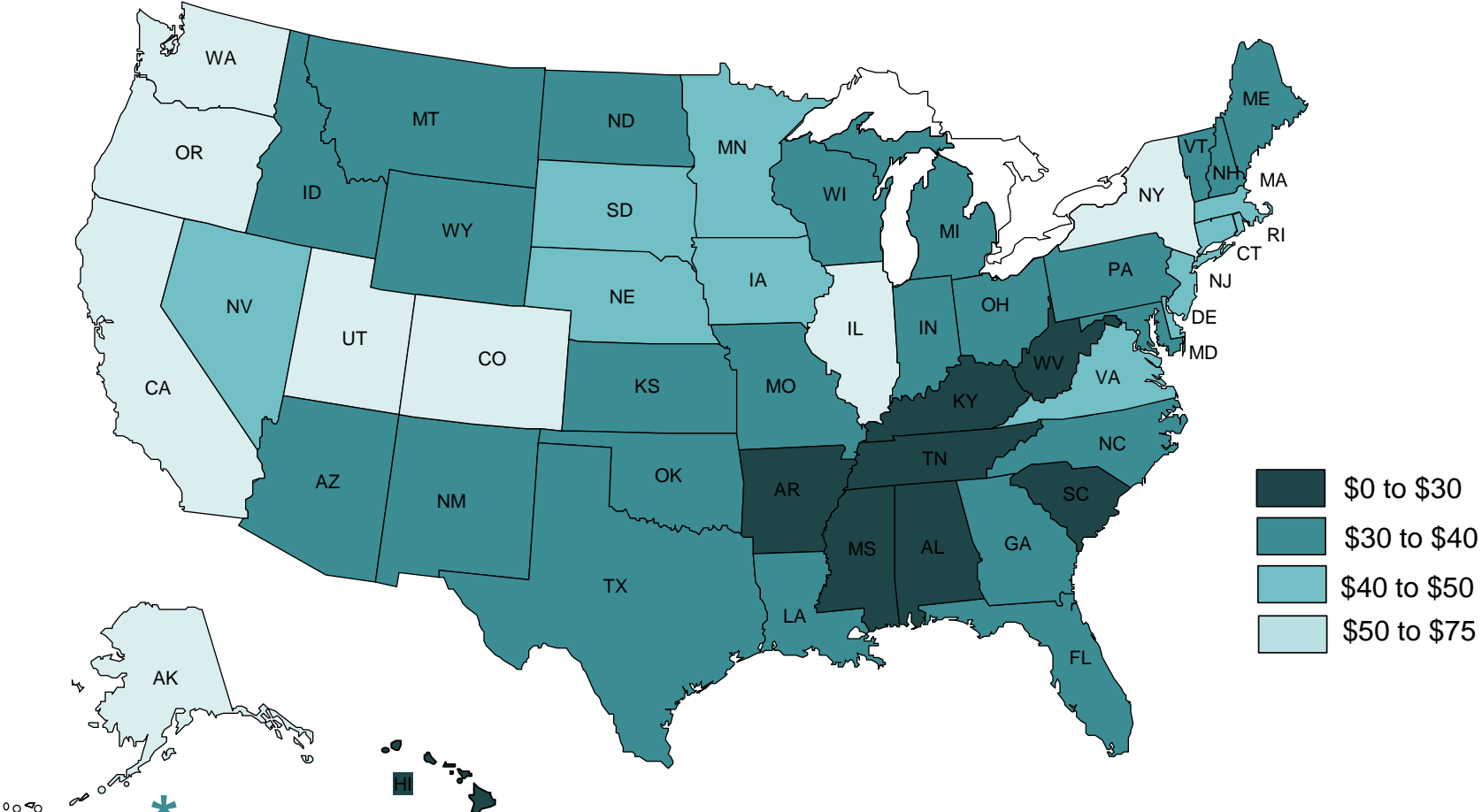




http://www.washingtonpost.com/world/asia_pacific/people-stay-indoors-as-air-pollution-in-notoriously-polluted-beijing-goes-off-the-index/2013/01/12/c2e88b48-5d3a-11e2-b8b2-0d18a64c8dfa_story.html;
<http://www.guardian.co.uk/environment/2012/dec/17/pollution-car-emissions-deaths-china-index>;
<http://www.thegreencarwebsite.co.uk/blog/index.php/2011/09/27/how-to-combat-the-rise-in-global-emissions-green-niece/>

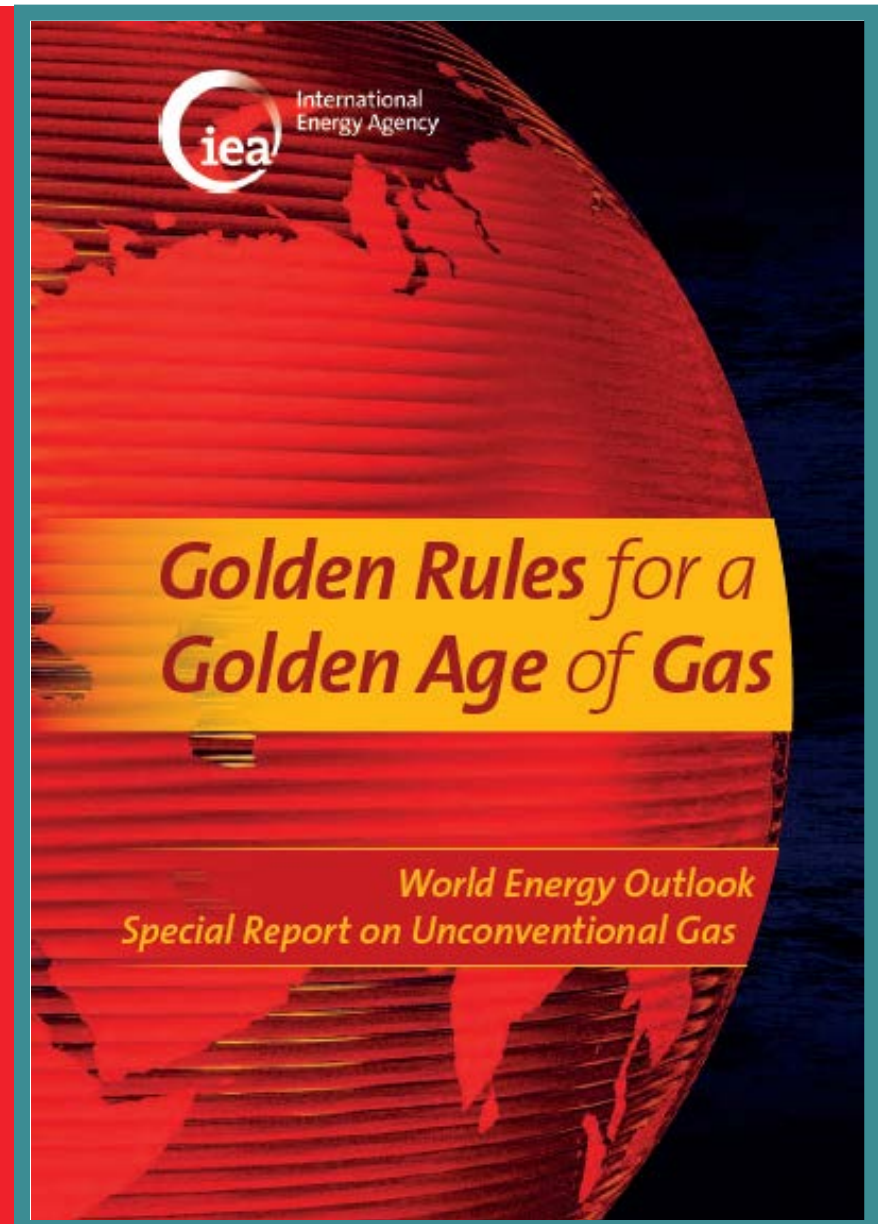
Double U.S. energy productivity by 2030*: Gains in energy efficiency

\$ of Gross State Product Per \$ Spent on Electricity (2011)



*** Target for upcoming recommendations of the
Alliance Commission on National Energy Efficiency Policy**

Prudently develop shale gas resources is necessary – but not sufficient



Unleash innovation & investment in low-carbon energy resources – starting now

Offshore and on-shore wind

Solar power

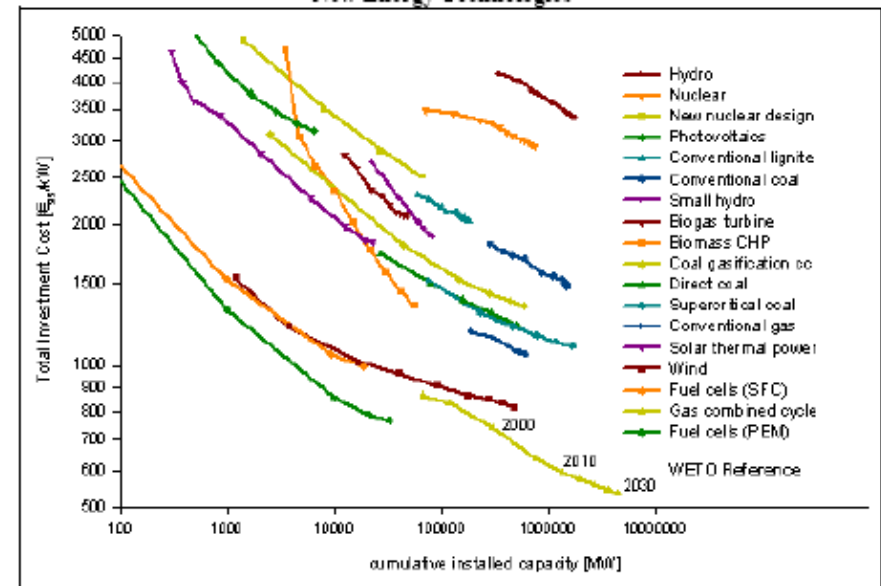
Nuclear


Carbon capture, utilization and sequestration (for coal and natural gas)

Biofuels

Combined heat and power

Grid integration/connections



A world map where the density of yellow and white lights represents electricity use. The lights are most concentrated in North America, Europe, and East Asia, with significant clusters in India and South America. Africa and Australia show much lower density of lights.

**Deepen and broaden electricity use –
and decarbonize electricity supply**



**Our children are
counting on us**