

UCSD Physics 12



Course Wrap-up
Loose Ends
What did we learn?
What can you do?

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How can we respond to Global Warming?

- The first thing we should do is try to cut back on CO₂ emissions
 - after all, this is what we put out of whack
 - won't "fix" the problem, but will limit the damage
 - much resistance to the idea of cutting back
- Kyoto Protocol is one example of a guideline:
 - reduce emissions to 1990 levels by 2012
 - virtually all developed countries except U.S. signed on
 - Canada has backed out
 - very hard to meet goal, but important to try
- Can also ask Will Ferrell what he thinks...

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An Interesting Twist

- Even if we don't adopt policies to reduce CO₂ emissions, we may end up doing a better job than any policy could set out
- If the world at large faces a decline in the rate of oil production, then reducing our rate of emissions is mandatory!
 - both oil and natural gas are poised to peak
- Global Warming would still progress, but less quickly than it would have under a Business as Usual plan

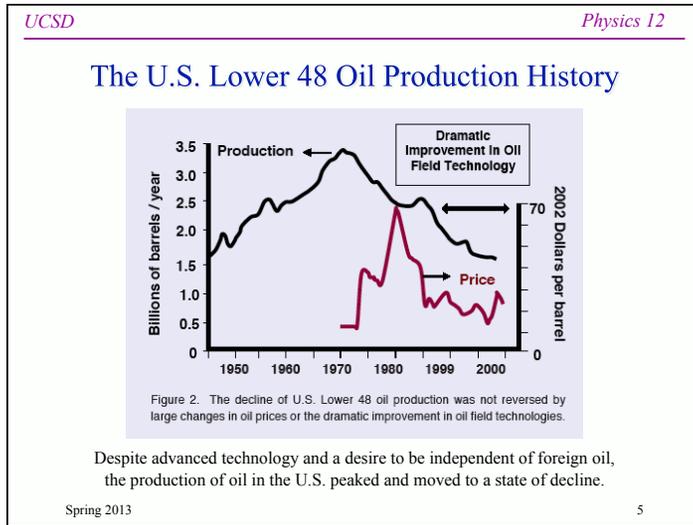
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Our Energy (thus Economic) Outlook

- This course has looked at:
 - how we use energy
 - the finite nature of our fossil fuels
 - the prospects for alternative forms of energy
- Main conclusion:
 - fossil fuels are *hard* to replace!
 - our alternatives are limited in scope and capability
 - no single replacement is sufficient
 - probably solar, nuclear, wind, hydroelectric will all play roles
 - transportation is the hardest to accommodate

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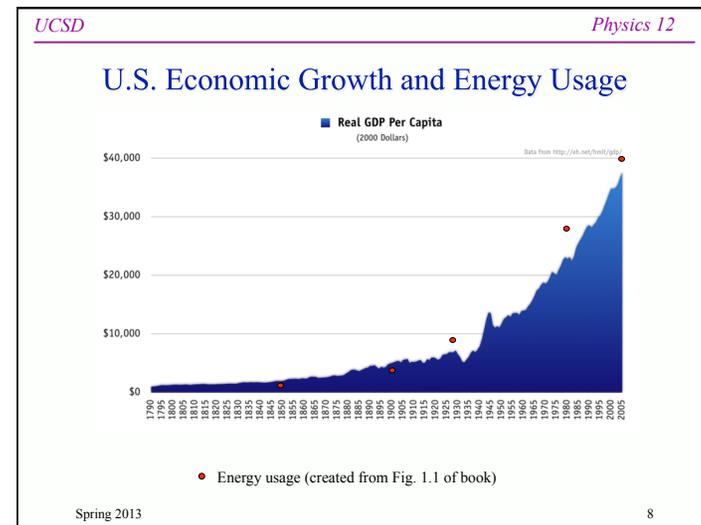
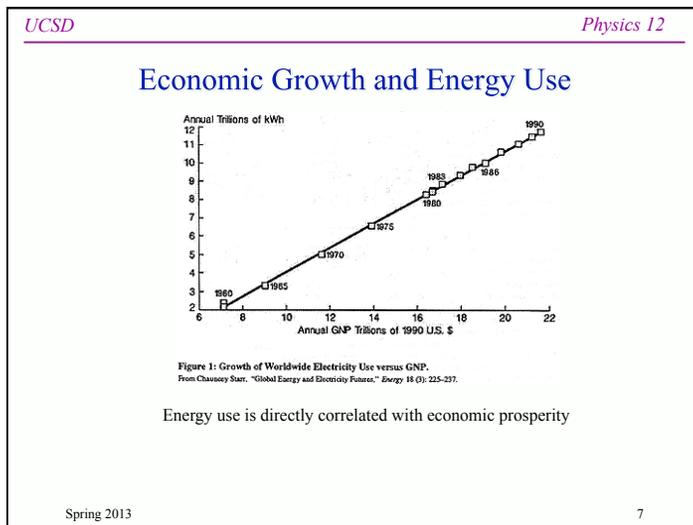


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We live in a special time and place...

- Industrial Revolution is really Fossil Fuel Revolution
 - surplus energy is what permitted innovation to flourish
- We have experienced the wild-ride upswing
- Extrapolation is foolish
 - no one can predict how we cope: abandon assumptions

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Chicken-and-Egg Problem

- Is energy use just keeping pace with economic growth?
- Or is economic growth possible only if energy is available?
 - related issue: indefinite growth means unbounded exponential behavior—incompatible with a world containing finite land, water, resources
- The world changed with the industrial revolution, and this was only possible because energy (coal) was cheap and abundant

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What happens after world oil peaks?

- Worldwide oil production will inevitably peak
 - the speed with which we can extract oil from the ground is limited, and *will* diminish
 - the U.S. experience (and the majority of major oil-producing countries *are in decline*) is a good example
- What happens then?
 - gas prices go way up (even more!)
 - transportation becomes expensive
 - all sectors of our economy impacted
 - all consumer goods, agriculture, tourism, etc. depend heavily on liquid petroleum

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My Plans for Your Brain

this is your brain...

...this is your brain after physics 12

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“Top Ten” things to take away from this class

11. Fossil Fuels are finite, and will be spent this century → significant economic implications panic?
10. Transportation hardest hit; electricity production less so
9. Fossil fuels inevitably produce prodigious CO₂ → global warming
8. Nuclear fission is pretty limited, unless breeder programs
7. Nuclear fusion is the dream resource, but maybe fantasy resource
6. Hydroelectric production is near capacity, has long-term limitations

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Top eleven, continued

5. Wind is clean and renewable; biggest drawback is intermittent nature
4. Solar is abundant, clean, long-term (though intermittent and currently expensive) → my top pick for the future
3. The United States tends to behave irresponsibly toward global well-being (unwilling to give up anything)
2. Never believe information implicitly: check the source, understand the agenda, do **quantitative** checks
1. It **is you** who can make a difference in the world → be a thinker, strive for the greater good

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What can you do?

- Understand that we don't *know* what the future holds
 - I may be over-reacting to the potential seriousness
- Read news items; raise your awareness about energy issues
 - keep (and sharpen) your quantitative analysis skills
 - be skeptical
- Keep tabs on world oil, U.S. gasoline supply
 - www.eia.doe.gov
 - <http://www.eia.doe.gov/ipm/supply.html>
 - get the raw data and interpret yourself (you can trust *yourself* not to lie/distort the facts)
- Talk to your friends and family about these issues
 - but don't spread information you don't trust yourself
 - when you don't know an answer, try to find it

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More to do

- Make flexible life plans
 - have a plan B, or pick a direction that will be valuable in any eventuality
 - don't assume our lifestyle today is a fact of nature
 - there *are* no guarantees, no money-back
 - you can be useful just by having a detached perspective
- Choose a life with less stuff
- Learn how to get by with alternate energy/transportation
 - ride buses, bikes, walk, etc.
 - try out solar or other alternatives
 - get a solar battery and/or cell phone charger
 - cut back on usage (so you learn how with a safety net)
 - avoid a commuting lifestyle, if possible

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And you can...

- Read Chapter 7 of the textbook
 - insulate houses well
 - use heat pumps rather than direct heat in houses
 - buy Energy Star appliances (and seek low energy use)
 - use compact fluorescent or LED lighting
- Also Powerful:
 - change expectations: become hardier
 - winter is cold, summer hot: deal with it
 - shower behavior can have big impact
 - dietary choices can scale down energy investment

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Recommended Book

- The Union of Concerned Scientists put out a good book:
 - The Consumer's Guide to Effective Environmental Choices, by Brower and Leon
 - Looks at consumer impacts on global warming, air pollution, water pollution, habitat alteration

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UCS Book Most Harmful Activities

- Cars and light trucks
- Meat and poultry
- Fruit, vegetables, and grains
- Home heating, hot water, and air conditioning
- Household appliances and lighting
- Home construction
- Household water and sewage

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UCS Book High-Impact Activities

- Powerboats
- Pesticides and fertilizers
- Gasoline-powered yard equipment
- Fireplaces and wood stoves
- Recreational off-road driving
- Hazardous cleaners and paints
- Products made from endangered or threatened species

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UCS Priority Actions

- Transportation
 - choose a place to live that reduces the need to drive
 - think twice before purchasing another car
 - choose a fuel-efficient, low-polluting car
 - set concrete goals for reducing your travel
 - whenever practical, walk, bicycle, or take public transportation
- Food
 - eat less meat
 - buy certified organic produce

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UCS Priority Actions, continued

- Household Operations
 - choose your home carefully
 - reduce the environmental costs of heating and hot water
 - install efficient lighting and appliances
 - choose an electricity supplier offering renewable energy

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Special Topic: Recycling

- Is recycling a net benefit?
 - mixed bag: metals, and especially aluminum: definitely
 - paper: 50% energy savings (and fewer trees)
 - plastics: maybe a net wash
 - best practice: reduce amount of packaging you use
- Aluminum can recycling saves 95% of the energy needed to make a new can from ore
 - in 2001, the energy lost from NOT recycling aluminum cans was equivalent to 16 Mbbl oil
 - recycling one ton of Al saves enough energy to drive a 35 m.p.g. car 80,000 miles
 - source: http://recycling.stanford.edu/recycling/caq_metal.html

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Plastics Recycling

- Most recycled plastic ends up in one-time products, not back to drinking containers
- False sense of comfort leads to more plastic packaging, so net plastic to landfill is NOT reduced
- Best strategies:
 - use your own refillable container (could be plastic!)
 - buy goods with less packaging: consumers have voting power!
 - at least put plastic into recycling rather than trash: it is more likely to do *some* good
- source: <http://www.ecologycenter.org/ptf/misconceptions.html>

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Announcements

- Do your CAPEs (look for e-mail with access code)
- HW 8 posted, due Friday 6/07
- Don't forget final quiz on TED
- Final Exam Study Guide posted on course website
- Final Exam Review Sessions:
 - Tuesday, 6/04 6:00 to 7:50 PM Solis 110 (Tom)
 - Finals week (Matt): TBD
- Final Exam in York 2622, Wed. June 12, 3:00 to 6:00 PM
 - bring No. 2 pencil, calculator, and red half-sheet scantron (the one with space for Student ID number)

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