Kicking the Carbon Habit

Climate Change, and the Case for Renewable and Nuclear Energy

KICKING CARBON

- CATACLYSMIC CLIMATE CHANGE, AND THE CASE FOR CONSERVATION AND AGAINST COAL
- WITH:
  - —three cheers for wind
  - —two cheers for natural gas
  - —and one cheer for nuclear energy

What's Changed Since 2006?

- United States has radically reversed policy *attitude*:

http://tpmelectioncentral.talkingpointsmemo.com/2008/11/in_surprise_speech_obama_promi.php

- Most scientific news is even worse than expected
- Silver lining in economic clouds: global emissions are lower, creating opportunities

Assumptions/Postulates

- World in uncharted waters
- We need to do our part to strike new course
- No guarantees against disaster
- No choice but to prepare in every way
- Setting stage for stronger action to come

Uncharted Waters

- CO_2 levels are nearly 50 percent higher than at previous interglacial peaks and on track to be at least twice those peaks in this century
- We know what happens when carbon dioxide levels drop by a third, from 300 to 200 ppm—we get an ice age
- We don’t know what might happen when they increase by 50 or 100 percent; computer projections are merely best case scenarios

Our Part

- Focus just on United States, next 10-12 years
- Kyoto would have required United States to cut greenhouse gas emissions about 7 percent by 2012, by comparison with 1990; our emissions are instead about 15 percent higher
- Europe has not met Kyoto targets either, but its emissions are about flat by comparison with 1990
- Current U.S. legislation would cut emissions 17 percent by 2020 by comparison with 2005

No Guarantees

- No program, however aggressive, can stop the world from getting significantly warmer in the coming decades, can stop undesirable changes we are already seeing, let alone prevent “irreversible” climate changes
- Definition of threshold beyond which climate change could be “dangerous” is necessary for policy formulation, but let’s not kid ourselves

Pursue all Reasonable Options

- no choice between climate adaptation versus carbon mitigation; even geoengineering deserves a close look
- no choice between “hard” and “soft” paths, à la Amory Lovins
- no room for “no regrets” policies only: we need to do whatever’s most cost-effective
- choice between fossil/non-fossil is not black-white

Set Stage for Stronger Future Action

- We need do do as much as we can now so as to persuade the fast developing countries to do more soon
- The China/India problem:

  —China is doing more than generally recognized, and India is shifting ground

  —both countries have very compelling reasons to be acutely concerned about local effects of pollution and global warming

GHG Sources in the U.S.

- 1/3 from coal-fired generation of electricity
- 1/3 from oil/gas use in automotive sector
- 1/3 everything else
  --residential/commercial buildings
  --industrial processes
  --mass transportation
  --etc

Residential/Commercial/Industrial

- Our per capita energy use is twice Europe's
- Can be attacked with building codes, standards, regulations, outright prohibitions (eg incandescent bulbs), etc.
- But such measures run up against consumer tastes, business preferences
- The efficiency paradox
- Hence a case for higher energy prices/carbon tax

Automotive Sector

- What if we wanted to achieve a 15-17 percentage point reduction in the automotive sector alone?
- We'd have to cut gas consumption by nearly 50 percent.
- That implies a 100 percent hike in prices.
- That's what Princeton proposes.

Focus on Coal

- Put charge on carbon emissions, tuned to boost cost of coal-generated electricity by 50%
- Or adopt cap-and-trade system that has similar net impact; auction allowances
- Why politicians don’t like first choice; why second is second-rate
- Cash for (coal) clunkers?

Impacts

- Coal is about twice as carbon-intense as oil and two to three times as carbon-intense as natural gas
- About half of U.S. electricity comes from coal
- Accordingly, a 50-percent tax on coal-generated electricity will boost average electricity prices by 25% and gasoline prices by about 25%
- And carbon emissions will be 15-20% lower

Electricity Sector Implications

- Total U.S. coal capacity: ~ 340 GW
- To get cut of 170 GW in 10 years,

  --30 GW of added nuclear plants (three GW per year, ~50% higher than expected rate)

  --90 GW of total wind (to be installed @ current rate, which is 3X what it was in 2006)*

  --(0 GW of “clean coal”)

  --50 GW of new natural gas (roughly a one third increase from current capacity)

* however, because of wind’s intermittency, actually 3x 90 GW is required; where can we get that?

What Won’t Help Much, Soon

- Photovoltaics
- “Hydrogen economy”
- Biofuels
- Carbon capture and sequestration

PV versus Wind Costs

- 27 GW of wind installed globally in 2008, at cost of about $53 billion
- 5.5-6 GW of PH installed, at cost of $37 billion
- Average per-watt wind installation cost: $1.96
- Average per-watt PV installation cost: $6.2
- Wind was $.9 in 2004, PV was $7

Wildcards

- Thermal concentrating solar
- Biodiesel/cane ethanol
- Combined heat and power; cogeneration
- High-Tc Superconductivity, HVDC, smart grid

What You Can Do At Home

- Try out IEEE Spectrum's upcoming energy calculator: http://spectrum.ieee.org/energy/renewables/energy-calculator (Nov. 1)
- Or its Carbon Footprint calculator, one of many: http://www.spectrum.ieee.org/energy/environment/spectrums-carbon-footprint-calculator
- Write angry letters to the magazine's EnergyWise editor and frequent energy & climate blogger: w.sweet@ieee.org