There Is No Free Lunch:

But There Are Cost-Effective Solutions

*By Pamela W. Person**

Both bottom up and top down studies indicate that there is substantial economic potential for the mitigation of global GHG [greenhouse gas] emissions over the coming decades, that could offset the projected growth of global emissions or reduce global emissions below current levels…

Intergovernmental Panel on Climate Change Fourth Assessment Report from Working Group III "Mitigation of Climate Change—Summary for Policymakers." (IPCC, WGIII, SPM) May 5, 2007

Nine Basic Energy Concepts

Before we can reduce GHG emissions cost-effectively, citizens and policymakers need to understand nine basic energy concepts.

1. All energy sources have costs and benefits. No single source is perfect.
2. To compare costs properly, one must look at all costs of any energy source through its whole life cycle (energy production, use and disposal).
3. When considering fossil fuel energy sources, one must compare the carbon content per million Btu (unit of energy) in pounds of carbon dioxide ($C0_2$). (The lower the better!) Coal has a carbon content of 56, oil and gasoline: 47–43, and propane and natural gas: 38–32. Natural gas is mostly methane, a GHG that needs to be stored and handled carefully because it is over 20 times as strong but shorter lived than $C0_2$. (State of Maine Climate Change Action Plan 2000, p. 22)
4. Electricity is produced and used almost simultaneously. Very little is stored; more could be in the future. Regional electric organizations that manage the electricity sent over high voltage transmission lines plan one day ahead for power production for normal-, peak- and low-use times. Managers gather meteorological, industrial and area data to decide how much and when power is needed. They then request bids; prices can vary substantially for each hour, with peak hours costing the most.
5. The farther electric power travels over the transmission lines, the more "line losses" occur (less electricity actually delivered). It's better to produce power closer to the users to reduce line losses and maintain reliability.
6. "Base load power plant capacity" is needed to meet 24-hours-a day/365-days-a-year electric needs. Coal-fired, nuclear, and some combined cycle natural gas, biomass, oil and hydroelectric dams are base load plants. Nuclear, biomass and hydroelectric plants produce no net GHG.
7. Wind farms and photovoltaic arrays do not produce GHG and are becoming more efficient, reliable and less expensive. But without storage capacity, they are not "base load"; power is produced only when there is wind or sunlight.
8. Producing power once and using the waste heat—known as combined heat and power or co-generation—increases energy efficiency, adds reliability and reduces line losses.
9. **Not using** energy, rather than producing, using and disposing of it, is far easier on the environment, the economy, ratepayers and taxpayers. Reduced energy use means reduced GHG emissions and other pollutants.
   - Individuals can start their own conservation program by installing compact fluorescent bulbs, turning off lights, using power strips to turn off TVs, DVDs and computers, hanging wash outside, and purchasing efficient equipment. Choosing a vehicle that gets more MPG, combining trips, telecommuting, slowing down, having proper tire inflation and clean air filters can save fuel.
   - State electric utility commissions frequently require energy efficiency and conservation programs to reduce kilowatt usage. "Peak shaving" programs that reduce use during times of peak demand (very hot days, for example) can reduce the need for more power plants. Such programs might include having the ability to turn off household electric water heaters or reducing industrial and commercial lighting and power use. "Any time use reduction" programs might include incentives to replace old, inefficient appliances, lighting and motors.
   - Designing buildings to take advantage of sunlight and insulating adequately produce savings.
   - Land use planning to better suit mass transit, walking, or reducing traffic congestion will reduce GHG emissions.

Some of these energy concepts relate to the mitigation strategies below: concepts 4–7 to "Energy Supply"; concept 8 to

"Energy Supply" and "Industry"; and concept 9 to "Transport" and "Buildings" and "Life Style and Behavior Patterns."

Key Mitigation Strategies

The 2007 IPCC WGIII reports the following technologies to reduce GHG emissions are commercially available today or projected to be available by 2030. (IPCC, WGIII, SPM, p.13)

- **Energy supply**—Improved supply and distribution efficiency; fuel switching from coal to gas; nuclear power; renewable heat and power (hydropower, solar, wind, geothermal and bioenergy); combined heat and power, early application of CCS (carbon capture and storage, e.g., storage of CO_2 removed from natural gas).
  By 2030: CCS; advanced nuclear power; advanced renewable energy including tidal and wave energy; concentrating solar and solar photovoltaic.
- **Transport**—More efficient vehicles; hybrid vehicles; cleaner diesel vehicles, biofuels; shifts from road transport to rail and public transport systems; non-motorized transport (cycling and walking); land use and transport planning.
  By 2030: Second generation biofuels; higher efficiency aircraft; advanced electric and hybrid vehicles with better batteries.
- **Buildings**—Efficient lighting and daylighting; more efficient electrical appliances and heating and cooling devices; improved stoves; improved insulation; passive and active solar design; alternative refrigeration fluids; recovery and recycling of fluorinated gases.
  By 2030: Integrated design of commercial buildings including intelligent meters that provide feedback and control; solar photovoltaic cells built into buildings.
- **Industry**—More efficient end-use electrical equipment; heat and power recovery; material recycling and substitution; control of non-CO_2 gas emissions; and a wide array of process-specific technologies.
  By 2030: Advanced energy efficiency; CCS for cement, ammonia and iron manufacture; inert electrodes for aluminum manufacture.
- **Agriculture**—Improved crop and grazing land management to increase soil carbon storage; restoration of cultivated peaty soils and degraded lands; improved rice cultivation techniques and livestock and manure management to reduce methane emissions; improved nitrogen fertilizer application techniques to reduce nitrous oxide emissions; dedicated energy crops to replace fossil fuel use; improved energy efficiency.
  By 2030: Improvement of crop yields.
- **Forestry/Forests**—Reforestation; forest management; reduced deforestation; harvested wood product management; use of forestry products for bioenergy to replace fossil fuel use.
  By 2030: Tree species improvement to increase biomass productivity and carbon sequestration. Improved remote sensing technologies for analysis of vegetation/soil carbon sequestration potential and mapping land use changes.
- **Waste**—Landfill methane recovery; waste incineration with energy recovery; composting of organic waste; controlled waste water treatment; recycling and waste minimization.
  By 2030: Biocovers and biofilters to optimize methane oxidation.

The report also notes that "changes in lifestyle and behavior patterns can contribute to climate change mitigation across all sectors." (IPCC, WGIII, SPM p.16)

- Consumption patterns can emphasize resource conservation.
- Education can change behavior and choice.
- Land use and transportation planning can reduce vehicle usage.

Earlier Studies Concur

The mitigation technologies listed above have been known for years. In 2004, the "Stabilization Wedges" study published by the Carbon Mitigation Initiative group from Princeton (www.princeton.edu/~cmi) covered similar ground.

The U.S. Department of Energy Interlaboratory Working Group on Energy Efficient and Clean Energy Technologies "Scenarios for a Clean Energy Future" (p. ES-1, Nov. 2000) concluded:

- Smart public policies can significantly reduce carbon dioxide emissions, air pollution, petroleum dependence, and inefficiencies in energy production and use.
- Overall, the economic benefits of these policies appear to be comparable to their costs.
- Uncertainties in the Clean Energy Future assessment [of all assessed technologies] are unlikely to alter the overall conclusion. The policy and technology opportunities identified in the CEF are so abundant that they compete with each other to reduce carbon emissions.

The Time Is Now

If we continue "business as usual," the IPCC 2007 WGI report, "The Physical Science Basis," projects an average temperature rise of 4°C (almost 6°F) with likely outcomes between 2.4 to 6.4°C by 2099.

Working Group II's 2007 report "Climate Change Impacts, Adaptation and Vulnerability" details some of the more severe economic, human health and ecological consequences (droughts, floods, sea level rise, food and potable water shortages, vector borne diseases, and air and water quality degradation) projected to occur with rising temperatures and higher levels of GHG concentrations in the atmosphere.

The mitigation technologies and behavior changes are available today. The time to act is now. ■

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VOTER LINKS

- *IPCC "Summary for Policy Makers" reports from all three Working Groups and other IPCC documents are available at http://www.ipcc.ch.*