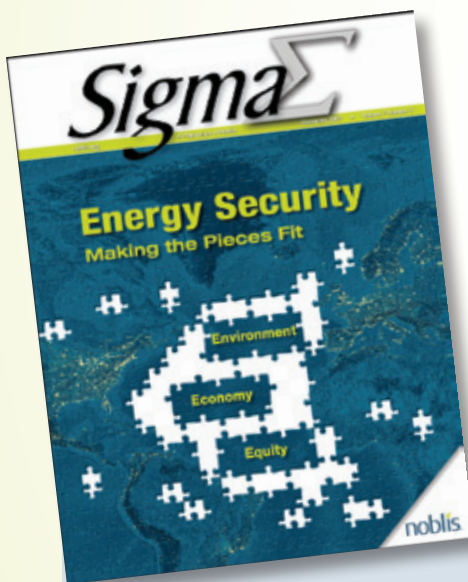


Revisiting Energy Security

Rodney K. Lay
with input from David Gray,
Catherine E. Campbell,
and Matthew H. Hardy



In *Energy Security: Making the Pieces Fit* (vol. 7, no. 3, Dec. 2007) Noblis reported on the environmental, economic, and equity aspects—the pieces—of energy security. Articles addressed the world's insatiable and unequal appetite for energy, the lack of a quick fix, and the sea-change implied by achieving energy sustainability.

Energy issues continue to be inextricably entangled with environmental, economic, and equity issues in unpredictable ways. We authors warned that as each of the specific energy, environmental, economic, and equity issues blend, "... they form a new breed of complexity that is truly a wicked problem."

In light of 2008 and 2009 so far, that assessment was somewhat academic. We didn't foresee how insufficient the concept of blending would be with its implication that smart resolutions, although difficult, would be controlled and controlling.

Indeed, "blending" is totally inadequate to describe the turmoil of interactions that have developed in the intervening 18 months, as getting the economy back on track clashes with rational energy security policy in the face of climate-change realities in an inequitable world.

There is no way to suboptimize the outcome for an individual energy, environmental, economic, or equity issue because each element has a global span. The world needs to rewrite its basic rules of engagement among energy, environmental, economic, and equity concerns as a system of very influential systems.

The truth: no one is in control

It is common to hear that the economy is global. No one debates that environmental concerns are global, that equity concerns are global, that energy supply and demand is a global endeavor. The unspoken rider is or was "... but we are in control." That is false; no one is in control. Globalized re-

cession has acted like the proverbial "2 by 4 upside the head" for global trade, which was expected to perpetuate an era of excess as modeled by (and to the primary advantage of) developed nations.

It is problematic to capture highlights of this extremely complicated situation. Table A looks at some interrelationships, but the entries are not intended as value judgments. Rather, they underline inherent contradictions.

Any long-term energy-use plan must transition to a state that supports, or at the very least does not work against, the interdependent goals for the environmental, economic, and equity aspects of energy security.

Such a plan must focus on and fuse each of the rows in the table. Work started on any one concern must be consciously in relation to the others. Symbolically, the table has empty cells on the diagonal—the implication is that improved energy conditions could be influenced more by working the environmental, economic, and equity concerns first rather than by addressing energy-specific issues.

Shifting the focus to equity, if nations work from where they want the energy, environment, and economy to settle out, the equity goal will become clearer.

However, any action, regardless of its initial focus, might not lead to an acceptable end state. Iteration will be required, and the clear challenges will be in managing the contradictions and their resolution. This effort will be political. Scientists and engineers will provide the pragmatic

The articles made these key points:

The horizon of the energy vision should not be 20 or even 100 years. True sustainable energy using inexhaustible supplies must be the overarching goal from the start. The continued use of fossil fuels will act as a stop gap or bridge until that time.

Nations now enjoying a nearly unlimited energy supply must change their lifestyles and attitudes and lower their energy intensity.

Industry is realizing that green can be profitable. Energy conservation must be an integral part of demand-side management and conservation can be considered to be the first fuel.

Long lead times are necessary to implement new energy conversion systems; delay exacerbates the problem.

If history repeats itself—which is likely for new energy infrastructure—cost-estimating practices, public perception, and regulatory requirements could seriously impact total project costs.

Pigouvian (market-linked) taxes could be a tool to account for the environmental impacts associated with consuming energy for, say, automobile use.

Coal and biomass co-conversion has a double benefit in reducing carbon dioxide: no carbon input penalty from the biomass and the ability to capture and sequester carbon during conversion.

Microbial fuels are renewable, clean burning, and potentially efficient. But they come with waste remediation and scalability issues, which research must continue to address.

The world needs to rewrite its basic rules of engagement among energy, environmental, economic, and equity concerns as a system of very influential systems.

measures such as rates of global warming, timing of peak oil production, and demographics, but nations must negotiate the availability. Hopefully, it will be possible to avoid the colonial model that controlled access to rubber, teak, sugar, and tea.

The sidebar “Some Energy Security Paradoxes” on p. 48 looks at the implications of Table A’s contradictions and where they have led. The examples cannot possibly tell the whole story because the paradoxes are global. Any update on our earlier report is driven by this globalization and the failed model of excess.

But the news isn’t all bad

Progress has been made toward some of the goals we reported in 2007. Clearly the new administration’s priorities focus on environmental stewardship and this appears to trump energy security concerns.

As a result renewable energy is gaining traction, particularly wind and solar. Also conservation is becoming more important, with emphasis on greater efficiency in residential and commercial lighting and heating and increased Corporate Average Fuel Economy (CAFÉ) standards for transportation.

Carbon dioxide reduction

There is considerable focus on reducing carbon dioxide (CO₂) and other greenhouse gas (GHG) emissions, and the water-energy nexus is gaining focus. Emphasis is being placed on post-combustion CO₂ capture from existing coal-fired power plants. The regional carbon sequestration partnerships are conducting several large-scale CO₂ transport, sequestration, and monitoring projects. There is pressure to implement a carbon cap-and-trade program to limit CO₂ emissions from fossil fuel use.

The concern is that politics and regulations are getting too far ahead of technol-

ogy. More research, design, and development (RD&D) on carbon capture and long-term sequestration is needed so that viable options are available for the disposal of the large quantities of CO₂ involved.

However, the struggle continues with increased fossil fuel use generally and coal use in particular. And the struggle includes alternative fuels for transportation—from oil sands, shale, and coal liquids. The world’s economic meltdown, lack of credit and project financing, and collapsing oil prices are some of the reasons.

Another is that Section 526 of the Energy Policy Act (EPACT) forbids federal agencies from purchasing alternative fuels with greater GHG life-cycle emissions than conventional petroleum-derived fuels. The U.S. Air Force, once an advocate for jet fuel from natural gas and coal, has become less interested partly because of Section 526 and partly because of the high costs.

The situation for nuclear is unclear although nuclear fits the bill in terms of being nearly GHG free. However, concern over radioactive nuclear waste has increased, given the most recent decision on Yucca Mountain.

Automobile use policy

People are now seriously recognizing that the gas tax is not a sustainable source of revenue to fund transportation systems. The government has increased fuel-efficiency requirements (CAFÉ), the cost of gasoline is higher, and the realization is growing that vehicles do indeed produce significant amounts of pollution and that individuals can make a difference by changing to a hybrid or more fuel-efficient vehicle.

Although these are great ideas, they erode the transportation infrastructure funding because the gas tax revenue is

lower. No one seems to agree on how to solve this problem: raise the gas tax or implement a miles-traveled user fee?

Transportation and land use go hand-in-hand and any policy change needs to be viewed in the long-term. Researchers have long recognized this interlinking, but policy makers have not created conditions for deeply assessing the problem.

Transportation funding comes primarily from the federal and state governments, but land use is purely local. The notion of building transit-oriented development or implementing smart growth principles ignores the fact that existing (heritage) land use will be with us for the next 50 years. Thus, in Northern Virginia, the incremental impact of extending the Metro (Washington, D.C.’s rapid transit system) through Tysons Corner will be microscopic, since existing land use will not change nearly as quickly as the transportation network.

This raises another point: Transportation and land use need to take a longer term view. People are keeping their cars and homes for more years, so it will take longer for the technologies that improve energy efficiencies to propagate. If the government were to require all vehicles be equipped with IntelliDrive technologies beginning in January 2010, it would take 10 years for 40 percent of the cars on the road to be equipped with the technology, and perhaps 20 years for 80 percent.

Incentives will be needed to purchase new vehicles, such as tax rebates (as in Japan) or an increase in taxes on existing vehicles after a certain period.

Synthetic fuels

On developing fuel from combination feedstock such as coal and biomass, there have been many words but little progress. Three major events have put the brakes on

Table A. Impacts on the state of energy, environment, economic, and equity interrelations as each individual condition improves.

If Improved	Impact on			
	Energy	Environment	Economy	Equity
Energy—increased (more BTUs per dollar)		More energy use increases current rate of climate change	Cost of living reduced—helps economy get back on current track	Uneven availability invites political unrest
Environment	Mother nature starts charging for the air and water insults		Cost of living increases—recent excesses not repeatable	Developing countries slowed—gap exacerbated
Economy	Exploration and research sustain status quo	Climate change addressed, but slowly		Developed and undeveloped trajectories continue diverging
Equity	Global increase and redistribution of fossil fuel use	Climate change exacerbated as nations catch up	Global redistribution of trade—economy back but on new track	

Progress has been made toward some of the goals we reported in 2007. Renewable energy is gaining traction, particularly wind and solar, and energy conservation is becoming more important.

coal to liquid (CTL) and coal-and-biomass-to-liquid (CBTL) implementation plans.

First, the drop in the world oil price from around \$150 to around \$40 per barrel dislodged the economic viability for CTL, which would be about \$80 to \$90 per barrel. The world economic meltdown has reduced world energy demand. Second, it has been difficult to obtain construction loans for large capital projects such as CTL and CBTL. Finally, as described earlier, federal agencies cannot purchase alternative fuels with GHG emissions greater than those from conventional petroleum fuels.

Consequently, the Baard Energy CBTL plant in Ohio is on hold. Others have been cancelled: the Consol methanol-to-gasoline plant in West Virginia, the FutureGen plant, and the ExxonMobil gas-to-liquids plant in Qatar. Meanwhile, the Chinese Shenhua plant in Inner Mongolia is up and running.

In the world of microbial energy production, momentum is increasing to stop

growing corn and cutting down rainforests to produce ethanol, so ethanol may be on its way out as a biofuel. A Continental jet flew on jet fuel made from algae and plant matter in January 2009,¹ and there have been some rumblings about using algae for hydrogen.²

However, these biofuels have much lower priorities than wind, solar, and improved car batteries. By 2022, Congress wants 36 billion gallons of ethanol produced, but only 15 billion gallons can come from corn; the rest must come from second-generation sources, such as microbial fuels.³

The nation is short of the goal for second-generation sources at this time, and these may be the biggest growth industry in the next few years. However, in the switch from petroleum fuels to other energy sources, these second-generation sources should be viewed as alternatives, but carefully. As alternative fuel sources become widespread, they can reveal as many or more downsides, relative to petroleum—not only higher cost, but also toxic byproducts, spikes in commodities prices, food shortages, and ecosystem destruction. Ethanol is the most recent example.

Priorities for progress

These observations give rise to priorities for progress—particularly in the twin contexts of the stimulus spending plan and green business revolution.

Progress requires a *multi-pronged approach* that balances concerns over the economic recession, environmental degradation and climate change, energy security, and equity.

There must also be greater emphasis on *reducing energy demand*. Several reduction strategies are possible: Deploy distributed electrical generation through solar panels, use smart grid metering to improve demand-side management, rely more on electric vehicles by improving electric storage, and give mass transit a larger role in urban areas.

Safe nuclear reactor technology and *government leadership in nuclear waste management* must also become priorities.

Finally, *more science and engineering* must be devoted to studying how water use, GHG emissions, and energy use interrelate.

In the context of these priorities, progress will be served by meeting five RD&D goals:

- Ensure the safety and viability of long-term CO₂ storage and look further into algae as a dual benefit—carbon sequestration plus a renewable energy source for biodiesel or hydrogen or both.
- Make existing power-generation plants more efficient.
- Explore electric storage devices for intermittent wind and solar and integrate renewable and fossil power transmission through upgraded and smart grid systems.
- Provide new water resources.
- Increase insights into the unintended consequences of large-scale biomass plantations for energy crops, for example, the release of disturbed soil carbon from cultivating new land.

Aside from the specific technology recommendations just given, there is a need to recognize that decisions are made at the state and local level; governments need the flexibility to spend money as they see fit within certain guidelines or goals. If Virginia thinks that cutting taxes will stimulate the economy and produce better jobs in the long-run rather than funding several roadway repaving projects, or if Maryland thinks it's better to fund transportation projects, then, let them. The federal government should not assume that it knows how best to spend money at the local level.

Also, tools need to be developed that can better inform decision makers of tradeoffs. This is not to say that tools always produce the correct answer, but they do serve as a way to engage stakeholders and provide needed data on different scenarios and assumptions. ■

References

1. "Continental Flight Takes Off on Algae & Jatropha Fuel," *Oilgae Digest*, Jan. 2009; <http://www.oilgae.com/blog/2009/01/continental-flight-takes-off-on-algae.html>.
2. "New Possibilities for Hydrogen-producing Algae," *ScienceDaily*, Mar. 25, 2009; <http://www.sciencedaily.com/releases/2009/03/090324171556.htm>.
3. C. Kraus, "Ethanol, Just Recently a Savior, Is Struggling," *NY Times*, Feb. 11, 2009; http://www.nytimes.com/2009/02/12/business/12ethanol.html?_r=1&ref=science.

For more information on energy security, contact Rodney Lay at rlay@noblis.org.

Some Energy Security Paradoxes

- General Motors sold only half as many vehicles in 2008 as in the year before. For the economy to "get back on track," the nation must manufacture and consume energy-intensive goods that degrade the environment, such as cars.
- If the environment improves (plentiful clean air and water, for example), industry's real process costs must rise, thus diverting funds from consumerism and the goal of reducing the gap between rich and poor.
- Technology will solve the dilemma—so say the prophets of a culture that accepts the inevitability of, and even plans for, boom-and-bust business cycles. Driving is an example. Improving automobile mileage is an incentive for taking more trips. Environmentalists view the Tata Nano as a disaster in the making while equity is clearly served.
- If more traditional energy resources become affordable and are used, the environment and equity will suffer while the excess is reflected in such indulgences as single-occupancy vehicles.
- The closer developing nations move toward equity with developed nations, the greater the generation of greenhouse gases.