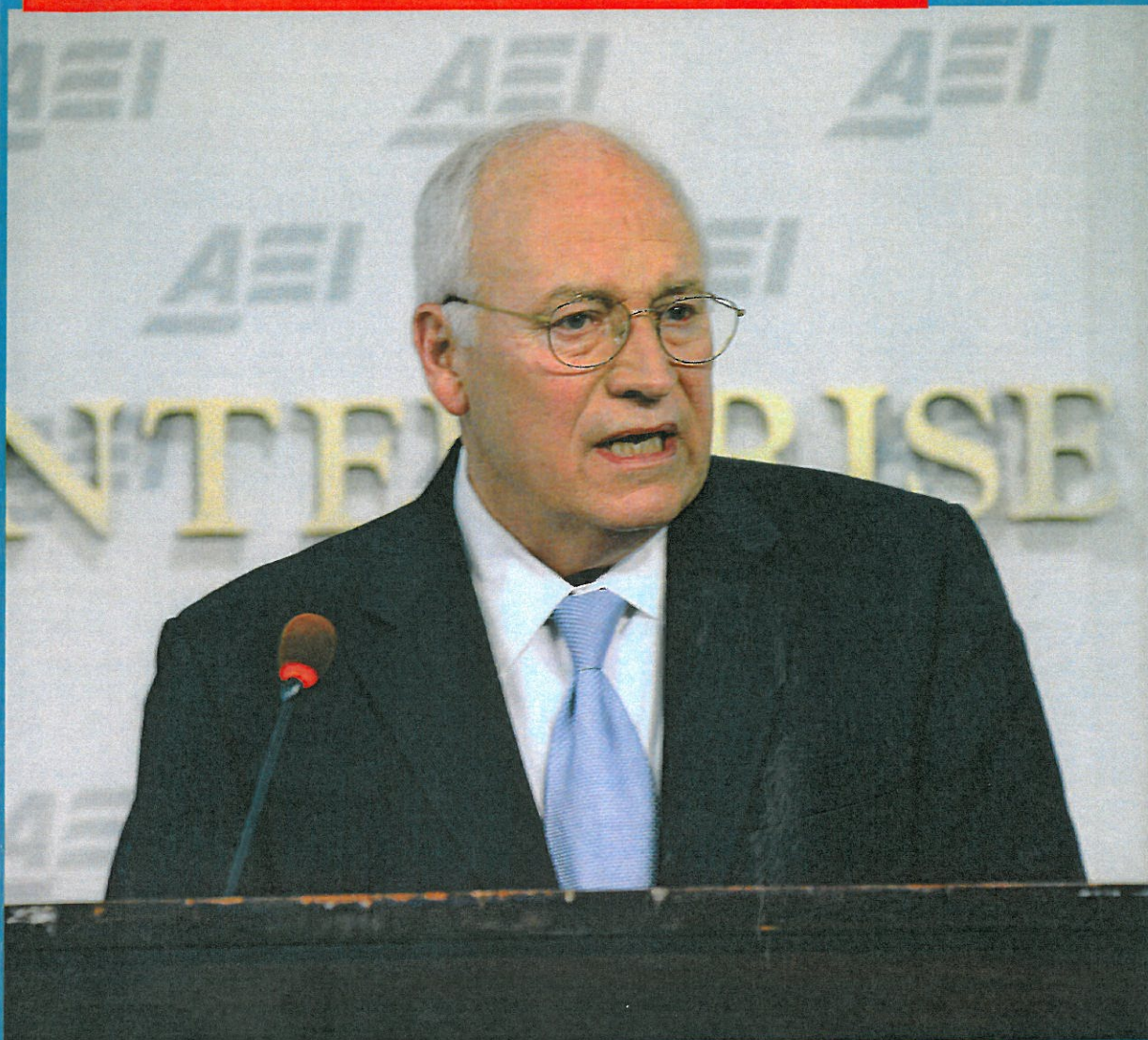


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Representative American  
Speeches 2008–2009

Edited by Brian Boucher



# Representative American Speeches

2008–2009

Edited by Brian Boucher

## The Reference Shelf

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## Preface

As the nation limped through 2008 and 2009, burdened by high unemployment and seeing few signs of a broad recovery, as salary caps and government bailouts continued to spur debate across the country, the main topic on many Americans' minds was the economy. While the current volume of Representative American Speeches does not include a chapter exclusively devoted to the subject, the sputtering economy serves as a backdrop to the five topics addressed this year: the efforts of the new administration, the future of journalism and the media, ongoing initiatives to "green" American energy, the plight of the U.S. auto industry, and the state of the American city.

January 20, 2009, saw the inauguration of Barack Obama, the first African-American president, and this volume offers a survey of speeches by members of the new administration, as well as assessments, approving and critical, by several commentators. Obama's inaugural address is included as well as talks by two key members of the administration: Vice President Joe Biden speaks at the 45th Munich Security Conference, and Secretary of State Hillary Clinton gives an address on foreign policy at the Council on Foreign Relations. All three stress a radical departure from the policies and tone of the previous administration. Representing that faction is Vice President Dick Cheney, who follows in the Al Gore tradition of high-profile vice presidents with a lecture at the American Enterprise Institute, arguing against the new administration's national-security policies. Also representing the loyal opposition is Louisiana's governor, Bobby Jindal, who delivered the Republican response to Obama's first State of the Union address. Providing a more approving view is the Brookings Institution's Thomas E. Mann, who evaluates the Obama presidency after its first 100 days in office.

Abundant evidence speaks to the troubled condition of the American newspaper. Ever a bellwether, the satirical newspaper *The Onion* published in October 2009 an item entitled "Report: Majority of Newspapers Now Purchased By Kidnappers To Prove Date." The American Society of News Editors, for the first time since 1945, canceled its annual convention in 2009 due to constrained budgets at so many of its members' papers. (The month before making that announcement, in an effort to broaden membership, the organization changed its name from Newspaper Editors to News Editors.) As another indication of the shifting ways people get their news, *The New York Post* pointed out on July 22, 2009, that a

Nielsen report indicated there are now more televisions in the country than there are people. Amid steep declines in circulation and revenue, according to *The New York Review of Books*, “newspapers lost 15,974 jobs in 2008 and another 10,000 in the first half of 2009.” On an even more somber note, the passing in 2009 of Walter Cronkite, “the most trusted man in America,” prompted many to reflect on the state of journalism today. In these pages, top industry figures, an academic, and a former reporter weigh in. Incoming National Public Radio (NPR) CEO Vivian Schiller discusses the lessons public and private media can learn from each other, while her former boss, Arthur Sulzberger, Jr., publisher of *The New York Times*, makes a case for the continued importance of old-fashioned journalism in new and traditional media. Former newspaperman and now television writer and producer David Simon, as well as Columbia University’s Todd Gitlin, describe the crisis (or, as Gitlin puts it, “crises”) facing journalism today, and both of them sketch out possible solutions.

Even as the dangers of climate change become more and more widely understood, global demand for energy grows. A chapter herein includes some highlights of the recent national discussion of green energy. An energy company CEO, a government administrator, and two academic scientists comment on how to reconcile the need to meet demand with a desire to change the way energy is provided, how government can foster innovation, and what forms of energy are most promising. James Mulva, the CEO of ConocoPhillips, calls for a national energy policy and outlines some of the principles that should define it. Shirley Ann Jackson, the president of Rensselaer Polytechnic Institute (RPI), introduces the term “energy security” as an alternative to “energy independence” and explains why the designation is more apt while offering a perspective that is informed by both international realpolitik and technical considerations. Lisa Jackson, the administrator of the U.S. Environmental Protection Agency (EPA), calls for big ideas to meet the challenge of climate change and points out the close links between environmental and other national dilemmas. Finally, Rockefeller University’s Jesse H. Ausubel makes a case for natural gas as the most realistic option to provide power on a large scale and even argues against the term “fossil fuels,” based on an evolving understanding of how energy is produced by the Earth.

Speeches in the subsequent chapter describe how the U.S. auto industry came to its current perilous state and ask whether and how it can be saved. During the credit crisis of 2008, Americans witnessed unprecedented—and highly controversial—government intervention in an industry that was on the brink of collapse. The addresses in this chapter trace the arguments over that intercession, including testimony by prominent figures such as United Auto Workers (UAW) President Ron Gettelfinger and Public Citizen’s Joan Claybrook before the U.S. Senate and House, respectively. Also included is Barack Obama’s announcement on the government’s response to the automakers’ appeals and remarks by the new General Motors (GM) president and chief executive officer (CEO) Fritz Henderson on “day one” of the new GM, post-government intervention.

As America becomes increasingly urbanized, the state of the American city has

come under discussion. Three city officials and a Brookings Institution scholar herein offer their observations on America's urban areas and their changing relationship to the federal government. Brookings scholar Bruce Katz lobbies for a more integrated relationship between local, state, and federal governments. Mayor Greg Nickels of Seattle, in his State of the City address, points out the ways that cities have taken the lead on matters like environmental change. Jay Williams, the mayor of Youngstown, Ohio, meanwhile, discusses the ways that America's "shrinking cities," especially those hurt by the departure of heavy industry, can remake themselves. Departing Bronx Borough President Adolfo Carrión, Jr., who had been tapped to become director of the White House Office of Urban Affairs Policy, took advantage of his final State of the Borough speech to address New York City's status and to offer a preview of the new administration's urban policy.

**Brian Boucher**  
**December 2009**



## Natural Gas and the Jackrabbit\*

Jesse H. Ausubel

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**Editor's introduction:** In this speech, presented to the PowerSouth Energy Cooperative, which provides wholesale power in Alabama and Florida, Jesse H. Ausubel makes a case for methane as a viable form of green energy instead of so-called “renewable” sources. Ausubel advises against irrational exuberance about the potential for change due to temporary financial upheavals and describes long-term trends in energy use as defined by decarbonization. Methane, he maintains, is the best source for providing electrical power, and he urges the development of methane-fueled zero-emissions power plants, or ZEPPs. He claims that the whole notion of “fossil” fuels is erroneous, and that massive stores of energy from methane may come from within the Earth. Ausubel further insists that in fact renewables are quite damaging to the environment and are largely inefficient.

**Jesse Ausubel's speech:** Thanks to Chairman Gary Smith and the PowerSouth Energy Cooperative for the opportunity to speak about the energy business viewed through a green lens. In the end my green lens will focus on natural gas, methane, not so-called renewables. My task is to explain why methane is green and destiny, and why renewables are neither green nor destiny.

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\* Delivered on January 22, 2008, at Sandestin, Florida. Reprinted with permission.

First, let me comment on a current temptation. The sudden crash of the US and world economies during 2008 tempts us to have faith in revolutionary change. For energy systems, we should resist the belief that in a short time everything can be different. Very stable trends characterize the energy system. In fact, the stable trends finally appear to go unscathed through economic depressions, wars, and, for better or worse, fashions in public policy.

Let me begin with an extreme example of public policy, the central planning that followed a famous revolution, the Bolshevik Revolution of 1917 in Russia's. The Russian Revolution and later World War II literally drove Russians back into the woods to collect their fuel. Yet, these extreme political and economic shocks were later entirely absorbed. A "business as usual" extrapolation of market substitution using logistic curves for the period 1890–1915 predicts market shares of primary fuels in the USSR in 1950 very nicely. By 1950 one sees no visible effect on the energy system of World War I, the Bolshevik Revolution, the Great Depression, or World War II. Wood was disappearing right on schedule, coal peaking, oil growing, and soon gas would be soaring, and nuclear penetrating.

I would say the energy system had arrived at its genetic destiny. Along the way, the leaders of Russia and its adversaries had made the population miserable. Yet, the so-called leaders and planners made no lasting effect on the USSR energy system.

America's experience in energy systems differs little from Soviet Russia. Consider for the US the change of four variables—population, affluence, consumer behavior, and technological efficiency—that together cause emissions of sulfur dioxide and carbon dioxide. Charting the changes of combinations of these variables against growing affluence between 1900 and 2007 reveals the effect of intervals of economic depression and recession. For sulfur, in the Depression of 1930–1935 the system backtracked and then resumed its trajectories, barely affected. The chaotic fluctuations during the post-war recession of 1945–1952 were similarly soon absorbed. For sulfur, the system worked its way through a 100-year program of growing and then declining emissions. Richer was first dirtier, but then richer became cleaner, in a great arc economists call a Kuznets curve, for the American economist Simon Kuznets.

What differs between sulfur and carbon is the duration of the life or product cycle. For carbon, completing the arc—the Kuznets curve—will take three hundred rather than the one hundred years sulfur took. Carbon will weigh in the energy system for another 75 years or so.

Returning to the regressive effects of economic turmoil, a zoom into the carbon dioxide emission story during the Depression in shows the effects in detail. The system darts this way and that before regaining its long-run orientation. We observe the jack rabbit behavior of a system in a depression. To summarize, periods of depression and other forms of shock such as war do not revolutionize an energy system, though they do release lots of hot air from politicians and pundits.

Here let me introduce the most important trend in the environment for the energy business, namely decarbonization. Hydrocarbons are of course a mix of hydrogen (H) and carbon (C). Each combines with oxygen to release energy, with the hydrogen converted to water ( $H_2O$ ), and the carbon mostly converted to carbon dioxide,  $CO_2$ , which is food for plants but also a greenhouse gas that now worries a lot of people. On average, when one removes the water, biomass fuels such as wood, hay, and oats have a ratio of about 40 C to 4 H. Charcoal is essentially pure C. Coal comes in many shades but typically has about 8 C for each 4 H. Popular liquid products, like gasoline and jet fuel, average about 2 C for each 4 H. Methane,  $CH_4$ , burns only 1 carbon for each 4 hydrogen atoms, 1/40th the ratio of wood.

Twenty-five years ago, my colleagues Cesare Marchetti, Nebjosa Nakicenovic, and Arnulf Gruebler and I put all the hydrocarbons humans used each year for the past two centuries in a hypothetical gigamixer and plotted the history of fuel in terms of the ratio of C to H. To our surprise we found a monotonic trend, namely the ascent of hydrogen. We named the trend decarbonization for the concomitant descent of carbon.

The history of hydrocarbons is an evolutionary progression from biomass to coal to oil to natural gas and on to hydrogen, eventually derived from non-fossil fuels in order to keep the primary mix clean of carbon. Carbon loses market share to hydrogen as horses lose to cars or typewriters lose to word processors. The slow process to get from 90 percent C to 90 percent H in the fuel mix should take about 300 years and pass the 90 percent mark about 2085. Let's say 2100 so as not to appear overconfident.

Some decades have lagged and some accelerated but the inexorable decline of carbon seems clear. Times make the man. The patron of my university, John D. Rockefeller, surfed on this long wave by standardizing oil. Al Gore surfed the wave to a Nobel Peace Prize. Over the past 20 years decarbonization has entered the vernacular, and a New York money manager even has a decarbonization mutual fund. Successful people and companies ride the wave of history and arrogate fame and money. I hope people hearing or reading this speech do so.

A variation of decarbonization as a competition between carbon and hydrogen shows the kilos of carbon per unit of energy, thus integrating fuel switching with increases in efficiency, that is, technical progress, for example better motors. The global kilos of carbon per joule of energy slide inexorably downward. The variation of carbon per GDP further integrates energy with consumer behavior, that is, whether consumers favor energy with their marginal dollar. The US is not an exception to the world trend. The US will soon celebrate its centennial of falling carbon per dollar.

One naturally asks why long-term decarbonization lines always point down for C and up for H. The explanation is that the overall evolution of the energy system is driven by the increasing spatial density of energy consumption at the level of the end user, that is, the energy consumed per square meter, for example, in a

city. Finally, fuels must conform to what the end user will accept, and constraints become more stringent as spatial density of consumption rises.

The spatial density of consumption in vertical cities like Shanghai is soaring. Such rich, dense cities accept happily only electricity and gases, now methane and later hydrogen. These are the fuels that reach consumers easily through pervasive infrastructure grids, right to the burner tip in your kitchen.

Ultimately the behavior of the end user drives the system. When the end user wants electricity and hydrogen, the primary energy sources that can produce on the needed scale while meeting the ever more stringent constraints that attend growth will eventually and inexorably win. Economies of scale are a juggernaut over the long run.

One contributor to economies of scale is the heat value of the fuel per kilo. Replacing brown coal with methane raises the energy per ton of fuel as it decarbonizes. Thirteen railroad cars of biomass such as switchgrass equal about one railcar of coal and half a car of oil. Economies of scale match best with technologies that grow smaller even as they grow more powerful, as computer chips, electric motors, and power plants all have done. Miniaturization matters because it multiplies the potential market, as laptops show compared to mainframe computers. Moreover, miniaturization is green. It shrinks our footprint.

Miniaturization also matters because, notwithstanding the present depression, over the long-run energy use will keep rising. One reason is that computer chips could well go into 1000 objects per capita, or 10 trillion objects worldwide, as China and India log into the game. By the way, some studies suggest the total energy system demand of a cell phone is not unlike a refrigerator, because the telecom system must flood the skies with waves and always be on. PowerSouth managers probably know exactly how its customers have increased demand by filling homes, hotels, and offices with wifi and flat screens even as lamps and appliances became more efficient.

What is the most promising way for the energy system to meet fluctuating and then again rising consumer demand amidst green fears? For electricity, the obvious and destined route is methane, and PowerSouth is about halfway there. Methane is inherently good for reasons now well established, but it can be even better.

The next big trick is to take rocket engines and turn them into power plants. One might, say, take a cruise missile or even the space shuttle and turn it upside down and operate it for a few hundred thousand hours. While methane consumption grows, humanity will not permit itself to dispose of much of its carbon in the air. So, engineers and managers must also capture the emissions and make a methane-fueled Zero Emission Power Plant or ZEPP.

Operating on methane, a ZEPP puts out electricity and carbon dioxide that can easily be sequestered. From an engineering point of view, the key is air separation or abundant cheap oxygen so that the fuel can be burned neatly with the  $O_2$  and leave streams only of  $CO_2$  and water. While in principle any fuel could be an input to such a machine, the theme of clean-up on the front end favors methane. Coal is a minestrone with sulfur, mercury, cadmium, and other headaches. Why



buy rocks that will leave piles of these elements that will likely cause a plant site to become a regulated toxic waste dump, when one can purchase methane that is already almost purely C and H? Chemical engineers appreciate the benefits of fine feedstock.

ZEPP technology is exemplified by the Kimberlina plant of a company called Clean Energy Systems in Bakersfield, California, which already has operated for 4 years a prototype ZEPP of 20 MW, which I visited myself. Some day the Kimberlina plant may become an environmental world heritage site for its contribution to decarbonization. Operating at high temperatures and pressures, the plant, or rocket one might say, is delightfully compact.

Clean Energy Systems is also working on a 200 MW generator, whose dimensions are even more striking. Think of a 200 MW generator or turbine as a mobile home and the power park as half a dozen trailers. The "All in" efficiency of the ZEPP including compressed  $\text{CO}_2$  as a by-product should be about 50 percent. The  $\text{CO}_2$  can be sequestered underground in a saline formation or used lucratively for enhanced oil recovery or enhanced gas recovery.

Pushing the envelope on pressure and temperature, Japanese colleagues at Tokyo Electric Power Company calculate that a ZEPP a few decades hence could reach 70 percent efficiency, green indeed compared to the 30 percent of today's coal plants. Doubling the efficiency of power plants attracts me as a way to spare carbon emission. My dream is a 5 GW ZEPP, super fast, operating at high temperatures and high pressures and thus super compact. A single machine the size of a locomotive would more than double PowerSouth capacity and fit comfortably within the existing infrastructure!

Where will the methane come from? Here let me introduce a heresy. I reject the notion of "fossil" fuels, which implies that all or most oils and natural gases derive from the buried and chemically transformed remains of once-living cells. Think of Earth instead as a steaming plum pudding, outgassing since forever. Primordial, non-biological carbon comes in the first place from the meteorites that helped form Earth and other planetary bodies. Abiogenic carbon clearly abounds on such planetary bodies as Titan, which enjoyed no Carboniferous or Jurassic eras with giant ferns and dinosaurs. Now astronomers sniff outgassing methane on Mars, too.

Water also abounds inside Earth, perhaps ten times as much as in the oceans. Suppose the carbon is upwelling from the core and mantle of the planet and then, through a range of interactions with hydrogen and oxygen at high temperatures and pressures, enters the crust from below as a carbon-bearing fluid such as methane, butane, or propane. Continual loss of the very light hydrogen brings it closer to what we call petroleum or even coal. Emissions from volcanoes and earthquakes give further evidence of very deep hydrocarbons eager to outgas.

The fossil theory relies on the long unquestioned belief that life can exist only at the surface of Earth. In one of the most exciting scientific developments of recent years, science has now established the existence of a huge, deep, hot biosphere of microbes flourishing within Earth's crust, down to the deepest levels

we drill. In fact, humanity has never drilled deeper than life. Mud from the deepest holes of 30,000 and 40,000 feet bears life. These deep microbes can best be explained by diffuse methane welling from the depths on which methane-loving bugs thrive. Oil, too, is very desirable to microbes.

So, the alternate concept is that the deep hot biosphere adds its products to the upwelling hydrocarbons. The bioproducts have caused us to uphold the belief that the so-called fossil fuels are the stored energy of the Sun. I believe much, maybe most, of the oil and gas is not the stored energy of the Sun but primordial hydrocarbons from deep in Earth. And they keep refilling oil and gas reservoirs from below, as reported in fields deep under the Gulf of Mexico. Alternate theories of the origins of gas, oil, and coal may well revolutionize Earth sciences over the next two to three decades, and lift estimates of resource abundance. Methane may more truly be an inexhaustible and even renewable fuel, generated continually deep in Earth, than forests, which humanity managed to eliminate from much of North Africa, for example, for about 2000 years.

New theory will also help reveal methane resources in little-explored places, such as the continental margins, where the sea floor slopes from a few hundred meters deep to a few thousand. Now frequent discoveries of communities of life that live around cold seeps of methane on continental margins suggest that margins have lots of fracture zones where gas upwells. Methane seeps are plentiful on the slopes of PowerSouth's service area in the Gulf of Mexico, near the potentially giant Jack Field touted in September 2006.

A more embracing theory of the margins in which outgassing methane occurs all along their extent creates not only startling life on the margins but vast ribbons of opportunity for offshore exploration. Israel just proved the opportunity by finding deep carbon 16 thousand feet beneath 5 thousand feet of water on its continental margin. The abundance of deep carbon, especially accessible offshore, and its possible explanation, is a big story for the energy industry. The big news from Brazil is not the few gallons of alcohol from sugar cane that provide less than 10 percent of that nation's primary energy, but the plans of Petrobras to expand offshore natural gas extraction from astonishingly rich and surprising superdeep wells from 7 million cubic meters per day in 2013 to 40 million per day in 2020.

Working in the oceans brings immense responsibility. The oceans are beautiful beyond imagination, as the discoveries of the Census of Marine Life research program repeatedly show. But we have already squandered many riches of the oceans, and we do not want to squander or harm more. The energy industries, including PowerSouth, should become leading stewards of marine life, supporting creation of protected areas, research, and monitoring, while operating perfectly where society does permit operation. Florida and other states in the Gulf Region can see the example of operators in places such as Norway, where gas extraction activities from subsea structures minimally impact the environment.

Returning to the land, shale formations such as the Barnett and Marcellus also harbor vast amounts of methane. The recent documentation of the US reserves

of about 2000 tcf, comparable or larger than the fabled Russian reserves, should limit methane price volatility, a widely cited objection to the growth of methane's market share.

Methane is compact, but uranium is 10,000 to 100,000 times more so. Small is beautiful, and nuclear is very small. It is, after all, atomic power. While the competition will take another century or so, finally nuclear energy remains the overwhelming favorite to produce the hydrogen and electricity that Alabama and Florida, not to mention Bangalore and Shanghai, will demand. The important point is nuclear's environmental superiority to so-called renewables.

The reason, as hinted already, is that efficiency must be reckoned in space as well as energy and carbon. The essence of green is "No New Structures!", or at least few new visible ones, in the Gulf of Mexico or South Alabama. I repeat that, like computers and the Internet, the energy system to be deeply green should become more powerful and smaller. During the 20th century, electric generators grew from 10 to 1 million kW, scaling up an astonishing 100,000 times. Yet a power station today differs little in the space it occupies from that of 50 or 100 years ago.

What about the so-called renewable forms of energy? They may be renewable, but calculating spatial density proves they are not green. The best way to understand the scale of destruction that hydro, biomass, wind, and solar promise is to denominate each in watts per square meter that the source could produce.

In a well-watered area like the Southeast, a square kilometer produces enough hydroelectricity for about a dozen Americans, while severely damaging life in its rivers. In any case, one needs catchment areas of hundreds of thousands of square kilometers to provide gigawatts of electricity, and no such areas remain in the Southeast.

The Southeast abounds in productive forest, but PowerSouth would need to harvest from every acre of three typical Alabama counties to provide kilowatts equal to those generated by a single 1000 MW nuclear power plant on a square kilometer or two.

Shifting from logs to corn, a biomass power plant requires about 2500 sq km of prime Iowa farmland to equal the output of a single 1000 MW nuclear power plant on few hectares. PowerSouth would need to farm every acre of Covington County to generate the kilowatts you would get from a nuclear power plant.

Windmills to equal the same nuclear plant cover almost 800 square km in a very favorable climate.

Photovoltaics require less but still a carpet of 150 sq km to match the nuclear plant.

The spatial ratio for a Toyota rather than a large power plant is equally discouraging. A car requires a pasture of a hectare or two to run on biofuels, unwise as the world's vehicle population heads toward 1 billion.

Biofuels, wind, solar, and other so-called renewables massacre habitat. I want to spare land for nature, not burn, shave, or toast it.

No economies of scale adhere to any of the solar and renewable sources, including by the way the sources of ocean energy, such as tides, waves, and the thermal gradient, which also suffer from combinations of dilution and intermittency. If customers need another megawatt, suppliers must site and build yet another windmill, another structure. Supplying more customers or more demanding customers requires matching increases in infrastructure, indeed likely even larger areas, as energy suppliers will probably have used the most fertile, most wavy, windiest, sunniest, and wettest sites first.

Moreover, bridging the cloudy and dark as well as calm and gusty weather takes storage batteries and their heavy metals. The photovoltaics raise nasty problems of hazardous materials. Burning crops inflates the price of food. Wind farms irritate with low-frequency noise and thumps, blight landscapes, and whack birds and bats.

And, solar and renewables in every form require large and complex machinery to produce many megawatts. Per average megawatt electric, a natural-gas combined cycle plant uses 3.3 million tons steel and 27 cubic m concrete, while a typical wind energy system requires construction inputs of 460 million tons of steel and 870 cubic meters of concrete per average megawatt electric, about 130 and 30 times as much. The wind industry is a very heavy industry, as the sight of some of Earth's largest trucks transporting turbines shows.

Renewable energies also invoke high risk as sources of supply in a changing climate. Clouds may cover the deserts investors covered with photovoltaics. Rain may no longer fall where we built dams and planted biomass for fuel. The wind may no longer blow where we build windmills. Maybe PowerSouth should put its Iowa windmills on railcars, as Ronald Reagan wanted to put Peacekeeper intercontinental ballistic missiles on railcars rather than in silos.

And finally, without vastly improved storage, the windmills and photovoltaics are supernumeraries for the coal, methane, and uranium plants that operate reliably round the clock day after day.

Lots of politicians, consumers, and even investors live in an era of mass delusion about solar and other renewables, which will become an embarrassing collection of stranded assets. But let's use our intelligence and resources to build what will work on the large scale that matters for decarbonization rather than to fight irrationality. Humans are not rational after all, and the environment for the energy business never will be.

What about efficiency? On efficiency, I maintain the engineer's view that improvements are embedded in the lines of development of any machine or process. In spite of market failures and other obstacles, increases in efficiency are documented for everything from aircraft and autos to air conditioners and ammonia production. We will be busy squeezing out inefficiency for at least another millennium. The overall thermodynamic efficiency of our energy system, measured from the woodchopper to the hot soup on the dinner table, advanced from only perhaps 1 percent in 1000 to 5 percent in 2000. Cars, most reviled, are perhaps 15 percent efficient, while homes viewed as machines may be only 3–5 percent



efficient. The difficulty is, no one has found a way to sustain improvements in efficiency beyond the 1–2 percent/year that seem built into most processes. A big problem seems to be user's time budgets. People discard efficiency strategies like car-pooling if they conflict by even a few minutes with convenience.

While social and other engineers have not discovered durable ways to multiply the rate of increase of energy efficiency, the year 2008 reminded households and enterprises broadly of the virtues of thrift. Thrift and frugality have not been prominent values in world society in recent decades. Indeed, one may attribute the present economic crisis to a worldwide pandemic of Debt Culture. Fortunately, PowerSouth, rooted in rural economy in the best sense, did not join the Debt Culture. For the US, debt soared to three times Gross Domestic Product, as individuals, households, companies of all sizes, and governments at all levels basically decided they could print money a go-go. The adjustment will likely create jackrabbit behavior in the energy system, as Stalin or the Great Depression did, but does not change the fundamentals, like the destiny of natural gas. But it may make finding capital for pipelines and ZEPPs harder.

Now let me return to strategies and fate. Despite public impressions about renewables or coal, in fact during the last decade most orders for new US power plants were gas. Befitting its high rank in decarbonization and benefiting from low prices, gas will become dominant in the next 10–20 years. In the end, the system wins. Don't forget the System; it won't forget you.

So, what is left for strategy, of businessmen or politicians? Their challenge is to minimize waste and unproductive debt, to be on the right side of fate. Waste in the US energy play comes, for example, from the failure to separate natural gas from oil. As an environmentalist, each time I hear "oil & gas" talked about like inseparable twins, I hear missed opportunity. Oil and gas are very different fuels. I spend most of my time with Greens of various kinds, and I believe many Greens would accept drilling for natural gas, whether off-shore Florida or in upstate New York, if natural gas is the exclusive target, if it is not a cover for drilling for more oil and the problems that come with oil.

Politicians could help, or could recognize reality and ratify and legitimize it, by forming state and national energy policy directly about natural gas and not "oil & gas" or "fossil energy." The rights of way for pipelines are the sorts of problems that the political system must and should address. So are liquefied natural gas (LNG) terminals; LNG adds flexibility to the system. So are safety of transport and storage of gas, and underground sequestration of CO<sub>2</sub>. Oil will remain a big product for another thirty or forty years, but oil is not a growth industry, whereas enormous need and room exist for growth in thoroughbred natural gas.

Keep in mind that natural gas can penetrate oil's stronghold, the market for mobility. CH<sub>4</sub> can provide both the gigawatts to charge batteries and other forms of electrified transport and the hydrogen to power fuel cells. Americans might be surprised how civil the energy discussion would become if a Natural Gas First policy were decisively promoted.

Let me now summarize. Very stable trends, particularly those of decarbonization and miniaturization, appear finally to go unscathed through economic depressions, wars, and central planning. Fortunately, these trends are green, or perhaps they persist as trends precisely because they are green, that is, they meet constraints of the system associated with increasing spatial density of energy consumption.

Renewables may be renewable but they are not green. Failing to benefit from economies of scale, they offer few watts per square meter and demand more space and volume from nature than the system finally will permit.

Planning, strategy, and R&D should essentially support the invariants in the system. Symmetrically, one should avoid the wasteful, painful excursions around the long-term trends organized by Lenin and Stalin, or the US coal and renewable interests, whom I lump together. For a trillion-dollar industry like energy, jackrabbit search strategies are very costly. For PowerSouth, the strategic green prescription is simple: with due attention to environment and safety, favor methane and compact new machines that use methane efficiently.