Energizing Rural America: How Renewable Electricity Standards Generate Rural Economic Prosperity

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A huge new agricultural market for clean energy products is within reach, opening tremendous opportunities for rural economic renaissance. Bioenergy, windpower and other renewable energies are emerging as competitive solutions to the growing problems of fossil fuels – volatile and rising prices, insecure overseas supplies and climate-disrupting pollution.

"Some of the most promising new markets for American agriculture involve a greater role in providing clean, secure, domestically-produced forms of energy," former Senators Bob Dole and Tom Daschle declare in a May 2007 report on 21st century farm sector opportunities.[1]

A niche producer of clean energy today, agriculture could grow to supply 20-25 percent of U.S. energy needs over the next two decades. Study after study has concluded that spurring the production of renewable electricity will provide significant benefits for rural America. Economic models project significant increases in jobs, business activity and local tax revenues as a result. This report highlights these key findings.

For example, a University of Tennessee study finds that supplying 25 percent of U.S. electricity and vehicle fuels from America's working lands will directly add $114 billion in annual revenues and 1.2 million jobs to the agricultural sector by 2025.[2]

A 20 percent clean energy share for electrical power alone would produce immense benefits for rural America, a new study shows. The study by the Union of Concerned Scientists takes a look at a range of scenarios based on different cost projections for emerging clean energy sources. One scenario is more optimistic about windpower prospects, while another projects greater growth for dedicated biopower stations fueled by biomass. Employing the U.S. Energy Information Administration's National Energy Modeling System, UCS finds that significant investment capital and revenues would flow to farmers and rural communities under either scenario. [3]

BIOPOWER – Payments for biomass energy crops would total at least $25 billion by 2020, and could reach $34 billion. The latter would occur if power plants fueled primarily by biomass become economical. The lower figure reflects a market primarily for biomass co-fired in existing fossil power plants.

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[1] Bob Dole and Tom Daschle, *Competing and Succeeding in the 21st Century: New Markets for American Agriculture*, 21st Century Agriculture Policy Project, May 2007, p.12
[2] Burton English et al, *25% Renewable Energy for the United States by 2025: Agricultural and Economic Impacts*, University of Tennessee, November 2006, p.55
[3] Dollar benefits shown are cumulative net present value based on a seven percent real discount rate.

WINDPOWER – Payments to rural landowners for wind farm leases would total $475 million to $562 million. The higher amount is based on more rapid improvements in windpower performance. And locally owned wind facilities can generate three times the local income benefits of a leased wind farm.

CAPITAL INVESTMENT - $43.4 billion to $66.7 billion would be invested in new clean energy facilities, mostly in rural areas. The larger figure reflects more optimistic projections for wind costs, and includes $39 billion in wind investments.

LOCAL PROPERTY TAX REVENUES - New clean power plants would increase revenues by $1.5 billion-$2 billion.

A 20 renewable electricity share would also have general benefits for the nation including:

- **185,000 new full-time jobs** including 44,500 new manufacturing jobs,
- **$10.5 billion in lower electricity and natural gas bills** (growing to $31.8 billion by 2030).
- **223 million-310 million metric tons in annual reductions of carbon dioxide emissions,** the largest contributor to human-caused global warming, equal to taking 36.4 million-50.6 million cars off the road.[4]

Rural areas across the U.S. possess the potential to supply abundant clean energy:

- **Wind** – A Stanford University study finds that wind resources capable of generating power competitively with new natural gas and coal power plants blow across one-quarter of U.S. lands.[5] The Great Plains alone have potential in excess of current U.S. power generation, and economical wind resources are available in three-quarters of the states.[6]
- **Bioenergy** – A study by the U.S. Department of Agriculture and Department of Energy finds that the U.S. has capacity to produce 1.3 billion dry tons of biomass by 2030 while still supplying food, feed and fiber needs. Of that around one billion tons come from farmlands and the remainder from forests. One billion tons would replace the equivalent of 30 percent of U.S. petroleum use.[7]

Electrical power opens a massive new market for farmers. U.S. retail electricity sales are $330 billion per year.[8] By comparison, farmer cash receipts for all products in 2006 were

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[4]Union of Concerned Scientists factsheet, "Cashing in on Clean Energy," July 2007 (rural benefits figures); Steve Clemmer, UCS, personal communication (national benefits figures). Manufacturing jobs were developed by UCS based on an analysis completed by the Renewable Energy Policy Project. Differing projections for carbon dioxide emissions reflect different assumptions for future amount of coal in power mix.

[5] "Harnessing the Wind," Stanford Report, May 21, 2003.

[6] American Wind Energy Association, *Wind Power and Economic Development: Building Sustainable Jobs and Communities*

[7] U.S. Department of Energy & U.S. Department of Agriculture, *Biomass as Feedstock for a Bioenergy and Bioproducts Industry: The Technical Feasibility of a Billion-Ton Annual Supply*, April 2005,

[8] U.S. Energy Information Administration, "Revenue from Retail Sales of Electricity to Ultimate Customers: Total by End-Use Sector," figure is 12 months preceding March 2007

$236 billion.[9] John Doerr, leading Silicon Valley venture capitalist who placed winning bets on Google and Intuit, calls energy "the mother of all markets." The clean energy prospect is "bigger than the Internet. It could be the biggest economic opportunity of the 21st century." This represents unparalleled opportunity for American agriculture and rural communities, which are uniquely positioned to serve this massive, growth market.[10]

OPENING UP THE ELECTRICITY MARKETPLACE

But due to the exceptional nature of the electricity market, fully tapping rural America's clean energy potential is not likely to occur without the support of federal and state government policies. Renewable electricity technologies face many barriers when competing in today's marketplace. While they can stabilize and even reduce long-term energy costs, renewables generally have high upfront capital costs and longer payback periods. In some cases, utilities have used the monopoly they have over their service areas to block new renewable energy competitors from entering the market. Renewables also lack the developed infrastructure of fossil fuel and nuclear industries which have enjoyed decades of government subsidies. Fossil and nuclear subsidies have even been expanded in recent years.

One of the surest ways to break open the power marketplace is enactment of a federal Renewable Electricity Standard (RES) which requires that a certain percentage of the market be supplied by new renewable energy.[11] Ensuring a predictable, steadily growing market encourages investors to build the manufacturing capability and infrastructure needed to continually reduce the price of renewable electricity technologies.

This type of policy has worked successfully in spurring the development of the ethanol industry. In 2005, Congress passed and the President signed into law the Energy Policy Act of 2005 that included the Renewable Fuels Standard (RFS), which mandated an increasing usage of ethanol and biodiesel in the United States. The domestic ethanol industry will more than double over the next two to three years. Seventy-three new plants are under construction and several others are being expanded, together adding nearly six billion gallons of ethanol production capacity.

Federal incentives jumpstarted the biofuels industry. High oil prices offered it an opportunity for growth, and an RFS gave investors the long-term assurance they need to finance plants. This investment certainty is especially important in the transition to cellulosic feedstocks, where investors will be placing multi-billion dollar bets on new and innovative technologies.

Renewable power has also benefited from federal incentives and high prices for natural gas and coal. But given the high capital costs of renewable power plants, reducing

[9] USDA Economic Research Service, "Table 33, Cash Receipts from Farming,"
[10] An Energy Foundation report that overviews the farm energy opportunity is *The New Harvest: Biofuels and Windpower for Rural Revitalization and National Energy Security*, by Patrick Mazza and Eric Heitz, November 2005
[11] This is also known as a Renewable Portfolio Standard.

investor risk is even more critical for power markets. The RES gives investors greater assurance to finance new technologies, especially those that are still emerging in the market. Biopower for example has many innovative approaches that require a long lead time to implement.

Enactment of an RES would lead to investment in renewable electricity technologies. Now in place in 23 states and the District of Columbia, state-level Renewable Electricity Standards have proven a tremendous success. The overwhelming bulk of windpower development is taking place in states with standards such as Texas, Washington and California. State Renewable Electricity Standards will support addition of more than 48,500 megawatts (MW) in new renewable energy development by 2020.[12] That is equal to around five percent of total U.S. generating capacity at present.

A federal Renewable Electricity Standard would expand this share to 15-20 percent under proposals now working their way through Congress. That will be good news for rural America. Dole and Daschle note that at least two-thirds of the RES should be met on agricultural lands. However, they warn, "Without a national (renewable) portfolio standard . . . it seems unlikely that rural America can realize the full economic potential associated with the development of renewable electricity projects."[13]

The UCS modeling study underscores the significant rural stake in a national RES. State standards already in place will generate 65,000 jobs by 2020. A 20 percent national RES will create an additional 120,000 jobs, and of those 18,350 would be in the agricultural sector.[14]

Given the regulated structure of the electricity market, an RES is appropriate. Until recently, every utility in America was a regulated monopoly. Under regulation state regulators set rates, determine appropriate profits, and oversee every aspect of utility operations. Even after a decade of utility restructuring, utilities in most parts of the country remain regulated. A "mandate" to produce more renewable power is simply another form of the comprehensive regulation under which most utilities operate, similar to requirements for power reliability and fair prices.

An important benefit of increased renewable energy production is lower natural gas bills resulting from reduced demand for gas-fired electricity. U.S. Department of Energy researchers surveyed 13 studies of those impacts. They found "studies generally show that each one percent in natural gas demand is likely to lead to a long-term (effectively permanent) average reduction in wellhead gas prices of 0.8 percent to two percent." Consumer gas bill savings generally range from $7.50-$20 for each megawatt hour of renewable energy that is generated. Most studies show RES saving gas customers $10

[12] Union of Concerned Scientists Renewable Energy Maps
[13] Dole-Daschle, p. 46, 51
[14] Alan Nogee, UCS, personal communication

billion-$40 billion annually by 2030, with results ranging as high at $74 billion.[15] Lower gas prices have special significance for farmers. Eighty percent or more of the cost of anhydrous ammonia that goes into nitrogen fertilizers is derived from natural gas.

A federal RES is critical to creating new clean energy markets that will add substantially to rural economies, as documented below.

THE NEW WIND HARVEST

Agriculture is the original solar energy industry. Farmers have always harvested the power of the sun in the form of crop growth propelled by photosynthesis. Farmers have long employed solar energy in the form of windpower to pump water and process products. These traditional solar power technologies are now taking on modern shape. Farm residues and energy crops fuel electrical generators via direct combustion or after conversion to biogas. Modern wind turbines rise hundreds of feet to harvest sun-driven air pressure pushing above fields.

The natural partnership of energy and agriculture should come as no surprise. The fossil energies we use today are, after all, ancient solar light collected in plants and animals and concentrated in the depths of the Earth over millions of years. But solar energies freshly arriving on the planet are diffuse, and gathering them in useful forms requires a land base. That base is typically in rural areas, so much of the benefit of expanding clean energy production will accrue to farm belts. Though the crop might be streams of electrons running down wires, it is no less an agricultural product than wheat or apples. In fact, fuels for energy generation represent a vital fourth leg under farming supplementing traditional food, feed and fiber markets. And as everyone knows, a four-legged chair is far more stable than one with only three.

Because of state RES requirements, the new wind harvest is growing rapidly:

- The U.S. added 2,454 MW in wind capacity in 2006, a 27 percent growth rate that brought total American windpower to 11,603 MW – enough to power approximately three million homes and each year displace 23 million tons of carbon dioxide.
- The 2007 growth rate is projected at 26 percent, bringing another 3,000 MW on line.[16]
- John Deere has sighted the wind opportunity and is branching out from its farm equipment business with a new division to support farmer wind development. With proper public policy support, wind capacity could expand to 100,000 MW by 2020, Deere projects.[17]

[15] Ryan Wiser; Bolinger, Mark & St. Clair, Matt, "Easing the Natural Gas Crisis: Reducing Natural Gas Prices through Increased Deployment of Renewable Energy and Energy Efficiency, Lawrence Berkeley National laboratory, Jan. 2005, p.ix

[16] American Wind Energy Association, "Wind Power Capacity in U.S. Increased 27% in 2006 and is Expected to Grow an Additional 26% in 2007," Jan. 23, 2007

[17] Dole-Daschle, p.39

The Union of Concerned Scientists (UCS) has projected a range of windpower benefits with a 20 percent U.S. electric market share for new renewable sources by 2020. UCS forecasts the most likely scenario is for strong windpower growth based on improving performance and cost competitiveness. That results in:

- 48,000 MW in windpower added beyond the 2006 level,
- $39 billion in new capital investments for wind plants,
- $562 million in landowner royalties.[18]

Using somewhat less optimistic U.S. Energy Information Administration assumptions for wind performance still yields:

- 32,000 MW in windpower added beyond the 2006 level,
- $20 billion in new capital investments for wind plants,
- $475 million in landowner lease payments.[19]

Revenues would be even greater with local wind turbine ownership. A National Renewable Energy Laboratory (NREL) study compared local to outside ownership of 40 MW of wind capacity at 11 different sites in the U.S. The results of the study indicate that community owned wind projects generates 2.6 times more jobs and 3.1 times more rural economic development benefit. Average local income was $1.3 million under the outside model and $4 million when owners are neighbors. Average job creation was 18 when ownership was outside compared to 41 under local proprietorship.[20] Local owners have a greater inclination to hire their neighbors when they are building wind installations.

Echoing this point, a 2006 study by Oregon State University concluded that local ownership of wind turbines would greatly enhance the economic benefits of wind power development in rural America.[21] Researchers at Oregon State found that a farmer would receive five times the annual projected income by owning the wind turbines as entering into a land lease arrangement.[22]

A local wind ownership exemplar is the MinWind coops around Luverne, Minnesota. Farmers in the area already had experience in cooperative ownership of a local ethanol plant. In 2002 some of those farmers created one of the first farmer-owned wind turbine installations in the U.S. through the MinWind coops. MinWind has now spawned nine cooperatives in the area operating turbines with the output to run 8,000 homes. Also in Minnesota the locally owned 100-MW Trimont Area Wind Farm generates enough to run 29,000 homes. Minnesota has announced a goal of 800 MW of community wind.

Wind is already generating significant economic gains for rural areas across the nation:

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[18] Union of Concerned Scientists fact sheet; Steve Clemmer, UCS, personal communication
[19] Union of Concerned Scientists fact sheet; Steve Clemmer, UCS, personal communication
[20] U.S. Government Accountability Office, pp82-3
[21] Torgerson, Sorte et al, Umatilla County's Economic Structure and the Economic Impacts of Wind Energy Development: An Input-Output Analysis, Oregon State University, March 2006, p.28.
[22] Ibid, p. 24.

- Rural landowners are earning $2,000-$10,000 in royalties per turbine depending on the level of power production.[23] Each turbine typically requires a half-acre, mostly in access roads.
- Each 100 MW generates property tax payments of $500,000-$1 million. For rural counties, a wind farm represents a fiscal boost that can firm the base under schools and other public services vital to keeping young people in the community.[24]
- Two to five operations and maintenance jobs are created for each 50-100 MW in capacity, while each megawatt under construction provides 1-2 jobs plus revenues for local businesses.[25]

"Constructing a large windpower project with several dozen turbines requires the services of multiple businesses and scores of skilled an unskilled workers, as well as the purchase of equipment and material, such as turbines, towers, asphalt, cement, concrete and electrical cables," the U.S. Government Accountability Office notes. "In these activities, windpower project developers and operators have directly benefited rural communities by hiring local people and purchasing locally some of the goods and services needed to construct and operate a project. . . Furthermore, businesses and individuals directly employed by the wind project are likely to spend part of their income at local businesses . . ."[26]

Wind development can draw new businesses to an area. Wind turbines are growing increasingly large so makers are locating new factories close to markets. Iowa, for example, has attracted three turbine manufacturers, Clipper, Acciona and Siemens, thanks to strong public policy commitment to wind energy. Wind blade maker LM Glasfiber is located in wind-rich North Dakota. Spanish turbine manufacturer Gamesa has centered its U.S. manufacturing operations in Pennsylvania. That state's commitment to clean energy signified by an RES helped solidify Gamesa's decision.

In the Pacific Northwest, one of the nation's most active wind development regions, 954 MW were added in the year following October 2005. This brought rural counties in the windblown interior Northwest:

- $1.38 billion in new capital investment,
- 1,300 construction jobs,
- $2 million-$3 million in annual royalties to landowners,
- $5.8 million-$6.8 million per year in local property taxes.[27]

A study by Northwest Economic Associates took a look at three wind farms in Minnesota, Texas and Oregon and found ". . . the annual income received by households in all of the areas was a significant source of household income and had a significant total

[23] Dole-Daschle, p.43
[24] Larry Flowers, U.S. Department of Energy, *Wind Power Market Update*
[25] Flowers
[26] U.S. Government Accountability Office, Renewable Energy: Wind Power's Contribution to Electric Power Generation and Impact on Farms and Rural Communities," Sept. 2004, pp.36-7
[27] Renewable Northwest Project, "Wind Power & Economic development: Real Examples from the Pacific Northwest," Jan. 2007

effect on local economies. In all cases, the cost of foregone opportunities from farming and livestock grazing was small compared to the revenues obtained from leases for windpower. Tax effects, particularly property taxes that support local entities, were important in all cases . . . there is a redistribution of the local tax burden from residents to outside owners. This, in effect, shows up as an increase in household income, which can directly affect the local economy."[28]

THE NEW BIOPOWER HARVEST

Biopower potentials for agriculture are also large. NREL researchers conclude that biomass could supply 110,000 MW by 2030, displacing 230 million metric tons of climate-disrupting carbon emissions annually.[29]

The UCS scenario for biopower forecasts growth in biomass cofiring in existing fossil power plants, which can generate up to 15 percent of energy with biomass. With a 20 percent new renewables share for U.S.electricity biopower will generate:

- 24,500 MW,
- $2.6 billion in new capital investments,
- $25 billion in payments for biomass energy crops (beyond income from biofuels crops for vehicles).[30]

The U.S. Energy Information Administration is more optimistic about biopower prospects. Unlike UCS, EIA forecasts growth in both cofiring and dedicated biomass-fired plants. Using EIA assumptions the UCS study finds:

- 17,500 MW from dedicated plants,
- 30,000 MW from cofiring,
- $11.5 billion in capital investment for dedicated biopower plants,
- $3.3 billion in capital investment for biomass cofiring facilities,
- $34 billion in payments for biomass energy crops.[31]

Potential energy crops include perennial grasses such as switchgrass, and fast-growing trees including hybrid poplars and hybrid willows. Regions with particularly high biomass production potential include the upper Midwest, West Coast, Northeast and the Southern tier from the Carolinas to East Texas.[32]

For the South, which does not have the wind resources of other regions, biomass power could play an especially important role in meeting clean energy goals. A national RES would help jumpstart a Southern biopower industry. This would provide major new opportunities for farming and rural communities hit by the decline in tobacco

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[28] Northwest Economic Associates, *Assessing the Economic Development Impacts of Wind Power*, Feb. 2003
[29] Ibid, p.127
[30] Union of Concerned Scientists fact sheet; Steve Clemmer, UCS, personal communication
[31] Union of Concerned Scientists fact sheet; Steve Clemmer, UCS, personal communication
[32] Ralph P. Overend and Amelia Milbrandt, "Potential Carbon Reductions from Biomass by 2030," in *Tackling Climate Change in the U.S: Potential U.S. Carbon Emissions Reductions from Renewable Energy and Energy Efficiency by 2030*, American Solar Energy Society, Jan. 2007, p.119

consumption and threatened with loss of cotton supports due to international trade conflicts. Southern states are increasingly interested in biofuels production, with new commitments from governors and legislatures from Florida and Georgia to Texas and Oklahoma. Biomass crop payments to the South under UCS projections would be $9.5 billion by 2020, or 38 percent of the national total. Using EIA assumptions they would be $15.4 billion for 45 percent of the total.

Today biomass power is used largely in the paper and pulp industries, which employ wood residues to cogenerate electricity and process heat. Biomass is also co-fired with coal in regular power plants as a way to reduce costs and pollution. The Ottumwa, Iowa Generating Station is already co-firing switchgrass grown by the Charniton Valley Biomass Project in a USDA pilot project. Three thousand acres of switchgrass are under cultivation, including 1,000 owned or managed by John Sellers. He notes an additional benefit for the area's highly erodible soils, deep roots which hold soils stable.

"We're spending millions on soil conservation in this country so we can row crop when we could rotate switchgrass and accomplish the same thing," Sellers notes.[33]

On a small scale, biogas from manure biodigesters today provides on-farm power in dozens of U.S. locations. The prime driver for these installations is livestock manure management. The Dairyland Power Cooperative, headquartered in La Crosse Wisconsin, since 2005 has built "cow power" installations at three area dairy farms. Each generates between 775-840 kilowatts of energy, enough to power approximately 600 homes. Five Star Dairy in Elk Mound was the first site. ""There are a half a dozen direct benefits to the farm aside from the money,'' says owner Lee Jensen. Among them are odor-free bedding material, elimination of fertilizer weed seeds which cuts herbicide use, elevated Ph which reduces lime applications, and pathogen reduction that makes the manure safer for groundwater.[34]

The growth of the vehicle biofuels industry potentially could contribute to biopower as well. Already some advanced ethanol plants are using renewable energy to run plant operations. For example the recently opened Genesis Plant near Mead, Nebraska runs on biogas generated by manure from a nearby feedlot. The lignin byproducts of cellulosic ethanol production will be used to generate electricity and heat for biofuels plants. Renewable energy-powered biofuels installations could eventually sell surplus electricity, as well as thermal energy through district heating systems.

Modeling done by University of Tennessee researchers demonstrates that the U.S. has sufficient working lands to produce significant amounts of energy while still sustainably providing other needs. The study was done to assess the agricultural and economic impacts of generating 25 percent of U.S. energy from farm and forest lands by 2025. The goal includes both electrical and transportation energy. "The 25x'25 goal can be met

[33] Energy Foundation, *The New Harvesters: Rural Energy Entrepreneurs*, 2005

[34] Rebecca Cantwell and Patrick Mazza, *Bright Futures: Reenergizing Public Power for Rural Prosperity*, in press

while allowing the ability of the agricultural sector to reliably produce food, feed and fiber at reasonable prices," the researchers conclude.[35]

The University of Tennessee model found:

- Energy crops would become a significant element of the American agricultural sector, with around 106 million acres under cultivation.
- The Midwest would be the leading source of biomass energy, but energy crops would first take hold in the Southeast and Southern Plains.
- By 2025, annual net farm income would increase $37 billion and farm land values would farm returns will increase in all states, and most counties in the Midwest and Southeast would gain over $100 million annually.
- Farm returns would increase partly because of overall gains in crop prices, $0.71 per bushel for corn, $0.48 for wheat and $2.04 for soybeans. The better market would cumulatively reduce the need for government support payments by $15 billion.
- Impacts on the livestock industry would be moderated in several ways. Ethanol and biodiesel feed coproducts would expand. High-protein byproducts from cellulosic biomass would enter the feed market. Pasture and forage would partially replace corn and soybean meal for feeding livestock. Pasture lands would be more intensively planted in grasses for animal feed at very low additional cost. Cattle industry returns would actually increase 3.9 percent by 2025. [36]

RISING TO THE ENERGY CHALLENGE

The nation's critical energy needs are coming to the fore. Every day the news is filled with evidence of instability in key oil production areas such as the Persian Gulf, Venezuela and Nigeria. All fossil fuels prices are hovering at high and often near record levels. With Asian economies booming and global oil demand on a sharp upward curve, the fundamental global energy economy has shifted.

A Stanford University Energy Modeling Forum study gives high odds for severe oil shocks over the next 10 years – an 80 percent probability for a month-long disruption eliminating two million barrels a day with 50 percent odds that five million daily barrels would disappear. "Foreign disruptions of this magnitude would have more serious effects on oil prices than we have seen with the Katrina and Rita hurricanes," Stanford's Hillard Huntington told the Senate Foreign Relations Committee. " . . oil price shocks preceded nine of the last 10 recessions in the United States" Oil price doubling could cut 2-5 percent off GDP for one of the most severe recessions in post-WWII history.[37]

While oil plays only a small part in electrical generation, disruptions of any fossil fuel source tend to ripple to others. For example, natural gas readily replaces oil in many industrial processes. Farmers are especially vulnerable to increased fuel and fertilizer

[35] English, p.i
[36] English, p.ii, pp.32-52
[37] Prepared Statement by Hillard Huntington, Executive Director, Energy Modeling Forum, Stanford University, Senate Foreign Relations Committee, March 30, 2006

prices caused by oil and gas price escalation, as the price volatility of the past several years has painfully underscored. Natural gas is also increasingly coming from overseas sources, increasing the same disruption concerns U.S. oil import dependence now arouses. The U.S. Energy Information Administration projects that imports of liquefied natural gas will by 2030 increase to 4.5 trillion cubic feet (TCF) annually, a nine-fold increase over today. That compares to projected 2030 production of 29.6 TCF in North America.[38]

Diversification to clean energy sources will reduce vulnerability to disruptions in both oil and natural gas. A move to plug-in hybrid vehicles that run partly on wall socket charge would also open the way for renewable electricity to directly displace petroleum.

On top of immediate economic security concerns are emerging environmental security concerns around human-caused global warming. Among the most serious are increasingly wild swings in the water cycle so vital to all human activities, particularly agriculture. Temperatures are measurably increasing and this accelerates evaporation, drying out some areas and adding to drenching rainfalls in others.[39]

American agriculture can vitally contribute to meeting these security challenges by harvesting windpower, biopower and other renewables. As this paper has shown, America's farmers and working lands have the capacity to bring abundant clean energy supplies to the marketplace. This will stabilize prices, provide secure supplies in an uncertain world and reduce the global warming threat. The process will spur economic renaissance in farm belts across the country, and give new generations a chance to stay in rural communities.

But fully realizing these contributions will require a leg up from market-oriented public policies. To level the competitive playing field, Renewable Energy Standards must be enacted at federal and state levels. Standards in 23 states are already spurring a windpower boom. A federal RES will:

- magnify this effect across the range of new renewables,
- create a new national market in which all states can participate,
- achieve economies of scale that will continue to reduce the cost of renewable energy, and,
- help accomplish critical national objectives for greater fuel diversity and energy security.

America needs new clean energy sources and agriculture is ready to step up and supply them. With Renewable Energy Standards in place, our farmers will rise to the challenge and grow a solid foundation for America's energy future.

[38] U.S. Energy Information Administration, *International Energy Outlook 2007,* p.42-3

[39] Intergovernmental Panel on Climate Change, *Climate Change 2007: The Physical Science Basis – Summary for Policymakers*