Conditions for Renewable Energies in the USA

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From *Energiewirtschaftliche Tagesfragen*, Essen, Germany, October 2003

The utilization of renewable energies in the USA is hindered by existing supply structures for conventional energy, with which requirements are satisfied under market conditions. Considerable growth perspectives exist, however, in particular areas of application owing to continuing increases in energy demand and seasonal power restrictions.

The Status of Renewable Energies

Hydroelectric power and wood combustion are long-established components of regional economies. More than half-million solar thermal installations are employed mainly for heating swimming pools.(1) Plant oil and ethanol are used as fuel additives to achieve improved combustion characteristics without motor modifications. Leasing income from wind turbines increases the effective yield of farmland.

The survey data of the US Department of Energy (USDOE) nevertheless make apparent the minimal contribution of renewable energies to total energy consumption.(2) The figures in the table exclude net energy product imports (cokes, electricity from fossil fuels).

Energy Consumption USA 2002	**BTU*10^{15}**	**Percentage of Total Consumption**	**Percentage Change since 1990**
Total Consumption	96,107		13.7
Fossil Fuels	81,145	84.4	12.5
Nuclear Electric Power	8,202	8.5	33.1
Hydroelectric Power	2,908	3.0	-7.6
Wood, Waste, Alcohol	3,396	3.5	27.7
Geothermal	303	0.3	-14.6
Solar and Wind	153	0.2	62.8

The decline of hydroelectric power in 2002 reflects weather conditions and is not due to any principal reduction in capacity. However, in order to realize the additional generation

potential of 20,915 MW by 2020 (current capacity 78,563 MW), the National Hydropower Association considers it necessary to ease licensing regulations within the framework of an energy policy based on climate protection.(3)

Apart from hydroelectric power, renewable energies currently account for about 2% of electricity generation.(4) In the National Energy Policy report issued by the US Government in 2001, an increase to only 2.8% by 2020 is predicted. During the same period, 1300 to 1900 conventional power plants (most fuelled by natural gas) are expected in order to correct the "fundamental imbalance between supply and demand"(5) and prevent a "national energy crisis".(6)

The influence since revealed of industrial lobbyists on the contents of the energy report makes its cautious appraisal necessary.(7) According to the American Wind Energy Association,(8) the national wind energy potential is sufficient to fulfill three times the electrical energy requirements of the USA. The wind power capacity of 2578 MW in the year 2000 will have more than doubled by the end of 2003. Steadily declining generation costs for new wind turbines are currently 3 to 5 cents/kWh under inclusion of federal incentives and will likely have fallen below the rising price level for competitive bulk power within a few years.(9)

Many locations with high wind intensities are have not been developed because of excessive connection costs. However, calculations of the Center for Energy Efficiency and Renewable Technology demonstrate that renewable energies would be capable of contributing 20% of electrical power generation within two decades.(10) The necessary investment of 20 billion dollars per year could be realized by eliminating gas imports for generating the same quantity of electricity.

While surveys have shown that 50% to 95% of the US population are principally interested in using green power, actual customer participation is less than 1%.(11) This diminutive quota is due to the insufficient cost effectiveness of many generating facilities under varying regional feed-in and marketing practices.

Long capital payback times likewise render the implementation of CO_2 reduction strategies difficult. In consequence, the US Climate Action Report predicts a 42.7% increase in national greenhouse gas emissions from 5773 million CO_2 equivalent tons in the year 2000 to 8237 million tons by 2020.(12) Since a population increase of nearly 18% (from 276 to 325 million

inhabitants) is anticipated for the same period, the emissions per inhabitant will likely increase despite efficiency enhancements and a trend to decarbonization of fuels in use.

Initiatives of the States

Unified measures for reducing air pollution are materially impeded by different climate zones and infrastructures. Under the Clean Air Act of 1980, each state is therefore required to submit its own State Implementation Plan (SIP) for air pollutants (CO, NO_2, SO_2, O_3, lead, and particulate matter). Due to carryover effects and supplementary strategies,(13) the emission of greenhouse gases can likewise be reduced.

Some states and regions are pursuing a quantitative reduction of greenhouse gases to address long-range employment needs. The governors of the six New England States and the premiers of the five Eastern Canadian Provinces passed a joint action plan on climate protection in August 2001 stipulating a CO_2 reduction of 10% by 2020 (reference year 1990) and 75% - 85% long term.(14) This program is intended to "promote future job growth by harnessing sustainable energy resources and advanced technologies".

The most comprehensive climate protection regulations to date are in effect in California, where both a 20% portion of renewable power by 2017(15) and CO_2 standards for automobile emissions beginning with model year 2009(16) have been mandated. Due to the delayed market introduction of zero emission vehicles (ZEVs) with electrical and fuel cell drive, the Air Resources Board mandates certain sales percentages of automobiles and small trucks with highly reduced exhaust emissions (partial ZEVs) in fulfilling emissions goals.(17)

The DSIRE data bank (Database of State Incentives for Renewable Energy)(18) at North Carolina State University compiles state and federal incentives for promoting renewable energies. Tax rebates, low-interest loans, net metering, and contributions from public benefits funds are widely employed. In the latter case, renewable energies and energy conservation projects are financed from surcharges on electrical power tariffs. Most of the incentives are provided by states and communities or by utility companies, as is indicated in the summary table.

Incentives in the USA for Renewable Energies	Source: DSIRE Data Bank www.dsireusa.org
States, Cities, Utilities	
Financial Incentives	tax rebates and deductions, grants, low-interest loans, discounts, industry recruitment premiums, leasing/sale of photovoltaic equipment by utilities
Rules, Regulations, and Policies	payments from public benefits funds, renewables portfolios standards, net metering, line extension analysis, generation disclosure, contractor licensing, equipment certification, solar/wind access laws, construction and design standards, green electricity pricing guidelines, installer certification
Investment and Public Outreach Programs	green power marketing, green power aggregation/purchasing, instruction and cooperation, demonstration projects, research and development centers
US Government	tax credits and exemptions, subsidies, capital allowances, low-interest loans

The utilities in 14 states are required to provide a green electricity mix (renewables portfolio standard) between about 1% (Arizona) and 30% (Maine). In some states, sales turnover is promoted by the mandatory use of green power by state institutions and the operation of photovoltaic equipment on public buildings.

Industrial recruitment incentives have been realized in an exemplary fashion in Virginia for in-state production of photovoltaic equipment. The manufacturers receive a subsidy of up to 0.75 dollars per Watt of delivered product capacity during a period of six years.

Since property taxes are a main source of revenue in American communities, property tax incentives may be employed as a subsidy. In one method, solar technologies or the renewable energy components of private heating equipment are not included in building tax appraisals. Property tax reductions are granted in some communities for all land hosting wind turbines and compensated by the additional business tax income realized for the municipal budget.

Marketing Strategies

The DSIRE data bank contains numerous market offers for renewable power (green pricing programs). By purchasing green certificates or tags, a consumer obligates his utility to invoice the corresponding quantity of renewably generated power. Generation payments are made either via certificate trading or directly to a producer such as the Bonneville Power

Administration.(19) With sufficient participation, the proponents of green power point to the possibility of forcing conventional power stations out of city and residential areas.

At the initiative of the World Resources Institute (WRI), aggregate purchasing of renewable electricity by large corporations (including IBM, DuPont, Johnson & Johnson, Alcoa and General Motors) under competitive market conditions has been instituted.(20) This Green Power Market Development Group is committed to achieving 1000 MW of supply capacity by 2010.

The environmental consequences of road traffic have led to blending plant oil with diesel fuel in ratios up to 20:80 (B20 biodiesel) as well as to ethanol used as a substitute for the gasoline oxygenate methyl tertiary-butyl ether (MTBE). The resulting economic perspectives for agriculture constitute an important aspect of rural political advocacy.

Concentration at Points of Restricted Supply

Frequent overloads of the high-voltage and distribution network of the USA, created a half-century ago as "the largest machine ever built by man",(21) have served to emphasize the supply benefits that decentralized power sources may provide. The Distributed Power Program(22) of the USDOE is intended to reduce the vulnerability of the national grid through increased distribution of generation capacities. The program website contains all state provisions on electricity feed-in as well as on restructuring regulations.

Utilities in the American Southwest are required by law to inform customers about the alternate installation of a photovoltaic system whenever upgrading the power line system would be particularly expensive (line extension analysis).

In order to reduce load peaks caused by air conditioning units, the Long Island Power Authority (LIPA) near New York City provides an allowance of five dollars per Watt for newly installed photovoltaic equipment.(23) Two offshore wind parks with a long-term capacity of 5200 MW are being planned along the local Atlantic coast.(24) The Energy and Research Development Authority of the State of New York has financed feasibility studies on five additional inland wind power projects with a total of approximately 17 million dollars.(25)

Wind power provides a negotiating advantage for regional utilities confronted with price increases for electricity affected by seasonal gas price changes. The payback time is further

enhanced in certain areas by hydroelectric shortages resulting from drought conditions or by insufficient cooling water capacities for steam power plants.

Security Considerations

Renewable energies are increasingly seen as a preferable alternative to the dangers of nuclear power and to the increasing dependency of the USA on fuel imports. According to the National Renewable Energy Laboratory: "These conventional energy sources are vulnerable to political instabilities, trade disputes, embargoes, and other disruptions."(26)

Possible terrorist attacks on atomic power plants and nuclear transports as well as the federal decision on the Yucca Mountain (Nevada) geological repository, realized with considerable delay, have intensified public awareness of the temporary storage of radioactive waste at 103 commercial locations in 31 states and at military facilities in eight states.(27) In the future, security considerations could render the licensing of nuclear facilities more difficult, thus enhancing the status of fossil and renewable energies.

However, imported fossil fuels impose a burden on the US trade balance. According to the analysis of the National Energy Policy, the dependency on oil imports will be increasing from currently more than 52% to 64% in the year 2020 despite extensive national coal reserves.(28) A 50% increase of domestic natural gas production "may not be high enough to meet projected demand".(29) These estimates are based on prognoses in which all economical measures of energy conservation have already been considered. Import dependency can therefore be diminished only by increasing the deployment of renewable energies.

Reducing Impediments

The limited duration of home ownership often prevents solar equipment or a small wind turbine from being purchased. At present, some 43 million US citizens, or 16% of the population, change their address per year.(30) Work-related moves are particularly prevalent among college-educated people and those with above-average incomes.(31) Partial stabilization of living and working conditions might therefore be achieved by increased employment of renewable energies, while concurrently strengthening regional economies.

The Million Solar Roofs Initiative (MSRI) of the USDOE is dedicated to realizing solar installations on one million roofs for producing electricity or heat by 2010 while reducing power plant emissions and creating 70,000 new jobs.(32)

In San Francisco, a 100 million dollar revenue bond issue passed in November 2002 will enable the construction of 40 MW of additional renewable energy equipment.(33) Solar power units with a total capacity of 10 to 12 MW will be erected on city-owned facilities and schools. In the opinion of Donald E. Osborn, Chairman of the Solar Electric Power Association (SEPA), these actions "represent the next big steps in bringing solar electricity into the mainstream as a significant and cost-effective part of the nation's energy mix".

The US power law PURPA (Public Utility Regulatory Policies Act) regulates electricity supplied by small producers only to the extent of avoided costs of the grid operator, which are often insufficient to pay back equipment investments.(34) While the Sierra Club therefore proposes fixed tariffs such as those in Germany for power fed into the grid,(35) it also supports together with the AWEA investment incentives through tax benefits, supply contracts, and all other measures "that increase demand for renewable energy".(36)

In various legislative initiatives,(37) an extensive federal production tax credit (PTC) of 1.8 cents/kWh has been proposed for all renewable power generation technologies.(38) The current ruling expires at the end of 2003 and applies only to wind power and to closed-loop biomass generation using fuel from energy plantations. The US Administration presented an assessment of the renewable energy potential on all public lands in the western states in February 2003.(39) The use of renewable energies has been promoted on Indian reservations since the 1990's under the Tribal Energy Program of the USDOE for realizing new income and employment opportunities and powering the isolated homesteads of tribal members.(40)

According to the Energy Information Administration (EIA), a plausible market potential of at least 20% exists for renewable energies in the USA.(41) Rising prices for fuel imports and the security advantages of decentralized generation equipment make this perspective appear realistic. Realization could make the USA to the world's largest user and a prominent exporter of new energy technologies. The USDOE has already announced the goal of establishing "the U.S. wind industry as an international technology leader capturing 25% of world markets" by 2005.(42) In order to participate in this development, European companies should actively seek representation in the USA and secure partners for cooperative ventures in other countries.

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