Total Cost-Benefit Accounting for Electric Energy
Wind and Solar Are More Economical Than Coal and Nuclear

Support for coal and nuclear power retards the growth of renewable energy sources such as solar and wind. The costs of misguided energy decisions have been calculated and it they are substantial. Continued reliance on outdated, polluting facilities such as coal-fired and nuclear power plants has real costs borne by all citizens. Any true cost-benefit analyses of electric power must include environmental effects on forests, agriculture and species diversity, climate change including global warming, direct and indirect government subsidies, impacts on jobs and the economy, and adverse health impacts from pollution. Ratepayers and taxpayers should insist on policies which promote the accelerated growth of wind and solar power. Renewable energy production can and should reach a minimum of 20% of the total U.S. electric supply by 2020.

The Hohmeyer Study

Although renewable forms of energy are growing, unecessary costs to society are incurred because of the failure to introduce more renewable power sources sooner. In 1988 Olav Hohmeyer published an analysis of the impacts of renewable energy compared with fossil fuel and nuclear power.(a) He attempted to monetarize, or quantify in financial terms, the total costs and benefits of four major sources of electric power: coal, nuclear, solar, and wind. Hohmeyer found that the total cost to society of fossil and nuclear power is much higher than the market price would indicate and that the cost of solar and wind energy is much lower. The skewing of rates for conventional electricity below actual costs delays the introduction of cleaner forms of power. Hohmeyer devised a method to calculate the financial cost of this delay. This is a summary of Hohmeyer's findings.

Hohmeyer's analysis takes into account insofar as possible the costs and benefits of coal, nuclear, photovoltaic solar, and wind sources for the generation of electricity. The annual social costs C_S (t) can be calculated by the following equation:

$$C_S(t) = \{Q_{W1}(t) - Q_{W2}(t)\} \times \{P_{ECS}(t) - P_{EW}(t)\}$$

The impact over the long term can be calculated as the sum of the differences between the cost of renewables and conventional fuels, the reduced amount of renewable power generated, and the length of the delay in developing new renewable power generators. The total cost to society over time (TC_s) is calculated according to the formula at right and is presented in graphic form for wind electric generation on the next page.

$$TC_s = \int_{t_o}^{t_e} C_s(t)$$

$$t_e = f(t_d)$$

The Results Favor Renewables

The Hohmeyer study of the social costs of renewable energy technologies found a net social *benefit* of 0.3 - 0.6 cents per kilowatt hour for wind energy and 0.9 - 3.3 cents per kilowatt hour for photovoltaic.(b) The benefits come from employment gains and wage and tax benefits from the installation of wind and solar technologies. In contrast to the hidden benefits of renewables, conventional fossil fuel and nuclear power plants have net social *costs.* The net *costs* of fossil fuel are 2.4 - 5.5 cents per kilowatt hour and for nuclear energy 6.1 - 13.1 cents per kilowatt hour.(b) The hidden cost of conventional electric power is about equal to the electric power rate. In other words, the typical monthly electric bill covers only half the true costs. These expenses are buried in medical bills, lost workdays, decreased agricultural productivity, etc.

Although it was published in 1988, Hohmeyer's study is relevant today because 1) wind and solar power costs have decreased relative to coal and nuclear, and 2) difficult to quantify factors such as the lost of a species were calulated in favor of conventional fuels; that is, the assumptions and analyses are conservative. Even so, the results favor wind and solar power over coal and nuclear. Better quantification of difficult to monetarize external costs would further tip the balance in favor of the renewables, especially wind energy.

November 2004

(a) *Social Costs of Energy Consumption-External Effects of Electricity Generation in the FRG,* Hohmeyer, 1988
(b) *Power Surge, The Status and Near Term potential of Renewable Energy Technologies*, Rader, et al., 1989

BLUE RIDGE ENVIRONMENTAL DEFENSE LEAGUE
www.BREDL.org PO Box 88 Glendale Springs, NC 28629 (336) 982-2691 BREDL@skybest.com

Total social costs of delayed market introduction of wind energy

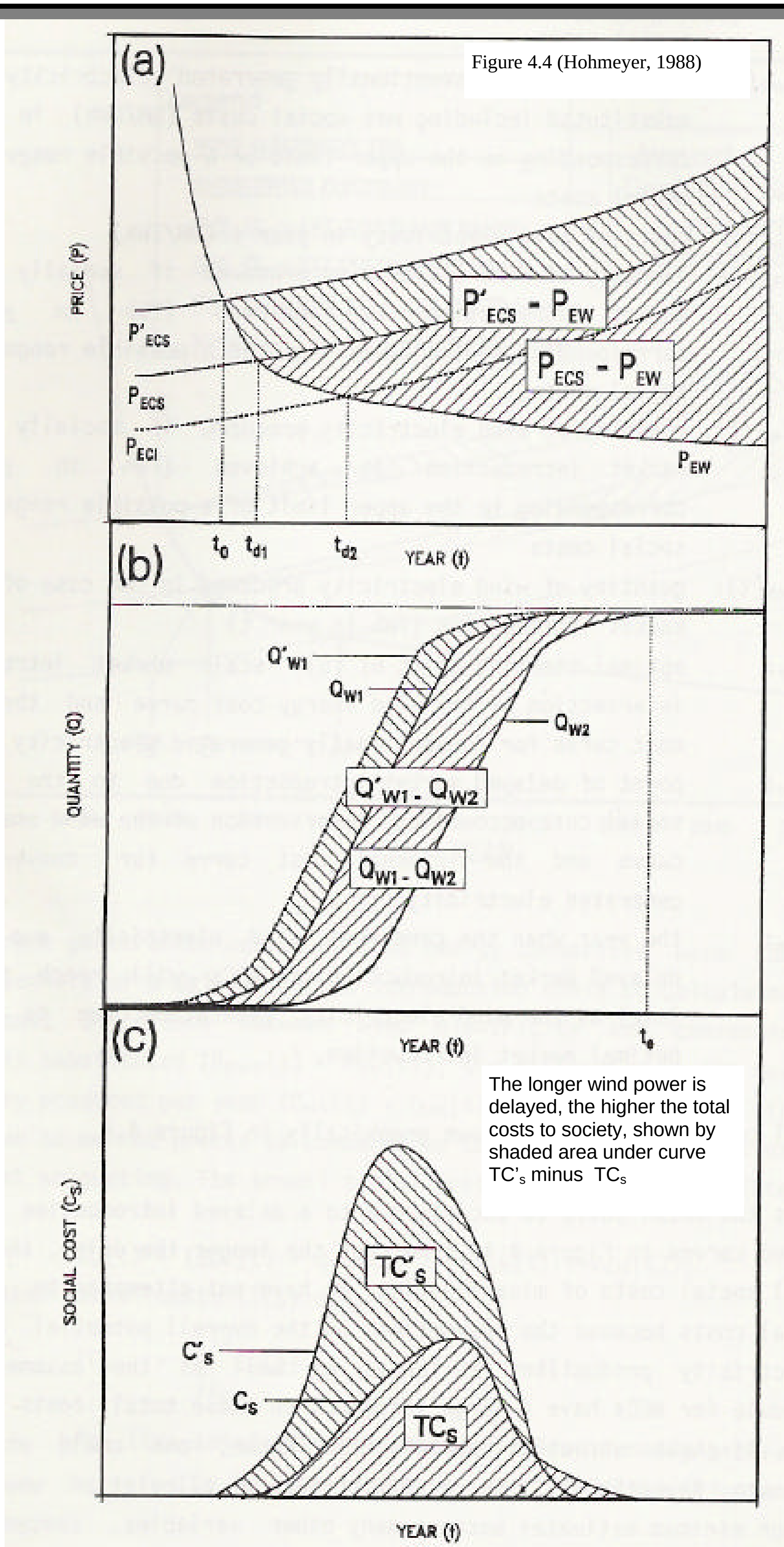

Figure 4.4 (Hohmeyer, 1988)

P_{ECI} (t) is the total internal costs of conventionally generated electricity to be substituted in year t.

P_{ECS} (t) is the total costs of conventionally generated electricity to be substituted including net social costs corresponding to the lower limit of a possible range of net social costs.

P'_{ECS}(t) is the total costs of conventionally generated electricity to be substituted including net social costs corresponding to the upper limit of a possible range of net social costs.

P_{EW} (t) is the costs of wind energy electricity in year t.

Q_{W1} (t) is the quantity of wind electricity produced is socially optimal market introduction is achieved (TWh in year t) corresponding to the lower limit of a possible range of net social costs.

Q'_{W1} (t) is the quantity of wind electricity produced is socially optimal market introduction is achieved (TWh in year t) corresponding to the upper limit of a possible range of net social costs.

Q_{w2} (t) is the quantity of wind electricity produced in the case of delayed market introduction (TWh in year t).

t_o is the optimal starting point of full scale market introduction, intersection of the wind energy cost curve and the social cost curve for conventionally generated electricity.

t_d is the point of delayed market introduction due to the lack of social cost accounting, intersection of the wind energy cost curve and the internal cost curve for conventionally generated electricity.

t_e is the year when the generated wind electricity due to the delayed market introduction of wind energy converters (WEC) will reach the same level as the wind electricity generation due to socially optimal market introduction.