RESIDENTIAL ELECTRICITY OPTIONS FOLLOWING ELECTRIC UTILITY DEREGULATION

By

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A Thesis

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Galen Martin

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The 1992 Energy Policy Act deregulated the wholesale energy market in the United States with the intent of decreasing cost and increasing service options by allowing competition between utilities. States were freed to pass laws restructuring their markets. As a result, many customers were allowed direct access to all providers of energy rather than being limited to a single local utility company. This development, along with the increasing cost-effectiveness and reduced environmental impacts of non-fossil fuel-based energy production, has led many utility companies to offer alternative energy sources to their customers. Conservation behaviors and price combine to determine the degree to which consumers choose to use the alternative energy options. A case study of Eugene, Oregon, demonstrates the interaction of these factors and indicates that price is the most significant indicator of consumer choice.

ACKNOWLEDGMENTS

I must start by acknowledging Elizabeth Beeuwkes, without whom I might still be contemplating a thesis advisor. The bootprint in my rear is evidence of her unceasing encouragement of my progress and her occasional chastisement for my lack thereof. Of course, this thesis would never have reached completion without the extraordinary support and effort of my advisors: Galen Martin, Greg Bothun and Erica Bastress-Dukeheart. Their honest critiques and suggestions helped me recognize weaknesses in my arguments, areas for emphasis and further directions of inquiry. I must thank all the friends and family who offered their support and suggestions throughout the process. Special thanks must go to my mom, who just a month ago completed her thesis and graduated, for commiserating about the frustrations of thesis writing and just being there when I needed her. For perhaps the first time in my life, I thought of her as a peer and felt like she really understood what I was going through. Thank you all.

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CHAPTER 1: INTRODUCTION

With most nations moving towards free market economies, the United States has been leading the way in global deregulation of industries. During the past 25 years, many industries have been deregulated, most notably telecommunications and airlines. Their success has paved the way for electrical utility deregulation and the future. Deregulation of the electric utility industry can lead to increases in alternative energy options and potentially decreased overall electricity costs at the residential level. I intend to demonstrate the effects of deregulation of the electric utility industry on service options, alternative energy usage, and cost at the residential level.

From 1920 to 1992 the federal government regulated the electricity market in an effort to ensure fair and reliable service to all consumers. In 1992 Congress passed the Energy Policy Act, deregulating the wholesale electricity market with the goal of increasing competition within the industry. As a result states were able to pass their own laws to allow competition on a local level as well. Twenty states had passed legislation favoring energy deregulation as of April 2000. The assumption of deregulation is that it increases competition and leads to lower costs and higher quality service.

Under many states' deregulation laws, consumers have access to several utility companies from whom to purchase their electricity. Each company offers different rates,

services, and sources of electricity generation. Consumers must choose which company to purchase from, taking each of those elements into account. In many areas of the country, utility companies offering alternative energy sources, such as hydroelectric or wind power, may present less expensive options when compared to standard local market price.

Some utility companies have begun offering customers energy options solely or primarily from sources other than fossil fuels. While certainly a step forward, alternative energy options have created some confusion among customers. One confusing aspect is the fact that the alternative energy purchased does not actually go to the consumer's house.

The Eugene Water and Electric Board (EWEB), a public utility company in Eugene, Oregon, presents a unique case. EWEB has chosen to remain regulated, as allowed under Oregon law. Its customers are therefore still restricted to choosing between whatever options EWEB offers; they choose within a utility rather than between utilities. Electrical power pricing in Eugene is also rather anomalous, spot market price being less than half the national average. There is no financial incentive for customers to choose alternative energy options since, despite still being less than the national spot market average, the local wind power option costs 75% more than the local spot market. Customer decisions, then, might be expected to be more based on cost factors. The city has a reputation for environmental consciousness, however, so I expect that the source of the electricity will play a significant role in consumer decision making. A recent increase in EWEB's rates makes now an even better time to observe the actions of EWEB

customers; by examining their reactions to the increase, we can evaluate their priorities in decision making. I expect that customers will continue to support EWEB windpower despite the higher base cost.

CHAPTER 2: BACKGROUND AND HISTORY

Legislative Background

In 1920 the Federal Power Act was passed, which, when amended by the Public Utility Act of 1935, authorized the Federal Power Commission to regulate the interstate transmission of electrical energy and rates for its sale as wholesale in interstate commerce (Energy Information Administration, 2000). In 1975 the Federal Energy Regulatory Commission took over those duties as the Federal Power Commission was broken up and distributed throughout the Department of Energy.

In 1992 Congress passed the Energy Policy Act, deregulating the wholesale electricity market. As a result, states were able to pass their own laws to allow competition on a local level as well. The Act took effect on October 24, 1997 and was followed promptly by states investigating and enacting deregulation (Block, 1998). As part of deregulating the electrical generation industry, the 1992 Energy Policy Act "amends the Public Utility Holding Company Act of 1935 (PUHCA) by creating a new class of power producers, called exempt wholesale generators (EWG's), that are not subject to PUHCA and are exclusively engaged in owning and/or operating facilities generating electricity for sale at wholesale" (Troy, 2000). The Act also requires that

transmission and distribution companies allow their lines and facilities to be used by all generation companies, provided the generation company pays all real costs of transmission and distribution (ibid.).

Legislation regarding energy deregulation has been passed in twenty states across the nation as of April 2000 (Energy Information Administration, 2000). Most of the others are investigating their options or have legislation pending. [See Appendix A for a sampling of other state legislation.]

The Oregon Senate passed Senate Bill 1149 on July 9, 1999, deregulating electricity sales to business and industrial customers. However, "unlike power deregulation in other states, the Oregon bill calls for residential customers to continue receiving electricity from their local utility" (Mapes, 1999). Under the law, utilities have the option to open the deregulated market to their customers. If they do, they are authorized to retain customers from outside their operational area. Current legislation only allows business and industrial customers direct access to multiple energy providers. Residential customers will not be considered for that privilege until 2003 under Section 2(2) of SB 1149. On January 1, 2003, the Oregon Public Utilities Commission must recommend to the legislature whether direct access to additional energy providers would be beneficial to residential customers. Until that time, residential customers are still restricted to the options given to them by their local provider.

Oregon SB1149 allows public utilities to choose whether or not to enter the open market. EWEB, for example, has chosen not to do so, citing a lack of overwhelming

desire by its customers (Robertson, 19 July 1999). By remaining regulated, EWEB keeps its captive market but is unable to sell electricity to end-users in other markets.

Purpose of Regulation and Deregulation

Federal regulation of the electric power industry prior to 1992 restricted consumers, both residential and commercial/industrial, to purchasing their electricity from the local provider. Because of this monopoly, concern existed that utilities might charge exorbitant rates in order to make high profits. Therefore, regulation also controlled pricing and distribution in order to ensure fair service to all sectors of the nation. Investor-owned utilities were overseen by the Public Utilities Commission, which determined what a fair rate of return would be, given the market being served. That level of profit was in turn guaranteed to the utility. Public utilities were not allowed to generate profits. Instead they were expected to charge only actual cost of generating and distributing power. A reasonable amount of "profit" was permitted to be held in a contingency fund to mitigate against disasters (Northway, 2000).

The purpose of deregulation is to increase competition within the industry. The belief was that increased competition would lead to lower costs and higher quality service for consumers. Posner (1969, 1975) suggests that regulated monopolies redistribute profits as cross-subsidies and that "...the costs of monopoly are quite probably much greater in the regulated sector than in the unregulated sector despite the greater size of the latter sector (821)." Crew and Rowley (1989) specifically discuss rent-seeking and rent-

protection, where "rent" basically means "profit" and which are integral parts of regulation. They suggest that those processes may become excessive and thus "so unprofitable and impose such large wealth losses that they disintegrate without outside influence (17)." Citing the collapse of the Soviet economy and the damage to the British economy around 1979, they suggest that regulation should be abolished or scaled-back before such devastation racks the American economy.

History and Effects of Deregulation in Other Industries

The divestiture of AT&T in 1984 and the gradual reduction of government control of the airline industry are often cited as the two largest examples of deregulation in U.S. history. In both cases, the effects of deregulation were ultimately to increase quality of service and decrease cost for customers. This precedent helps fuel the expectation that similar results will arise from deregulation of the electricity market.

The January 8, 1982 consent decree between AT&T and the U.S. Justice Department led to the divestiture of the telecommunications giant starting January 1, 1984. Critics of the deregulation charged that local rates would double in five years and that service would be negatively affected. In 1989, AT&T Chairman and CEO Robert Allen reported to the Federal Communications Commission that long distance rates had dropped 40% since the break up, local rates had not doubled, other companies were effectively competing with AT&T, and customers were receiving more value and services than before (Cole, x.). Between 1984 and 1990, the number of homes in the United States

without phone service dropped by 10%, countering the concern that deregulation would negatively affect the distribution of service (ibid., 358). Service quality has increased because customers are increasingly able to 'vote with their feet' – they choose whichever company offers the best services for a given price. As a result, most companies are using a 'pay for what you use' structure, whereby they only make money if a call is completed satisfactorily (ibid., 267). Ignoring service, then, prevents profits.

Congress passed the Airline Deregulation Act in 1978 and thus began phasing out government control of airlines. Regulation had been in place because the Civil Aeronautics Board believed that customers on short-flight routes and in small communities would not fly if they had to pay the full cost of service. Congress deregulated the industry because of concerns that regulation caused inefficiencies and inhibited growth. Since then, conditions have improved dramatically. In 1994 the average fare per passenger mile had dropped just over 9% and the accident rate had fallen by 50% since 1979, from 0.008 accidents per million miles to 0.004 accidents per million miles (General Accounting Office, 1996). Deregulation also led to accelerated use of the hub-and-spoke system which allowed more single-carrier service, a preference of passengers, as shown by Carlton, Landes, and Posner (Morrison and Winston, 1986). The Department of Transportation also reports that the hub-and-spoke system has "increased competition and improved service...by providing greater frequency of flights, convenience, and travel options to the public than was provided during regulation" (General Accounting Office, 1996). In 1995, Morrison and Winston estimated that customers have saved a total of $22.7 billion annually since deregulation, $12.4 billion in lower fares and $10.3 billion

from routing efficiency and reduced travel time. Customers are not the only ones benefiting from deregulation, either. Since deregulation the airlines have earned $2.5 billion per year more (Morrison and Winston, 1986).

CHAPTER 3: EVALUATION OF CURRENT CONDITIONS

Theory of Expanded Options

If everything goes as expected with energy deregulation, the residential customer will have many more options of power generation from which to choose. The idea is that deregulation will lead to competition between utilities for previously captive markets, eventually on a residential and not just industrial level. This competition will lead suppliers, whether public or private, to offer more choices and lower rates to consumers. In response to growing concern for the environment, consumers will actively seek alternative sources such as hydropower, wind power, and solar power. If educators and the press are successful in informing the public about the coming depletion of fossil fuels, the desire for alternative energy sources can only increase. Many industries already advertise their use of recycled materials and soon they will likely advertise their use of renewable energy. They assume that consumers will tend to favor environmentally friendly businesses. Utilities assume this too (or they will soon) and will offer those energy sources to their customers. The success of pilot programs like EWEB's will only serve to hasten this process. Figure 1 shows the proportion of U.S. electricity generation by source:

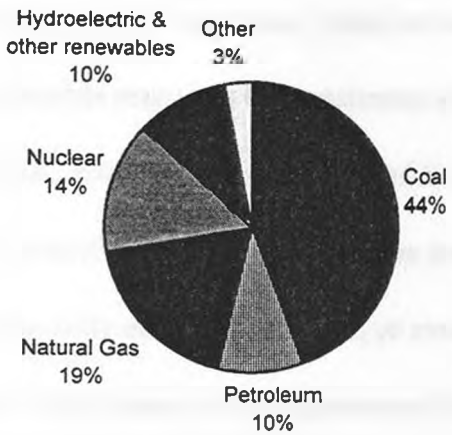


Figure 1: U.S. Electric Utility Generation by Source as of 1/1/99

Sources: Energy Information Administration, Form EIA-860A, "Annual Electric Generator Report - Utility."

Interestingly, residential customer may be better off without access to the entire energy market. In a restricted environment, the customer will have to make few decisions regarding their power supply. The utility will use its extensive resources and experts to fully examine the benefits and drawbacks of the multitude of options on the market, making an well-educated decision of which options are the most beneficial and cost-effective. In a fully deregulated environment, each residential customer would receive a list of available power providers and would have to choose from among them. A study by Katona and Mueller, examining consumer research prior to a major appliance purchase concluded that: "Any notion that careful planning and choosing, thorough consideration of alternatives, and information seeking accompanied every major purchase was

contradicted by the data" (Newman, 1977). Since commodity purchases are common and retailers generally advertise aggressively, one assumes that consumers have access to resources for comparison and education. Being so new, the competitive electricity market has less easily accessible resources for consumers seeking information on which to base their decisions. Thus, extrapolating the results of Katona and Mueller suggests that the vast majority of electricity customers will neither invest the time nor have access to the resources to become fully educated about all, or even most, of their options before making a decision. Many states have implemented consumer education programs to help alleviate this problem, but anecdotal evidence shows that most people do not invest much time decision-making. An intermediate option, available under Oregon law, is for utilities to offer multiple portfolio options. In effect, their consumers would have partial deregulation—while they are still restricted to one provider, they have options regarding their service and costs. Options are generally delineated as spot market or some collection of "green" alternatives. Spot market electricity is the aggregate of a utility company's sources combined and sold for an averaged price. Green energy generally refers to sources which are renewable or otherwise not based on fossil fuels. Examples include hydroelectric, wind, and solar. Nuclear power is no longer considered "green."

A similar concern about consumer's ability to choose between options arose when the airline industry was deregulated. The largest airlines, the ones with the near-monopolies, controlled the reservation systems used to find flights. Customers, and travel agents, were restricted to only the small number of options listed by the system programmer, who had obvious biases (Morrison and Winston, 1986). This restriction is

parallel, in a partially deregulated market, to the local utility offering a customer only limited options in portfolios, or choosing a customer's power source for them from the available options. In fully deregulated markets, the restriction represents the consumers' options between the local utility's offerings and researching competitors. To determine to what degree this restriction is really a welfare cost to the customer, Morrison and Winston suggest comparing the savings available to the customer by researching all options themselves and the cost of doing so as measured by the number of hours spent researching times the customer's value of that time (1986). As a general measure, they suggest using the customer's hourly wage. For example, if a person makes $10/hour at their job and spends 3 hours researching energy options, they must save at least $30 to make the search worthwhile.

An apparent weakness of applying Morrison and Winston's argument to energy choices is the question: Over what time period must the consumer save that $30? My personal opinion is that a one year period is appropriate. Rates, services, and options change over time, and deregulation will result in those factors changing regularly. During the initial years of deregulation, they will do so with even greater frequency as utilities establish their market positions and determine market demands. I anticipate that utilities will intermittently offer special deals and offers, much like airlines and other competing vendors do.

Concerns about reliability and service quality are nearly moot. Distribution of electricity is still the responsibility of the local utility, which is also responsible for service calls. All electricity providers presented as options to the consumers must, by law,

be licensed by the local public utilities commission. The PUC in turn is not going to license a provider who cannot be expected to provide reliable service. A few problems may arise during the early years of deregulation as new power generation companies emerge, but unreliable companies will rapidly lose their licenses and go out of business.

Financial Concerns

A major financial issue facing some residential customers is the tendency for some utilities to give large subsidies to big businesses and industries. This tendency is only present in districts where the state law allows those large customers access to other energy providers, but restricts residential customers to the local utility. If the local utility remains regulated under state law, all of its customers are restricted to the utility.

In cases where the local utility is on the open market, those large business and industrial interests are able to choose between the local utility company and other energy providers under the deregulation laws. To keep those big accounts from switching to private enterprise, the utilities sometimes offer them large subsidies as incentives to stay (Savage, 1993). In order to make up the cost of those subsidies, residential rates go up. Utilities argue that residential customers would, if they understood the situation, fully agree to the subsidies. The argument is that if subsidies were not offered, than the industries would switch to private energy sources, costing the utility extraordinary amounts of revenue. Because they are guaranteed certain profit levels by the government, the utility would then have to raise residential rates significantly. Therefore, the

residential customer would support subsidies since they lead to only small rate increases, rather than large ones (ibid.). The situation becomes even more prevalent in areas with high electric rates. Industries merely threaten to move out of the area if they are not given substantial subsidies. The utility company, in turn, offers a drastic discount and passes the cost on to the residential customer. The theory, again, is that residential customers would rather pay higher electric bills than lose their jobs when the business leaves town (ibid.). [See Appendix B for an example of this situation taken to a logical extreme.]

Benefits of Alternative Energy

The advantage of buying into alternative energy, such as a wind farm, is the benefit in a broader context. Across the entire region a certain number of megawatts of electricity are required. By paying for a wind farm to be built, purchasers help prevent another coal-fired steam plant (or other, less environmentally-friendly facility) from being built. This substitution is the real benefit of purchasing alternative energy. While everyone might like to receive wind-generated power directly, only certain areas are truly appropriate for wind farms. [See Appendix C for a brief description of alternative energy options.]

Given the growing public concern about the environmental costs of fossil fuel based generation, some utilities have begun offering customers energy options from sources other than fossil fuels. Table 1 shows the pollutants which fossil fuel-based electrical generation facilities produce and the effects of those pollutants. Table 2 shows

the quantity of the organic compounds released by fossil-fuel electricity generation in 1998.

Table 1: Pollution Effects of Fossil Fuel Based Electricity Production

Pollutant	Percentage caused by fossil fuel based electricity production (nationally)	Probable Environmental Impact
Sulfur dioxide (SO_2)	66%	Acid rain
Carbon dioxide (CO_2)	36%	Global warming
Nitrogen oxide (NO)	29%	Smog
Mercury (Hg)	21%	Air & water contamination

Source: Block, David

Table 2: Estimated Emissions from Fossil-Fueled Steam-Electric Generating Units at U.S. Electric Utilities by Fossil Fuel, 1998. (Thousands of Tons)

	Coal	Petroleum
Sulfur dioxide	11,671	759
Carbon dioxide	1,911,627	100,895
Nitrogen oxide	6,701	137

Source: Energy Information Administration

EWEB states that "Generating just 100 kilowatt-hours (KWH) with a coal-fired plant releases over 200 pounds of carbon dioxide gas into the atmosphere"(1999). By using "green" energy, such as wind power, to generate that 100 kWh instead, a consumer can prevent that CO2 release, having the same effect of planting half an acre of trees or driving 2,400 fewer miles (ibid.) Another way to prevent the CO2 release would be to use ten 100-watt lights for 100 fewer hours each, a reasonable annual goal for a standard

household, thus eliminating the need to generate the power in the first place. [See Appendix D for information on green energy certification.]

Accelerating the competitiveness of alternative energy is the rising cost of fossil fuels. We can all see the cost of gasoline rising at the pumps and numerous studies have shown that global oil reserves are dwindling. The Energy Information Administration, a branch of the U.S. Department of Energy, reports that, as of January 1999, proven global oil reserves were approximately 1000 billion barrels. It also reports that consumption in 1998 was approximately 26.6 billion barrels of oil (2000). Dividing reserves by consumption yields an exhaustion timeline of 38 years. [See Appendix E for further explanation of fossil fuel exhaustion.] Even optimistic estimates, which presume extensive future discovery of new oil fields, predict exhaustion within 100 years at current consumption levels.

Energy consumption is rising, coupled to the exponentially growing population, both domestic and global, and many energy sources are being lost. In addition to the depletion of fossil fuel reserves, utility companies are also facing the loss of some hydroelectric facilities. Breaching of dams to restore salmon populations and riverine systems is already underway in some areas and is under consideration in many others. Removal of dams is approaching, if for no other reason than their lifespan is expiring. Dams generally have approximately a 50-100 year lifespan and most of the big dams, particularly in the Pacific Northwest, were built during the 1940's and 1950's.

Confusion About Alternative Energy

One aspect of alternative energy which confuses many consumers is the fact that the alternative energy purchased does not actually go to the consumer's house. When a consumer chooses to purchase wind-generated electricity, for example, they do not generally receive electrons directly from a wind turbine. Practical aspects of power transfer make that option highly inefficient. Instead, the consumer pays for their utility to purchase the rights to a portion of a wind farm. The electrons generated by that wind farm will go to the nearest electricity customers, regardless of what source those customers choose. If the wind-purchasing customer lives near a coal-fired steam plant, the electricity they receive and use will come from that plant. Here is another way to think of it: I pay for the right to believe that my electricity comes from that distant wind farm; however, if that wind farm blows up, I will not lose power, but if the local coal-fired steam plant blows up, I will suffer a black-out. Hence, in theory I am purchasing my electricity from a wind farm 500 miles away while in reality I receive my electricity from the coal plant 50 miles away.

Receiving the wind-generated electricity is similar in some sense to the transfer of money between banks. We all know and understand that banks do not make shipments of billions of dollars of cash back and forth between their vaults every time payday comes. Each bank merely agrees that the proportion of the cash in its vault which belongs to its own customers changes. For example, an employee in Oregon receives cash from

their bank in Oregon, even if the employer's bank, and hence the employer's "cash," is in New Jersey. The "transfer" of cash exists in theory only. Electricity is similar. While it is possible to transmit electricity over long distances, it is much more efficient to transmit locally.

Characteristics of Conservation

The studies I focused on looked at consumers' reduction of gasoline usage as a form of conservation behavior, which can be defined as any action, or inaction, taken to reduce usage of a resource. In applying these studies to the use of windpower, I am identifying a reduction of fossil fuel usage as a conservation behavior. Olsen (1978) identified higher socioeconomic status and lower age as two major determinants of conservation behavior. Martin (1981) found that citizens are more likely to conserve resources when they feel a "personal obligation to help other people" and when they "believe that other Americans conserve," a conclusion supported by Olsen's work (1978). In a study on energy usage and conservation, the Demand and Conservation Panel of the Committee on Nuclear and Alternative Energy Systems, stated that "Energy conservation is a direct expression of economic efficiency and enlightened self-interest" (1979). Collectively, these studies present a general picture of the reasons behind conservation behaviors and can be extrapolated to explain the usage of alternative energy.

CHAPTER 4: CASE STUDY OF EUGENE, OREGON

Eugene was chosen for multiple reasons: First, the relative ease of obtaining actual data and information; second, the fact that EWEB has an active, though fairly new, alternative energy option for its customers; third, a timely rate increase allows us to test financial vs. environmental decision making; and fourth, Eugene's diversity is representative of the state of Oregon as a whole, as shown in Table 3.

Table 3: Diversity Comparison of the City of Eugene and the State of Oregon

Race	Eugene pop.	Eugene %	Oregon pop.	Oregon %
All	112669	100	2842321	100
White	105137	93.3	2636787	92.8
Black	1360	1.2	46178	1.6
American Indian, Eskimo, or Aleut	1012	0.9	38496	1.3
Asian or Pacific Islander	3935	3.5	69269	2.4
Other	1225	1.1	51591	1.8

Source: U.S. Census Bureau, 1990 data

In Eugene, citizens also have the advantage of living in a perceived "green bubble." This common phrase refers to the general tone and attitude of a majority of Eugene's residents. This tone and attitude include widespread environmentally friendly

does give utility companies a larger incentive to begin developing additional options for their customers. It seems likely that deregulation will spread to all utility districts in the foreseeable future.

EWEB customers were given the option of having 10, 25, 50, or 100% of their power come from wind power. Generating power from wind costs 4.5 to 6 cents per kilowatt-hour as compared to 1.5 to 2 cents per kilowatt-hour on the "spot market" (an average of EWEB's other generators and suppliers, which are primarily hydroelectric facilities) (EWEB, 1999). [See Appendix H for a list of EWEB power generating facilities.] The net result of the difference in generation cost means that while residential customers pay approximately 4 cents/KWH for the standard spot market electricity, they must pay approximately 7 cents/KWH for wind-generated electricity.

Electrical power pricing in Eugene is rather anomalous. The local spot market rate of 4 cents/KWH is less than half the national average of 8.5 cents/KWH, so even the 75% higher cost for wind power in Eugene gives local customers a relatively low rate (EWEB, 1999). Consequently, we cannot expect an enormous response from customers. There is no financial incentive to purchase EWEB's windpower because of the inordinately low spot market price. The large difference between spot market and wind power prices afford us the opportunity to evaluate consumer choice—to what degree is it cost-based vs. environment or conscience-based. By examining the popularity of wind power, we can infer the degree of the willingness of consumers to bear additional cost for a less environmentally harmful, and perhaps more desirable, power source. If spot market and wind prices were similar, than such an inference would have a maximum limit equal to

the price difference. With the large difference, and EWEB's multiple options, we have four stages of additional cost to consider. A 10% wind power customer faces a 7.5% overall increase in their bill, assuming constant power usage. At 25% wind power, the customer faces a 18.75% increase, while at 50% wind power their overall bill will be 37.5% higher. Of course, at 100% wind power, the customer's bill is 75% higher than it would be with spot market electricity.

Despite the added cost, wind power has been relatively popular. So far about 2,600 of EWEB's 68,300 residential customers have signed up for wind power, purchasing almost 40% of EWEB's available wind-generated electricity (Northway). Initially, over half of the wind power customers opted for 25% wind power and over 100 customers chose the 100% option (Robertson, 11 June 1999). As of 17 April 2000, about half of subscribers were choosing 10% and a third were choosing 25% windpower (Northway). This rate of subscription means that EWEB will likely only need to sign up 6,000 customers to be at capacity, rather than the 12,000 originally projected (Robertson, 11 June 1999). EWEB is slightly behind it's 2 year schedule for exhausting it's windpower capacity, but that delay is believed to come from a recent rate hike, driving customers away from windpower (Northway). The subscription rate had been fairly steady until the rate hike was announced (ibid.).

Subscription levels for the wind power are moderately consistent with the findings of Lopreato et. al.. Her research suggests that price increases of 10% or less are tolerable to consumers, but that tolerance drops markedly at price increases of 40% or more (Lopreato, 1976). EWEB's subscriptions demonstrate that 83% of subscribers are

accepting increases of up to 18.75%, while the remaining 17% have accepted increases of 40% or more, including about 140 customers accepting the 75% increase. It should not be a great surprise that only a small portion of EWEB's customers (about 4%) have chosen the higher costs of wind power at all.

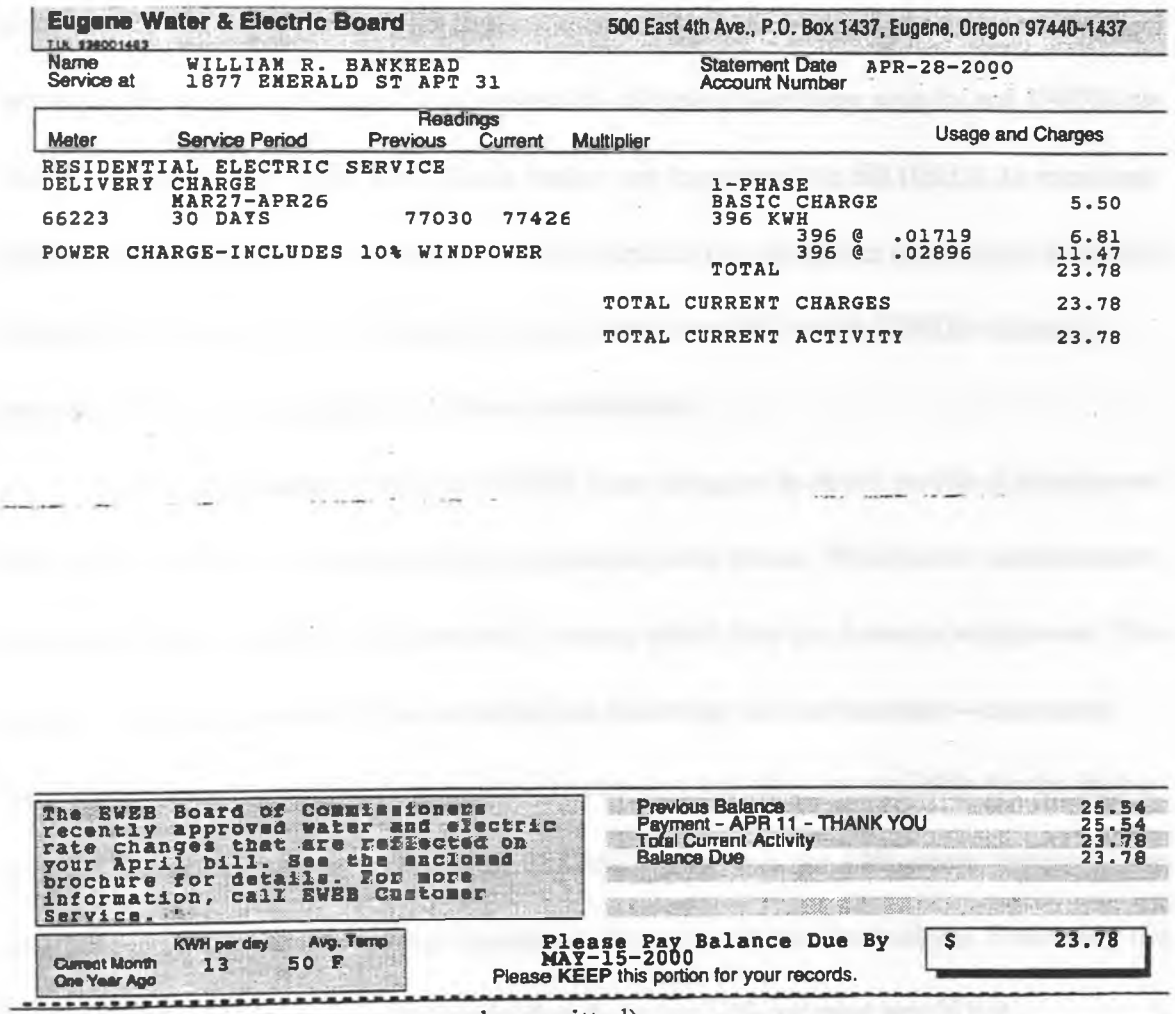
The current spot market rate increase, the first since October 1993, took effect in April 2000, and raised rates by approximately 0.4 cents/kWh, or about 12%. The rate increase is due to cost increases for purchasing electricity from the market. EWEB purchases approximately 75% of the electricity it sells (Northway). Many customers who had signed up for windpower canceled their subscriptions when the rate hike was announced.

EWEB does not offer specific subsidies to industrial customers. Instead, they use a system referred to as "cost of service" in which the utility determines how much it actually costs to produce and deliver power to a particular class of customer. In general, it costs more to supply residential customers than industrial customers because of differences in usage patterns (Northway). On a per-kWh basis, EWEB must spend more time checking meters, making service calls, and maintaining equipment for residential customers. Therefore, many classes of industrial customers are charged less per kWh than residential users. No individual customer within a given class receives any special rates or subsidies.

Very large customers, those using over 10 megawatts monthly, do receive special options, however (Northway). Those customers are permitted to choose their own sources of electricity from the open market. Since they are not actually deregulated, the customer

does not purchase directly from the supplier. Instead, EWEB acts like a broker, purchasing the power from the open market seller and then in turn selling it to the customer.

Another potential source of confusion, particularly for EWEB customers, is the structure of the bill.



Eugene Water & Electric Board 500 East 4th Ave., P.O. Box 1437, Eugene, Oregon 97440-1437

TIN 936001462

Name WILLIAM R. BANKHEAD
Service at 1877 EMERALD ST APT 31

Statement Date APR-28-2000
Account Number

Meter	Service Period	Readings Previous	Current	Multiplier	Usage and Charges		
RESIDENTIAL ELECTRIC SERVICE							
DELIVERY CHARGE	MAR27-APR26				1-PHASE BASIC CHARGE		5.50
66223	30 DAYS	77030	77426		396 KWH		
					396 @	.01719	6.81
POWER CHARGE-INCLUDES 10% WINDPOWER					396 @	.02896	11.47
					TOTAL		23.78
					TOTAL CURRENT CHARGES		23.78
					TOTAL CURRENT ACTIVITY		23.78

The EWEB Board of Commissioners recently approved water and electric rate changes that are reflected on your April bill. See the enclosed brochure for details. For more information, call EWEB Customer Service.

	KWH per day	Avg. Temp
Current Month	13	50 F
One Year Ago		

Previous Balance	25.54
Payment - APR 11 - THANK YOU	25.54
Total Current Activity	23.78
Balance Due	23.78

Please Pay Balance Due By MAY-15-2000 $ 23.78
Please KEEP this portion for your records.

Figure 2: EWEB Bill (Account number omitted)

Meter readings are shown and the number of kilowatt-hours used are listed under "usage and charges". The rate is confusing—it is divided into three parts: the 1-phase

basic charge, which is clearly defined, and the distribution and power costs, which are not clearly delineated. There is also no way to see the effects of windpower on the bill—the power charge section merely states that it includes a particular percentage of windpower. According to Mat Northway, an EWEB manager, very few customers have expressed concerns about their bills (2000). Customers generally do not appear to examine their bills very closely and just pay the listed fee. Some general concerns about the confusing nature of the bill overall have been expressed, of which Northway says he and EWEB are aware. Efforts are being made to find a better way to present the bill (ibid.). As rates and options increase, however, customers can be expected to pay closer attention to their bills. When that happens, they will expect a clear, easily read bill which EWEB will need to provide if it wants to maintain customer satisfaction.

Limited resources prevented EWEB from doing an in-depth profile of windpower customers; however, some anecdotal conclusions were drawn. Windpower customers are believed to have a degree of expendable income which they put towards windpower. This conclusions is supported by the cancellations following the cost increase—customers' expendable income was used up by the increase and was thus not available for the higher costs of windpower. Many subscribers, particularly those in the 10% range, appear to live in apartments, suggesting college students and others with limited budgets. Following the research of Lopreato, we would expect that the mere 12% increase would not significantly impact electricity usage levels. Unfortunately, that 12% increase in spot market power exceeds the increase in the overall bill for a 10% windpower user. For example, a 1000 kWh customer using 10% windpower before the increase paid

$48.24/month, as compared to $45.15/month for no windpower. After the increase the same 1000 kWh with no windpower costs $49.01/month, while remaining with 10% windpower costs $51.65/month. For some customers the difference between $3/month and $6.50/month (increase over old base rates) may be significant. Looked at another way, the customer previously spent an extra $3/month for windpower. Now they must spend an extra $4/month just to accommodate the rate increase; if they want to keep the 10% windpower, they must spend an additional $2.50/month.

Customer feedback and requests for information also indicate that the typical windpower customer is fairly well educated. The number of apartment residents, which suggests college students, would also seem to support such a claim. This evidence supports Olsen's and Martin's conclusions that conservation behavior is more prevalent among well educated people.

CHAPTER 5: FUTURE DIRECTIONS AND CONCLUSIONS

Future Directions

Even with 6,000 customers using wind power, that option has only a 9% market penetration. Current subscription of 2600 customers represents about 4% penetration, which is quite good compared to national averages of about 2% (Northway). EWEB invested $13 million in the Wyoming wind farm in return for usage by 4% of it's customers. Such a ratio is unlikely to be sustainable—it would require an investment of $325 million ($13 million times 25) to reach 100% of residential customers, assuming a linear relationship. If EWEB does reach the expected 6000 customers with this venture, then the ability to achieve 100% involvement becomes more reasonable, costing just $144 million ($13 million times 11). That investment would almost fully develop the Foote Creek site. In theory, EWEB could generate another bond authority like the last one and, by spending it all on the wind farm, reach every residential customer at current subscription percentages.

The Foote Creek site currently hosts 69 turbines but could handle up to 800 wind machines, about a twelve-fold increase, with a potential production of about 500 megawatts (EWEB, 2000). If EWEB were able to find investment partners to support

such a project, as they did initially with Pacificorp, a significant reduction in fossil fuel generated power could be achieved. In fact, since EWEB's average power demand is about 250 MW with a peak demand of about 500 MW, the Foote Creek wind project could theoretically provide 100% wind power to all EWEB customers, residential, commercial, and industrial (Bemis, 2000). The cost of that venture would be prohibitive for EWEB alone, being over $1 billion dollars. Even though EWEB is not likely to be able to afford 100% windpower for all customers, fully developing the site is possible as shown above. While the power would be distributed across the region, we would know that the power produced is equivalent to taking all EWEB customers off the spot market power grid.

In order to best serve the consumers and develop infrastructure, utilities need to know with whom they are dealing. Intensive study and profiling of alternative energy users will be necessary. By knowing who is choosing alternative energy and why, utilities will be better able to market it to a wider segment of the population. A positive feedback loop can be created wherein consumers increasingly support and purchase alternative energy, allowing utilities to increasingly develop those options and minimize environmental impacts of conventional sources. As options get better and better, consumers will be more and more motivated to choose them.

Change is critical for the future. We must change not only the way we generate electricity, but also the way we consume it and the way we think about it. Our modern world depends on vast power supplies, which we often take for granted. There are ways to reduce our consumption with little effort or inconvenience: Fluorescent lights are more

economical than incandescents in the long run and have become small enough to fit almost all fixtures. Utility companies often offer rebates for purchasing energy efficient appliances. Additional insulation, which typically pays for itself within 5 years, can help reduce heating costs. Even remembering to turn off the light when leaving a room can make a difference. These small changes add up to a large reduction in energy usage. Southern California Edison helped its customers improve efficiency so much that electricity demand dropped by "an amount equal to the output of more than three large nuclear power plants" (Miller, 1998).

Conclusion

Precedent shows that deregulation successfully reduces costs and improves service for customers without regard to which industry is being deregulated. Confusion and transitional glitches do occur, but in the long run both the consumer and the industry prosper. Federal repeal of regulation has left the states free to create their own structures for the electrical industry. Some states force utilities to offer all available options to all customers; some states require that only certain categories of customers receive full retail access; some states allow utilities the choice between deregulation and remaining regulated; and some states have chosen to keep their utilities regulated without choice. In all cases, the residential consumer will eventually benefit. Their desires are affecting the market and the market is responding with more options, better options, "greener" options, and cheaper options.

These options have not yet shown their full effects. The United States is cutting edge with its development of deregulation and increasingly free markets. The globalization of economies is progressing based largely on the model of the U.S.

This study supports the general anecdotal belief that cost is the basis for American decision making. Despite being "environmentally conscious," consumers in Eugene have apparently chosen their energy options based primarily on cost. Contrary to expectation, they have made cost a much higher priority in energy options decision making than source. They are willing to pay slightly more for pure "green" energy, but not much. The willingness to bear additional cost is very low. I see two primary factors as likely culprits: largely alternative spot market electricity and significantly higher cost for windpower. EWEB's spot market electricity is primarily produced from hydroelectric dams owned by EWEB, Bonneville Power Administration, Portland General Electric, and PacifiCorp. Hydroelectricity is already very "green" in a relative sense. EWEB's windpower is also 75% more expensive than the spot market, representing a significant increase in a customers electric bill if they were to purchase a large percentage of windpower.

Costs for alternative energy are continuing to fall, however, as better technology makes these sources more economical and the cost of fossil fuels rises. EWEB estimates that by around 2010, wind generated electricity will cost the same as, if not less than, conventional fossil fuel generated electricity (Northway, 2000). As the cost curve for fossil fuels rises and the curve for alternatives falls, as shown in Figure 3, the question becomes how far ahead of the curves can utilities afford to plan?

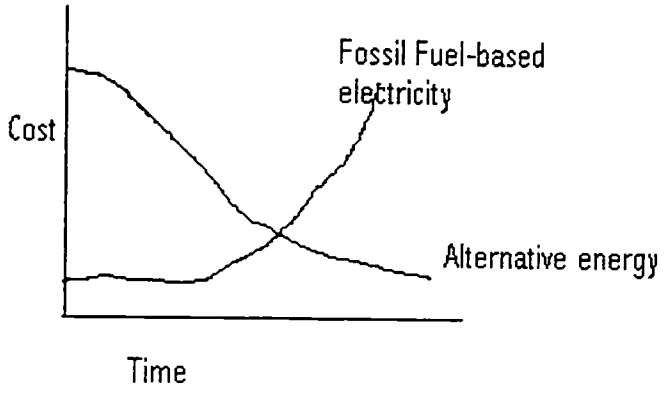


Figure 3: Cost Curves for Electricity

If they lag behind, when alternatives become cheaper or otherwise more desirable, the utility will not have sufficient infrastructure to support demand. If, however, they are too far ahead, demand for the alternative energy will not make efficient use of the supply. The enormous costs of developing the infrastructure will be debilitating if the energy cannot be sold to recoup the loss.

If consumers had to pay the real cost of energy, alternative sources would already be cheaper. Government subsidies and tax breaks keep oil and coal prices down, a critical consideration since the U.S. imports over 50% of its oil (Miler, 1998). How much are we paying for national policy designed to protect our access to oil? Our dependence on fossil fuels has a significant impact on our financial costs, national policy, and environmental impact.

Such limits on the continued usefulness of fossil fuels for electricity make it imperative that we continue to investigate and promote alternatives. Doing so, however,

is going to require some initial sacrifice. Utilities are going to have to embrace the maxim that to make money, you often must first spend money. Studying, developing, and constructing alternative and renewable energy facilities is not cheap, but the end result will be far superior then continuing to rely on fossil fuels. Energy managers must be forward-looking and plan ahead for these future demands.

The intent of this study is to demonstrate the benefits of deregulation, particularly increases in alternative energy options and decreases in cost, while pointing out that, from a practical standpoint, some degree of regulation may be beneficial. Hopefully, this paper will be useful to a wide range of readers. Energy managers and policy makers may use it as a compass, pointing the best direction in which to progress. Researchers may use it as a basis for routes of beneficial inquiry. Residential electricity consumers may use it to better understand the way the electricity industry can operate and what part they can play. Sound energy usage and policy, and successful transition away from fossil fuels, will require that all four segments of the population interact constructively.

Appendix A

Deregulation Legislation in Other States

PENNSYLVANIA: In December of 1996, House Bill 1509 required that electricity consumers be given access to competitive supplier, one-third of customers every two years, beginning in 1999. The State legislature introduced HB 2286 in March of 1998 allowing all consumer access to competitive suppliers by January 1999. A modified bill passed and two-thirds of customers gained access in 1/99; the remaining third received access in 1/00. The public utilities commission initiated a public education program in June of 1998 which is available at http://www.electrichoice.com.

ILLINOIS: House Bill 362 passed in December 1997 to allow competitive access for residential customers in May 2002. It also provided for a 15% rate cut by 8/98 and a further 5% cut by 5/02. In July of 1999, SB 24 passed, accelerating the 5% rate cut to take affect in October 2001. A January 2000 report from the Illinois Commerce Commission stated that more customers have switched suppliers in Commonwealth Edison's territory than in the rest of the state, presumably because of ComEd's relatively higher rates.

MAINE: May 1997 marked the passage of LD 1804 which required retail competition by March 2000. Large investor-owned utilities were also restricted "to a market share cap of 33% in old service areas, a requirement for divestiture of generation assets by 3/00, and the nation's most aggressive renewables portfolio, requiring 30% of generation to be from renewable energy sources (including hydroelectric)". January 1999 was the initiation of consumer education programs and a requirement that electric bills show "unbundled" costs of power generation and distribution. As of January 2000, three investor-owned utilities had sold their generation facilities.

NEW MEXICO: The legislature received a report in January 1998 recommending full retail competition by January 2001 and estimating that over $60 million/year could be saved. They passed SB 428 in April 1999, restructuring New Mexico's power industry. Unlike most other states, New Mexico's law will grant competitive access to residential and other small customers (in 2001) prior to large commercial and industrial customers (in January 2002).

MONTANA: All consumers received the right to competitive retail access by July 2002 under SB 390 passed in April 1997. A measure to repeal the law failed to generate enough signatures to get on the November 1998 ballot. In July 1999, SB 406 passed, creating the unique opportunity for residential and small businesses to form buying cooperatives. This combined purchasing power led to the creation of a cooperative serving over 250,000 customers and purchasing 330 megawatts (MW) of power. A pilot program allowing 5% of residential and small business customers to choose their supplier was initiated in November 1998. Full retail access was achieved in April 2000.

RHODE ISLAND: All residents were approved for retail choice on January 1, 1998 by the public utilities commission in December 1997. This approval followed the August 1996 passage of HB 8124 which allowed retail choice in phases beginning in July 1997. Residential customers were guaranteed retail choice by July 1998. No real competition occurred initially because the standard option rate was 3.2 cents/kWh. On January 1, 1999, the rate increased to 3.5 cents/kWh and increased again to 3.8 cents/kWh in January 2000. As of September 1999, 2000 of the state's 456,000 customers had chosen alternative generation suppliers.

Appendix B

Industrial Subsidy Example

"If I was a really smart energy analyst, I'd suggest to business executives that they follow Chevron USA's lead. Chevron, PG&E's biggest customer, signed up for a discount gas contract from the utility. That gas will be used, in part, to fuel the company's own cogeneration plant that will produce electricity and steam. Electricity from the cogen plant will make Chevron self-sufficient on the electricity side and take it right off of PG&E's grid. Thus, the refinery no longer will pay any electric bills and will get gas at a discount. Since it no longer contributes to the electric infrastructure, ratepayers will have to take up the slack in payments in addition to making up for the discount cost of natural gas."

Source: Savage, J.A. 1993, "Electric Avenues," Business and Society Review, n85.

Appendix C

Alternative Energy Options

Electricity is generated by spinning a magnet inside a coil of wire. In virtually all cases, the magnet is connected to a turbine which is typically spun using steam. The "source" of electricity refers to the method by which the turbine is made to spin, or the method by which water is converted to steam. Standard generation is done by burning a fossil-fuel such as coal, natural gas, or oil to boil water. This method has an efficiency of approximately 25%.

Alternative energy generally refers to any source which is not based on fossil fuels. A few of the more common options are nuclear, hydro, solar, and wind. Others which have received attention are geothermal, biomass burning, and ocean thermal-electric conversion.

Nuclear power plants use the heat of radioactive decay to boil water, creating steam and spinning the turbine. Advantages include less air pollution than is produced by burning fossil fuels. Disadvantages include radioactivity and toxicity of wastes, difficulty safely transporting and storing fuel and wastes, and possible radiation leaks.

Hydropower consists of damming a river and allowing water pressure to spin the turbine. Advantages include very high efficiency (~80%), no waste products, very low operating costs, flood control, irrigation, and the ability to adjust output with ease. Disadvantages include high construction costs, interference with fish migration, massive evaporative loss from reservoirs, and severe changes in surrounding ecology—upstream regions are flooded and the river downstream becomes colder, clearer, and faster.

Solar power converts solar energy to electrical energy in photovoltaic cells. Advantages include low operational cost, no waste products and small-scale adaptability. Disadvantages include high purchase costs, low efficiency (~10%), practical limitations on scale and inconsistent sunshine.

Wind power uses a windmill to spin the turbine. Advantages include high efficiency (~30%), no waste products, and minimal environmental impact. Disadvantages include interference with migratory bird routes, land area needed for large-scale production and inconsistent winds.

Appendix D

Green Energy Certification

To ensure that the growing number of green power products live up to their name, the San Francisco-based CRS *[Center for Resource Solutions]* developed the Green-e program, the nation's first voluntary certification system for clean energy. Green electricity products that meet certain standards earn the Green-e designation. A logo provides easy identification for consumers in a similar vein as the "chasing arrows" recycling symbol.

"The Green-e program is expanding as a variety of stakeholders invite us to their states to become involved in developing renewable energy choices," says Jan Hamrin, CRS executive director. "Sometimes it's consumer protection advocates, or environmental or health organizations. Sometimes it's even companies who want to buy green energy and see the value of displaying the Green-e logo to demonstrate that they are good corporate citizens."

In California, the Green-e logo guarantees that: At least 50 percent of the electricity supply for the product comes from renewable resources; Any nonrenewable portion of the product has lower air emissions than the traditional mix of electricity

would have; and The company offering the product agrees to abide by the Green-e program's Code of Conduct. The level of renewables content is listed under the logo and on the resource disclosure label on the bill. If actual renewables generation over the year is not within five percent of the amount stated on the product label, the company has four months to purchase the necessary renewable power to make up the difference. Power marketers also have to furnish easily understood information about products and services in a manner specified by the Green-e program, and must follow the professional standards in their business practices.

According to its mission statement, the Green Power Board that created the Green-e program seeks to: "Bolster customer confidence in the reliability of retail electricity products reflecting renewable energy generation; Expand the retail market for electricity products incorporating renewable energy, including expanding the demand for new renewable energy generation; Provide customers clear information about retail 'green' electricity products to enable them to make informed purchasing decisions; Encourage the deployment of electricity products that minimize air pollution and reduce greenhouse gas emissions."

Source: Block, Dave. 1998, In Business, v20, n4.

As of April 18, 2000, three utilities had received Green-e accreditation: Wisconsin Electric's Energy for Tomorrow™ program, the Tennessee Valley Authority's (TVA) Green Power SwitchSM and Madison, Gas & Electric's MGE Wind Power. All three

earned accreditation "by meeting or exceeding a series of stringent guidelines that include the use of renewable resources, appropriate product pricing and marketing, and customer education."

Source: Center for Resource Solutions

Appendix E

Fossil Fuel Exhaustion

World oil demand is rising at a rate of between 1.5% and 2% per year. The U.S. Geological Survey states that global discovery of large, new oil fields has been declining since its 1962 peak (Miller, 1998). Compounding the problem, companies consider an oil source depleted after 80% usage; the remaining 20% is economically inefficient to produce, at least at current prices (ibid.).

The Energy Information Administration reports that, as of January 1999, proven global oil reserves were approximately 1000 billion barrels. It also report that consumption in 1998 was approximately 26.6 billion barrels of oil (2000). Dividing reserves by consumption yields an exhaustion timeline of 38 years. The American Petroleum Institute acknowledges that at current consumption rates, viable oil reserves will endure for about 45 years. Citing a U.S. Geological Survey estimate, the API points out that between 1400 and 2100 billion barrels of oil remain to be produced. That estimate specifically breaks down to a 95% chance of sustaining current consumption levels through 2059 and a 5% chance of sustaining them through 2091 (Cozic,1998). The

USGS estimate, however, does not take into account the viability of converting those resources into actual production.

Coal reserves are more expansive and will last centuries at current usage levels; however, if they are forced to compensate for the loss of oil, than the coal reserves will be exhausted on a similar timescale. According to the Energy Information Administration, US consumption of coal was approximately 1 billion tons in 1997 (2000). Divided into the known recoverable reserves of approximately 275.1 billion tons, we know that current coal usage can be sustained for about 275 years (ibid.). Increased ability to recover coal deposits may enlarge the coal reserve, but is not expected to exceed the 507.7 billion tons in the Demonstrated Reserve Base, a less reliable estimate (ibid.). Coal accounts for about 57% of U.S. electricity generation and 23% over overall U.S. energy (Miller, 1998). If global usage increases at 2% per year (the same rate as oil), than known reserves will be exhausted in approximately 65 years (ibid.). Increased use of coal is thus not a replacement option, and it does not even begin to address the devastating environmental impact of coal-based electricity generation. "Clean" coal technology, while an improvement, is certainly not what could be considered "green energy."

Appendix F

EWEB Bond Expenditures

$150 million dollar bond authorized by 1993 ballot measure.

Project	Expenditure
Foote Creek Rim Wind Farm Arlington, WY	$13 million
Wauna Cogeneration Project Clatskanie, OR	$16 million
Smith Creek Hydroelectric Plant Smith Creek, ID	$27 million
Stone Creek Hydroelectric Plant Estacada, OR	$30 million

Earmarked for future conservation	$24 million
Unused	$40 million
Total	$150 million

Source: Mat Northway, EWEB

Appendix G

Regional Large-Scale Power Facilities

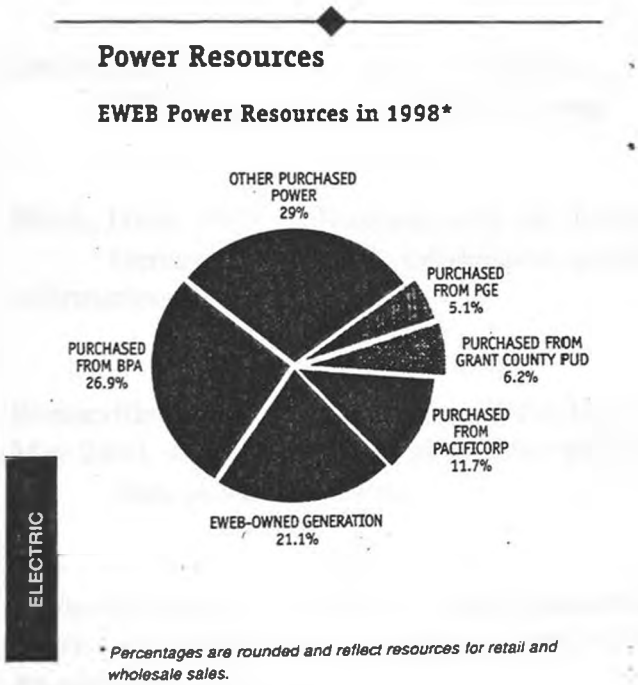
(capacity rounded to nearest 100 MW)

Bonneville Power Administration		
Grand Coulee Dam	Hydro	6800 MW
Chief Joseph Dam	Hydro	2600 MW
John Day Dam	Hydro	2500 MW
The Dalles Dam	Hydro	2100 MW
Centralia Power Plant	Coal	1300 MW
Bonneville Dam	Hydro	1200 MW
McNary Dam	Hydro	1100 MW
Portland General Electric		
Trojan	Nuclear	1100 MW (closed in 1993)
(Boardman Power Plant	Coal	500 MW)
Public Utility District No. 1 of Chelan County		
Rocky Reach	Hydro	1300 MW
Energy Northwest		

WNP	Nuclear	1100 MW
Seattle City Light		
Boundary	Hydro	1100 MW

Appendix H

EWEB Power Facilities



Generation Resources	Nameplate Capacity (MW)*
Carmen-Smith Hydroelectric Plant, McKenzie River, OR	108
EWEB/Weyerhaeuser Cogeneration Plant, Springfield, OR	51.2
Foote Creek Rim Wind Project, Arlington, WY**	41.4
Leaburg Hydroelectric Plant, McKenzie River, OR	13.5
Smith Creek Hydroelectric Plant, Smith Creek, ID	36
Stone Creek Plant, Estacada, OR	12.5
Trail Bridge Hydroelectric Plant, McKenzie River, OR	10
Walterville Hydroelectric Plant, McKenzie River, OR	9
Wauna Cogeneration Project, Clatskanie, OR***	36

Contracted Resources	Nameplate Capacity (MW)
Priest Rapids Hydro Plant, Grant Co., Washington****	15
Wanapum Hydro Plant, Grant Co., Washington****	21

**Nameplate capacity is a generator's maximum electrical output.*
*** EWEB owns 21.21% of this project, with PacifiCorp owning the balance. EWEB sells 5.51% of its share of the power to BPA.*
****EWEB is a part owner of this project through the Western Generation Agency. Power from this resource is sold to BPA.*
*****EWEB's share of product capacity.*

Figure 3: EWEB Power Facilities

Source: EWEB Facts &Figures 1998

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