Green Futures:

Managing Financial Risks and Protecting the Environment

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Background

It is widely recognized that consumers have a general interest in promoting the use of renewable sources of energy. Some regulated utilities have satisfied this demand by providing green products for their customers. It appears that electric restructuring will enable consumer demand to be satisfied at a broader level by allowing them to select their energy service provider as well as the type of electricity that they purchase.

The typical green product offered by an energy service provider (in either a regulated or deregulated environment) is to charge customers a premium over existing electricity prices and then to deliver a certain fraction of their total demand from a renewable resource. This green power product can be represented by the vertical rectangle in Figure 1; i.e., a certain quantity of electricity is derived from renewable resources and then delivered over a short period of time. In essence, customers are buying the knowledge that they are promoting the use of renewable energy.

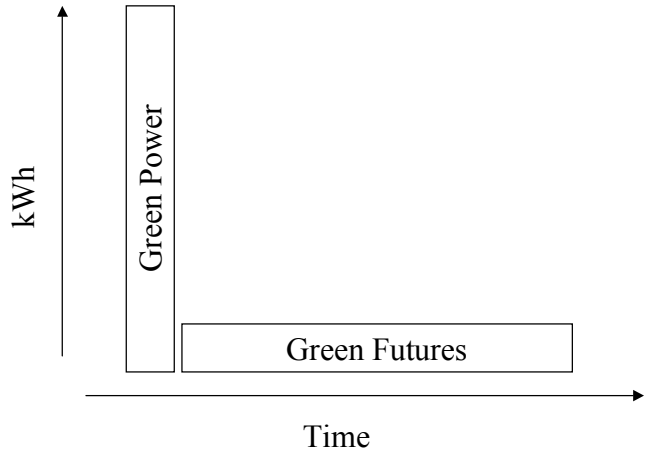


Figure 1. Two green products.

Suppose that an energy service provider commits to providing all of the green power from new wind plants. For illustration purposes, assume that 20,000 residential customers each with an annual demand of 6,600 kWh sign up for the program and agree to pay a $0.03/kWh premium (or about $200 per year for the average customer). As shown by the top line in Figure 2, satisfying the annual electricity needs of these customers would require about a 50 MW wind plant. At a capital cost of $1,000/kW, this translates to a $50 million investment.

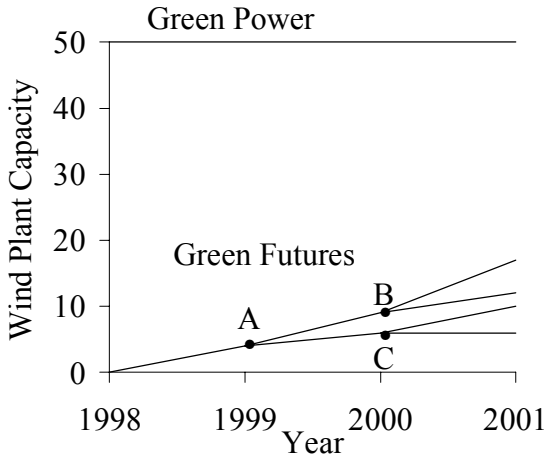


Figure 2. Green Futures Product Capitalizes on Wind's Modularity.

Perhaps even more important than the magnitude of this investment is the lack of flexibility once the investment has been made. The result is that an energy service provider faces a large risk in offering this type of green product. The risk is that consumers sign up for the green product, the energy service provider builds a wind plant to produce green energy, and then its customers lose interest and/or change to another service provide. This leaves the energy service provider with an automated factory that is producing a product without customers who are willing to pay the premium to buy the product.

One way energy service providers are limiting their exposure to this risk is to obtain only a portion of the green energy from new plants. For example, in the California market, Enron is providing 12.5 percent of the power from new wind plants and Green Mountain Energy Resources is providing up to 10 percent of the power from new wind plants (Wiser and Pickle 1998).[1]

An Alternative Green Product

There is an alternative to the green power product described above. Rather than providing consumers with green power that is consumed all at one point in time, an alternative product is to charge consumers a premium in exchange for a green future; the

[1] New wind is expected to increase to 25% in future years.

green future gives the consumers green energy over a long period of time. This type of product is represented by the horizontal rectangle in Figure 1. This product could be attractive for both energy service providers and consumers.

From the energy service provider's perspective, it allows them to minimize their financial exposure. To illustrate, suppose again that 20,000 customers sign up for the program and that each one pays a premium of $200 per year. The energy service provider collects $4 Million in 1998 and then spends $4 Million to build a 4 MW wind plant (point A in Figure 2). In 1999, the actions of the energy service provider depend upon the number of customers that are participating in the program. If the 20,000 customers continue with the program, the energy service provide collects another $4 Million and then spends $4 Million to build a second 4 MW plant (point B). If, however, 10,000 customers drop out of the program, the energy service provider collects only $2 Million and then spends $2 Million to build a 2 MW plant (point C). This protects energy service providers from customers whose preferences change.

From the consumer's perspective, the green futures product has several desirable attributes. First, there is the potential that there will be a financial return on the investment. The green power product (the vertical rectangle in Figure 1) has the customer pay a premium to receive green power immediately; there is no financial return to the customer from this investment. As with the green power product, the customer pays a premium immediately for the green future, but unlike the green power product, the customer receives green electricity at no additional cost over time. This electricity has value because the customer can either use it to satisfy their own demand or can sell it in the market. This is closely tied to a second potential benefit for the customer. By investing in the green future today, the customer is protected against future increases in electricity prices. That is, a green future is somewhat like electricity insurance with the added benefit that the customer gets the electricity no matter whether prices are high or low.

As a result, the green futures product has the potentially to result in a larger market than the green power product. In addition, it is likely that more new wind plants will be built with the green future than with the green power product.

Specific Example

This product can be packaged and sold in a variety of ways. One option is for the energy service provider to guarantee that the customer will be given a fixed amount of green electricity over a set time period. For example, the terms of the agreement might be that the customer will receive 400 kWh of green electricity per year for 20 years by paying $200 today. In this case, the energy service provider bears the risk of weather and equipment uncertainties as well as operation and maintenance costs. While there is less of a risk for the energy service provider than in constructing a full plant, low wind years or high O&M costs could hurt the energy service provider.

An alternative product is to transfer more of the risk as well as the potential benefit to the customer. The detailed example that is in the remainder of the paper is of this type.

Suppose that customers have the goal of getting to the point that their investments produce enough electricity so that they never need to purchase any electricity again. In the first year, they pay their premiums and the energy service provider invests in new wind units. Once the investment is made, the wind plant will begin to produce electricity with the electricity used as follows: (1) enough to the wind plant's output is sold to pay for the wind plant's operation and maintenance expenses and transmission costs; (2) 80 percent of the remaining output is reinvested in new wind plants; and (3) 20 percent of the remaining output goes to the energy service provider. The premium is collected from customers in the second year and the cycle is repeated.

Once a customer stops making payments, a portion of the wind plant's output is used to supply the customer's demand; the remaining amount is sold and then reinvested in new wind plants. If the customer makes payments for a sufficient amount of time, the wind plant will be self-sustaining; i.e., the wind plant will produce enough electricity to:

- satisfy the customer's electricity needs;
- pay for wind plant operation and maintenance expenses and transmission costs;
- buy enough new wind units to replace units as they wear out; and
- pay the energy service provider.

The whole cycle is illustrated in Figure 3.

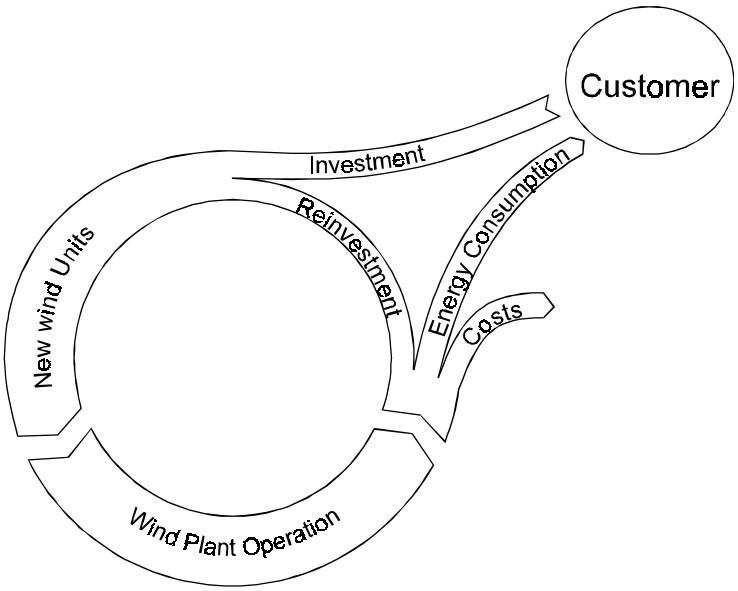


Figure 3. Green futures investment cycle.

Product Details

To illustrate how this product might work, make the assumptions presented in Table 1. These assumptions are discussed in more detail in this section.

Customer

As shown in the table, the customer uses 6,600 kWh of electricity per year; this is the amount of electricity consumed by an average residential customer in Pacific Gas and Electric Company's distribution area. The customer pays a price premium of $0.030/kWh or $16.50 per month. All of this money is invested in new wind plants. (It is anticipated that customers will need to make payments for 15 years in order for the wind plant to be completely self-sustaining.)

The first year of payments will result in about 0.2 kW of new wind capacity for every customer that signs up. Once the first part of the wind plant is built, it will begin to produce electricity. The operation and maintenance expenses and the transmission costs are covered by selling a portion of the electricity to the PX or to the energy service provider's customers; 80 percent of the remaining output belongs to the customer. As long as the customer makes payments, the electricity is sold and the funds are reinvested (along with the customer's premium) in new wind plants. Once the customer stops participating in the program, the electricity is used as follows: First, customers that participate for less than 10 years pay an annual fee of $20 worth of electricity; customers that participate for more than 10 years pay no fee. Second, the customer's electricity needs are met. Third, the remaining wind output (if there is any) is sold and the money reinvested in new wind units.

Energy Service Provider

The energy service provider incurs the initial cost of signing up the customer (a one-time cost of $50) and an annual cost of maintaining the customer's account ($10 per year). The energy service provider gets 20 percent of the plant's (after-costs) output in return.

Electricity Costs

"Brown energy" can be purchased for $0.030/kWh and "green energy" can be sold for $0.035/kWh. These prices are constant over time.

Wind Plant

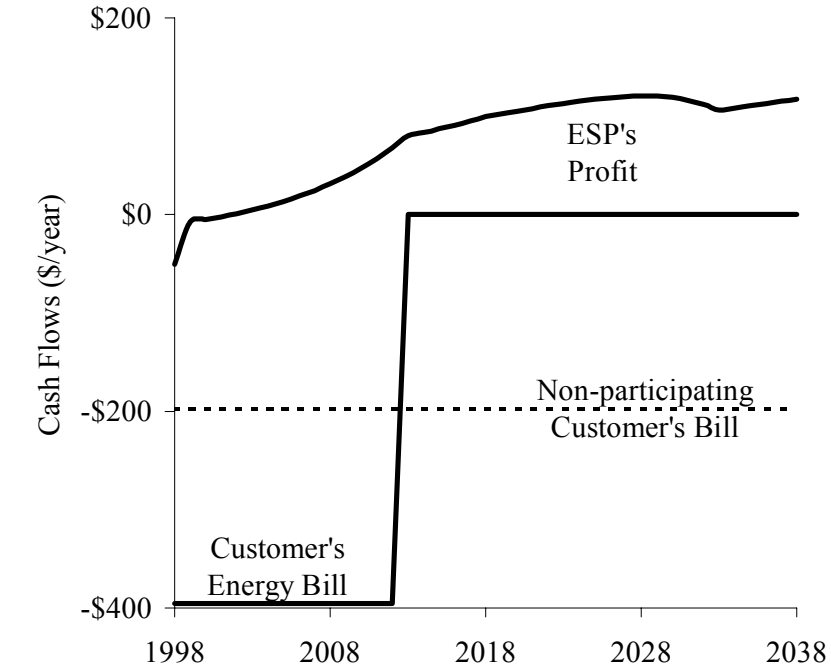
New wind plants currently cost $1,000/kW and are declining at a rate of 5 percent per year; the cost will go no lower than $500/kW (this is reached in year 15). Plant O&M costs are $0.010/kWh and transmission costs are $0.005/kWh. The plants have a 35 percent capacity factor and a 20-year life.

Results

Figure 4 presents the energy service provider's profit, the customer's cash flows, and the wind plant's electricity production based on the assumptions in Table 1. The top part of the figure shows that the energy service provider has a negative cash flow for the first year and a positive cash flow in subsequent years. The customer's cash flow is negative relative to what it would have paid for the first 15 years (the dashed line) and then is positive in subsequent years. The bottom part of the figure shows that the output from the wind plant exceeds the customer's electricity demand in 7 years and that the customer stops making payments after 15 years but the wind plant is self-sustaining.

Table 1. Technical and economic assumptions.

Customer	
Energy consumption	6,600 kWh/year
Price premium	$0.030/kWh
Duration of premium	15 years
Share of plant output (after costs)	80%
Account fee for quitting before 10 years	$20/year
Energy Service Provider	
Customer signup cost	$50
Administrative cost	$10/year
Share of plant output (after costs)	20%
Energy Cost at the Power Exchange	
Brown energy	$0.030/kWh
Green energy	$0.035/kWh
Wind Plant	
Current capital cost	$1,000/kW
Capital cost decline	5%/year
Minimum capital cost	$500/kW
O&M cost	$0.010/kWh
Transmission cost	$0.005/kWh
Capacity factor	35%
Plant life	20 years



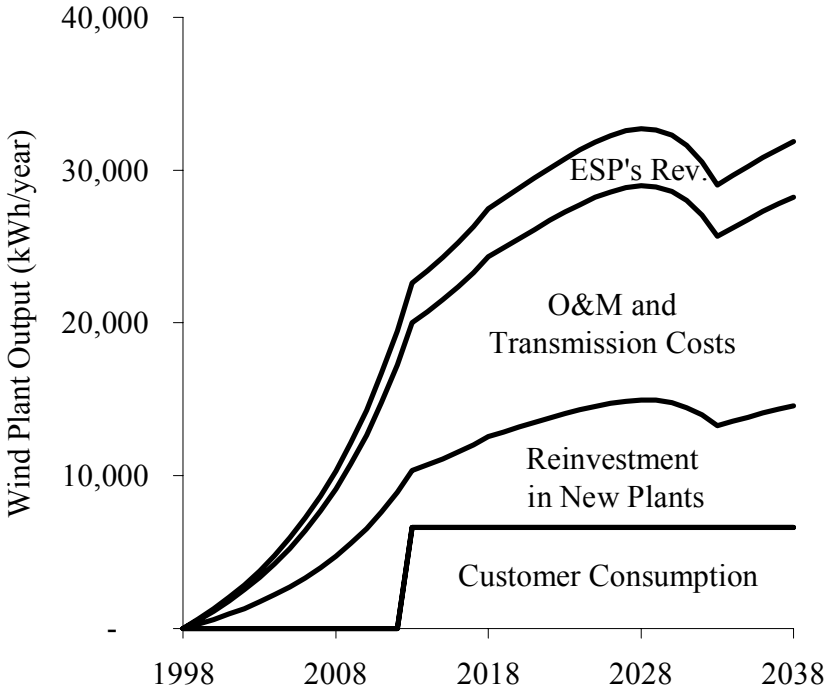


Figure 4. Cash flows and wind plant output.

Project Profitability

An important question from the energy service provider's perspective is how profitable is this investment? Recall that customers are penalized by dropping out before 10 years through the $20/year inactive account fee. As shown in Figure 5, as long as the customer participates in the program for at least 2 years, the energy service provider will earn about a 20 percent rate of return. If the customer quits before this, the energy service provider is essentially out the cost of signing the customer up.

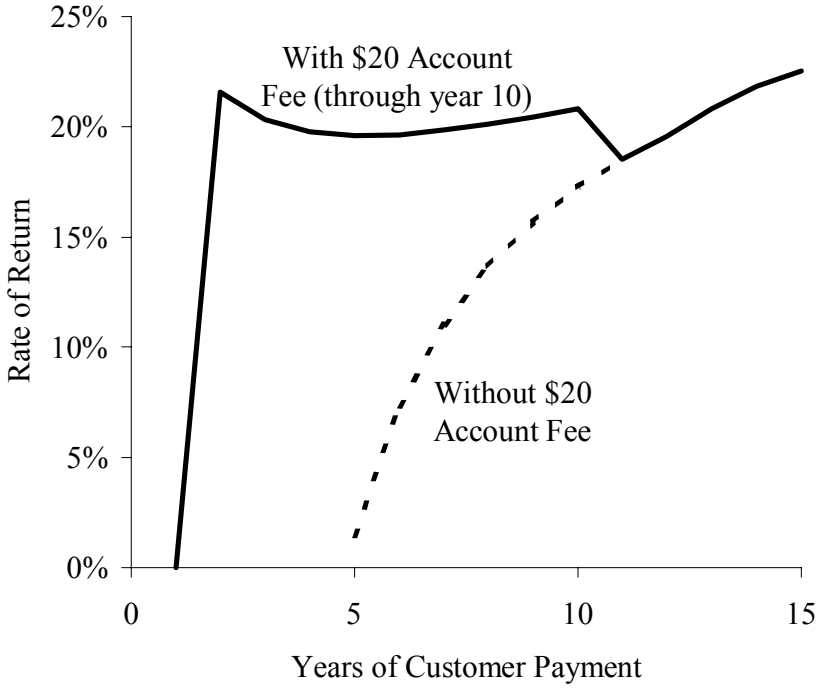


Figure 5. Energy service provider's rate of return.

Conclusions

It is widely recognized that consumers have a general interest in promoting the use of renewable sources of energy. As a result, green power products are being developed in both regulated and deregulated environments. This paper suggests that an alternative product, called a green futures product, has the potential to be even more attractive to customers because it gives them the opportunity to make a rate of return on their

investment in addition to supporting the environment. It also has the potential to be more attractive to energy service providers because the market size for this type of green futures product may be much larger than the market size for other green products. As a result, those interested in offering green products should consider offering green futures.

References

Ryan H. Wiser and Steven J. Pickle, "Selling Green Power in California: Product, Industry, and Market Trends," *Proceedings of the American Solar Energy Society's 27th Annual Conference*, Albuquerque, New Mexico, June 13-18, 1998.

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