

## **PREMIUMS PAID FOR GREEN GENERATION IN THE APX GREEN POWER MARKET**

Janis C. Pepper  
Enertron Consultants / APX  
[pepper@enertroncons.com](mailto:pepper@enertroncons.com)  
650-949-5719

Presented at Windpower 2000  
May 1, 2000

### **Abstract**

Automated Power Exchange (APX) operates markets that allow buyers and sellers of electricity to do business with each other easily, efficiently, and directly. The APX Green Power Market opened on March 30, 1998 with the start of the restructured electricity market in California, providing a wholesale marketplace for buyers and sellers of renewable power to transact. Those renewable energy plants that are no longer under utility contracts, and new merchant renewable plants, are selling through this market. The overwhelming majority of green buyers and green sellers operating in the California market use the APX Green Power Market. APX opened a Green Power Market in the Midwest on March 20, 2000 and plans to operate Green Markets in other areas of the country and the world.

During the first 14 months of the California market's operation, APX operated the APX Green Power Market as an hourly green market. Starting in May of 1999, APX transitioned to a "Green Ticket" approach, by which green power is traded via two components: 1) the hourly commodity energy and 2) the green attribute, represented by a "green ticket". Based on the results in the APX Green Power Market over the last two years, wholesale purchasers of green power have demonstrated a consistent willingness to pay a premium price for renewable energy.

The premiums paid for green power through the APX Green Power Market are presented, starting from the start of the market and ending with the current month. The variation in premiums is shown by technology, plant vintage, and CEC eligibility. "New Wind" has commanded the highest premium for all renewable technologies thus far.

### **Introduction**

Automated Power Exchange was founded in 1996 to offer a market to buyers and sellers of electricity that was simple to understand and easy to use. APX opened its first markets in California on March 30, 1998. Since then, APX has opened the APX-Ohio hub in First Energy's control area in July of 1999 and the APX Illinois hub in Commonwealth Energy's control area in March of 2000. The APX Midwest Green Power Market opened concurrently with the availability of ComEd EcoPower<sup>SM</sup> and Generic Renewable Green Tickets in the APX Midwest Green Power Markets, when ComEd launched its marketing of EcoPower<sup>SM</sup>, marking the first time renewable energy has been sold on the wholesale market in the Midwest.

The APX Green Power Market is the first forward, physical market specifically designed to facilitate direct transactions between suppliers and purchasers of renewable energy. Up until May 1999, APX operated the APX Green Power Market as a week-ahead hourly market. In May 1999, APX transitioned to a "Green Ticket" approach, whereby the green power is traded in

two components: 1) the commodity energy and 2) the green premium as represented by the Green Ticket. The commodity energy continues to be traded up to a week-ahead and scheduled in hourly blocks; the Green Ticket is traded in a calendar year market corresponding to the tracking and verification procedures of regulatory agencies.

Generators trade and schedule the commodity portion of their “green power” through a number of markets that APX offers in California:

- APX Week-ahead Hourly Electricity Market
- APX Week-ahead On-peak Block Electricity Market
- APX Week-ahead Off-peak Block Electricity Market
- California PX Day-Ahead Market
- California ISO Ancillary Services Markets, including Spin, Non-Spin, and Replacement Reserve, and Supplemental Energy

Generators trade the green attribute through APX’s Green Ticket Market. APX differentiates green tickets by technology, plant vintage, and eligibility for the California Energy Commission’s renewable programs (in California). The Green Tickets are traded in a calendar year market, as the attribute does not have to be “scheduled” into the grid. Rather, the Green Ticket represents the financial premium a green buyer is willing to make to a green seller. The yearly market corresponds with the California Energy Commission’s requirements for annual true-ups of green purchases by the energy service providers that serve direct access end-users. The Green Ticket approach provides a mechanism for buyers to buy 100% firm renewable energy and offers sellers an opportunity to receive a price premium for every megawatt-hour of renewable energy they input into the electric grid.

APX takes no position or title in any of the power that trades through its markets. In this way, APX maintains its impartiality as a disinterested facilitator of trades among buyers and sellers. All employees of APX must follow a code of conduct that explicitly prohibits them from trading any electricity commodities and from owning any interests in participating firms.

### **How the APX Green Market Works**

The APX Green Power Market provides wind plants a marketplace into which they can sell their environmentally preferred power. For green buyers, APX’s unique Green Ticket approach offers a simple and convenient way to buy green power and accurately track purchases.

The Green Ticket Market separates the green attribute from the hourly energy production, providing an opportunity to match the purchase of the green attribute with the green demand. Since the hourly demand for green power may not match the hourly production, this allows generators to receive a green premium based on the aggregate green demand, rather than any hourly green demand. This is particularly beneficial for intermittent generators such as wind plants and run-of-river hydro facilities, but also helps baseload plants to receive a premium for every megawatt-hour of green power produced.

Generators sell their projected hourly output up to one week forward, into any of the APX Markets for commodity energy. APX also provides scheduling services for the generators with the Independent System Operator (ISO). APX issues Green Tickets to generators to sell in the APX Green Power Market based on the actual meter readings from those generators. Buyers

purchase their projected commodity energy needs for their electric loads up to one week forward from any of the APX Markets. The buyer then purchases Green Tickets to match the amount of green power they want to deliver to their customers. The payment for the Green Tickets goes directly to the generators selling the tickets. Figure 1 shows the relationship between Green Tickets and meter reads.

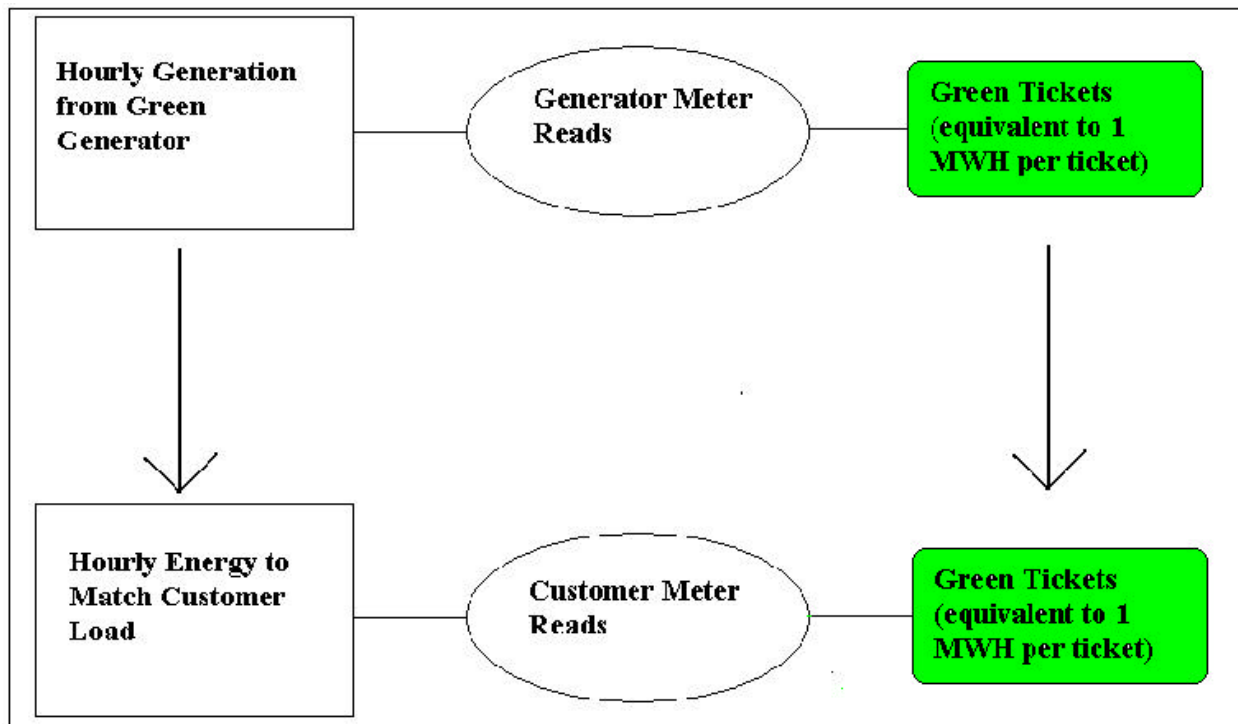


FIGURE 1. MATCHING GREEN TICKETS TO METER READS

Green Tickets are traded in a calendar year market. Year 1999 Green Tickets represent green power produced by generators in calendar year 1999, through December 31, 1999. Year 2000 Green Tickets represent green power produced by generators starting January 1, 2000. The California Energy Commission (CEC) requires energy service providers (ESP) to true up their green purchases on an annual basis for customer disclosure purposes. Thus an ESP would purchase a quantity of Green Tickets for each year equal to the total yearly-metered demand of the ESP's green customers. APX is keeping the Year 1999 Green Ticket market open for the foreseeable future, as the CEC is allowing ESPs to make "Customer Credit" claims for Year 1999 Green Tickets matched to year 2000 commodity deliveries. However, ESPs must match Year 2000 Green Tickets to year 2000 commodity deliveries for customer disclosure purposes.

APX opened the year 2000 market for Green Tickets on October 1 of 1999. This allowed ESPs the opportunity to purchase Green Tickets forward, thereby locking in the green premium up to 15 months forward. APX issued a small amount of Year 2000 Green Tickets to the generators forward, with the requirement that any shortfalls in generation would need to be made up by purchases from the market. As it turned out, ESPs did not start purchasing Year 2000 Green Tickets until January 2000.

Using a Green Ticket approach, it is easy and inexpensive to audit and verify green power production and delivery. APX is cooperating with the CEC and other regulatory agencies in the Western states as they adopt a green tracking approach to verify green power deliveries to consumers.

### **The APX Green Market in California**

The APX Green Power Market differentiates between different types of green power to meet the needs of the green marketplace. In California, Green Tickets are differentiated by the following categories:

- *Technology*
  - Biomass
  - Geothermal
  - Landfill Gas
  - Small Hydro
  - Solar
  - Wind
  - Generic Green
- Plant Vintage*
  - Existing
  - New (started operation on or after 9/26/96)
- CEC Credit Eligibility*
  - Eligible
  - Non-eligible

Sellers can sell into their own technology/vintage/CEC eligibility, and the Generic Green category. Buyers can purchase from any category.

To participate in the California green market, any green generator, whether they are located in California or another Western state, can and should register with the California Energy Commission as a "Registered Renewable Supplier". APX requires a copy of this certificate for green generators to participate in the APX Green Power Market. This certificate does not mean that the generator is "CEC Eligible" which is described in more detail below, but rather that they are a renewable generator according to the California definition.

Incentive programs administered by the California Energy Commission have played a big role in the development of the green power market in California. California's electricity industry deregulation legislation included a provision to collect \$540 million from customers for use in supporting existing, new, and emerging renewable electricity generation technologies from 1998 to 2002. The CEC developed guidelines for disbursement of these "Renewable Resource Trust Funds". Extension of most of these programs for another 10 years is being proposed in the California State Legislature at this time.

APX operates the APX Green Power Market™ consistent with the CEC's guidelines so generators can qualify for funding from the Renewable Resource Trust Funds. Buyers that are "Registered Renewable Providers" with the CEC can qualify for funding from the CEC's Customer Credit fund if they purchase "CEC Eligible Green Tickets" that match their commodity energy purchases. The Customer Credit started out at \$15/MWH in March 1998, and dropped to \$12.50/MWH in December 1999. It is currently proposed that this drop to \$10/MWH starting on July 1, 2000.

Green Tickets currently offered in APX's California Green Power Market include both resources that are "eligible" for funding from the CEC's Renewable Resource Trust Fund and those that are "non-eligible".

## **The APX Green Market in the Midwest**

On March 20, 2000, APX opened its Midwest Green Power Market. In the Midwest, Green Tickets are currently differentiated by the following categories:

- ComEd EcoPower Tickets
- Generic Renewable Tickets

The Wholesale Energy Group of Commonwealth Edison (ComEd) has entered into an agreement with the Environmental Resources Trust (ERT) to market renewable energy using ERT's EcoPower<sup>SM</sup> label. EcoPower<sup>SM</sup> is electricity that demonstrates net-environmental benefits over average system power. ComEd is initially marketing EcoPower<sup>SM</sup> composed of landfill-gas-to-energy resources located in Illinois. The company is considering including other renewable energy resources such as small hydropower, wind and solar. Electricity suppliers purchasing green tickets generated by a ComEd EcoPower<sup>SM</sup> source can use the EcoPower<sup>SM</sup> label in marketing EcoPower<sup>SM</sup> to their retail customers. Buying "Green Tickets" generated by a ComEd EcoPower<sup>SM</sup> resource guarantees that most of the price paid for the tickets will be deposited into a Renewable Energy Reinvestment Fund. Administered by the Environmental Resources Trust, this fund will provide low-interest loans to developers for additional renewable energy projects in Illinois and the Midwest.

Suppliers of qualifying renewable energy generated anywhere in the U.S. can offer to sell Green Renewable Tickets in the APX Green Power trading window. Generic Renewable Tickets represent the environmental benefits of electricity generated from one or several of the following sources: landfill gas to energy, wind, small hydro, solar, biomass and geothermal energy. Generic Renewable Tickets represent the environmental attribute from renewable generation. Generic Renewable Tickets currently are based on the generation of renewable power from plants throughout the United States. These plants have generated and input renewable-based electricity into the electric grid in their locale; they have also received payment for their electricity as a non-differentiated power plant. The Green Ticket is issued to the generator based on the actual meter read of the plant, allowing the generator to receive an additional premium for having produced power from environmentally-preferable resources. The generator also has signed an affidavit that they have not sold the renewable attribute to any other customer.

A purchaser of Generic Renewable Tickets from the APX Midwest Market can serve customers located anywhere in the United States except for California. According to the draft guidelines published by the National Association of Attorneys General, it is recommended that the provider purchasing Green Tickets disclose to their customers the nature of how the renewable energy was procured. APX also recommends that the providers disclose to their customers that the renewable energy may have been generated in a different part of the country than where the purchaser resides.

## The APX Green Market Window

Buyers and sellers interact with the market via the APX Market Window™, which is an electronic interface to the APX Market Engine™. As this electronic marketplace is open 24 hours a day, 7 days a week, buyers and sellers can place their orders to buy and sell when it is most convenient for them. At its simplest, all that is required is a PC and an Internet connection.

A sample screen shot of the California APX Green Ticket window is shown below in Figure 2. This is the screen by which buyers and sellers submit their orders for Green Tickets. Buyers and sellers can view all of the different Green Ticket categories being offered for a particular calendar year, in this case Year 2000, through this window. The user selects a different year, such as 1999, to see the Green Tickets still being offered for Year 1999.

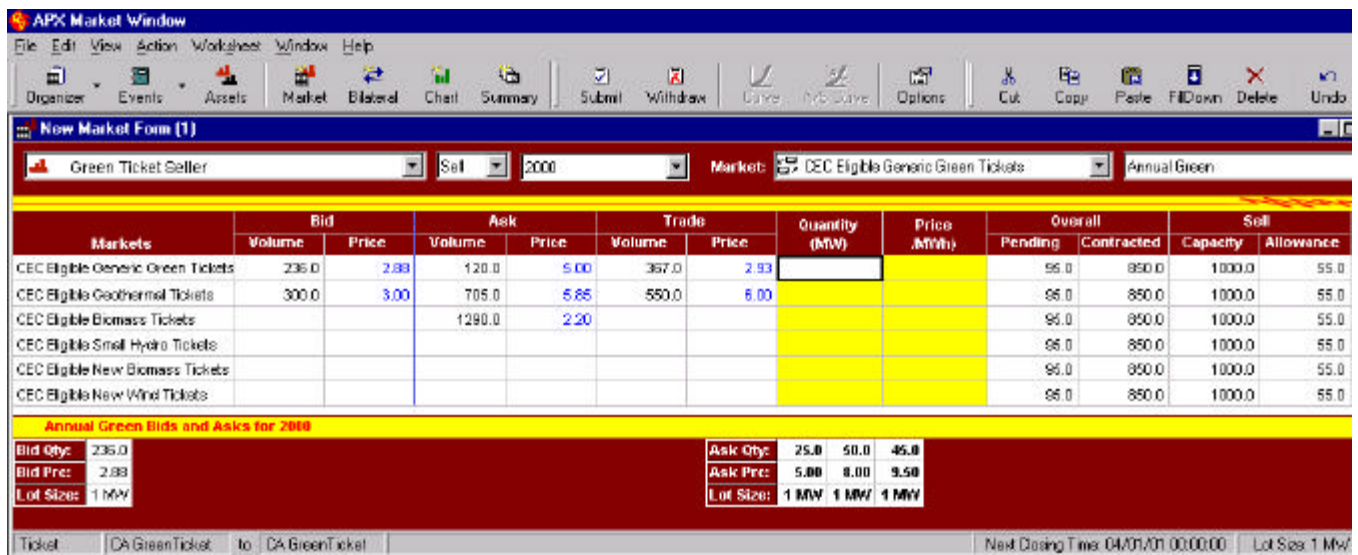


FIGURE 2. APX MARKET WINDOW GREEN TICKET SCREEN SHOT

## Prices in the APX Green Power Market in California

The price for power on the APX Green Power Markets is determined by a combination of available supply and market demand. If market demand exceeds available supply, the market price will increase to attract sellers. Similarly, if there is an excess of supply compared with market demand, the market price will decrease to attract more buyers.

Figure 3 shows the price history in the APX Green Power Market from July 1998 through April 1999, when this market was operated as an hourly green commodity market. During that time, the commodity energy and green attribute were traded together in hourly trades. This figure subtracts the commodity energy price, using the average California Power Exchange commodity energy price in each month, as the proxy for the commodity price. What's left is the premium, as shown in this figure.

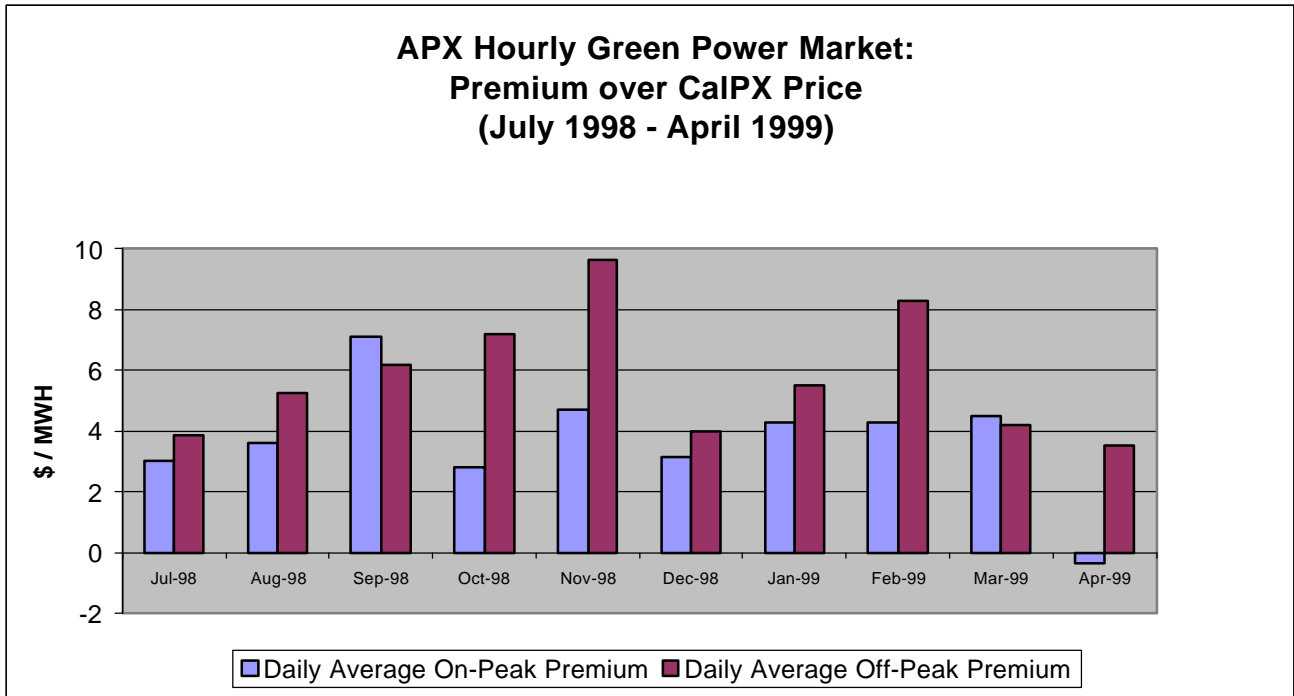


FIGURE 3. GREEN POWER PREMIUM FROM JULY 1998 TO APRIL 1999

Table 1 presents information on the trading of Year 1999 Green Tickets, showing the volume of trades and average prices for these tickets from the start of the Green Ticket Market in May 1999 through April 15, 2000. Figure 4 shows the Year 1999 Green Ticket results graphically. Table 2 presents information on the trading of Year 2000 Green Tickets, showing the volume of trades and average prices for these tickets from the start of trading in this market in January 2000 through April 15, 2000. The Year 2000 market was opened in October 1999 to allow forward trading by buyers and sellers, but no transactions occurred until January of 2000. Figure 5 shows the Year 2000 Green Ticket results graphically.

TABLE 1. SUMMARY OF AVERAGE PRICES BY TECHNOLOGY FOR APX YEAR 1999 GREEN TICKETS TRADED FROM MAY 1999 THROUGH APRIL 15, 2000

Green Ticket Type	Volume Traded (MWH)	Average Price (\$/MWH)	High (\$/MWH)	Low (\$/MWH)
CEC Eligible Generic Green Tickets	214,696	\$1.43	\$6.00	\$0.20
CEC Eligible Geothermal Tickets	390,211	\$3.09	\$5.25	\$0.25
CEC Eligible Biomass Tickets	35,138	\$3.10	\$8.56	\$1.25
CEC Eligible Small Hydro Tickets	3,591	\$5.99	\$8.52	\$0.30
CEC Eligible New Biomass Tickets	3,002	\$4.96	\$9.75	\$2.00
CEC Eligible New Wind Tickets	1,397	\$21.01	\$29.95	\$9.00
Total for Year 1999 Green Tickets	648,035	\$2.61		

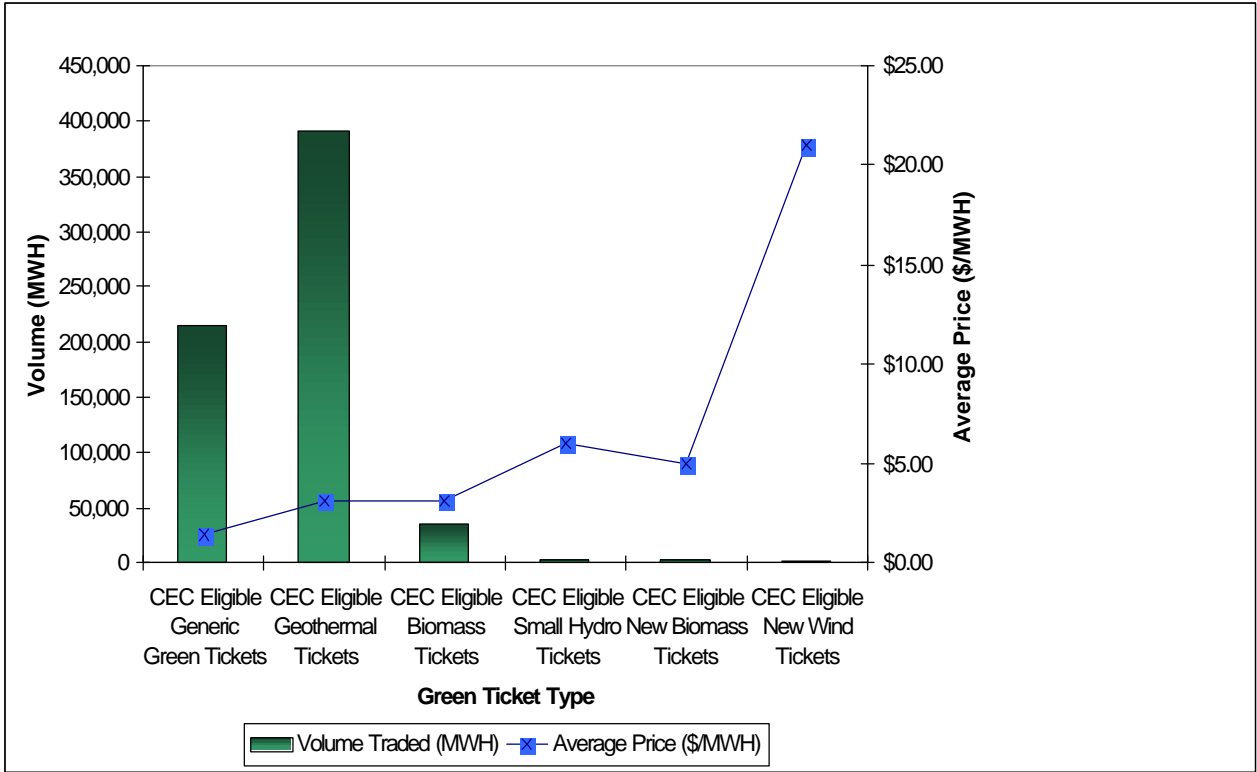


FIGURE 4. GREEN POWER PREMIUM FOR YEAR 1999 GREEN TICKETS, JANUARY 2000 TO APRIL 15, 2000

TABLE 2. SUMMARY OF AVERAGE PRICES BY TECHNOLOGY FOR APX YEAR 2000 GREEN TICKETS TRADED FROM JANUARY 2000 THROUGH APRIL 15, 2000

Commodity	Volume Traded (MWH)	Average Price (\$/MWH)	High (\$/MWH)	Low (\$/MWH)
CEC Eligible Generic Green Tickets	30,638	\$4.22	\$8.75	\$0.50
CEC Eligible Geothermal Tickets	37,830	\$4.30	\$6.00	\$3.00
CEC Eligible Biomass Tickets	1,540	\$3.03	\$4.00	\$3.00
CEC Eligible Small Hydro Tickets	11,170	\$4.30	\$5.00	\$4.00
<b>Total</b>	<b>81,178</b>	<b>\$4.25</b>		



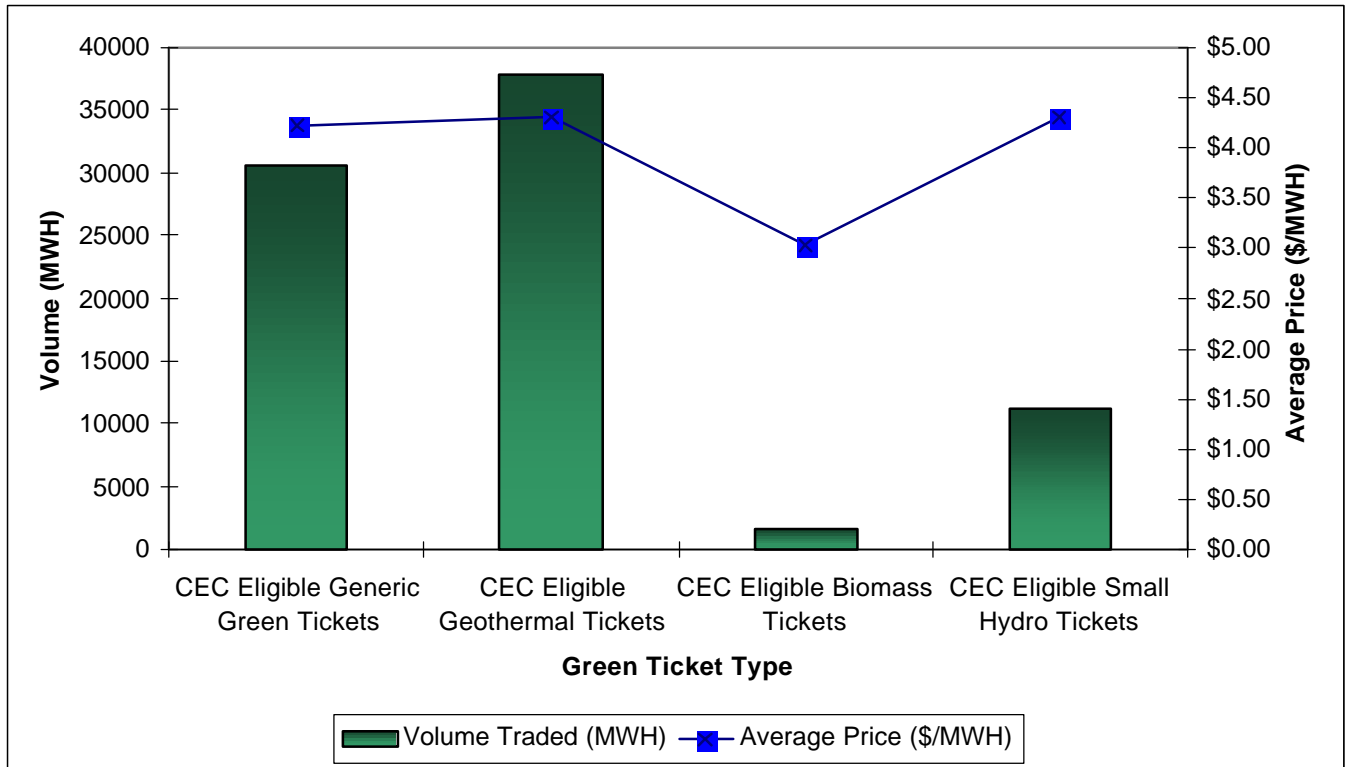


FIGURE 5. GREEN POWER PREMIUM FOR YEAR 2000 GREEN TICKETS, JANUARY 2000 TO APRIL 15, 2000

### **Opportunities in the Midwest Green Power Market**

Trading of Green Tickets began on March 20, 2000 in APX's Midwest Green Power Market. Depending on the disclosure requirements of different states, wind generators in the Midwestern states may be able to sell Generic Renewable Tickets via APX to wholesale buyers in the Midwestern and Eastern states. As the market develops in the Midwest and East, APX will further differentiate the Green Tickets to reflect the specific attributes of each renewable technology and/or the requirements of different states.

### **Opportunities for Wind Energy in the APX Green Power Market**

At this time, many existing wind plants are still operating under their standard offer contracts with the investor-owned utility companies in California. However, the utilities are interested in buying out some of these contracts. Once a wind plant is no longer under its utility contract, it is free to sell that power into the APX Green Power Market. In this market, the plant can easily sell its output to a diversified portfolio of buyers who are specifically interested in purchasing renewable energy generated from wind plants.

The APX Green Power Market provides an opportunity for wind plants in California and the Midwest to receive a market premium for renewable power. As a unique offering of any power exchanges in existence today, the APX Green Power Market provides a one-stop shop for both buyers and sellers of renewable resources. As new markets open in the U.S. and around the

world, APX will open Green Power Markets to provide biomass plants and other green generators with an easy, accurate, and inexpensive method to capture a premium for their environmentally-preferred power.

*Jan Pepper was the Director of Green Market Development for Automated Power Exchange from April 1997 to May 2000. She is currently providing consulting services in the renewable energy industry through her firm, Enertron Consultants. She is in the process of starting up a new company with some other investors that will be involved with green power markets and green power verification across the country.*