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MEMORANDUM

From: Jurgen Weiss[1]

To: CPUC

RE: Summary of Recommendations for REC trading within the California RPS

Date: September 24, 2007

This memo is to summarize the analysis and recommendations contained in the presentation given at the REC workshop held at the CPUC on September 5, 2007.

Executive Summary

The principal purpose of a renewable portfolio standard is to encourage incremental electric generating capacity from renewable sources. There is both theoretical and empirical evidence that long-term contracts for renewable power play a crucial role in enabling project financing for renewable power projects. California's existing implementation of the RPS makes the signing of long-term contracts an important component of RPS compliance. There is some concern that the current reliance on bundled long-term contracting presents RPS compliance hurdles for some Electricity Service Providers, notably smaller and competitive suppliers, and that furthermore the bundling of energy, capacity and renewable attributes leaves some renewable development potential unused. Renewable Energy Credits ("RECs") should be seen as a complement to existing long-term contracting practices rather than a substitute. Therefore, any implementation of a REC-based compliance system should not create an incentive to move away from long-term contracting for renewable power, but rather provide a means for enabling additional renewable power generation in ways the current long-term contracting structure does not allow, or to enable the same new renewable generation at a lower cost.

Both supply of and demand for RECs are likely deviate from the standard model of competitive markets. Demand is driven by the RPS itself and, absent banking and borrowing, is essentially perfectly inelastic at the RPS level. The supply of RECs is likely to be very elastic, with a marginal cost close to zero, up to the level of the total

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amount of renewable power generated in any given compliance period, and perfectly inelastic beyond that point. As a result, given the uncertainty surrounding the exact levels of both REC supply and demand in any given compliance period, the price of RECs implied by the intersection of supply and demand is expected to fluctuate between very high levels (if there is a supply shortage) and very low levels (if there is excess supply), but rarely at intermediate level. The resulting potential volatility of REC prices makes financing of renewable power projects more difficult than it would be if markets for RECs could be structured in ways that make them behave more like other markets.

The relationship between renewable project financing and long-term contracting

The recent history of power generation in the United States provides strong evidence that it is very unusual for new power plants to be built without the support from long-term contracts. The brief episode of the late 1990s, when many power plants were built on a merchant basis and often without significant long-term contract coverage, resulted in the melt-down of electricity markets and the bankruptcy of many of the companies involved.

The reasons are simple: power plants, including most renewable power projects, require large, lumpy and sunk upfront investments. Typically, such projects are funded with a significant amount of debt. Even though equity incentives such as the production tax credit also lower the cost of equity for renewable projects, the same will typically be true for renewable power projects. Debt is generally tax-advantaged relative to equity; it is also generally cheaper than equity, at least for companies without significant default risk.

However, debt financing typically requires that certain financial conditions be met. Among the most important criteria banks used for making lending decisions are interest coverage ratios, i.e. measures that captures the relationship between the minimum amounts of certain future revenues available to service interest from debt obligations. Traditionally, enforceable long-term contracts with creditworthy counterparties have provided the necessary certainty of future revenues generally required for banks to finance power plant construction projects.

Acknowledging that the amount of stable and predictable revenue streams will generally be a key determinant of the amount of debt financing available for a (renewable) power generation project, it is important to ask to what extent RECs do or can contribute additional benefits above and beyond the alternative of contracting for

renewable power through long-term contracts that bundle both energy and renewable attributes.

A related question is whether the long-term bundled contracting approach to meeting RPS goals should be replaced with a pure REC-based approach, or alternatively, to what extent REC markets can supplement and improve the functioning of a system characterized by a significant amount of bundled contracting.

The answer depends on the extent to which unbundling of power and renewable attributes increases or decreases the ability to create predictable and guaranteed future revenue streams from renewable power projects.

Standard REC market design results in volatile REC prices

Unfortunately, several aspects of "standard" REC market design limit the situations, in which REC markets are likely to provide additional or better opportunities for locking in stable revenues over some future period.

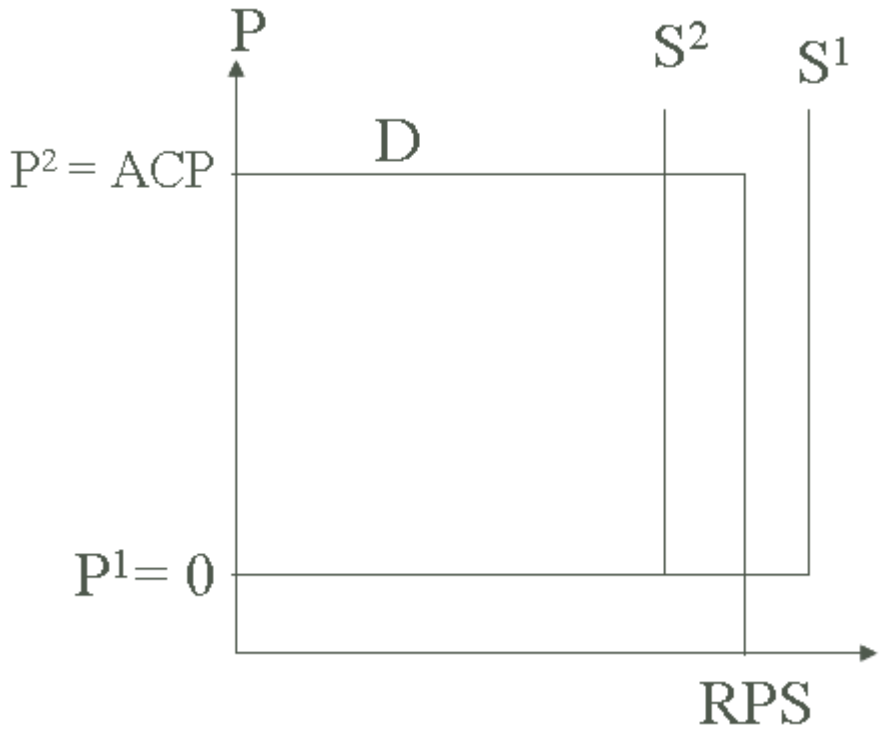
The limited experience with REC markets to-date suggests that REC markets, by themselves have not been very effective at stimulating additional renewable power project development. Although little empirical research has been published, it appears that REC spot markets have been quite volatile and that the development of forward market activity for RECs has also been slow.

The sometimes extreme volatility in spot markets for RECs and associated limited development of forward market activity for RECs is quite likely linked to a fundamental design element of REC markets.

REC markets are created by the RPS requirements. The RPS typically defines a goal for renewable power as a percentage of retail load served. While significant uncertainty exists as to the exact number of MWh of retail demand in any given compliance period until the compliance period is over, the percentage target ultimately translates into a fixed number of MWhs from renewable power needed for compliance with an RPS in any given compliance period. In most states with REC markets, there are no rewards for over-compliance, and failure to comply results in an alternative compliance payment ("ACP"), essentially a penalty of some amount per MWh of shortfall of

renewable power procurement relative to the RPS target[2]. This creates a demand curve for RECs that looks quite different from demand curves in "typical" markets. Rather than the standard downward-sloping demand curve, this regulatory demand curve will tend to be vertical, or perfectly inelastic. Furthermore, the supply of RECs is also likely to differ significantly from the ideal of the standard upward-sloping supply curve. This is because RECs, the renewable attributes of renewable power generation, are a by-product of the energy produced from renewable sources, which in turn are in most cases from projects with relatively high fixed and low variable cost. As a result, the generation of an incremental REC from a typical renewable power plant will have extremely low marginal cost. Furthermore, the number of RECs that can be supplied is directly tied to the amount of electricity generated by the renewable power project, which in turn for many renewable technologies cannot be controlled by the power plant owner, but rather depends on external forces such as the amount of wind or sun in a given year. Therefore, the supply of RECs will be very elastic at a price close to zero up to the total amount of electricity produced by renewable sources, and perfectly inelastic thereafter. Figure 1 below illustrates the resulting REC market.

Figure 1: Supply and Demand in a simplified REC market



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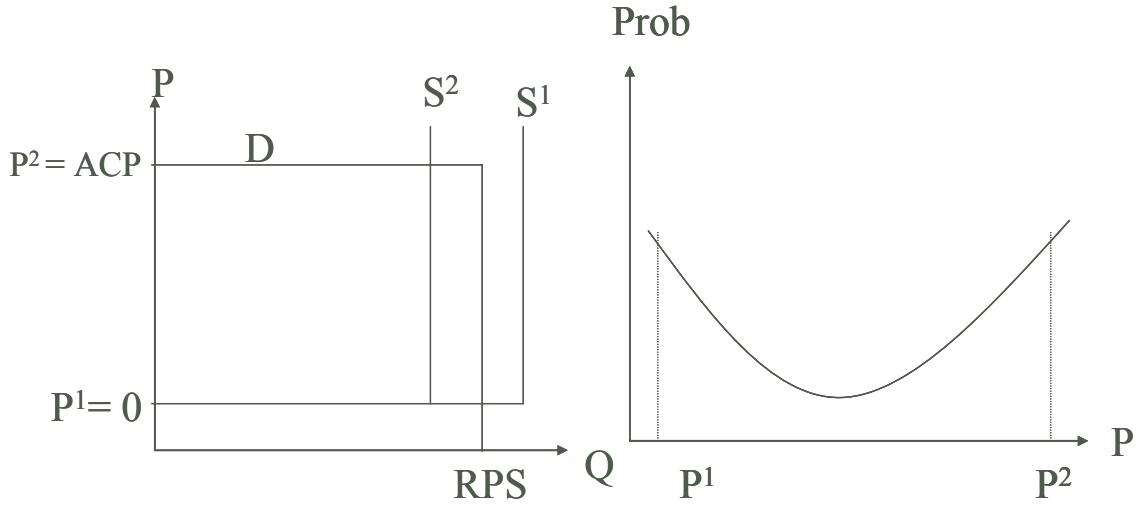
Because both supply and demand for RECs depend on factors typically only known at the end of the compliance period and not easily controllable – wind, sunshine, weather – there is significant uncertainty about the exact positions of the vertical parts of both supply and demand for RECs. The result of these uncertainties will be that in any given compliance period the price of RECs will be either very high or very low, depending on whether there is excess supply or excess demand, but rarely in the middle. When there is excess supply of RECs, spot prices for RECs will tend to be very low. When there is excess demand, prices will tend to be very high and likely near or at the ACP. In the theoretical set-up, prices are only at the intermediate level if supply and demand for RECs is exactly equal, a situation that is very unlikely to arise, and even then the price of RECs is indeterminable. This boom-bust feature of a REC market is very different from the standard view of markets with downward-sloping demand and upward-sloping supply, where prices are expected to be at the intersection of supply and demand and, as supply or demand shifts due to some unforeseen event, prices move away from the expected price more gradually. Figure 2 below shows the impact of this boom-bust feature on the expected distribution of REC spot prices.

Figure 2: Distribution of Spot Prices for RECs



In summary, the nature of supply and demand for RECs create a basic market framework that lends itself to REC prices that follow a boom-bust pattern, i.e. spot market prices characterized by large swings from very high to very low. This means that the certain or predictable price of a spot-market REC is very low, which in turn implies that bank financing from the revenue stream created by spot market RECs is limited.

Possible Solutions

The boom-bust feature of markets created by fixed demand created by regulatory mandate is not new – it has been prominent in capacity markets for energy for a while, and the discussion of how to address the problem in those markets has been active. Two solutions seem to be emerging: the requirement to procure capacity through long-term contracts, and the introduction of a regulatory and downward-sloping demand curve for capacity.

Procurement through long-term contracts typically involves a set of auctions for long-term contracts to procure capacity. If applied to renewable power, as is already done in New York through NYSERDA, a certain amount of renewable power is typically procured through an RFP process, a process that is similar to an auction process. To the extent that a portion of the RPS goal is achieved through such a long-term contracting approach, the supply of and demand for RECs would be reduced by the amounts already procured through long-term contracting, with a REC market primarily designed to provide a balancing mechanism for the amount of renewable power over- or under-procured through long-term contracts.

A downward-sloping regulatory demand curve has been implemented for electricity capacity in the NYPP and has been approved in PJM. The demand-curve replaces the fixed capacity target – such as some percentage above expected peak demand – with essentially a target range.

In addition, REC markets, either by design or by subsequent actions, generally include features that tend to alleviate some of the boom-bust concerns. Among those, the ability to bank (or borrow) RECs across several compliance periods[3] is most prominent. Also, Massachusetts has supported the creation and funding of risk mitigation tools

[3] There is little experience with what an optimal banking and borrowing period may be.

similar to those used in other financial and commodity markets through the Massachusetts Technology Collaborative ("MTC"), which are also designed to overcome some of the problems associated with spot market volatility of RECs. MTC uses some of its funds to buy unbundled RECs under long-term contracts. It also offers a variety of other risk management tools such as options and collars that allow at least partial hedging of the price risk associated with RECs.

Among the various solutions, banking and borrowing of RECs and the insistence on long-term contracting emerge as the most promising avenues when redesigning the fundamental RPS standard itself is unlikely to be feasible.

Banking and borrowing of RECs allows for the kind of intertemporal arbitrage that is a very standard feature of many markets. Expressed positively, banking and borrowing allows market participants to react to uncontrollable supply and demand uncertainties and should lead to more stable demand and supply balances over time and is likely to create some incentives for forward-contracting for RECs at intermediate prices. If spot-market prices for RECs are low, load-serving entities may buy extra RECs and bank them for use in future compliance periods. If spot market prices for RECs are very high, the same LSEs may use either previously banked RECs or borrow from the future, which essentially means under-complying in one year by committing to over-comply in the future. Both actions would tend to introduce some elasticity in REC demand and will go some ways towards attenuating the REC price volatility issue.

California's RPS and the Potential Role of RECs

California RPS currently does require long-term contracting and hence incorporates an important element of successful RPS design. Given that long-term contracting is likely an important precondition for the majority of renewable power development projects, RECs should be seen as a complement, and not a substitute for long-term contracting for renewable power. Therefore, it would be a mistake to copy East Coast REC and procurement regimes, where the regulated suppliers of last resort (under retail choice) are prohibited from signing long-term contracts.

Furthermore, current CA RPS rules put the burden of non-compliance on investors, not ratepayers, as penalties for non-compliance cannot be passed through to ratepayers. This feature additionally creates a positive incentive for new renewable power development and should be maintained in a system with RECs as an alternative compliance mechanism. The alternative compliance payment, which is a common feature of other REC markets (otherwise, REC prices could become untenably high in periods of supply shortage – an experience California is unlikely willing to repeat),

should not be an alternative way to comply with the RPS, but rather the penalty borne by investors should be maintained.

However, as discussed earlier, in a market with a shortage of renewable power supply, REC prices are likely to be close to if not equal to the ACP. It will therefore be important to develop mechanisms that ensure that total compliance costs are somewhat related to the actual cost of supporting renewable power projects and do not result in windfall profits to developers.

As discussed above, a system of banking and borrowing may alleviate this boom-bust pricing problem to some extent. It may be fruitful to explore alternatives to standard approach of banking (or borrowing) RECs without interest for a certain number of compliance periods. For example, the impact of borrowing and banking with interest may provide attractive incentives beyond those of the standard borrowing and banking approaches. For example, it might be fruitful to investigate the incentive effects of having a REC that is banked lose some of its value in each subsequent period – 1 REC in the current compliance period may only be worth 0.9 RECs if banked until the next compliance period. Similarly, a REC borrowed from next period may only be worth 0.9 RECs in the current compliance period.

Another approach for regulated utilities might be to require partial procurement of the RPS target through long-term contracts and/or to require utilities to show that renewable power could not have been procured more cheaply through long-term contracting or self-generation.

As long as some of the pitfalls associated with REC markets described above are avoided, RECs could complement a system for fostering renewable power already working reasonably well, notably by increasing compliance options for non-regulated electricity suppliers and small municipal entities and, in the ideal case, by providing an additional funding mechanism for renewable projects: As a goal, a successful REC market implementation would lead to projects that are not economically feasible with bundled long-term contracts, rather than displace long-term contracts as the norm for complying with the RPS.

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