

Volatility, Capacity and Reliability

Capacity and energy are separate commodities. Some contend that energy prices can be capped at politically expedient levels without issue if a capacity market is mandated. Really?

A price cap inevitably creates market distortions, only one of which is a tendency toward supply shortages. Can a separate capacity market correct this? The evidence is at best mixed; most weighs against this view. For starters, consider other markets. Is a purveyor of orange juice, oil, aluminum or pork bellies required to certify that production capacity exists? How can you be certain that your local supermarket will have orange juice when neither they nor their wholesaler can produce any evidence that their supplier has an orange tree? Does a pork belly trader have to show "Proof of Pig"?

No one expects other markets to embed specially designed incentives for reliability. In most markets, reliability is assured solely through a payment of damages guarantee backed with credit assurances. The consequences of non-delivery become financially painful, even ruinous to the seller. The result is a reliability requirement that finances reliable systems. Proof of Pig is less important than Proof of Bank Balance in creating reliable systems with an optimal level of backup supply.

But, some contend, electricity is different. Is it? Again, the evidence is mixed. Despite the teething troubles of experimental market structures, electricity can and does trade successfully like any other commodity in many countries and in regions within those countries.

Why is it that a profit-driven financial arbitrageur like Morgan Stanley will finance, build and operate peaking plants, the basic guarantor of reliability, outside of power pools, knowing the plants would be unlikely to operate much? Why did Morgan Stanley specifically seek out markets without capacity payment guarantees or special incentives of any type?

How Different is Electricity?

Options Not Forwards

Electric supply consists of options rather than forwards. Operating an electrical system does differ from other commodities. While an oil well or gas well can cease production, its variable operating cost is so low that this is rarely cost effective. By comparison, the fuel cost is so high a component of the variable

operating cost to a power plant that plants are switched on and off sometimes multiple times in a single day.

Integrated Physical Grid

The delivery system is an integrated grid, and the laws of physics drive flows more than the laws of economics. As a result, it takes quite sophisticated models to derive the opportunity costs and associated market prices at each point or node on a grid. An electricity market needs nodal prices to function effectively. By injecting power at the wrong location, a generator can impose costs on the grid that far exceed its own operating cost. Other markets also demonstrate location-specific prices, but price differentials between delivery points can be allowed to develop more naturally than in electricity on an integrated grid.

Costly Storage

Many claim electricity cannot be stored. This is not entirely true. It can be stored, but it is more costly to do so than it is for oil or gas. Electricity in fact has a few seconds of embedded, essentially costless, storage in the kinetic energy of the rotating generators. Gas by comparison has a few minutes of embedded storage in the compression of delivery pipelines and oil has a few days of this “free” storage in tanks and tankers. No wonder then that pressure to allow each market to trade more freely arose with the technology allowing prices to be discovered, communicated and acted upon within the time constraints of embedded storage.

Essential Commodity

Electricity is an essential commodity. Perhaps, but so are foodstuffs like grains as well as fuel oil and gas in winter.

Too Volatile

Electricity is too volatile. It has to be capped. But a price cap inevitably leads to supply shortages so we must also have a capacity market to offset this. While a price cap does indeed create market distortions, is electricity really too volatile? Volatility is a consequence of excess demand or a supply shortage, both of which can occur even in the presence of excess capacity. Power plants fail unpredictably. An expanding economy and weather patterns can drive demand to unexpectedly high levels. A capacity market reacts too slowly and cannot send the signals necessary to restore balance when this occurs. Only a high spot energy price can provide the short-term signals needed.

Capacity

What exactly is capacity? Capacity is an ability to produce. In electricity, capacity is measured in MW. One hundred MW of capacity has the ability to produce 100 MWh of energy over one hour of full output. To have marketable value though, capacity must represent some right or service obligation. In some cases it clearly does. Here are four separate cases.

Insurance Value

Capacity might be viewed as insurance/protection against market failure. Market failure is defined here as the circumstance when energy cannot be sourced no matter how high the bid price of a prospective buyer. In such a case, if reserves are used up, system operators begin to shed load. Theoretically, the first load shed would be the load served by a supplier that cannot lay claim to a source of supply. The ultimate source of supply is a physical generating asset. Allocating load shedding on an integrated electric grid is easier said than done however. If the market can truly be expected to work in this manner, then capacity as defined here would have value. That value would be driven by the probability of such market failure and the penalty for failure to supply under those conditions.

Consequently, the market may not allocate shortages as expected. In July 1999, during a period of low supply, Cinergy was reported to have simply relied on power available at its interconnections with other utilities rather than to have instituted load shedding to meet its supply shortfall.¹

Energy Option Value


An option to purchase energy at a fixed price is another perspective of capacity. This is just the financial analogue of the operating procedures of power plants. Subject to unit flexibility, a plant is switched on to generate when the variable cost of operating is less than the revenue earned (or cost avoided) in the wholesale electricity market. Likewise, a financial call option is exercised when the market price exceeds the strike price.

¹ *From Fortune Magazine March 5, 2001* "On three afternoons in late July {1999}, spinning generators all over the Eastern Interconnection, the grid east of the Rockies, had mysteriously slowed, a sign that somewhere a mammoth load had unexpectedly come online. The load alarmingly depressed the Interconnection's AC frequency--when the grid's normal 60-cycles-a-second rhythm dips as little as 2%, operators may be forced to activate emergency "load shedding," or rolling blackouts, to prevent damage to generators. (If generators go even slightly out of sync with the grid, terrific forces build up inside them, potentially cracking turbines or causing fires.)

NERC, the reliability council, launched an investigation that led to Cinergy. On the three days in question, the utility had quietly siphoned 9,616 megawatt-hours from power lines linking its service area to surrounding ones--in effect, it had taken electricity worth tens of millions of dollars from unsuspecting peers. Worse, it had knowingly "jeopardized the reliability of the Eastern Interconnection" in "blatant disregard for NERC policy," raged a Dec. 6 letter to the utility's CEO from NERC's regional office in Ohio. Cinergy, which didn't contest the charges, says it has taken vigorous steps to ensure such episodes don't happen again."

<http://www.fortune.com/fortune/articles/0.15114.367749.00.html>

Many argue that this value is insufficient to ensure the financing and construction of supply. However, it is exactly and solely this value that has caused Morgan Stanley to finance, construct and operate not one but three peaking power plants. All three are in regions where no mandated capacity payment was expected and no price caps were expected.



ICAP Market Design Overview

- Deficiency Rate Options
 - FERC has Stated that the Deficiency Rate Should be Based on the Levelized Carrying Cost of a New Combustion Turbine
 - Current Rate is \$4.87/ kW-MO. This is Based on the PJM Rate Adjusted for UCAP vs./ ICAP
 - Option 1 Would be to Match the Current PJM UCAP Rate of \$5.33/ kW-MO.
 - PJM has Stated that “This Rate is Old and Needs to be Updated.”
 - Option 2 Would be to Use the Results of the e-Acumen Study that the ISO Commissioned
 - Calculated Rate is \$6.15/ kW-MO.
 - A Number of Participants have Questioned Assumptions Used
 - Option 3 Would be to Match the NYISO “Upstate” Rate of \$10.50/ kW-Month

Arbitrage Value

If the holder obtains a special usage right, value is created. For example, PJM imposes a \$1,000 price cap. In 1998, the mid-continent markets like ECAR did not. Only the owner of a generator in PJM, or the owner of the rights to that unit specific capacity, held the right to move energy out of PJM when PJM was capacity constrained. When prices in PJM hit the \$1,000 cap, the capacity holder could sell outside PJM at a higher price. Accordingly, when forward market prices migrated upward, the value of a right to this unit specific capacity migrated toward that of a call on energy struck at \$1,000 per MWh. Capacity transferred a usage right in this case.

Regulatory Value

Finally, capacity can be given value by regulatory fiat. In the case where a rule requires retailers to purchase a certificate of access to capacity, this "regulatory capacity" will have value. This is the case in some pools where retailers must hold a multiple of their peak load in certified, installed capacity (ICAP) or face a deficiency charge. Obviously though, any change in the regulatory decree changes this capacity value. For example, lowering the amount of capacity that must be held will lower capacity value. Also, since this value relies on regulatory whim, a viable forward market for ICAP will not develop. With no forward market, there is no ability to hedge and so financing ICAP supply is expensive.

Sample slide from a NEPOOL presentation on ICAP illustrating the arbitrary nature of ICAP in the Deficiency Rate underpinning ICAP values.²

² http://smdint.iso-ne.com/cmsmss/Standard_Market_Design/Draft_Market_Rules/Technical_Review_Sessions/31

The problem for developers, owners and financiers in all these cases is simple. How much are they prepared to bet on these theoretical values? As an option on energy, capacity has value and, though that value is volatile, it can be hedged. So selling energy or options on energy forward at a fixed price to a creditworthy buyer is a sensible way to ensure earnings targets are met and interest payments are made. Forecasting and then relying on the forecast of value that only exists in the presence of either market failure or price caps or regulatory action, is not hedgeable and not so sensible.

Optimal Mix of Generating Assets

Under cost-of-service regulation, utilities practiced least-cost planning. The objective of the plan was to build the mix of plant, base, intermediate and peaking that would serve expected load at the lowest possible cost. The peak loads should be served by plant having low capital cost and high operating cost. Baseloaded plant serves load with a longer duration. Greater efficiency and a lower variable operating cost over a longer operating time offsets the higher capital cost.

If one accepts that an optimal mix of supply exists and is desirable, it is hard to see how a market that specifies a capacity market separate from a capped energy market can get it right. The regulatory capacity component is not readily hedgeable. Thus to be effective, it needs to be far larger than it would be as a simple call on energy in an uncapped market. The call on energy is hedgeable and financeable whereas ICAP is not.

A cursory look at the RDI database shows that, since 1995, a higher proportion of peaking plant was built outside capped power pools than inside them. One would expect a bias toward high efficiency plant in the presence of a price cap. A price cap devalues an option having a high strike price relatively more than it devalues an option with a low strike price.

Encouraging Investment in Capacity

- Why does an investment bank commodity trading division build plant?
- Why is this peaking plant rather than intermediate or baseload plant?
- Why not build in a Power Pool?
- Why build outside of markets where ICAP exists?

Why Build?

When forward markets indicate the need for new plant, development, and operating costs of a plant can be hedged and the plant therefore financed. Plant will be built.

Only in areas where the historically vertically integrated industry is disaggregated will this readily occur. In one example, the Oglethorpe Power Corporation in Georgia restructured, removing all-requirements service contracts with the 29 member EMCs. When Morgan Stanley won a contract to serve part of this load the expectation was that the power needed would be purchased from the open market. This happened immediately in the form of proxy hedges placed at liquid trading points. These hedges signaled to the market that a shortage was looming and forward power prices rallied as traders saw the buying and realized that market fundamentals had changed. The pre-purchased hedging power was then sold at a profit and used to finance local peaking supply to meet OPC's needs. OPC ended up with stable supply at below then-market prices.

Why Peaking?

There are two components of forward markets that drive plant value. As an option, the plant value is sensitive to volatility as well as to absolute price levels. Capturing an overall price increase requires a forward or in-the-money, low strike option. A combined cycle or coal plant suffices. Capturing volatility value is best accomplished with at-the-money options. Forward price curves logically trend toward levels at which no existing supply option can make abnormal profit. In the shorter term though, arbitrage can exist. The fastest, lowest capital cost manner in which to capture this arbitrage tends to be peaking plant. The development cycle is short and the capital costs are low. In uncapped markets, capacity shortages are rapidly covered.

Why not a Pool?

Power pools have price caps. A peaking plant is heavily disadvantaged in such a market both absolutely as well as relative to other types of plant. As will be discussed next, an ICAP payment does not offset this disadvantage.

Why no ICAP?

Institutionalized and legislated ICAP values are not readily modeled using customary financial technology. As such, they are not readily hedged. Worse still, it is axiomatic that political pressure to reduce ICAP values when they rise is matched with an explicit ability to do so. By contrast, energy prices are harder to influence except by adding supply. Hence, the traders who provide the speculator function to facilitate long-term contracts are inherently bearish - willing sellers and not buyers - of long term ICAP. This component is not readily hedgeable and thus not readily financeable.

ICAP diverts regulatory attention from the real issues. In lobbying for it, incumbent developers see a windfall, but few can seriously argue that it is an efficient incentive to build. Why is an uncapped spot market in combination with a vibrant forward market in which to hedge against high prices not preferable?

Summary

Market price caps lead to suboptimal investment. This is widely accepted. In electric markets, popular opinion currently seems to hold that uncapped markets are politically unacceptable and, therefore, the required price cap must be matched with some form of capacity payment or ICAP market to restore appropriate investment incentives.

In fact, as with most well intended interference in markets, unintended consequences follow. ICAP markets cannot function as designed. At a minimum, being designed as a form of regulatory interference, the inherent regulatory ability to change ICAP values makes it difficult for financial engineers to offer hedges against ICAP volatility. Furthermore, the bias of political whim to act against increases in traded ICAP values biases hedge providers toward selling down rather than bidding up forward ICAP prices.

There should be several predictable results from the bias introduced in capped energy markets with separate ICAP.

- Expect a bias toward building base and intermediate plant and away from peaking plant.
- Expect a perceived need to compensate for a lack of peaking resources through special demand side initiatives.
- Expect windfall profits to incumbent generators and a boom-bust development cycle where new plant is only built after spot prices clearly signal a need for investment rather than forward prices more gradually providing this signal.
- Expect a forward market in which energy trades out much further than ICAP.
- Expect an ICAP market that remains persistently backwardated where forward values are lower than prompt values.

Leaving consumers or their suppliers exposed exclusively to spot prices that rise and fall freely with changes in supply and demand fundamentals is politically unappealing. However, a market in which prices may rise and fall as needed to match supply with demand can work when coupled with a viable forward market in which to hedge against the inherent volatility of electricity prices.

Morgan Stanley's Commodities Group entered the North American electricity market in 1994 and has been an active dealer since then in all North American regions as those markets have opened up. Morgan Stanley has in that time helped numerous clients to successfully hedge electricity price risk as well as other commodity and financial market risks.

John Woodley is a Managing Director at Morgan Stanley responsible for all electricity product origination and structuring. He started his career in power plant operations in South Africa where he was an operator in a 3,600 MW coal fired plant. After moving to the United States in 1984, he held various positions within The Southern Company before being hired by Morgan Stanley in 1994 to help start the electricity desk. John has a BS in Electrical Engineering as well as an MBA and an MS in Finance.