An Efficient Centralised Forward Capacity Market

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Understanding the problem

- Most proposals would solve some problem.
- But, which problem?

- Much time is spent explaining the solution, but little time is spent modeling the problem.

What is the adequacy problem ?

Adequate capacity = enough capacity to minimize the cost of power + cost of lost load.

The Adequacy Problem: What design will provide adequate capacity (or come close)?

But markets provide "optimal" capacity.

So, why is the "adequacy problem," a problem?

A popular solution: the “market approach”

The problem is regulators (price caps), and
engineers (1-day-in-10 years is too much reliability).

So the solution is:
No price caps or capacity requirements.

These claims cannot both be right.
If engineers want too much reliability, that proves the market cannot solve the adequacy problem.

A pure market ➔ 100% reliable adequacy

1. When a pure market determines capacity, price is determined by:

   Supply = Demand

2. Loss of load ➔ Supply ≠ Demand
3. A pure market ➔ There is no loss of load.

   QED

No one believes 100% reliable adequacy is optimal. ➔ Adequacy problem is caused by a market failure, not by the regulator.

What flaw causes the market failure?

- Market risk ?
- Regulatory risk ?
- Too little long-term contracting ?
- Two demand-side flaws?

1. Market risk is not a market flaw

- All industries are risky, investors are risk averse, and this always increases costs.
- Peaker risk is not correlated with the stock market, so CAPM (capital asset pricing model) says it can be diversified.
- But what if the risk premium is huge?
- A peaker might costs 900 €/kW. It might take 18 hour to cover fixed cost instead of 6 hours.
- This would not break the market.

2. Regulatory risk

- Regulatory risk might cause a market failure
- Why is there so much regulatory risk?
- Because there are real market flaws which require regulatory intervention.

- Regulatory risk is not the <u>fundamental</u> problem.

3. Insufficient long-term contracting

- Few computer chips are sold 2 years in advance.
  (Because they have not been invented.)
- Few people buy their cars 10 years in advance.
- Few people book hotel rooms 10 years in advance.
- Car factories, chip factories & hotels are just as expensive as power plants.
- Lack of long-term contracts is not a serious problem—unless there is some other market flaw.

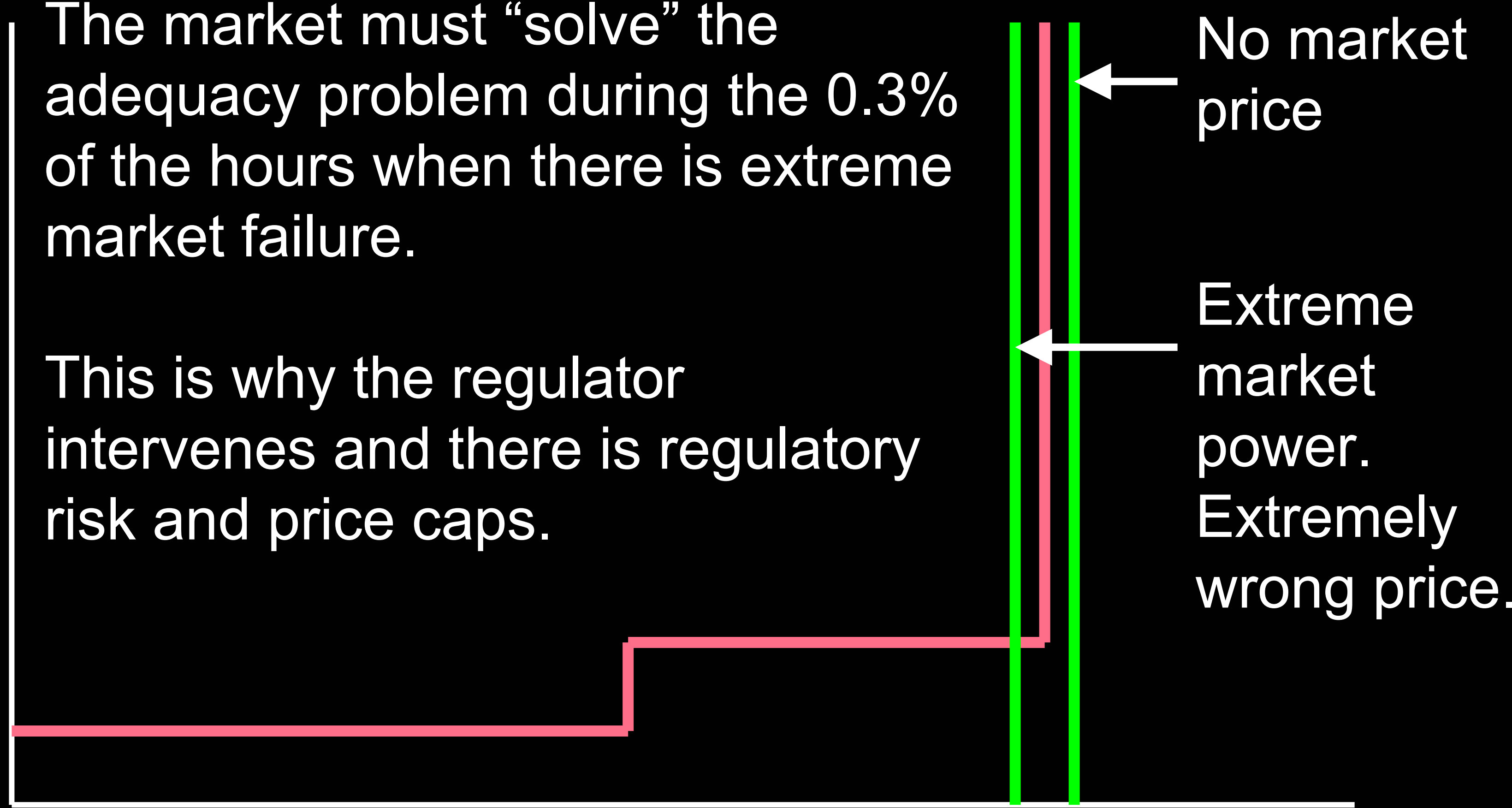
What does market failure look like?

- Ask an engineer: what is the problem of adequacy? Answer: **Supply < Demand**
- This is the worst market flaw I can think of.
- It is so terrible that economic text books never discuss it.
- There is no market price, not even a bad one.
- Ask the man in the street. Answer: **market power**. This is not so bad. But sometimes the price is 5,000 € when it should be 200 €.
- The market is only 2,500% wrong.

Two market failures

The market must “solve” the adequacy problem during the 0.3% of the hours when there is extreme market failure.

This is why the regulator intervenes and there is regulatory risk and price caps.



Actual market prices tell us nothing about consumer VOLL.

Two market flaws

- The 2 failures are caused by 2 flaws
  (Stoft, 2002, pp. xviii, 3, 8, 9, 15, …)
  Flaw 1: Lack of metering and real-time billing.
  Flaw 2: Lack of real-time control of power
  flow to specific customers.
  (Joskow, 2006, pp. 32-32.)

- With only 1 flaw, the market could solve the problem.

Adequacy is a public good

- This is the starting point of a good design
- Finon-Pignon, 2006, pp. 2-4.
- Joskow, 2006, pp. 8, 15, 34.

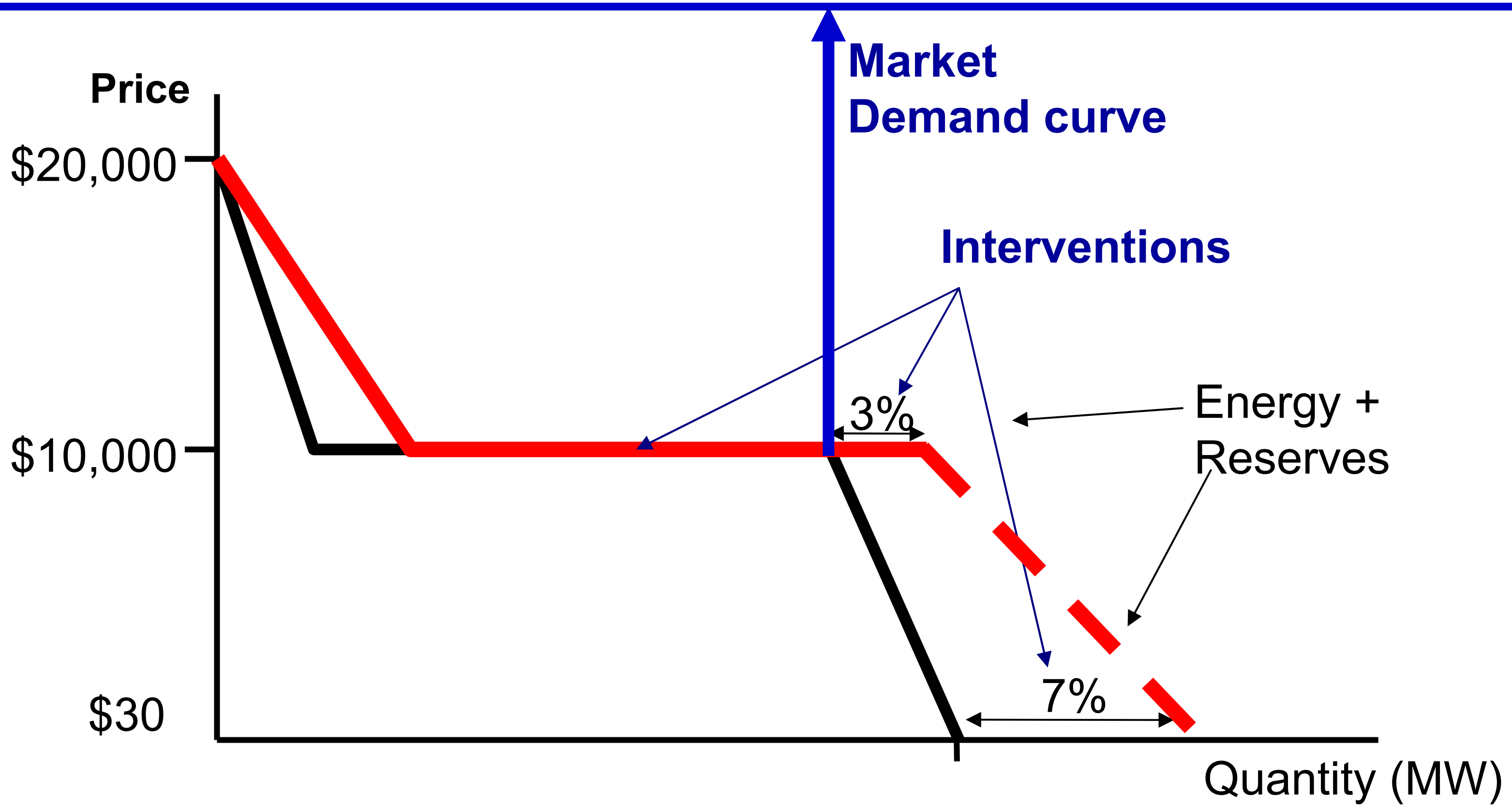
- Finon, Pignon, & Joskow, show a clear appreciation of the meaning of a public good. This is not a problem of near-sighted consumers, or too-little long-term contracting. Markets fail to provide public goods for more fundamental reasons.

Three possible solutions

1. Let the worst possible market (with no regulator) try to solve a public-good problem.
2. The regulator sets P = VOLL(economists)
3. The regulator sets $Q = Q_T$(engineers)

Fortunately, those who say they are doing #1, usually recommend #2.

Energy-Only Market "without Administrative Interventions"



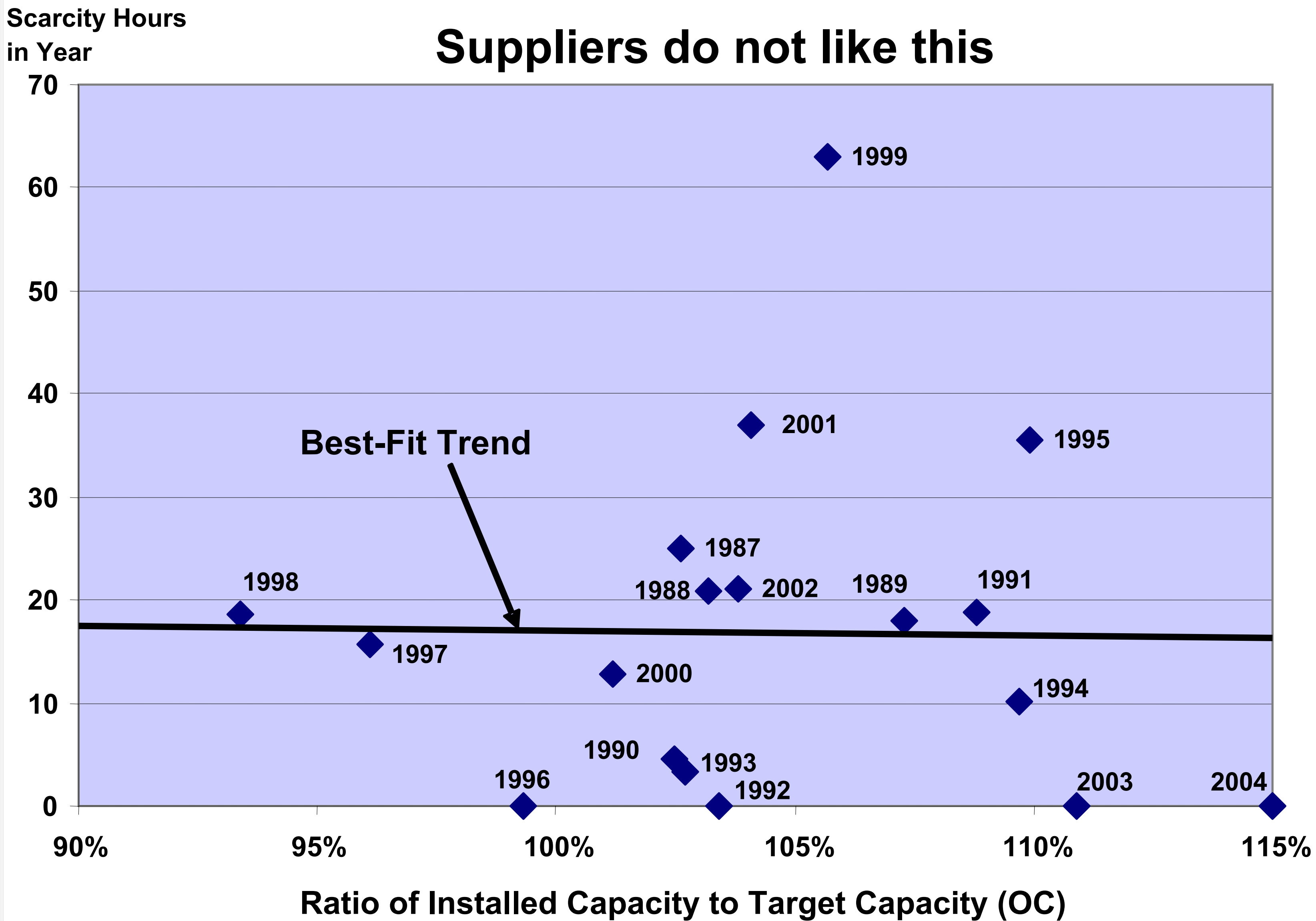
Proposed modifications of the market's energy demand curve for an energy-only market.

Only two realistic possibilities

- Regulate P = VOLL (or similar prices).
  - Good because it seems like a market approach
- Regulate $Q = Q_T$. Good because:
  - Much less market risk
  - Much less energy-market power
  - Less reliability risk
  - Less regulatory risk

Incentives of P=VOLL for ISO-NE

Suppliers do not like this



Design step #1: Target Q

- Let the engineers decide Q_T.
  - The have thought hard about this for years.
  - They actually understand electricity.
  - Any other approach will cause endless debate.
  - Economists don’t know VOLL.

Short-term vs. Forward capacity market

- A short-term market bases the ICAP price on existing capacity. It is (1) simpler and (2) can more easily control market power.
- A forward capacity market coordinates investment better (no investment cycles). And, consumers can see that they are buying capacity. Less regulatory risk.

- Design step #2:
  – Each year, buy capacity up to Q_T (e.g. 118%) 3 to 4 years in advance.
    - This guarantees capacity of Q_T because the auction price will go as high as needed to by that capacity.
    - Payment starts in 3-4 years.

Many secondary design problems

1. Performance incentives
2. Investment quality (dual fuel, ramping speed, etc.)
3. Cost of market risk (harms consumers not investors)
4. Energy market power
5. Technology mix (base vs peak)
6. Regulatory risk
7. ICAP market power
8. Open borders to other markets

Problems #1 & #2: performance & quality

- Everyone agrees on the answer
  (except generators – they do not like to perform)

- Design step #3:
  - "High energy prices." Pay ICAP winners competitive prices and pay ~VOLL when S < D.
    - Accuracy of VOLL is not important
    - It is best if scarcity prices are set by the TSO according to the level of operating reserves. (TSO demand curve.)
    - No extra penalties or dispatch controls are needed.

Problems #3 & #4: risk & market power

- Everyone now agrees on the answer:
- Design step #4
  - ICAP winners must give load a full option with a strike price a little above the marginal cost of the most expensive new generator.
  - Energy price revenues are the same as with a price cap of ~200 €.
  - Incentives are the same as with VOLL pricing.
  - Pérez-Arriaga (1999). Vázquez, Rivier & Pérez-Arriaga (2001, 2002). Vázquez, Batlle, Rivier & Pérez-Arriaga (2003, 2005, 2006).

Options in a non-mandatory market

- If there is no central market price, the TSO should set a price during all periods of scarcity.
- The option's strike price is defined relative to this price, as are option payments.

- Such options are very effective at reducing market risk and energy market power.

Problem #5 mix—peak vs. base

- Market prices in an ideal energy market pay all operating generators the same scarcity rents during periods of scarcity.
- These rents pay for peakers, but pay all other generators (who perform) the same rent / MW of capacity.

- Design step #5:
  - To avoid distorting the mix, all generating capacity must be included in the ICAP market.

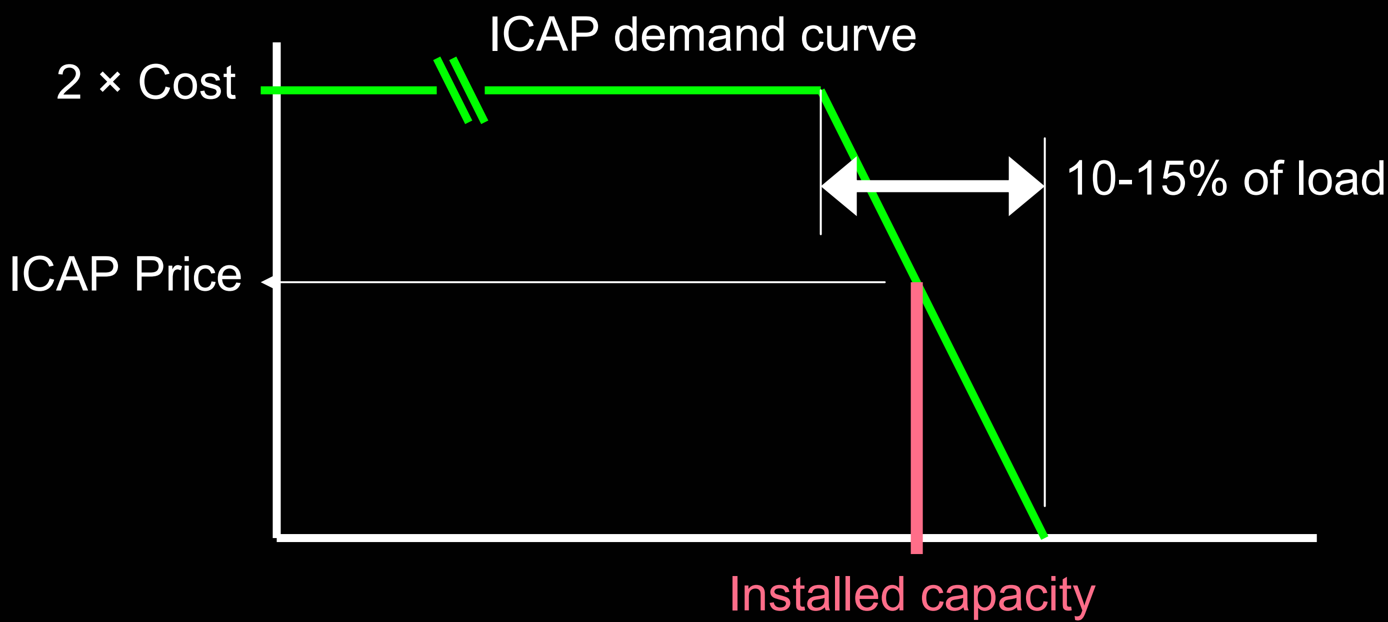
Problem #6: regulatory risk

- Hedging spot prices above ~200 €, prevents the single most dangerous cause of regulatory changes.

- Design step #6:
  - A forward auction should allow new entrants to lock in ICAP payments for at least 5 years.
  - Because these are locked in by contract, there is little regulatory risk for 5 years.

Problem #7: ICAP market power

- First consider a monthly ICAP market



- If existing generators can withhold capacity and raise the market price, they have enormous market power.

ICAP market-power solution

- Existing generators can withhold capacity.
- If they do, they do not receive the capacity payment of ~30,000 € / MWy.
- But withholding does not change the price.
- Price is based on the existence of generation, but not on participation in the market.
- They have no (zero) market power.
- With no market power and a 30,000 € payment most will participate.

Market power in a forward ICAP market

- Standard view: forward markets have less market power because of competition from new entry.
- Not true. (As just explained.)
- Design step #7:
  - Existing capacity should not be allowed to affect forward auction price.
  - Price should be based only on bids of new entry.
  - (more difficult in a forward market, but still good.)

Market power in a forward ICAP market

- Suppliers in the ICAP market receive capacity payment and high prices.
- Suppliers who choose to withhold receive no capacity payment and low energy prices.
- The will not withhold.

Problem #8: Open borders

- This is an old problem, but it will become worse if regulators give up control of exports during emergencies.
- However, high (VOLL) spot prices allowed by hedging are very helpful.
- California has imported 20% (?) of it's capacity for many years. Our engineers decide how much to build in CA, based on <u>expected</u> imports. An ICAP market will do this.
- It may be impossible control external installed capacity.
- Every approach to adequacy faces these problems.
- See De Vries, 2006, for more details.

A path forward

- Because load is fully hedged, it will accept high prices.
- High prices encourage demand elasticity.
- The strike price can be raised above prices commonly set by demand elasticity.
- The value of price spikes will be reduced as generators make more from prices set by demand.
- ICAP bids and prices will be reduced.
- Eventually, demand elasticity will replace the ICAP market.