Comments on Spot Pricing with Start-Up Costs
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Suppose generation is a perfectly competitive market, there are no transmission constraints or losses, and all generators have free and equal access to all customers. Suppose all generators have start-up costs of $50/MW and running costs of $20/MWH. Finally, suppose that the value of generation capacity is zero, due to excess capacity in generation. In this case, what are the competitive market prices?

Suppose there is just one customer with a fixed load for some portion of each day. To attract a supplier, the customer must pay at least the operating costs, and perfect competition guarantees that no additional payment is needed (suppliers compete away all margins). So the customer will pay $50/MW + $20/MWH. So long as the start-up cost is a fixed cost per MW, the customer will pay a demand charge as well as an energy charge. In this case, an hourly (or half-hourly) energy charge will not be appropriate, because it fails to accurately reflect the fact that the start-up cost is per MW of capacity, not per MWH of energy.

Now add a second customer. The cost of serving the second customer will depend on the relationship between the loads of the two customers. If the second customer's load begins at the same time as the first customer's load, its cost of service will also be $50/MW + $20/MWH. However, the second customer can reduce its cost of service by coordinating its load with that of the first customer. Specifically, if the second customer's load begins just as the first customer's load ends, start-up costs may be avoided. This reduces the overall cost of service, and competition guarantees that the savings will (primarily) accrue to the customers. But there's no rule for dividing up these savings between the two customers. One might think that the first customer would pay the $50/MW start-up cost and the second customer would just pay $20/MWH. But the first customer might buy or lease the generator it uses, for say $1/MW, pay the $50/MW start-up cost, then resell the power to the second customer for $49/MW + $20/MWH. In that case, the first customer would pay a net $2/MW start-up costs, the second customer would pay $49/MW, and one supplier would receive $1/MW. This situation is effectively a "bilateral monopoly" (or monopoly-monopsony), with no well-defined outcome. The customers may end up dividing the $50/MW start-up cost in half, as a "fair" outcome, but that's not guaranteed. Since there is no well-defined outcome, we can't really define "the" cost of service to each customer; nor can we assume that start-up costs will be paid by the customer using power first (i.e. when the supplier starts up).

The point is that hourly spot prices may not solve all of the problems of efficient coordination of electric supply and demand. Other methods of packaging and exchanging information may be appropriate in some circumstances. We should be open to different approaches, and try to avoid specifying how information must be packaged and exchanged.

Electricity Pooling Transmission

As the number of customers increases, it may be possible to better define "the" cost of service at each hour (following the "theory of the core"). Generally, the greater the number of traders, the smaller the range of cost allocations. Increasing the number of traders may constrain cost allocations to the outcome resulting from competitive prices (i.e. any differences in prices reflect true differences in costs). Also, as the number of traders increases, there should be less significance attached to each individual customer's MW "demand"; instead, the system peak period should shoulder the start-up costs. So the concept of hourly spot prices may be most useful for bulk power markets, where many traders are present.

COMPLICATIONS

Sometimes suppliers cannot be ranked in a simple dispatch order

- Start-Up Costs
- Ramping Time
- Declining Block Production Costs

Can still calculate avoided cost:

- Dispatch to minimize system's total cost
- Determine least-cost dispatch excluding Supplier X
- System Savings due to X = Difference between Total Costs
- Pay X its operating costs + system savings

Utilities already employ such calculations

- Power Coordination Agreement between Illinois Power (IP) and Cooperatives (See FERC Docket ER85-130-000)

  IP leases units to cooperatives

  Dispatches on systemwide basis

  Re-dispatches on separate basis to compute separate costs

Example:

Block	Size (MW)	Cost ($/MWH)
A1	1	70
A2	1	20
B	1	50
C	Purchase	60

Calculate Payment to Supplier A:

Demand	Dispatch	Cost	Ex. A	Cost	Savings	Payment
1	B	50	B	50	0	0
2	A1,A2	90	B,C	110	20	110
3	A1,A2,B	140	B,C	170	30	120
4	A1,A2,B,C	200	B,C	230	30	120

Calculate Payment to Supplier B:

Demand	Dispatch	Cost	Ex. B	Cost	Savings	Payment
1	B	50	C	60	10	60
2	A1,A2	90	A1,A2	90	0	0
3	A1,A2,B	140	A1,A2,C	150	10	60
4	A1,A2,B,C	200	A1,A2,C	210	10	60