

Pricing Behavior, Market Power and Vesting Contracts in a Deregulated Electricity Market

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An Overview

- Competition gaming model studies on pricing behavior and market power are prolific
 - Bertrand-type model
 - Cournot-type model
 - Supply Function Equilibrium (SFE) model
- But empirical studies are relatively rare
- Calculate Competitive Benchmark Price (CBP) and Price-Cost Margin Index (PCMI) and analyze pricing behavior and market power in a recently deregulated electricity market in a small open economy

Competition Gaming Models

- Bertrand-type model
 - Any firm is able to capture the entire market by pricing below others and expanding their respective output
 - However, there are significant constraints in capacity expansion
 - Increasing marginal costs of producing electricity
- Cournot-type model
 - A firm has a perfectly flexible real-time control
 - Instantaneous changes in generation are possible
 - In general, generators are not in total control of their real-time output
 - Potential ramping costs prohibit instantaneous changes

Supply Function Equilibrium Model

- Profit-maximizing equilibrium in the electricity market is attained under the condition of uncertain demand faced by competitors
 - Strategic biddings in a competitive spot market
 - Linear supply function
- Gives output levels for a range of prices
- Also with a linear marginal cost function
 - Interaction between contract markets and spot markets
 - Short-run incentive to exercise market power is removed

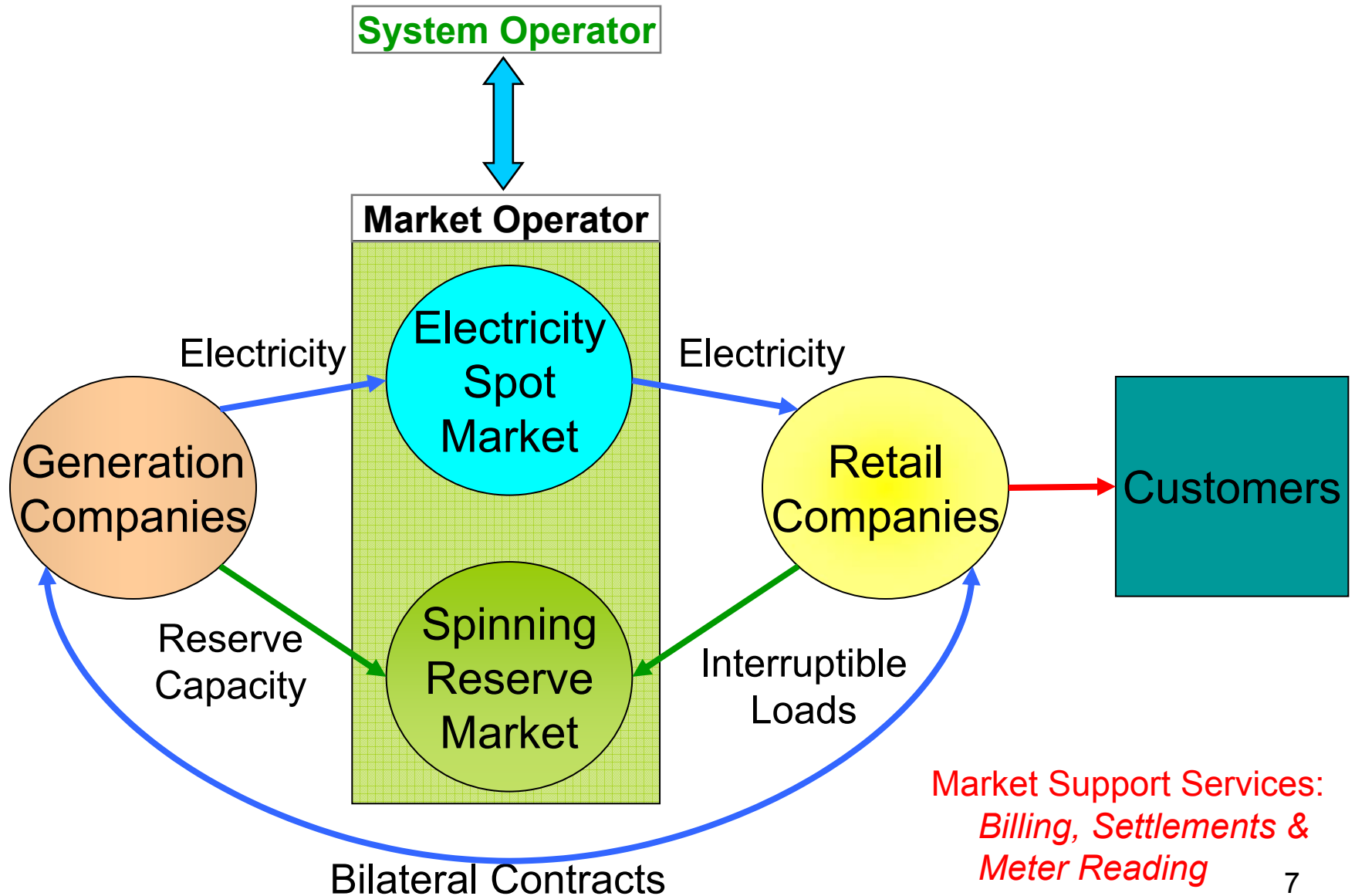
New Electricity Market in Singapore (NEMS)

- Vertically integrated-government-owned monopoly
 - Public Utility Board (PUB) was responsible for electricity supply
- Singapore Electricity Pool (SEP): A day-ahead market
 - From 1998 to June 2001
 - There was a sole purchaser of electricity (Power Supply Ltd)
 - From July 2001 to December 2002
 - Contestable consumers were introduced (whose power requirement is greater than 2MW)
- NEMS started on January 01, 2003
 - A mandatory pool, but a spot market for electricity and reserves operated by the Energy Market Company (EMC)

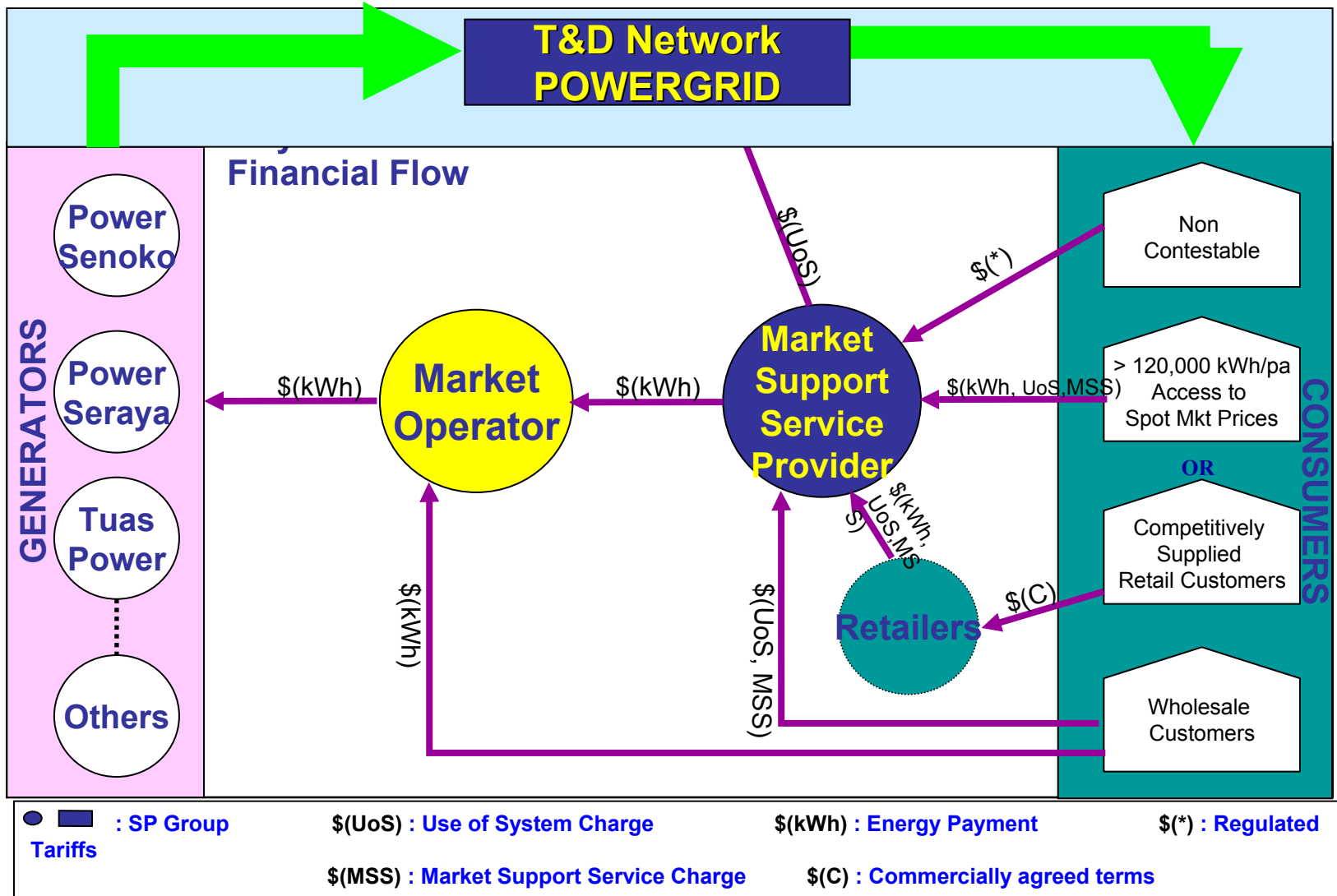
Characteristics of the NEMS

- Wholesale and retail market
 - Since July 2001, about 250 big consumers became contestable
 - June 2003, about 5,000 consumers
 - December 2003, another about 5,000 consumers
 - 75% of total electricity demand are contestable
 - Domestic (22%); Non-Domestic (78%)
- A mandatory 100% price cap during 2003
- Vesting contracts from January 2004
 - A contractual obligation to produce a specified quantity of electricity (65% of total electricity demand)
 - Non-contestable customers are fully covered

NEMS Industry Structure



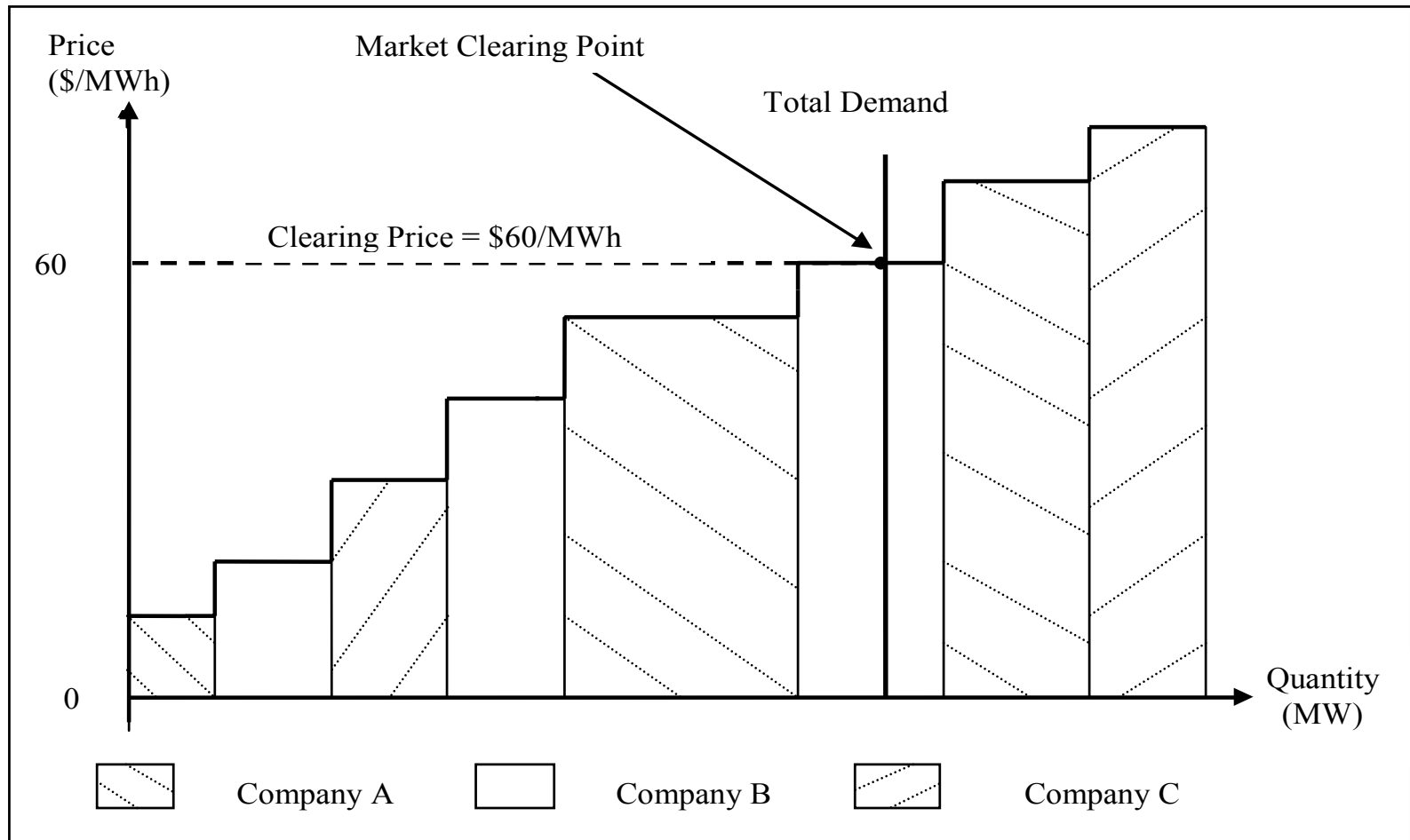
NEMS Market Structure



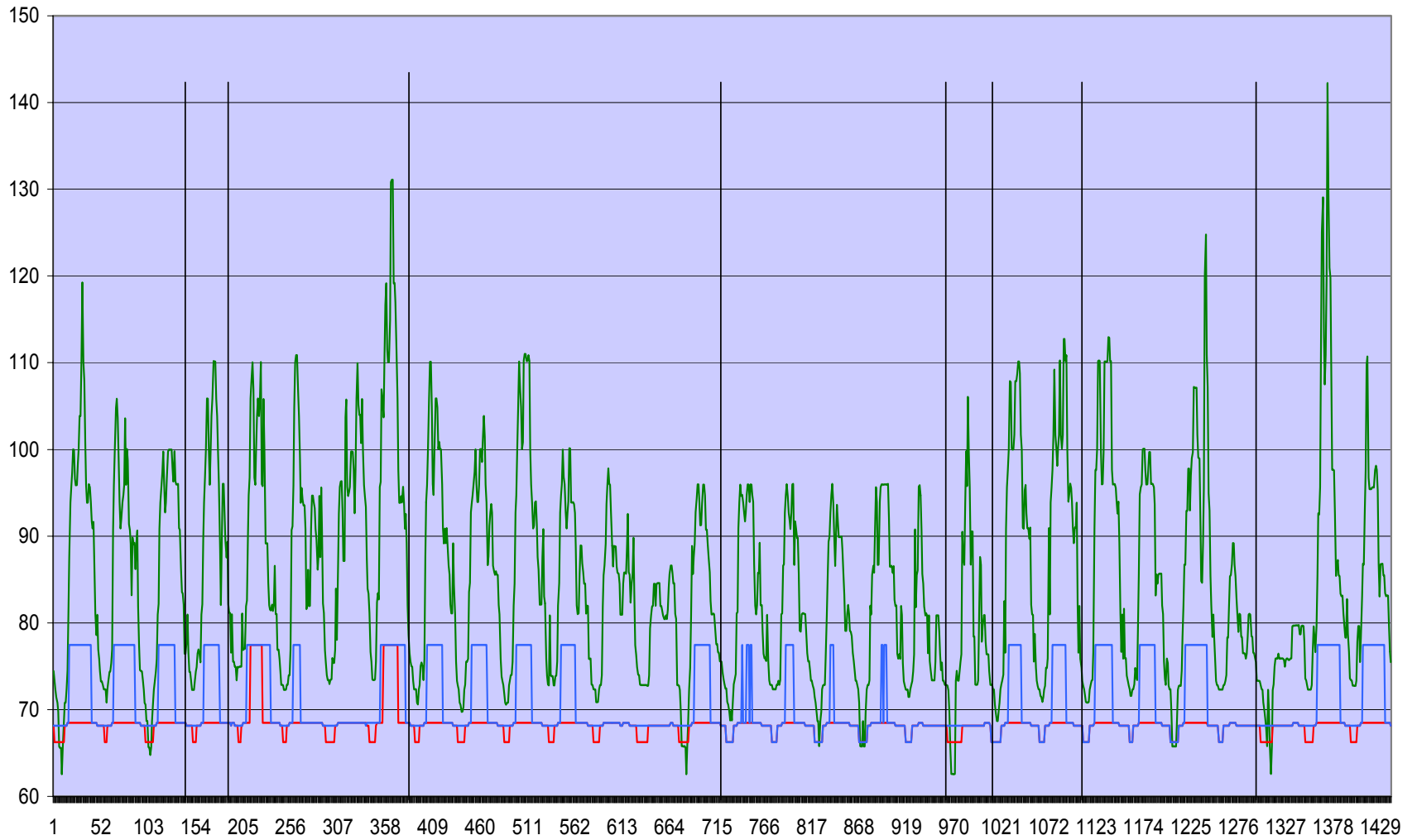
Competitive Benchmark Price (CBP)

- Definition
 - The short-run marginal cost of supplying electricity from the last unit that clears the market in each half-hour
- The calculated CBP considers
 - Daily available capacity by plant type
 - Daily plant outage level by plant type
 - Short-run marginal cost of each individual plant-type owned by the different generation companies
- This possibly reflects an intentional plant outage, considered an exercise of market power

Competitive Benchmark Price (CBP): Calculation



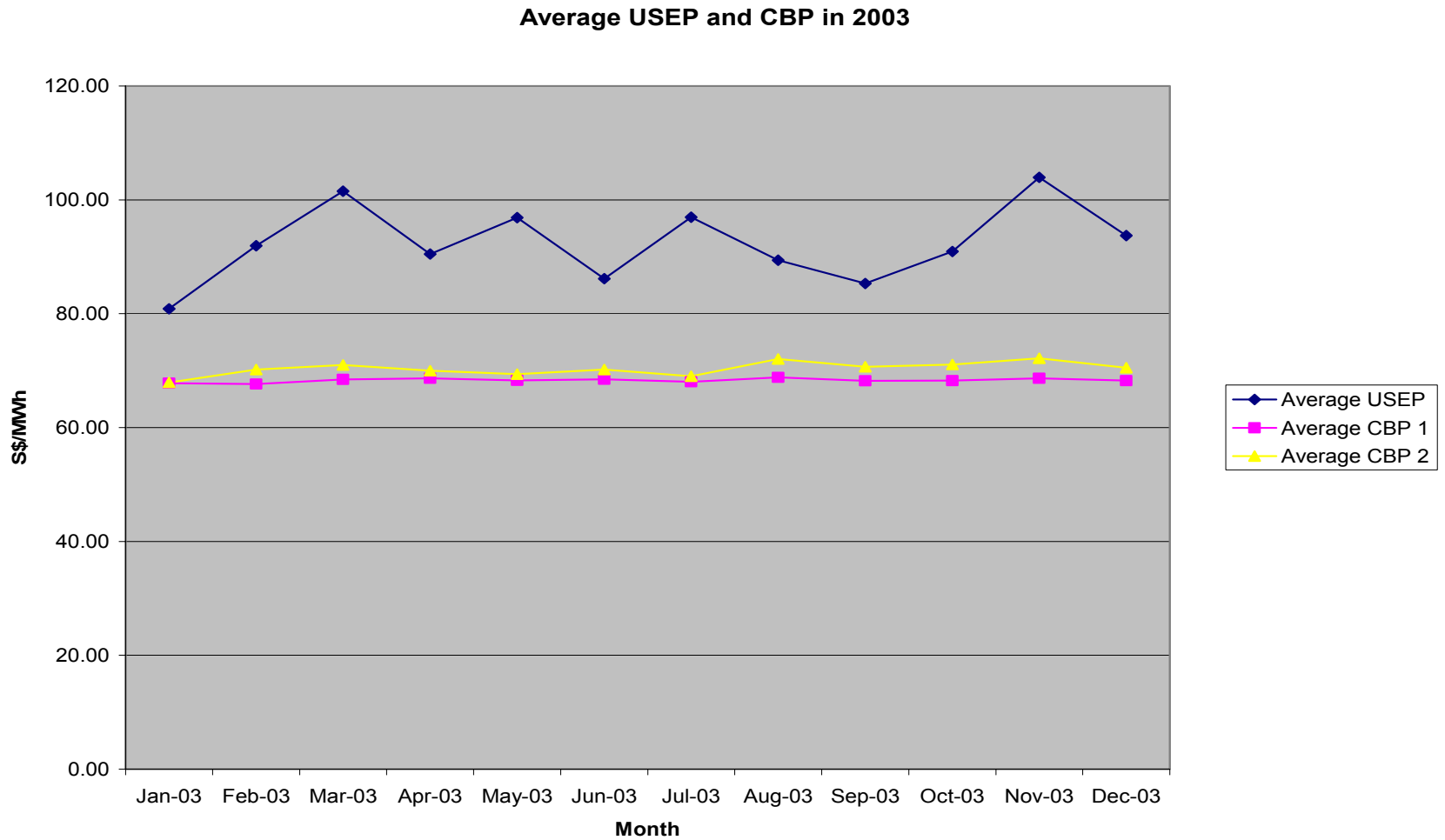
Observed USEP and CBP: September 2003



Observed Average USEP and CBP (2003)

Month	Average USEP	Average CBP 1	Average CBP 2
Jan-03	80.85	67.81	67.93
Feb-03	91.92	67.64	70.20
Mar-03	101.53	68.47	71.01
Apr-03	90.47	68.64	69.98
May-03	96.85	68.27	69.36
Jun-03	86.16	68.51	70.20
Jul-03	96.97	68.04	69.00
Aug-03	89.37	68.81	72.06
Sep-03	85.30	68.22	70.66
Oct-03	90.94	68.25	71.07
Nov-03	103.96	68.64	72.17
Dec-03	93.73	68.24	70.51
AVG	92.34	68.29	70.35

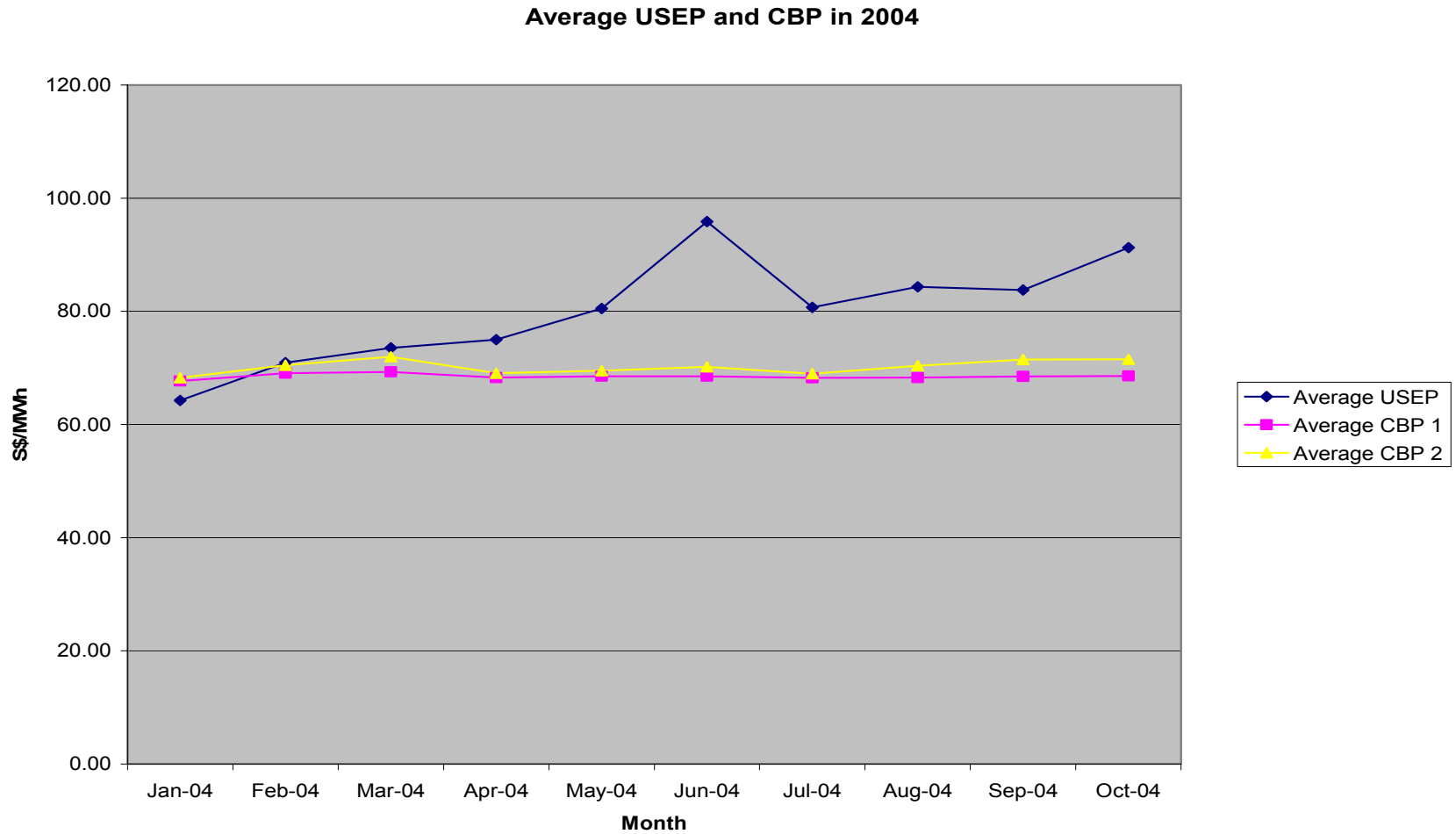
Average USEP and CBP in 2003



Observed Average USEP and CBP (2004)

Month	Average USEP	Average CBP 1	Average CBP 2
Jan-04	64.24	67.67	68.26
Feb-04	70.91	69.04	70.46
Mar-04	73.56	69.31	71.96
Apr-04	74.99	68.30	69.06
May-04	80.52	68.52	69.49
Jun-04	95.86	68.53	70.19
Jul-04	80.69	68.24	68.96
Aug-04	84.34	68.27	70.40
Sep-04	83.78	68.51	71.50
Oct-04	91.25	68.55	71.52
AVG	80.01	68.49	70.18

Average USEP and CBP in 2004



Price-Cost Margin Index (PCMI)

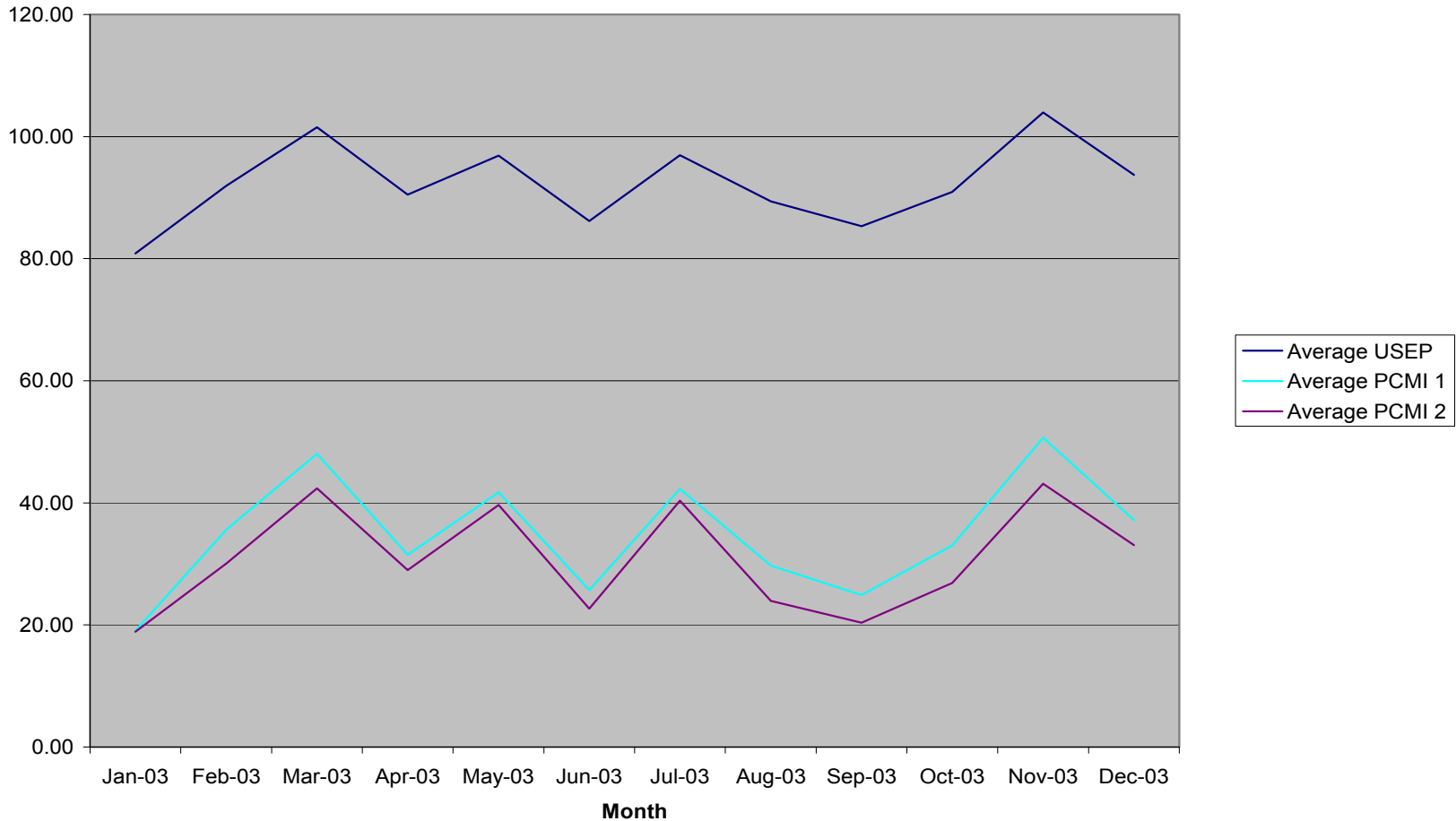
- Definition
 - Modified Lerner Index where CBP is used instead of MC $[(P-MC)/MC]$
- This is used as a proxy for gauging market power by examining how much the actual price observed deviates from the calculated CBP
- The larger the deviation, the higher the probability that the observed price is due to market power in the market

Price-Cost Margin Index (PCMI) in 2003

Month	Average USEP	Average CBP 1	Average CBP 2	Average PCMI 1	Average PCMI 2
Jan-03	80.85	67.81	67.93	19.04	18.86
Feb-03	91.92	67.64	70.20	35.63	30.08
Mar-03	101.53	68.47	71.01	48.03	42.37
Apr-03	90.47	68.64	69.98	31.49	29.01
May-03	96.85	68.27	69.36	41.73	39.68
Jun-03	86.16	68.51	70.20	25.71	22.69
Jul-03	96.97	68.04	69.00	42.29	40.36
Aug-03	89.37	68.81	72.06	29.70	23.92
Sep-03	85.30	68.22	70.66	24.89	20.39
Oct-03	90.94	68.25	71.07	33.02	26.88
Nov-03	103.96	68.64	72.17	50.66	43.15
Dec-03	93.73	68.24	70.51	37.22	33.06
AVG	92.34	68.29	70.35	34.95	30.87

Price-Cost Margin Index (PCMI) in 2004

Monthly PCMI in 2003

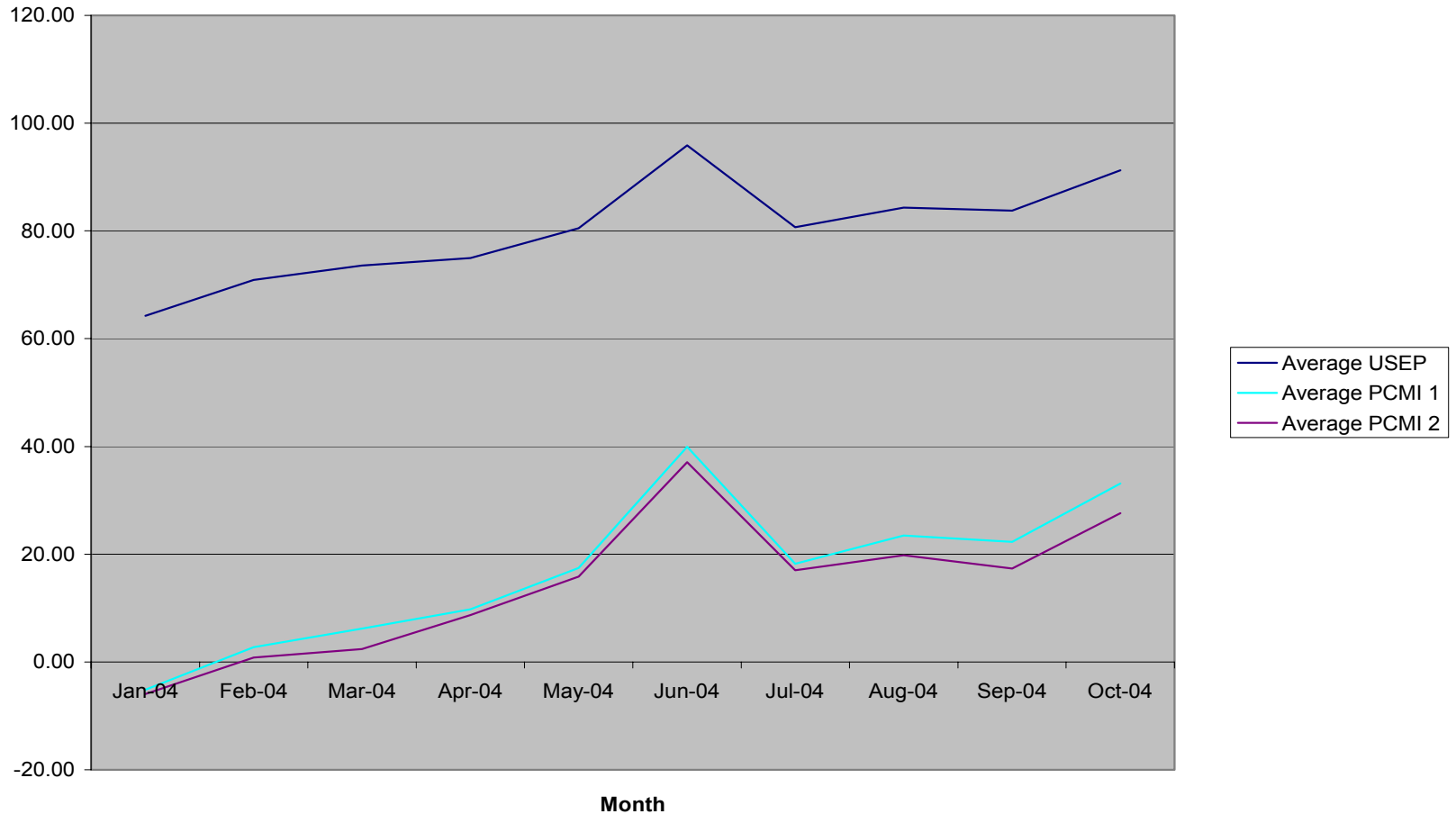


Price-Cost Margin Index (PCMI) in 2004

Month	Average USEP	Average CBP 1	Average CBP 2	Average PCMI 1	Average PCMI 2
Jan-04	64.24	67.67	68.26	-5.13	-5.95
Feb-04	70.91	69.04	70.46	2.77	0.80
Mar-04	73.56	69.31	71.96	6.20	2.39
Apr-04	74.99	68.30	69.06	9.78	8.69
May-04	80.52	68.52	69.49	17.47	15.87
Jun-04	95.86	68.53	70.19	39.92	37.08
Jul-04	80.69	68.24	68.96	18.21	17.05
Aug-04	84.34	68.27	70.40	23.50	19.79
Sep-04	83.78	68.51	71.50	22.32	17.38
Oct-04	91.25	68.55	71.52	33.12	27.61
AVG	80.01	68.49	70.18	16.81	14.07

Price-Cost Margin Index (PCMI) in 2004

Monthly PCMI in 2004

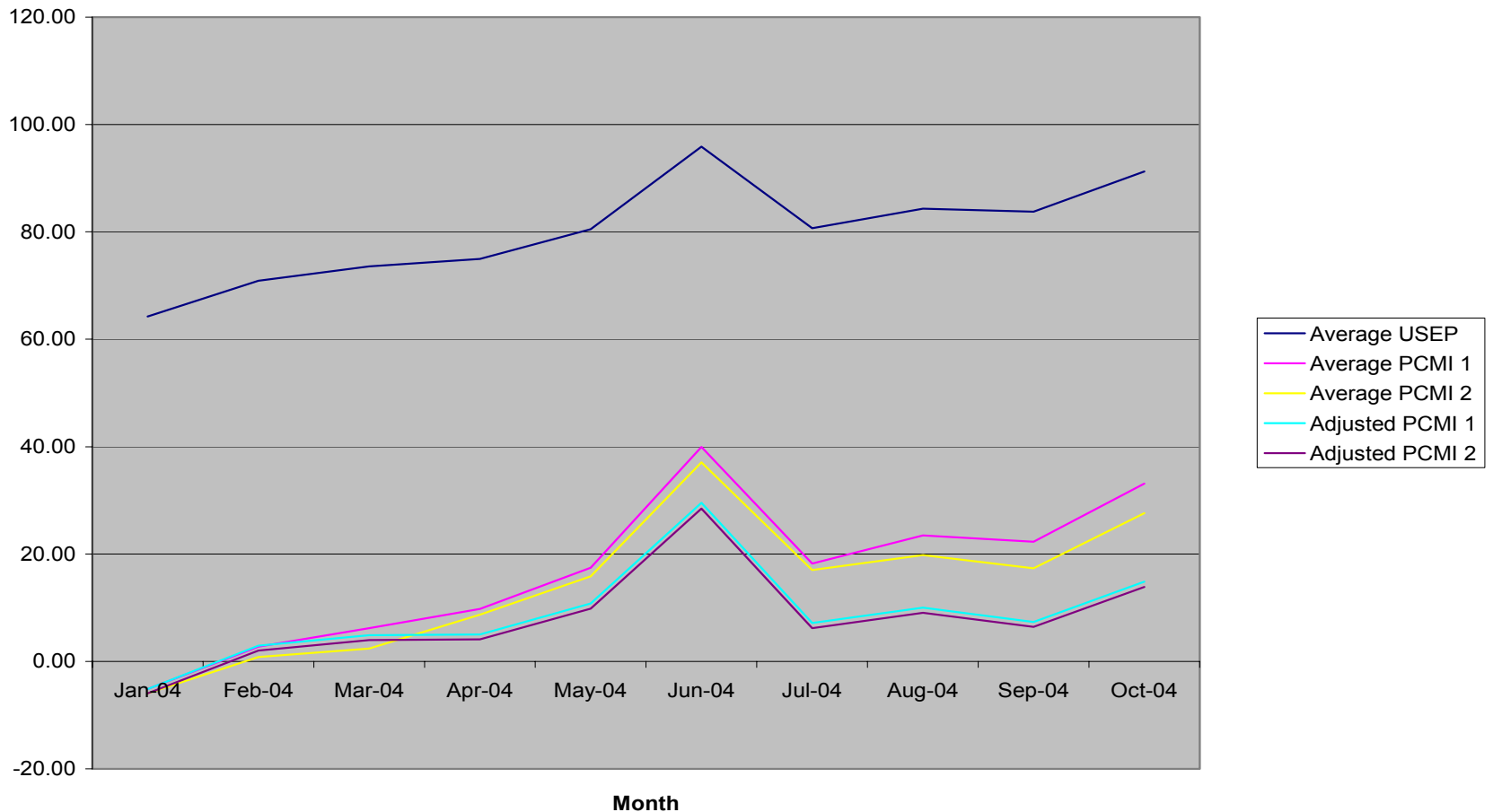


Oil Price-Adjusted PCMI (2004)

Month	Average USEP	Adjusted CBP 1	Adjusted CBP 2	Average PCMI 1	Average PCMI 2
Jan-04	64.24	67.67	68.26	-5.13	-5.95
Feb-04	70.91	68.89	69.49	2.94	2.05
Mar-04	73.56	70.13	70.74	4.89	3.99
Apr-04	74.99	71.39	72.01	5.04	4.13
May-04	80.52	72.68	73.31	10.79	9.83
Jun-04	95.86	73.98	74.63	29.57	28.45
Jul-04	80.69	75.32	75.97	7.14	6.21
Aug-04	84.34	76.67	77.34	10.00	9.05
Sep-04	83.78	78.05	78.73	7.35	6.42
Oct-04	91.25	79.46	80.15	14.84	13.85

PCMI and Oil Price-Adjusted PCMI (2004)

PCMI and Oil-price-adjusted PCMI in 2004



Concluding Remarks

- Competitive Benchmark Price (CBP) and Price-Cost Margin Index (PCMI) are used to analyze pricing behavior and market power in a recently deregulated electricity market of a small open economy
- USEP (Uniform Singapore Electricity Price) is lower in 2004 than 2003. But CBP is slightly higher in 2004 than 2003
- During 2003, PCMI is larger than 20% except January and it shows that market power seemed to exist in 2003
- During 2004, PCMI is larger than 10% except the first 4 months even under vesting contracts
- However, oil-price-adjusted PCMI is lower than 10% except June and October 2004 and supports non-existence of market power in general and effectiveness of vesting contracts in controlling market power vis-à-vis prices

THANK YOU!

ANY COMMENTS, ENQUIRY OR
RECOMMENDATIONS,
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