

**Central Electricity Regulatory Commission
New Delhi**

Petition No. 158/MP/2013

Subject : Petition under Regulation 63 and 64 of Central Electricity Regulatory Commission (Power Market) Regulations, 2010 for removal of difficulty arising due to present method of Transmission Corridor Allocation to Power Exchanges for Collective Transactions

Date of hearing : 19.6.2014

Coram : Shri Gireesh B. Pradhan, Chairperson
Shri M. Deena Dayalan, Member
Shri A.K.Singhal, Member

Petitioner : Power Exchange India Ltd.

Respondents : National Load Despatch Centre
Indian Energy Exchange Limited

Parties Present : Shri S G Tenpe, PXIL
Shri Kapil Dev, PXIL
Prof. S.A. Soman, IIT Bombay
Dr Som Shekhar, IIT Bombay
Shri Akhilesh Awasthy, IEX
Ms Shruti Bhatia, IEX
Shri Gaurav Maheshwari, IEX

Record of Proceedings

The representative of the Indian Energy Exchange (IEX) made a power point presentation and submitted as under:

(a) Auction or allocation of national resource should be tested on the yardstick of Public Good and in the present context Public means all participants of both the Exchanges and not the Exchanges themselves

(b) The suggested solution in the present petition is not supported by any theoretical and economic theory.

(c) The applicability of Max-Min/Min-Max fairness principle in case of transmission corridor allocation as suggested by Prof. Soman, IIT Mumbai is not relevant and is not used anywhere in the world.

(d) Min-Max principle is acceptable and is similar to *pro rata* allocation.

- (e) The calculation of % congestion in the present petition is incorrect and IEX has much higher % congestion.
- (f) There have been practical cases where total volume cleared on PX has not reduced with transmission congestion and there are several instances when this has happened in real life since it is dependent on the bidding pattern of participants, bid area, type of bidders and balance of the portfolios.
- (g) The representative of IEX cited number of economic publication on allocation theory.
- (h) An allocation is considered *fair*, if it is pareto-efficient and it has the property of being equitable.
- (i) Nash standard of comparison (Proportional Fairness) where a transfer of resources between two players is justified, if the gainer's utility increases by a larger percentage, and the loser's utility decreases, should be used.
- (j) The proposed mechanism of PXIL would adversely affect the other participant of IEX.
- (k) The representative of IEX suggested the following solution in order of preference :
 - (i) Option 1- Allowing Exchange participants to participate in the advance scheduling process and e-bidding of transmission capacity: This also fulfills the proportionate fairness criteria, as entities with highest utility gets corridor through explicit auction.
 - (ii) Option 2-Merging of bids: To allocate capacity to the participants with maximum utility (i.e. social welfare benefit), DAM bids from both the Power Exchanges should be merged so as to fulfill the proportionate fairness criteria
 - (iii) Option 3- Min-Max Fairness (supported by Dr. Soman as an alternative): Percentage loss to all the participants in allocation should be equal. '*Pro-rata allocation conforms to this fairness*'

2. The representative of the petitioner submitted that bid price data used by IEX in its analysis is incorrect.

3. Copy of the presentation is enclosed with the ROP.

4. Prof. Soman, IIT Mumbai submitted that fairness is not a unique philosophy and is subjective. However, it is important to establish fairness through a rigorous and detailed deliberation process. He emphasized the importance of use of Kirchoffs Voltage Law by NLDC in the transmission corridor allocation process. On the various options suggested by IEX, Prof Soman submitted that e-bidding for corridor by

participants may not be fair to small players and also that there would be a problem of identification of corridor for bidding.

5. In response, the representative of IEX submitted that price auction treats small and large players equally.

6. Prof. Soman observed that a single solution in the form of aggregation of bids of both Power Exchanges and would definitely be a superior solution and the social welfare maximization would be the greatest. However, it would be a radical change from what is presently followed and product innovation may be hampered.

7. The Commission directed POSOCO to submit its reply on affidavit by 5.7.2014, with an advance copy to the petitioner who may file its rejoinder, if any by 10.7.2014.

8. Subject to above, the Commission reserved its order in the petition.

By order of the Commission

**Sd/-
(T. Rout)
Chief (Law)**



Comments on PXIL's proposed mechanism of Transmission Capacity allocation b/w PXs in DAM

to

Hon. CERC on 19 June 2014

Akhilesh Awasthy

Director (Market Operations)

www.iexindia.com

To Recapitulate:

- Auction or allocation of National resource should be tested on the yardstick of Public Good.
- In the present context Public means all participants of both the exchanges and not the exchanges themselves. Therefore Public good in this context would mean Good for the Participant and any solution shall be Exchange agnostic.
- Neither examples were shown in the Petition where proposed mechanism was used nor any theoretical basis was discussed.
- Example of two service providers was given wherein it was demonstrated that the best solution for the public would not be reserving some common national facility for one service provider as compared to its competitor, rather the national service shall be distributed in such a way that the public good can be maximized.
- Petitioner is confusing between Public Good and its own good, is trying to utilize Public resources for the private gains in unfair way

- Max-Min fairness principle discussed by Dr Soman is not relevant in our situation.
- Internet communication network work differently:
 - There are different quality of services possible
 - If only best quality of data is supported then the consumers at the edge would be left out, therefore there is a need to provide minimum level of service to the consumers at the edge
- Min-Max principle supported by Dr Soman is acceptable as it refers to allocation of costs for availing services, this however leads us to Pro-rata allocation

Applicability of Max-Min Fairness

- Max-Min Fairness was originally used in Communication Networks, though alternate fairness mechanisms are being proposed by critiques due to its skewness in allocation.
- Various priority schemes including weighted fair queuing (WFQ) which takes into consideration the value for usage of congested corridor is gaining ground. Other non Max-Min fairness allocation methodologies are also being used for congestion management.
- As such there is no single principle that is universally accepted¹ for congestion management in internet communication network
- **Nowhere in the world Max-Min fairness criteria is adopted for allocating Transmission Capacity**

[1] Bertsimas, Farias, Nikolaos. The Price of Fairness. Operations Research, MIT, INFORMS, 2010.

Criticism of Max-Min Fairness adoption in Communication Networks

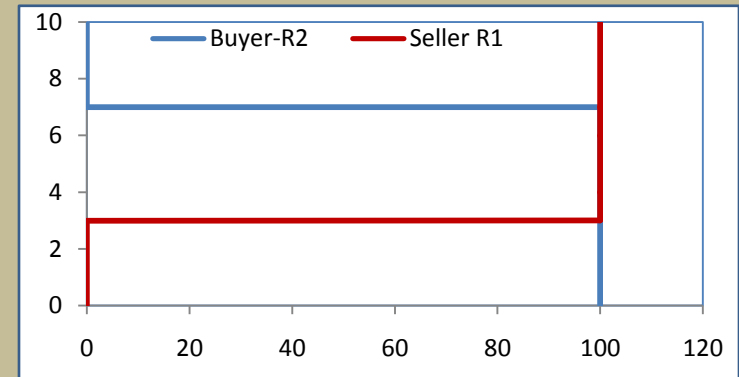
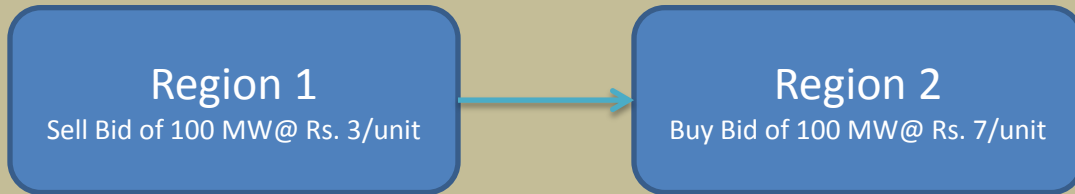
- In 1997, Kelly demonstrated² that realistic users would not choose max-min flow rate fairness if they were accountable for the congestion they caused to others. Kelly demonstrated that unless low bit rate and high bit rates are valued the same MaxMin flow rate fairness can not be established.
- Radunovic (Microsoft Research) and Boudec (2004) showed that max-min fairness results in severe inefficiency for wireless networks in a limiting regime, and used numerical studies to validate that observation for practical situations
- Oyeshile in his 2008 paper ‘ A Critique of Maximin principle’ says that “ *Rawls Maximin principle discourages hard work. This is because whatever gains an individual makes has to be viewed and controlled in relation to the worst off.*”

[2] F. P. Kelly. Charging and rate control for elastic traffic. European Transactions on Telecommunications, 8:33–37,1997. (Correction by R. Johari & F. Kelly)

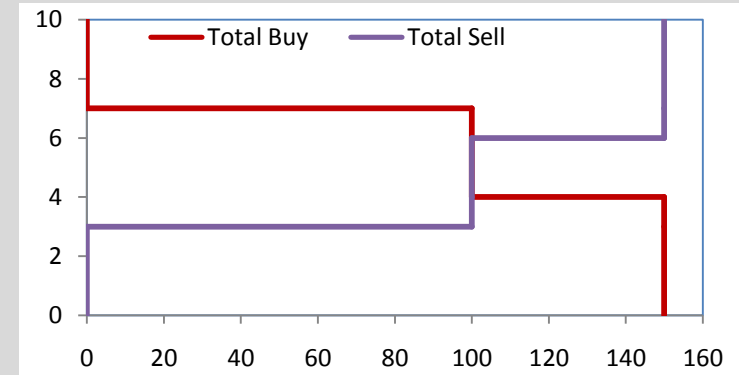
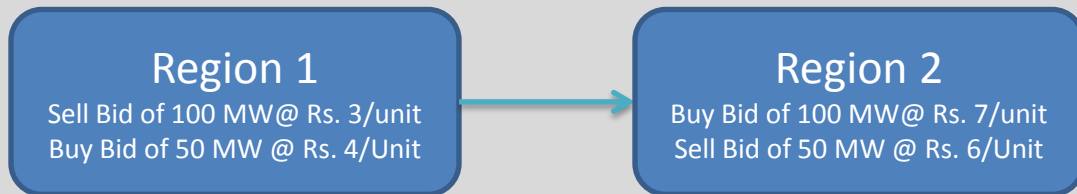
Examples demonstrating why Basic Premise itself is misplaced:

In all three scenarios Unconstrained MCP = Rs. 5 and MCV=100 MW.

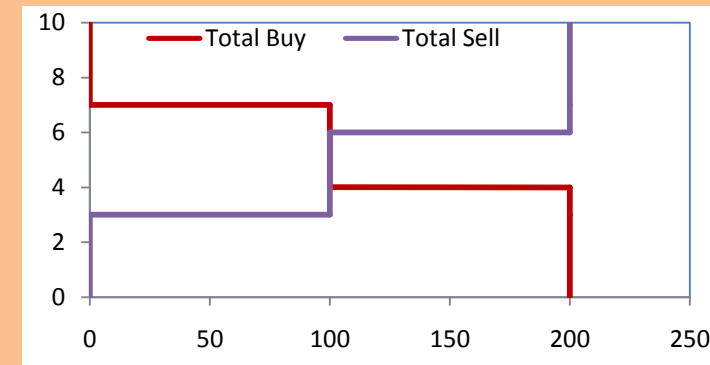
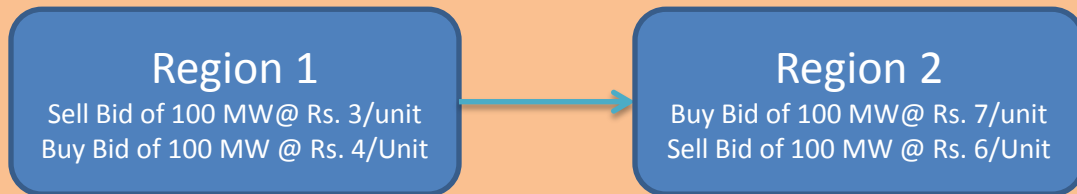
Scenario 1:-



Scenario 2:-



Scenario 3:-



No Available Corridor between regions



Region-1

Region-2

Region 1-

ACV - 0

ACP - -

Region 2-

ACV - 0

ACP - -

Region 1-

ACV - 50

ACP - 3

Region 2-

ACV - 50

ACP - 7

Region 1-

ACV - 100

ACP - 3.5

Region 2-

ACV - 100

ACP - 6.5

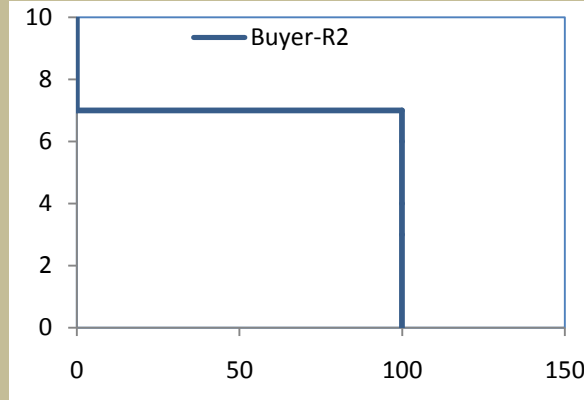
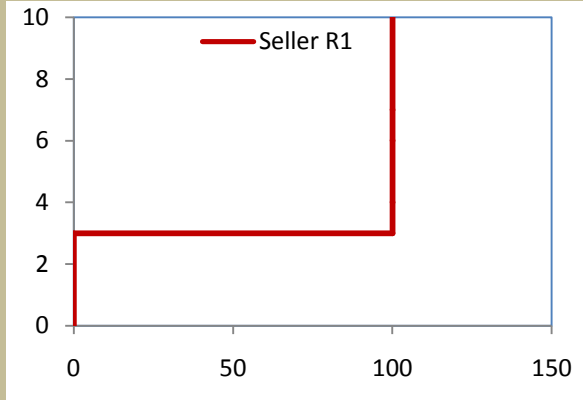
Scenario 1:-

Region 1-

Sell 100@3

Region 2-

Buy 100@7



Scenario 2:-

Region 1-

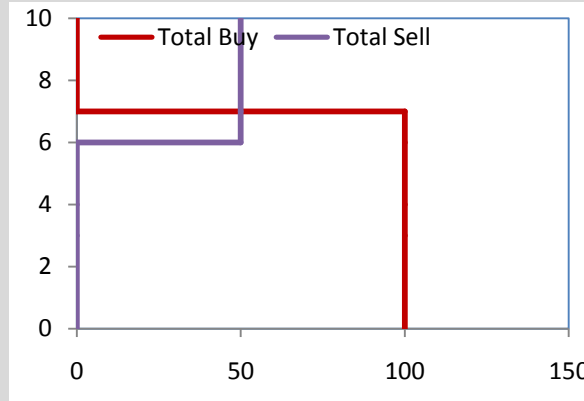
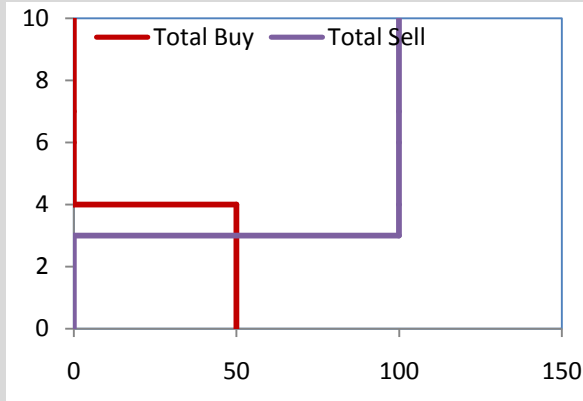
Sell 100@3

Buy 50@4

Region 2-

Buy 100@7

Sell 50@6



Scenario 3:-

Region 1-

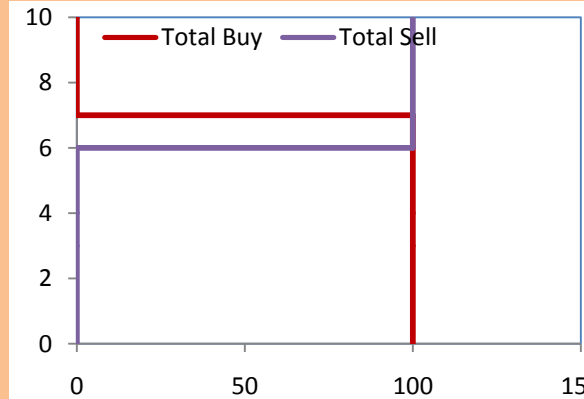
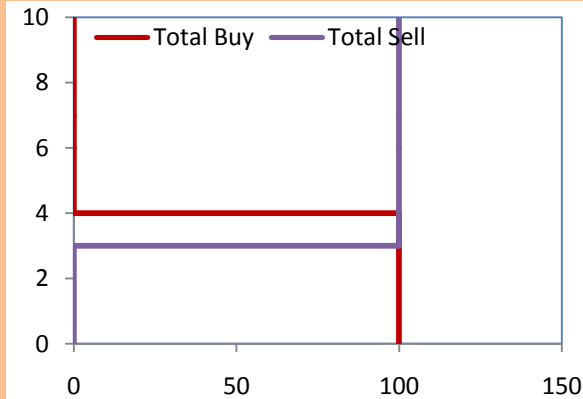
Sell 100@3

Buy 100@4

Region 2-

Buy 100@7

Sell 100@6



Calculation of % Congestion in PXIL Petition is incorrect:

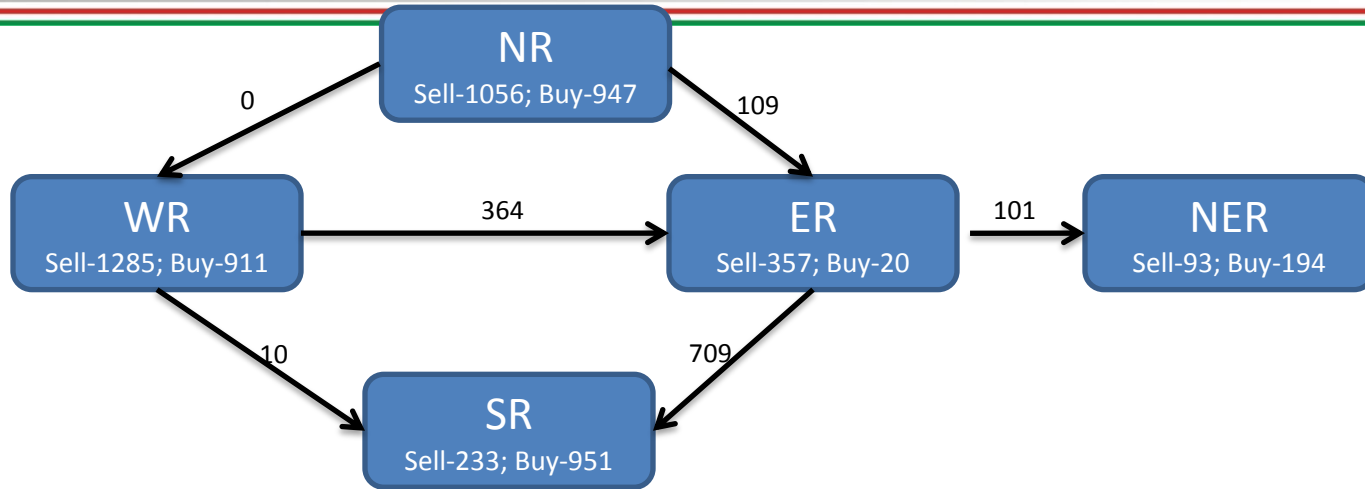


Congestion as shown in PXIL's petition

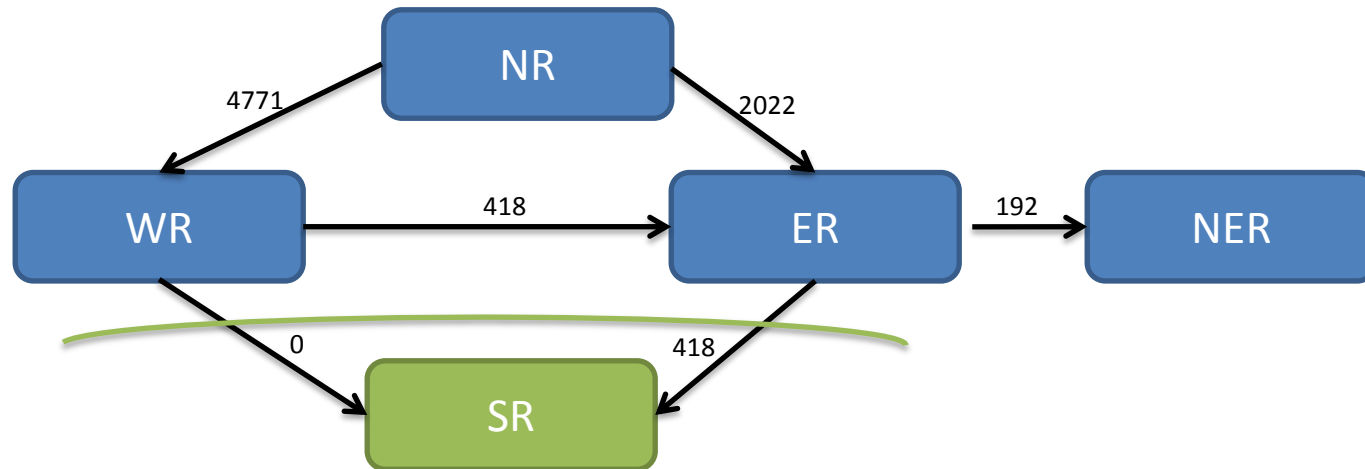
IEX faced severe congestion as below:

	PXIL			IEXL			Actual Congestion on IEX		
	UnConstrained MCV (MU)	Constrained MCV (MU)	Curtailment (%)	UnConstrained MCV (MU)	Constrained MCV (MU)	Curtailment (%)	Provisional Requisition on Inter-Regional Corridor (MUs)	Final Received on Inter-Regional Corridor (MUs)	Curtailment (%)
Jan-12	87.32	39.08	55.24	1249.71	1034.11	17.25	1481.45	447.55	69.79
Feb-12	183.95	51.62	71.94	1334.3	970.07	27.3	1675.13	265.07	84.18
Mar-12	225.45	60.29	73.26	1654.52	1164.09	29.64	1799.22	302.07	83.21
Apr-12	182.95	53.32	70.85	1586.96	1283.86	19.1	1336.613	196.26	85.32
May-12	124.29	89.69	27.84	1445.21	1388.39	3.93	1001.933	213.73	78.67
Jun-12	124.14	94.03	24.25	1609.69	1535.34	4.62	1124.19	577.67	48.61
Jul-12	79.29	52.93	33.25	1596.28	1547.91	3.03	824.50	313.73	61.95
Aug-12	87.35	39.93	54.29	2001.34	1821.02	9.01	1482.80	548.85	62.99
Sep-12	84.31	30.92	63.33	2217.58	1878.69	15.28	1904.79	192.84	89.88
Oct-12	53.19	23.32	56.16	2452.07	2277.6	7.12	1585.58	447.02	71.81
Nov-12	149.17	67.12	55	2479.54	2119.01	14.54	1922.28	200.30	89.58
Dec-12	185	72.1	61.03	2633.36	2242.51	14.84	1964.89	170.16	91.34
Jan-13	144.3	53.18	63.14	2587.02	2045.41	20.94	1941.74	230.27	88.14
Feb-13	147.5	36.97	74.93	2513.75	1975.42	21.42	1617.54	117.72	92.72
Mar-13	167.64	64.7	61.41	3020.39	2259.65	25.19	2168.05	230.90	89.35
Apr-13	139.5	60.86	56.37	3037.09	2515.68	17.17	2040.54	184.22	90.97
May-13	113.83	73.21	35.69	2862.21	2499.31	12.68	1435.99	287.53	79.98
Jun-13	64.19	53.2	17.12	2419.51	2114.56	12.6	1299.84	488.13	62.45

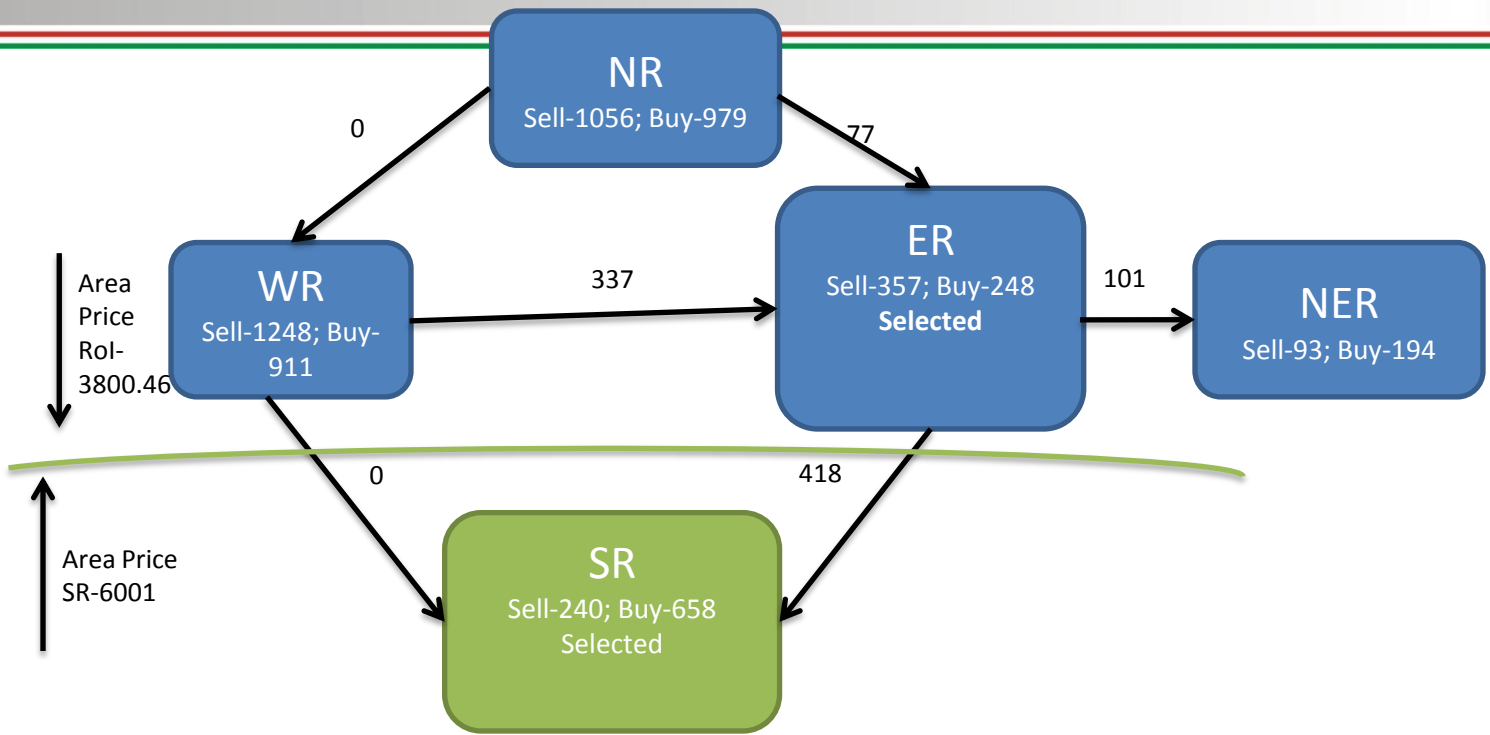
Provisional Requisition Status from IEX to NLDC at 1300 Hrs.---- MCP-3899.2; Unconstrained MCV- 3024 MW



Availability Status from NLDC to IEX at 1400 Hrs.----



Magnitude of Congestion should be difference in Provisional Requisition and Actual Available in congested corridor i.e. $(709+10)-(418)= 301$ MW.



As per petition magnitude of Congestion is difference of MCV and ACV which in this case is just 30 MW (3024-2994). Since at IEX Platform due to regional portfolio balance; In Final calculation Buy at Surplus Region and Sell at Deficit Region get selected which is may not be the case at PXI hence % Congestion seems low at IEX and high at PXI. The correct size of Congestion will be calculated based on difference in Provisional Requisition and Actual Available in congested corridor.

- An allocation is considered *fair*, if it is pareto-efficient and it has the property of being equitable.⁴

Pareto-efficient

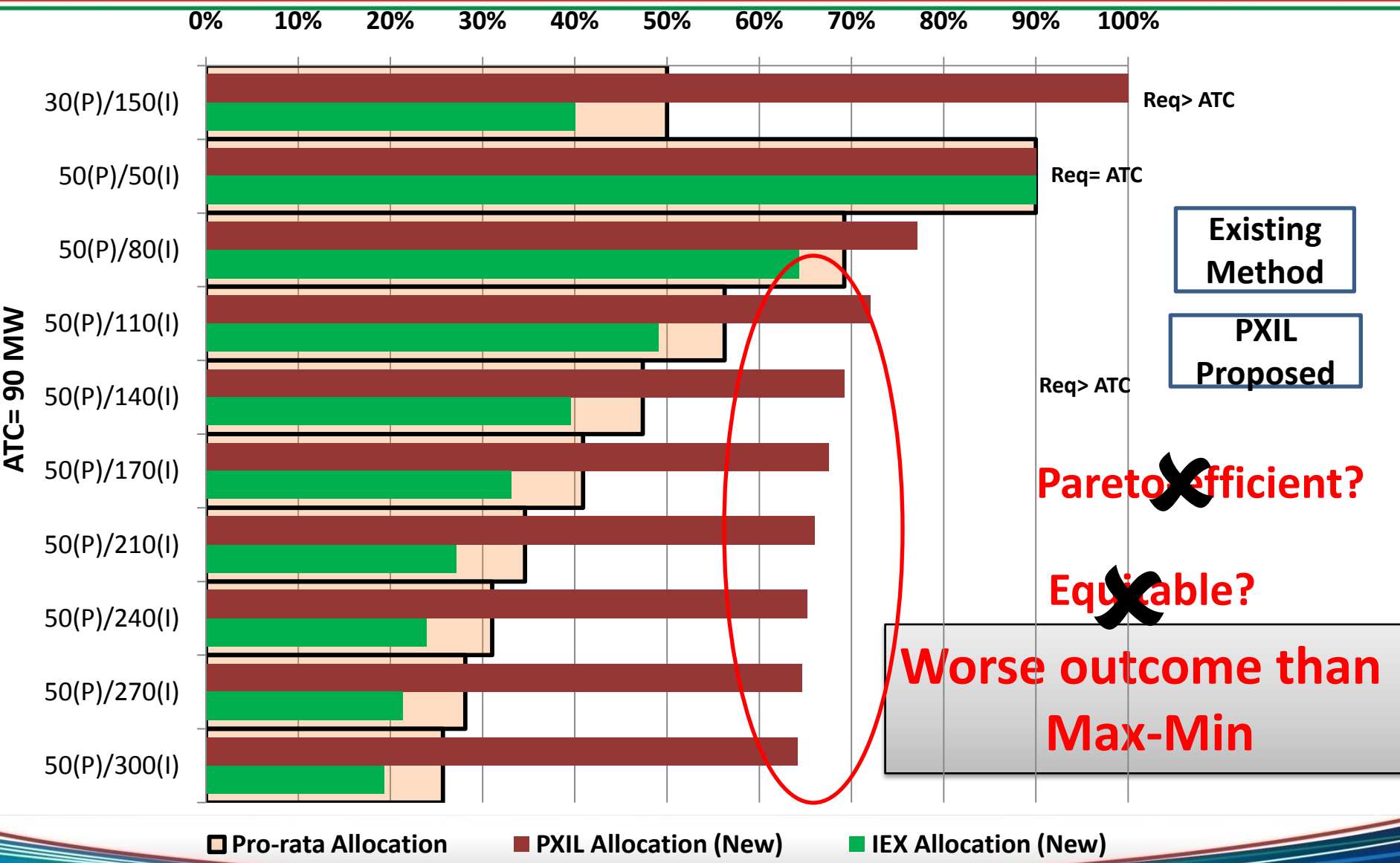
A balance of resource distribution such that one individual's lot cannot be made better-off without making someone else worse-off

Equitable

The symmetric property that no user wishes to trade his final bundle for another user's final bundle

[4] Hal R. Varian, 'Distributive Justice, Welfare Economics, and the Theory of Fairness,' Philosophy & Public Affairs, Vol.4, no.3, pp. 223-247, 1975

Comparing PXIL's proposed mechanism to the present pro-rata allocation (simulation)



Existing Method

PXIL Proposed

Pareto ~~efficient?~~

Equitable?

Worse outcome than Max-Min

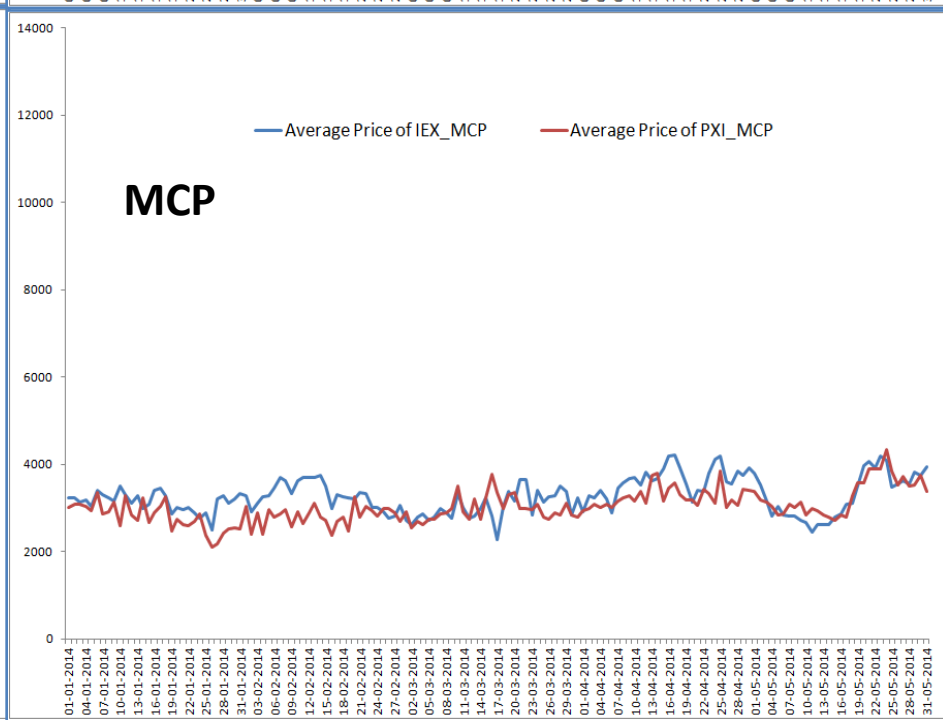
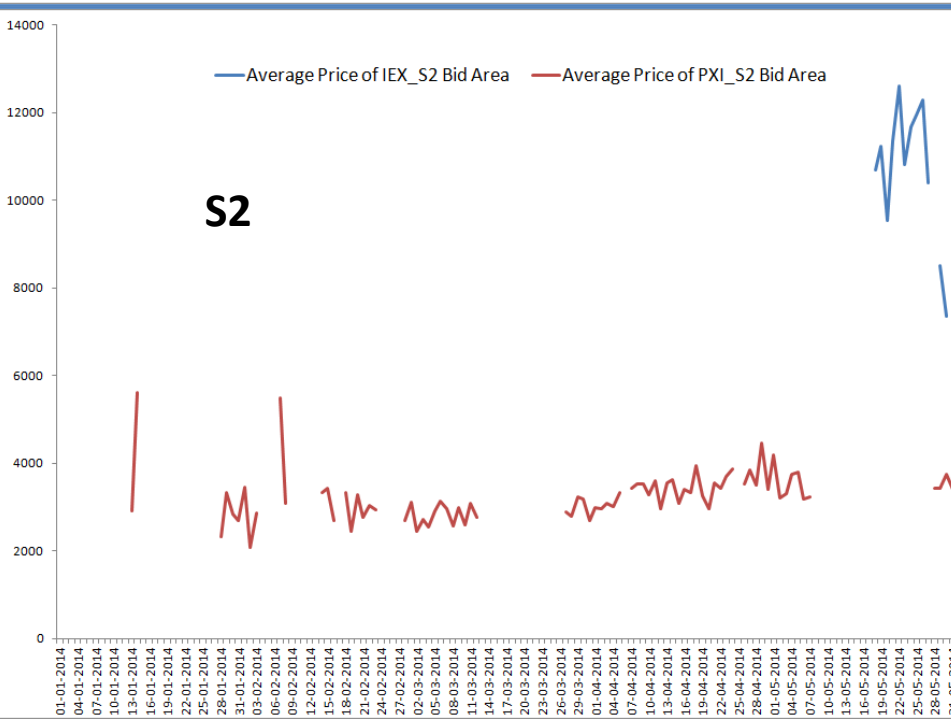
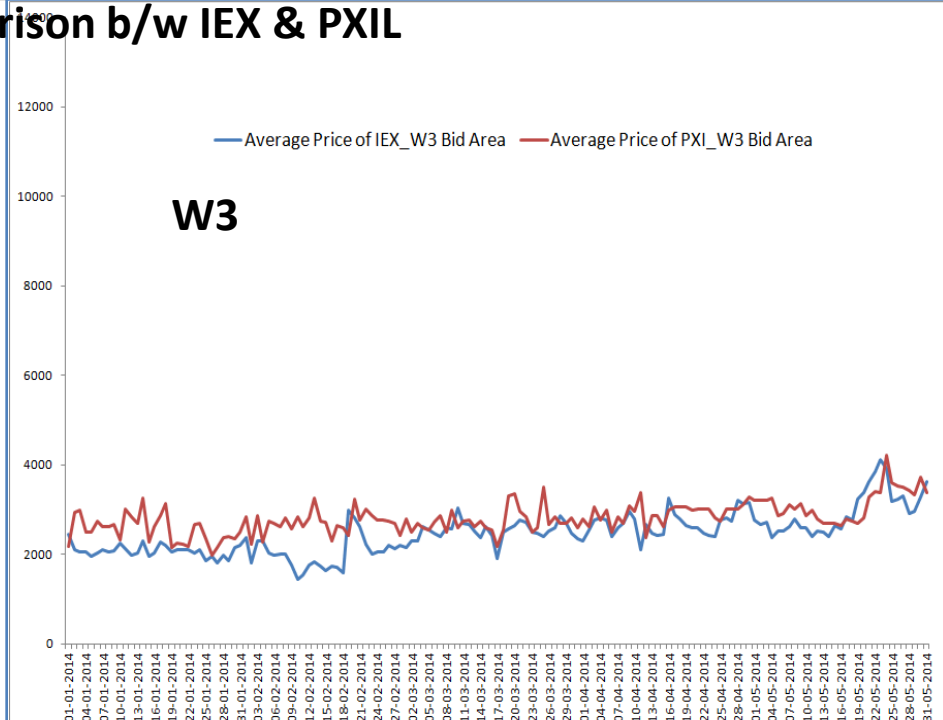
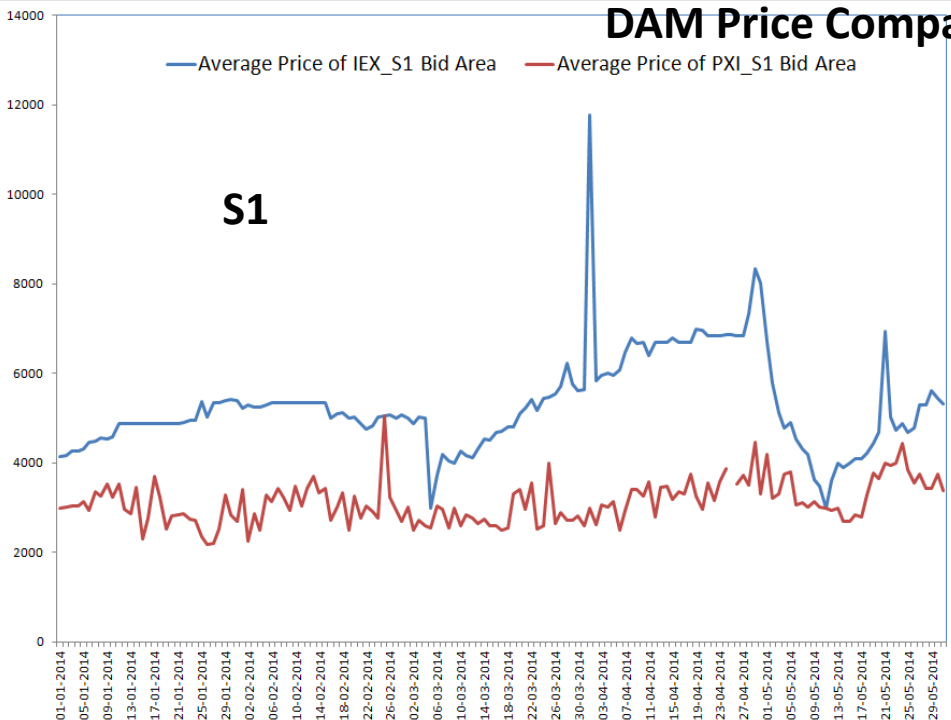
- **Nash standard of comparison** (Proportional Fairness): A transfer of resources between two players is then justified, if the gainer's utility increases by a larger percentage than the loser's utility decreases
- In the 2010 MIT paper 'The Price of Fairness' by Bertsimas, Farias and Nikolaos; it has been concluded that relative efficiency loss is small in Proportional Fairness criteria as compared to MAX-MIN Fairness
- Proportional Fairness is preferred over Max-Min Fairness

“Price a person is willing to pay for the fulfillment or satisfaction of his desire”⁵

- In the present context of Transmission Capacity allocation between Power Exchanges, **Social Welfare** is the measure of Utility.
- Utility should be considered w.r.t. participants of PXs as they are the final beneficiaries of the corridor. Hence Social welfare should be the criteria to measure utility, not the Volume

[5] Marshall, Alfred(1920), ‘Principle of Economics: An Introductory Volume, Macmillan.

DAM Price Comparison b/w IEX & PXIL



- ✓ **Option 1- Allowing Exchange Participants to participate in the advance scheduling process and e-bidding of transmission capacity:** This also fulfills the proportionate fairness criteria, as entities with highest utility gets corridor through explicit auction.
 - ✓ **Option 2-Merging of bids:** To allocate capacity to the participants with maximum utility (i.e. social welfare benefit), DAM bids from both the Power Exchanges should be merged so as to fulfill the proportionate fairness criteria
-
- ✓ **Option 3- Min-Max Fairness** (supported by Dr. Soman as an alternative): Percentage loss to all the participants in allocation should be equal. *‘Pro-rata allocation confirms to this fairness’*

Thank You for your attention

www.iexindia.com



Best Power Exchange in India

– Enertia Awards '13

Best Performing Power Exchange

– Power Line Awards '13 & '12

Best E-enabled consumer platform

– India Power Awards '09