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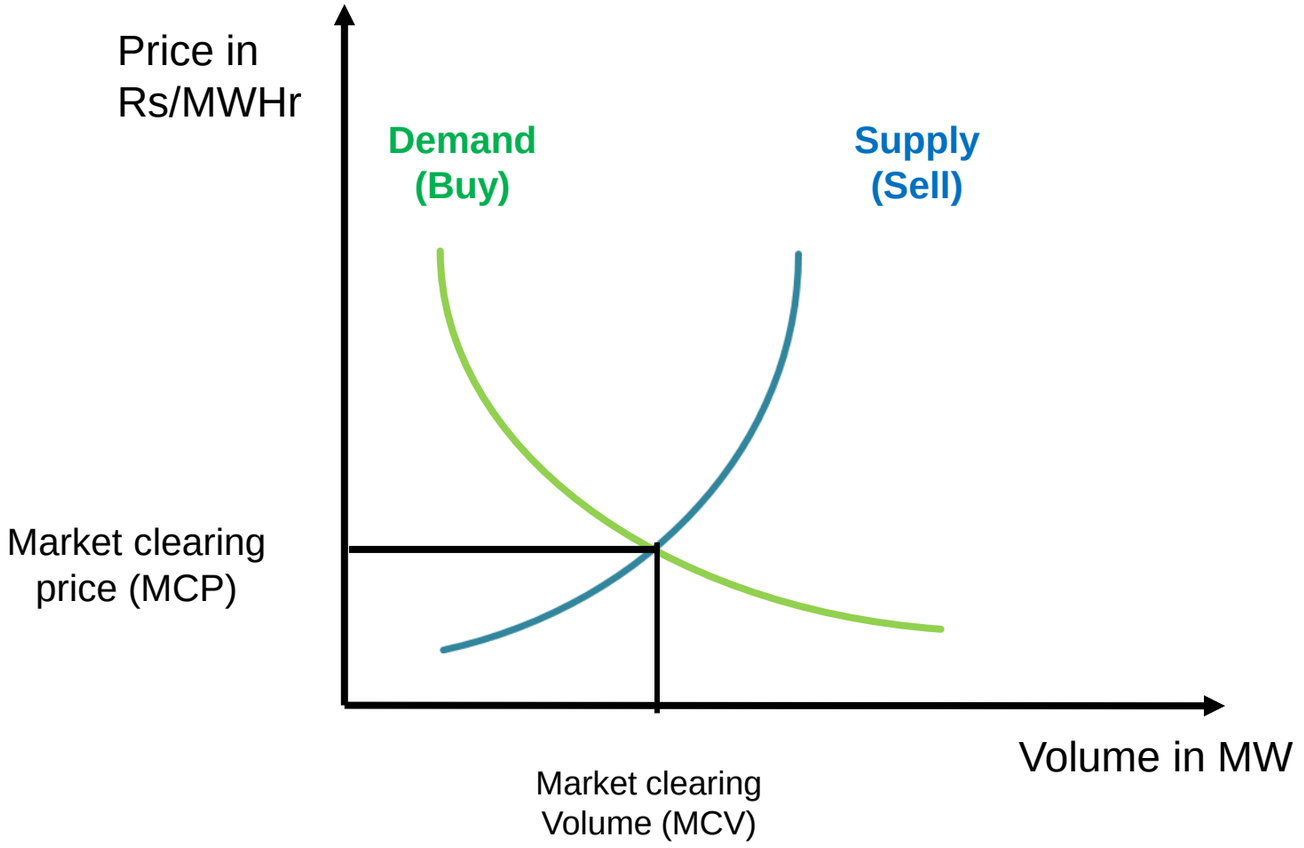
Stakeholder consultation Bhutan
29th -30th June 2017 at Thimpu

Basics of Power Exchange and the activities of SARPEX Mock Exercise

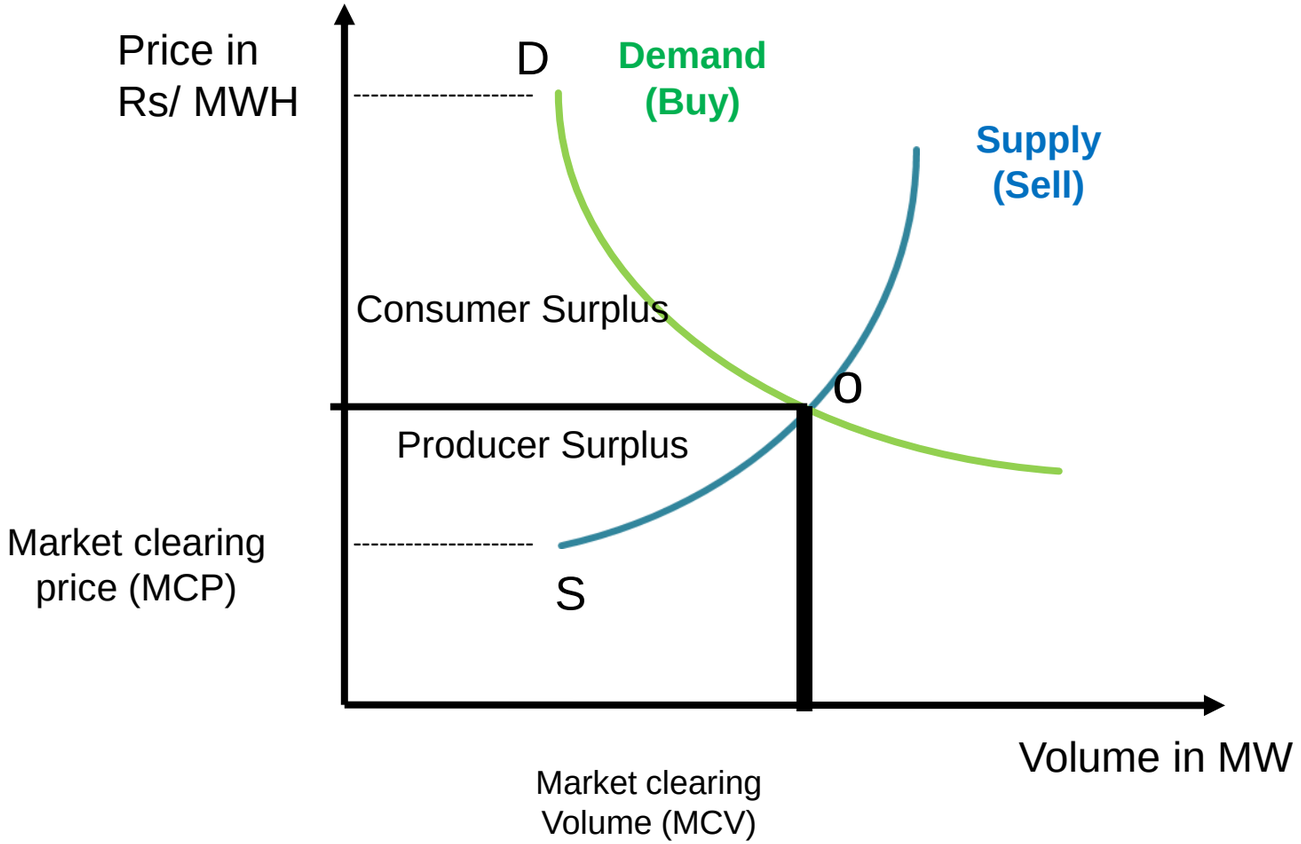
S.K.Ray, IRADe and Suruchi Sawhney, KPMG

Basic Concept of Market Clearing price and volume in a close double sided auction



1) A curve is plotted for the Demand. All the points in the curve represent the Demand bid volume for that price.
2) A curve is plotted for the Supply. All the points in the curve represent the Supply bid volume for that price
3) The point of intersection gives the Market clearing price (MCP) and the Market clearing volume (MCV)
4) All sellers willing to sell at MCP or at a lower price are cleared.
5) All the buyers willing to buy at MCP of at a higher price are cleared.
6) All trades are cleared at MCP irrespective of their bid price.

Concept of Consumer Surplus and Producer surplus



1) Consumer Surplus. All the buyers whose bids were higher than MCP have been cleared. However they will get power at a price lesser than their bid price. Thus they get power at a price lesser than that they were willing to pay. This gain is called the consumer surplus and benefits all buyers on the curve OD.
2) Producer Surplus. All the sellers whose bids were lower than MCP have been cleared. However they will get power at a price higher than their bid price. Thus they get to sell their power at a price higher than that they were willing to accept. This gain is called the producer surplus and benefits all sellers on the curve OS.

Objectives of SARPEX Mock Exercise

Objective :

- **To ascertain the feasibility of the South Asian Regional Power Exchange (SARPEX) with Bangladesh, Bhutan, India and Nepal (BBIN) as the participants. (These are presently interconnected and other neighboring countries will be added as and when grid connectivity happens)**
- **To build capacity of concerned stakeholders in all participating nations**
- **To develop the draft set of Market Rules and Design**

Some Terminology relevant to the exercise

- Day ahead market: Bidding in the market is done on day n, for trades which are effective on day n+1.
- Unconstrained Market Price and volume (UMP & UMV) : The discovered market price and volume which do not take into account transmission constrains.
- Constrained Market Price and volume (CMP & CMV) : The discovered market price and volume discovered after taking into account the transmission constrains
- Modes of operation of pilot market:-
    A. Residual Mode or Sequential Mode - The pilot market shall be run such that the Indian domestic exchanges are not in any manner influenced by the operation of the pilot market. The un-cleared bids of Indian Domestic exchanges shall be matched against the bids of the other nations in the pilot market platform.
    B. Unified Mode - The pilot market shall be run such that all the bids including the bids in the Indian exchanges are cleared simultaneously the pilot market platform

“THE GRID CONSTRAINTS & TRANSMISSION CAPACITY ALLOCATION PROCEDURES DON’T APPLY TO PILOT MARKET “

Key Consideration for SARPEX Mock Exercise

The implementation of a Day Ahead Market (DAM) is crucial to the electricity trade development in the SAR and more immediately in the neighbouring countries of BBIN

Social Welfare Maximization (SWM) and Efficiency are the two objective functions of price discovery and delivery for most of the Power Exchanges across the globe. SWM and efficiency are inter-related objectives, since one cannot exist without the other.

Efficiency aims to maximize total surplus, the sum of consumer surplus and producer surplus. Efficiency requires the output to be:
1. Produced at the lowest marginal cost in the right quantity &
2. consumed by those most willing to pay

Social welfare on the other hand is the difference between the willingness to pay of the bidders minus the cost of the offers. It is actually the sum of consumer and producer surplus, as described in the next slide.

Key Assumptions and Participants for SARPEX Mock Exercise

1

Determination of Unconstrained Market Clearing Price and Volume

The impact of transmission constraints in cross border lines as well as in the countries own national grid are not considered in the mock exercise because:

- **Difficulty of ensuring coordination with the related load dispatch centres of various nations**
- **The results of mock exercise are expected to give an indication of the indication of the direction and quantum of power flows between India and the neighbouring countries**

2

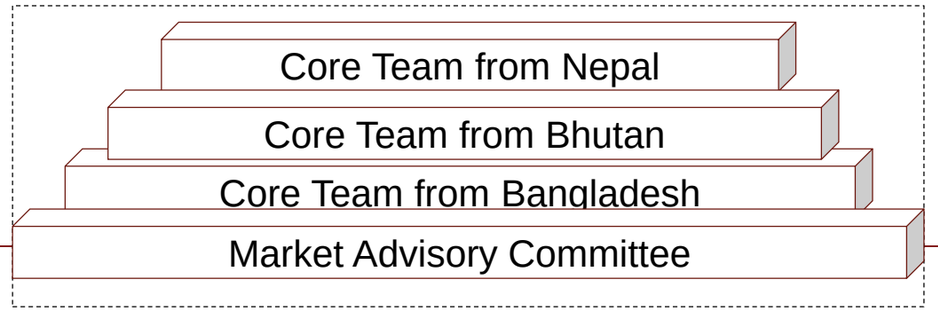
Quantification of Transmission Charges and Losses

The transmission charges and losses as currently applicable under the bilateral trade with BBN were adjusted in the bids submitted by BBN to account for the true cost of power procurement/sale.

The Exchange Fees and Grid Operating charges amounting to about 0.04 Rs/kWh are being ignored in the Mock Exercise.

The transmission charges and losses component was already incorporated by the Indian Participants while submitting their purchase and sell bids on Indian Exchange(s)

Key Participants



Transmission Charges and Losses for BBN

#	Country	Transmission Charges (Rs/kWh)	Transmission Losses (%)	Comments
1	Bangladesh	0.117	0.3%	The cross-border transmission network for India-Bangladesh has been included in the POC charges and transmission Withdrawal Charges and Losses are published for Bangladesh
2	Nepal	0.301	4.1%	The cross-border transmission network for India-Nepal has not been included in POC and therefore the transmission charges of Bihar and Cross-border line are assumed for Nepal
	Bihar Withdrawal	0.257	1.6%	
	Muzzafarpur Dhalkebar Line	0.044	2.5%	
3	Bhutan	0.089	1.1%	The cross-border transmission network for India-Bhutan has been included in the POC charges and transmission Injection Charges are published by NLDC for Bhutan

The bids submitted by BBN were adjusted for the above transmission charges and losses to reflect the true cost of power purchased or sold on the Exchange

Treatment of Transmission Charges and Losses for BBN

Both Transmission Charges and Losses have been incorporated in the Bid Price for the ease of implementation

1

For Buyers

Modified Price = (Bid Price + Transmission Charges) x (1 - % Loss)

2

For Sellers

Modified Price = (Bid Price / (1 - % Loss)) + Transmission Charges

PROPOSED MODES OF OPERATION

OPTION 1 – UNIFIED MODE

The bids from the Indian participants and BBN countries' participants would be cleared simultaneously.

OPTION 2 – SEQUENTIAL MODE (RESIDUAL MODE)

The bids from the Indian participants and BBN countries will be cleared in a sequential manner.

Both modes of operation are discussed on the basis of the structure, conduct and performance paradigms

Structure

Refers to the organization and structure of the DAM. The choice of trading arrangements – exchange over pool, and the auction design – DSCB, form part of the structure.

Conduct

Market mechanisms that determine price and volume cleared.
This also includes the rules and regulations that guide the market

Performance

Aims to understand the impact of each mode on social welfare maximization and wealth distribution

Approach and Methodology – UNIFIED MODE

SELECTION OF SAMPLE DAYS

BIDDING

MARKET CLEARING ALGORITHM IN UNIFIED MODE

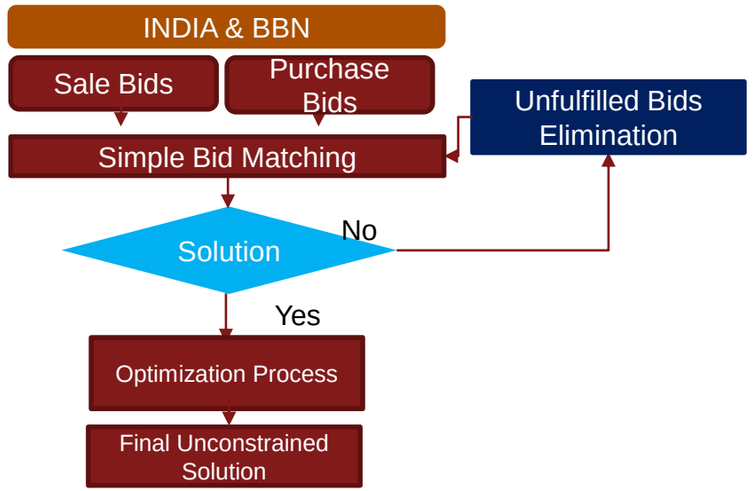
A total of 71 days were selected from the period Apr'15 to Mar'16 basis:

- **Average to Peak Load condition in all nations**
- **Unconstrained Market-clearing Price and Volume on Indian Exchange(s)**
- **Day and Month**
- **Effect and Public holidays/Special days observed in all the nations**

The 15-minute block level purchase/sale bids are submitted by Bhutan, Nepal and Bangladesh for all the selected days

The bids of Indian participants (both buyers and sellers) are extracted from the aggregate demand supply curves available publicly on the Indian Power Exchange(s)

UNIFIED MODE – 15 MINUTE DAM INTERVAL



Approach and Methodology – RESIDUAL MODE

SELECTION OF SAMPLE DAYS

A total of 71 days were selected from the period Apr'15 to Mar'16 basis:

- **Average to Peak Load condition in all nations**
- **Unconstrained Market-clearing Price and Volume on Indian Exchange(s)**
- **Day and Month**
- **Effect and Public holidays/Special days observed in all the nations**

BIDDING

The 15-minute block level purchase/sale bids are submitted by Bhutan, Nepal and Bangladesh for all the selected days

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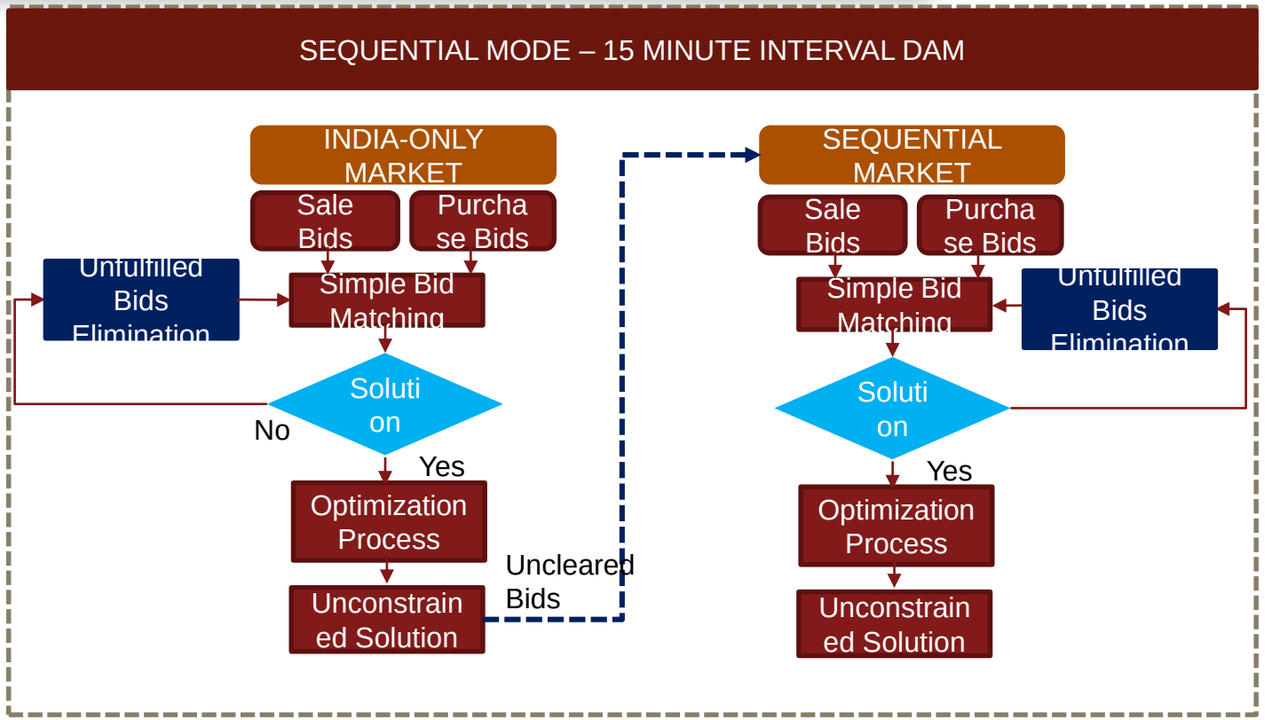
MARKET CLEARING ALGORITHM IN RESIDUAL MODE



OPERATING TIMELINES FOR SARPEX

The choice between single and multi time zones needs to be made in keeping with the impact on Operating Timelines

Time zones observed in BBIN relative to UTC

Country	Time zone (In Hours)	IST Deviation (In Minutes)
India	UTC + 5:30	-
Bhutan	UTC + 6:00	+30 minutes
Bangladesh	UTC + 6:00	+30 minutes
Nepal	UTC + 5:45	+15 minutes

Mismatches in time-zones has implications on coordination of DAM operational activities.

Benefits of Single Time zone

- Efficiency
- Bottleneck Elimination
- Global Best Practice – Nord Pool, OMIE
- Consistency & Simplicity to avoid Mismatch

A single reference time zone and operating timeline assumed for SARPEX mock exercise as per the Indian Standard Time (IST)

OPERATIONAL CHALLENGES DUE TO MULTIPLE TIME ZONES IN SARPEX

Electricity Dispatch at the "day boundary" for three consecutive days D-2, D-1 and D

Slots	41	48	49	71	95	96	1	2	41	49	95	96	1	2	41	49	95	96
India	10:00	11:45	12:00	17:30	23:30	23:45	00:00	00:15	10:00	12:00	23:30	23:45	00:00	00:15	10:00	12:00	23:30	23:45
Nepal	10:15	12:00	12:15	17:45	23:45	00:00	00:15	00:30	10:15	12:15	23:45	00:00	00:15	00:30	10:15	12:15	23:45	00:00
Bhutan	10:30	12:15	12:30	18:00	00:00	00:15	00:30	00:45	10:30	12:30	00:00	00:15	00:30	00:45	10:30	12:30	00:00	00:15
Bangladesh	10:30	12:15	12:30	18:00	00:00	00:15	00:30	00:45	10:30	12:30	00:00	00:15	00:30	00:45	10:30	12:30	00:00	00:15

Coordination Issues

Day D-2 Day D-1 Day D

Dispatch periods at the "day boundary" i.e. Slot 95 and Slot 96 may lead to coordination issues. While these slots belong to Day "D-1" in India, they belong to Day "D" i.e. the next day in Bhutan, Bangladesh and Nepal

Selected Days for Pilot Market Exercise

A total of 71 days were selected as the sample for Mock Exercise

Selection of the days was based on the following criterion:

Average to Peak Load condition in all nations, Unconstrained Market-clearing Price and Volume on Indian Exchange(s), Day and Month Effect and Public holidays/Special days observed in all the nations

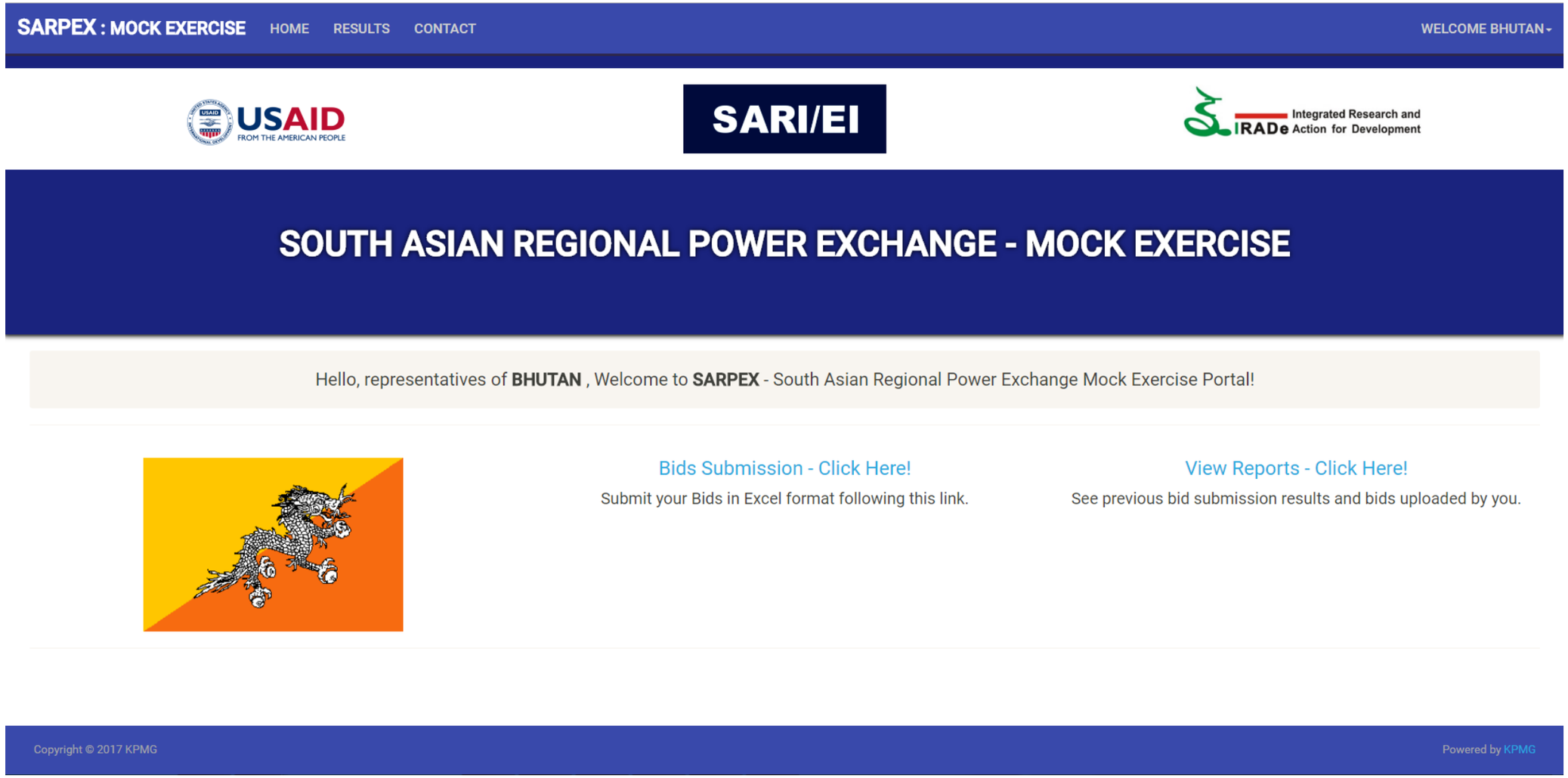
APRIL	MAY	JUNE	JULY	AUGUST	SPETEMBER
Sunday, April 5, 2015	Wednesday, May 13, 2015	Thursday, June 11, 2015	Thursday, July 2, 2015	Saturday, August 8, 2015	Sunday, September 13, 2015
Saturday, April 11, 2015	Friday, May 15, 2015	Sunday, June 14, 2015	Saturday, July 11, 2015	Sunday, August 9, 2015	Sunday, September 20, 2015
Monday, April 13, 2015	Saturday, May 16, 2015	Monday, June 15, 2015	Monday, July 13, 2015	Tuesday, August 11, 2015	Tuesday, September 22, 2015
Sunday, April 19, 2015	Tuesday, May 19, 2015	Sunday, June 21, 2015	Thursday, July 16, 2015	Wednesday, August 19, 2015	Wednesday, September 23, 2015
Wednesday, April 29, 2015		Friday, June 26, 2015	Sunday, July 26, 2015	Thursday, August 20, 2015	Monday, September 28, 2015
		Saturday, June 27, 2015	Monday, July 27, 2015	Saturday, August 22, 2015	
		Tuesday, June 30, 2015		Sunday, August 23, 2015	
				Wednesday, August 26, 2015	
				Sunday, August 30, 2015	

OCTOBER	NOVERMBER	DECEMBER	JANUARY	FEBRAUARY	MARCH
Tuesday, October 13, 2015	Friday, November 27, 2015	Thursday, December 10, 2015	Wednesday, January 6, 2016	Sunday, February 7, 2016	Saturday, March 5, 2016
Wednesday, October 14, 2015		Monday, December 14, 2015	Friday, January 8, 2016	Monday, February 8, 2016	Tuesday, March 8, 2016
Saturday, October 17, 2015		Tuesday, December 15, 2015	Saturday, January 9, 2016	Thursday, February 11, 2016	Monday, March 14, 2016
Thursday, October 22, 2015		Sunday, December 20, 2015	Monday, January 11, 2016	Sunday, February 14, 2016	Saturday, March 19, 2016
		Wednesday, December 23, 2015	Thursday, January 14, 2016	Wednesday, February 24, 2016	Monday, March 21, 2016
		Thursday, December 24, 2015	Tuesday, January 19, 2016		Monday, March 28, 2016
		Tuesday, December 29, 2015	Wednesday, January 20, 2016		Tuesday, March 29, 2016
		Wednesday, December 30, 2015	Thursday, January 21, 2016		Wednesday, September 9, 2015
			Friday, January 29, 2016		

Current Status of SARPEX Mock Exercise

- The mock exercise has currently been done only for a total of 22 days selected from April to July 2015 out of the total of 71 days
- The results for these 22 days are being presented in the stakeholder meetings in all the nations to incorporate their suggestions and feedback.
- The stakeholder consultation in Nepal has already been done; its is currently been done in India; and scheduled in Bangladesh in the next month
- The key findings of the exercise are discussed in the following slides. The key metrics of interest include:
  - Total (Combined) Regional Surplus
  - Total Surplus accrued to each Nation
    - This is further split into Consumer Surplus and Producer Surplus
  - Total Cleared Buy and Sell Volume for each Nation
  - Unconstrained Market Clearing Price

SARPEX WEB Portal for Submission of Bids and Display of Results



Results of SARPEX Mock Exercise

Total Regional Surplus for BBIN

Month	A Average Total Surplus** (in Rs Million) of All Participants in Unified Mode	B Average Total Surplus (in Rs Million) of All Participants in Residual Mode *	C = (A – B) Surplus Gain (in Rs Million) in Unified Mode over Residual Mode
April	3098.29	3095.87	2.42
May	3814.90	3812.47	2.42
June	3268.38	3267.27	1.11
July	3841.14	3839.60	1.54

-The average has been computed over the 5,4,7,6 days selected from April, May, June, July 2015 respectively

-The surplus figures include both Consumer and Producer Surplus

** The surplus in Residual Mode includes the surplus gain of Indian buyers and sellers in India Only Market*

Total Surplus accrued to Bhutan in Unified and Residual Mode

Month	Average Total Surplus (in Rs Million)		Surplus Increment in Residual Mode over Unified Mode(Rs Million, % Increase)
	Unified	Residual	
April	1.29	1.55	0.27(20.57%)
May	6.86	7.77	0.91(13.26%)
June	1.90	2.56	0.66(34.65%)
July	6.74	8.48	1.74(25.85%)

-The average has been computed over the 5,4,7,6 days selected from April, May, June, July 2015 respectively

**** The Total surplus for Bhutan is same as Producer Surplus; Consumer Surplus for Bhutan is zero***

Total Market Clearing Volume (MCV) in Unified and Residual Mode

Month	Average MCV (in MWh) in Unified Mode	Average MCV (in MWh) in Residual Mode **	Increment in MCV in Residual Mode Over Unified Mode	%Increment
April	90693	92502	1809	1.99%
May	101341	103592	2251	2.22%
June	92706	94097	1390	1.50%
July	96971	98649	1678	1.73%

-The average has been computed over the 5,4,7,6 days selected from April, May, June, July 2015 respectively

*** The MCV in Residual mode includes the cleared volumes of Indian participants from India-Only Market*

Cleared Sell Volumes for Bhutan in Unified and Residual Mode

Month	Average Sell Volume (in MWh)		Increment Sale of Power in Residual Mode over Unified Mode	% Increment
	Unified	Residual		
April	817	918	101	12.37%
May	1048	1133	86	8.16%
June	1395	1523	128	9.17%
July	2268	2358	90	3.98%

-The average has been computed over the 5,4,7,6 days selected from April, May, June, July 2015 respectively

Bhutan's share as Percentage of Total Power sold through the Exchange

Month	% of Total Power sold by Bhutan	
	Unified	Residual
April	0.90%	0.99%
May	1.03%	1.09%
June	1.5%	1.62%
July	2.34%	2.39%

-The percentage has been computed over all the blocks selected over 5,4,7,6 days selected from April, May, June and July 2015

Market Clearing Price(MCP) in Unified and Residual Mode

Month	Average MCP (in Rs/MW)		Increase in MCP in Residual Mode over Unified Mode (Rs/MWh, % Increment)
	Unified	Residual	
April	2748	2911	163(5.92%)
May	2859	3031	172(6.02%)
June	2622	2697	75(2.88%)
July	2868	3008	140 (4.87%)

-The average has been computed over the 5,4,7,6 days selected from April, May, June, July 2015 respectively

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Distribution of MCP in Unified and Residual Mode (Block Wise)

Month	Mode	MCP Range							
		<2000	2000 - 2500	2500 - 3000	3000 - 3500	3500 - 4000	4000 - 4500	4500 - 5000	>5000
April	Unified	4%	33%	32%	24%	6%	1%	0%	0%
	Residual	6%	28%	24%	33%	6%	1%	0%	2%
May	Unified	1%	28%	33%	24%	12%	2%	0%	0%
	Residual	1%	23%	22%	28%	20%	5%	0%	1%
June	Unified	2%	53%	26%	10%	4%	4%	1%	0%
	Residual	1%	49%	29%	9%	6%	4%	1%	1%
July	Unified	1%	28%	40%	19%	5%	6%	1%	0%
	Residual	0%	25%	39%	19%	7%	4%	1%	5%

-The frequencies has been computed block-wise, over the 5,4,7,6 days selected from April, May, June, July 2015 respectively

Distribution of Increment in MCP in Residual Mode over Unified Mode

Month	Increment in MCP (in Rs/Mwh)							
	< 0	0-50	50-100	100-200	200-300	300-500	500-1000	>1000
April	4%	50%	15%	15%	8%	5%	1%	2%
May	0%	38%	13%	17%	11%	12%	8%	1%
June	0%	62%	18%	11%	3%	4%	1%	1%
July	0%	54%	16%	16%	5%	3%	2%	4%

-The frequencies has been computed block-wise, over the 5,4,7,6 days selected from April, May, June, July 2015 respectively

Weighted Average Sale Price for Bhutan in Unified and Residual Mode

Month	Weighted Average Selling Price for Bhutan (Rs/MWh)		Increment in Weighted Average Sale Price in Residual Mode over Unified Mode	% Increment
	Unified	Residual		
April	2908	3010	102	3.51%
May	2964	3172	209	7.04%
June	2845	2936	91	3.19%
July	3111	3272	161	5.17%

-The average has been computed over the 5,4,7,6 days selected from April, May, June, July 2015 respectively

Key Takeaways for Bhutan

- The average sell quantum cleared for Bhutan in Unified Mode is 817, 1048, 1395, 2268 MWh for selected days in April, May, June and July respectively. The corresponding sell quantum in the Residual Mode for these months is 918, 1133, 1523, 2358 MWh.
  - The incremental sell quantum in Residual Mode (over Unified Mode) has been of the order of 101, 86, 128 and 90 MWh for April, May, June and July respectively.
- The average Market Clearing Price (in Rs/MWh) observed in the Unified Mode is 2748, 2859, 2622 and 2868 for April, May, June and July respectively. The corresponding prices for these months in the Residual Mode are 2911, 3031, 2697, 3008.
  - The weighted average sale price for Bhutan in the two modes is Rs 2957/MWh and Rs 3097/MWh (averaged over April – July) in Unified and Residual Mode respectively. The average % increase in the weighted average sell price in Residual Mode over Unified Mode is roughly 4% over April to July.
- The average total gain accrued to Bhutan from April to July is roughly 15 Million Rupees and 19 Million Rupees in Unified and Residual Mode respectively. The surplus gain to Bhutan in the case of Residual Mode is higher by an average of 23% than in the case of Unified Mode. This happens on the account of higher prices and incremental sell volumes getting cleared in the Residual Mode.

For more details please contact:-

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Annexure

Daily Total Regional Surplus for BBIN

Day	A Total Surplus (in Rs Million) of All Participants in Unified Mode	B Total Surplus (in Rs Million) of All Participants in Residual Mode *	C = (A – B) Surplus Gain (in Rs Million) in Unified Mode over Residual Mode
Day1 (05 Apr)	3358.90	3356.43	2.47
Day2 (11 Apr)	3159.59	3153.92	5.67
Day3 (13 Apr)	2994.13	2992.96	1.17
Day4 (19 Apr)	2745.52	2743.35	2.17
Day5 (29 Apr)	3233.31	3232.67	0.64
Day6 (13 May)	3803.73	3800.85	2.87
Day7 (15 May)	4106.90	4105.19	1.71
Day8 (16 May)	3712.73	3709.62	3.12
Day9 (19 May)	3636.23	3634.23	2.00

** The surplus in Residual Mode includes the surplus gain of Indian buyers and sellers in India Only Market*

Daily Total Regional Surplus for BBIN

Day	A Total Surplus (in Rs Million) of All Participants in Unified Mode	B Total Surplus (in Rs Million) of All Participants in Residual Mode *	C = (A – B) Surplus Gain (in Rs Million) in Unified Mode over Residual Mode
Day10 (11 June)	3153.71	3151.37	2.34
Day11 (14 June)	2769.41	2768.89	0.52
Day12 (15 June)	2962.73	2961.79	0.94
Day13 (21 June)	3074.74	3073.77	0.97
Day14 (26 June)	4005.61	4004.54	1.08
Day15 (27 June)	3397.36	3396.77	0.59
Day16 (30 June)	3515.08	3513.75	1.33

** The surplus in Residual Mode includes the surplus gain of Indian buyers and sellers in India Only Market*

Daily Total Regional Surplus for BBIN

Day	A Total Surplus (in Rs Million) of All Participants in Unified Mode	B Total Surplus (in Rs Million) of All Participants in Residual Mode *	C = (A – B) Surplus Gain (in Rs Million) in Unified Mode over Residual Mode
Day17 (02 July)	3461.91	3460.27	1.64
Day18 (11 July)	4554.05	4553.53	0.52
Day19 (13 July)	4294.62	4292.57	2.05
Day20 (16 July)	4257.01	4254.64	2.36
Day21 (26 July)	3191.24	3189.27	1.96
Day22 (27 July)	3288.02	3287.31	0.71

**** The surplus in residual mode includes the surplus gain of Domestic Indian Market.***

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Daily Total Surplus for Bhutan in Unified and Residual Mode

Day	Total Surplus (in Rs Million)		% Gain in Total Surplus in Residual Mode over Unified Mode
	Unified	Residual	
Day1 (05 Apr)	5.55	5.07	-8.50%
Day2 (11 Apr)	0.12	0.43	274.31%
Day3 (13 Apr)	0.19	0.36	84.83%
Day4 (19 Apr)	0.09	1.29	1289.30%
Day5 (29 Apr)	0.50	0.62	24.14%
Day6 (13 May)	1.10	1.70	55.19%
Day7 (15 May)	1.18	1.57	33.56%
Day8 (16 May)	24.75	26.79	8.27%
Day9 (19 May)	0.41	0.99	144.63%

Day	Total Surplus (in Rs Million)		% Gain in Total Surplus in Residual Mode over Unified Mode
	Unified	Residual	
Day10 (11 June)	5.54	7.93	43.15%
Day11 (14 June)	0.49	0.56	14.49%
Day12 (15 June)	0.44	0.49	11.75%
Day13 (21 June)	3.53	3.79	7.35%
Day14 (26 June)	0.82	0.98	19.83%
Day15 (27 June)	1.24	1.66	33.73%
Day16 (30 June)	1.23	2.48	101.90%

Daily Total Surplus for Bhutan in Unified and Residual Mode

Day	Total Surplus (in Rs Million)		% Gain in Total Surplus in Residual Mode over Unified Mode
	Unified	Residual	
Day17 (02 July)	10.77	13.44	24.82%
Day18 (11 July)	4.77	5.22	9.47%
Day19 (13 July)	6.71	9.61	43.23%
Day20 (16 July)	12.85	16.06	24.95%
Day21 (26 July)	1.44	2.22	54.46%
Day22 (27 July)	3.88	4.31	11.20%

Daily Market Clearing Volume (MCV)

Day	MCV(MWh) in Unified Mode	MCV(MWh) in Residual Mode **	Increment in MCV in Residual Mode Over Unified Mode	%Increment
Day1 (05 Apr)	85979	87912	1933	2.25%
Day2 (11 Apr)	86286	89075	2789	3.23%
Day3 (13 Apr)	92669	94520	1852	2.00%
Day4 (19 Apr)	87035	88164	1129	1.30%
Day5 (29 Apr)	101498	102841	1344	1.32%
Day6 (13 May)	103259	105805	2547	2.47%
Day7 (15 May)	105263	107344	2082	1.98%
Day8 (16 May)	101526	103587	2061	2.03%
Day9 (19 May)	95315	97632	2317	2.43%

*** The MCV in Residual mode includes the cleared volumes of Indian participants from India-Only Market*

Daily Market Clearing Volume (MCV)

Day	MCV(MWh) in Unified Mode	MCV(MWh) in Residual Mode **	Increment in MCV in Residual Mode Over Unified Mode	%Increment
Day10 (11 June)	103676	105894	2218	2.14%
Day11 (14 June)	84445	85366	921	1.09%
Day12 (15 June)	90291	91317	1026	1.14%
Day13 (21 June)	99396	101135	1739	1.75%
Day14 (26 June)	93802	94924	1122	1.20%
Day15 (27 June)	92557	93628	1071	1.16%
Day16 (30 June)	84779	86415	1636	1.93%

*** The MCV in Residual mode includes the cleared volumes of Indian participants from India-Only Market*

Daily Market Clearing Volume (MCV)

Day	MCV(MWh) in Unified Mode	MCV(MWh) in Residual Mode **	Increment in MCV in Residual Mode Over Unified Mode	%Increment
Day17 (02 July)	94659	96079	1420	1.50%
Day18 (11 July)	103963	105011	1047	1.01%
Day19 (13 July)	100739	102374	1636	1.62%
Day20 (16 July)	109984	111740	1755	1.60%
Day21 (26 July)	84035	87085	3050	3.63%
Day22 (27 July)	88443	89607	1163	1.32%

*** The MCV in Residual mode includes the cleared volumes of Indian participants from India-Only Market*

Daily Cleared Sell Volumes for Bhutan

Month	Total Sell Volume (in MWh)		Increment in Sell Volume in Residual Mode over Unified Mode	% Increment
	Unified	Residual		
Day1 (05 Apr)	3075	3380	305	9.91%
Day2 (11 Apr)	87	103	16	17.77%
Day3 (13 Apr)	248	312	65	26.06%
Day4 (19 Apr)	97	162	65	67.18%
Day5 (29 Apr)	579	635	56	9.63%
Day6 (13 May)	543	664	121	22.34%
Day7 (15 May)	674	701	27	4.01%
Day8 (16 May)	2106	2106	0	0.00%
Day9 (19 May)	869	1063	194	22.29%

Daily Cleared Sell Volumes for Bhutan

Month	Total Sell Volume (in MWh)		Increment in Sell Volume in Residual Mode over Unified Mode	% Increment
	Unified	Residual		
Day10 (11 June)	2073	2227	154	7.44%
Day11 (14 June)	659	705	47	7.06%
Day12 (15 June)	328	336	9	2.59%
Day13 (21 June)	1551	1587	37	2.35%
Day14 (26 June)	413	419	6	1.51%
Day15 (27 June)	1975	2421	446	22.56%
Day16 (30 June)	2767	2965	198	7.16%

Daily Cleared Sell Volumes for Bhutan

Month	Total Sell Volume (in MWh)		Increment in Sell Volume in Residual Mode over Unified Mode	% Increment
	Unified	Residual		
Day17 (02 July)	2962.25	2973.75	11.5	0.39%
Day18 (11 July)	2352.25	2402.75	50.5	2.15%
Day19 (13 July)	2379.75	2462.25	82.5	3.47%
Day20 (16 July)	3173.5	3183.75	10.25	0.32%
Day21 (26 July)	890	1141.25	251.25	28.23%
Day22 (27 July)	1847.25	1983.25	136	7.36%

Daily Market Clearing Price (MCP)

Day	MCP (in Rs/MWh)*		Increment in Price in Residual Mode over Unified Mode	% Increment
	Unified	Residual		
Day1 (05 Apr)	2920	2961	41	1.41%
Day2 (11 Apr)	3079	3541	462	15.01%
Day3 (13 Apr)	2618	2677	59	2.25%
Day4 (19 Apr)	2549	2747	198	7.78%
Day5 (29 Apr)	2574	2626	52	2.04%
Day6 (13 May)	2878	3096	217	7.56%
Day7 (15 May)	2826	2927	102	3.60%
Day8 (16 May)	2967	3222	255	8.58%
Day9 (19 May)	2764	2878	115	4.15%

Daily Market Clearing Price (MCP)

Day	MCP (in Rs/MWh)		Increment in MCP in Residual Mode over Unified Mode	% Increment
	Unified	Residual		
Day10 (11 June)	3161	3374	214	6.76%
Day11 (14 June)	2418	2449	32	1.30%
Day12 (15 June)	2519	2558	39	1.54%
Day13 (21 June)	2605	2641	36	1.37%
Day14 (26 June)	2389	2469	80	3.37%
Day15 (27 June)	2511	2545	34	1.34%
Day16 (30 June)	2750	2845	94	3.43%

Daily Market Clearing Price(MCP)

Day	MCP (in Rs/MWh)		Increment in MCP in Residual Mode over Unified Mode	% Increment
	Unified	Residual		
Day17 (02 July)	3058	3259	201	6.57%
Day18 (11 July)	2823	2860	37	1.31%
Day19 (13 July)	2990	3222	232	7.75%
Day20 (16 July)	3224	3459	235	7.30%
Day21 (26 July)	2556	2648	92	3.58%
Day22 (27 July)	2556	2598	42	1.64%

**** The sellers in India gain in both the modes. The MCP of the Residual Mode does not impact the Indian domestic buyers.*

Daily Weighted Average Sell Price for Bhutan

Day	Weighted Average Selling Price (in Rs/MWh)		Increment in Weighted Sale Price in Residual Mode over Unified Mode	% Increment
	Unified	Residual		
Day1 (05 Apr)	2910	2907	-3	-0.10%
Day2 (11 Apr)	3227	3955	728	22.55%
Day3 (13 Apr)	2993	3123	130	4.34%
Day4 (19 Apr)	3154	4936	1782	56.50%
Day5 (29 Apr)	2773	2860	87	3.15%
Day6 (13 May)	3098	3341	242	7.81%
Day7 (15 May)	3078	3207	129	4.20%
Day8 (16 May)	2941	3184	243	8.27%
Day9 (19 May)	2846	3021	175	6.13%

Daily Weighted Average Sell Price for Bhutan

Day	Weighted Average Selling Price (in Rs/MWh)		Increment in Weighted Sale Price in Residual Mode over Unified Mode	% Increment
	Unified	Residual		
Day10 (11 June)	3379	3586	208	6.15%
Day11 (14 June)	2576	2584	8	0.32%
Day12 (15 June)	2565	2599	34	1.31%
Day13 (21 June)	2661	2701	40	1.50%
Day14 (26 June)	2404	2498	94	3.91%
Day15 (27 June)	2731	2751	20	0.74%
Day16 (30 June)	2792	2907	115	4.10%

Daily Weighted Average Sell Price for Bhutan

Day	Weighted Average Selling Price (in Rs/MWh)		Increment in Weighted Sale Price in Residual Mode over Unified Mode	% Increment
	Unified	Residual		
Day17 (02 July)	3174	3395	222	6.99%
Day18 (11 July)	2952	2990	39	1.31%
Day19 (13 July)	3259	3534	275	8.44%
Day20 (16 July)	3290	3539	249	7.57%
Day21 (26 July)	3034	3104	70	2.31%
Day22 (27 July)	2756	2774	18	0.64%