

DSM (4th Amendtment)-2018

Eastern Regional Power Committee, Kolkata-33

S K Pradhan, AD-II (Comml.)

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DEVIATION

- Actual Generation Scheduled Generation (For Generators)
- Total Actual Drawl Total Scheduled Drawl (For Beneficiaries)
- Worked out for each 15 min time block
- Based on average frequency of the relevant time block
- Payable for over-drawl/under-injection by buyer/seller
 Receivable for under-drawl/over-injection by buyer/seller

Existing Overview:

- Came into force on 17.02.2014
- To strengthen the grid and improve grid stability
- Major provisions:
 - Frequency band (50.10-49.7 Hz)
 - Volume limit for buyer/seller
 - Cap Rate for CERC regulated APM Generators
 - Increased charges for deviation due to volume limit.

Major Changes in 4th Amendment:

- Frequency band has been tightened to 50.05 to 49.85.
- Charges for deviation for each 0.01 Hz step is changing everyday.
- Deviation price vector linked to Daily Average Area Clearing Price(ACP) in Day Ahead Market of Power Exchange.
- Cap Rate for all generators (irrespective of fuel source)
 - a) For CERC regulated generators- @ECR of Previous month .
 - b) for Other generators- @ 303.04 Paisa/KWH
- Additional deviation charge for sustained unidirectional deviation.

Frequency Band:

Existing	Fourth Amendment (w.e.f. 01.01.2019)
1 . 49.7 Hz to 50.1 Hz	1 . 49.85 Hz to 50.05 Hz
2. OD/UD by buyer or OI/UI by seller shall not exceed 12% or 150 MW whichever is lower when freq is 49.7 Hz and above and below 50.1Hz.	2. OD/UD by buyer or OI/UI by seller shall not exceed 12% or 150 MW whichever is lower when freq is 49.85 Hz and above and below 50.05Hz.
3 . No OD by buyer or UI by seller when grid frequency is below 49.7 Hz and no UD by buyer or OI by seller when grid frequency is 50.1 Hz and above.	3 . No OD by buyer or UI by seller when grid frequency is below 49.85 Hz and no UD by buyer or OI by seller when grid frequency is 50.05 Hz and above.

CHARGES FOR DEVIATION:

Existing Deviation Price Vector

Frequency	Rate for Deviation Charge(RDC)
f>=50.05Hz	RDC=0
50.05>f>=50.00	RDC increases by 35.6 p/u for each 0.01Hz step
50.00>f>=49.7	RDC increases by 20.84 p/u for each 0.01Hz step
f<49.7	RDC=824.04p/u

CHARGES FOR DEVIATION: Existing

Average freq of the	Average freq of the time block (Hz)	
Below	Not below	Paise/kWh
	50.05	0.00
50.05	50.04	35.60
50.04	50.03	71.20
50.01	50.00	178.00
50.00	49.99	198.84
49.99	49.98	219.68
49.72	49.71	782.36
49.71	49.70	803.20
49.70		824.04

Charges for Deviation (4th Amendment):

- Charges for deviation below 49.85 Hz is fixed at 800p/u, for freq 50.05 Hz and above charges for deviation is 0 p/u.
- Charges for deviation at 50.00 Hz will be Daily Average Area Clearing Price(ACP) discovered at DAM (Max ceiling being 800 p/u).
- The Day-ahead market price of the Power Exchange having a market share of 80% or more in energy terms on a daily basis shall be taken into consideration for linking to the DSM price vector.
- If no single Power Exchange is having a market share of 80% or more, the weighted average day-ahead price of power Exchange of having market share of 20% & more shall be used for linking to the DSM price vector.
- DSM rate vector will have a <u>dynamic slope</u> determined by joining the identified price points at 50 Hz(daily avg. ACP), frequency below 49.85 (800p/u) and 50.05 Hz (0p/u) on daily basis.

CHARGES FOR DEVIATION(4TH Amendment):

Average freq of th	Average freq of the time block (Hz)	
Below	Not below	Paise/kWh
	50.05	0.00
50.05	50.04	1x(P/5)
50.04	50.03	2x(P/5)
50.01	50.00	Р
50.00	49.99	50.00+15x(P/16)
49.99	49.98	100.00+14x(P/16)
49.87	49.86	700.00+2x(P/16)
49.86	49.85	750.00+1x(P/16)
49.85		800.00

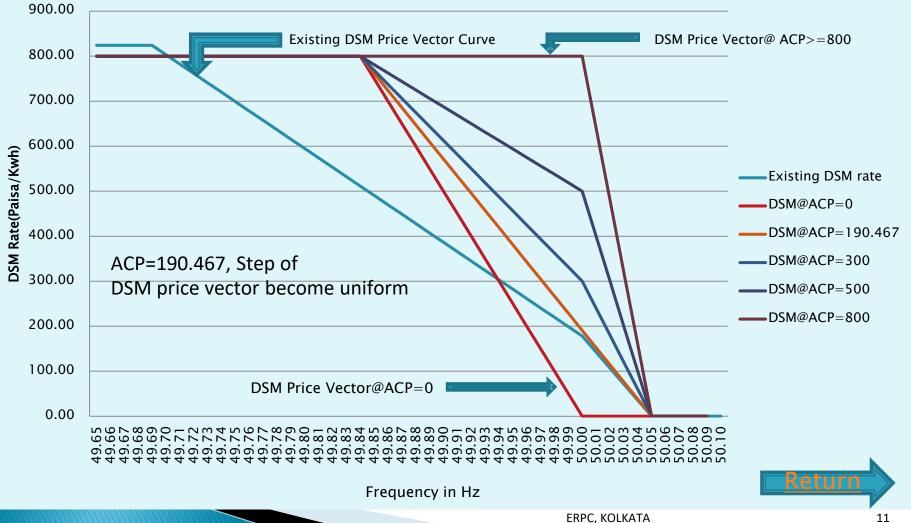
P=Average Area Clearing Price

CHARGES FOR DEVIATION(4TH Amendment):

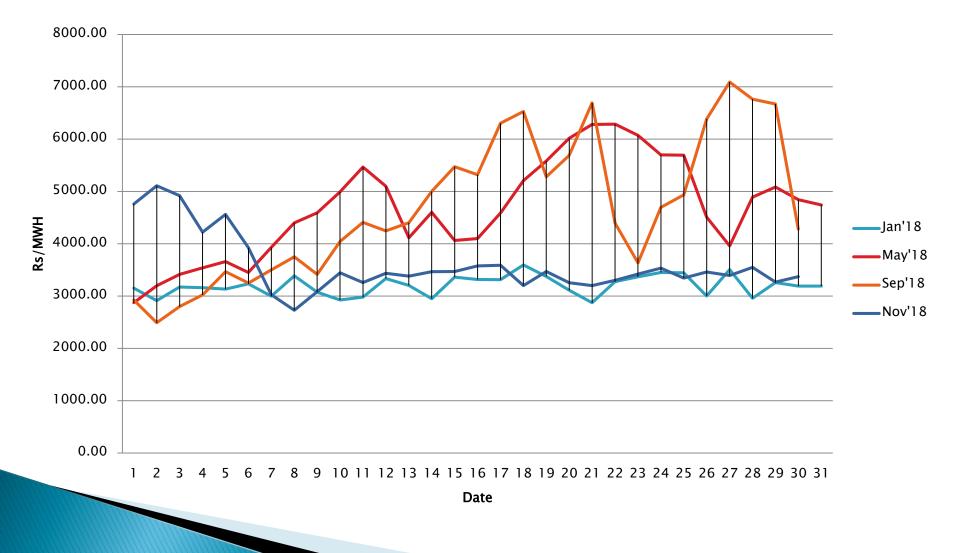
Average f time bloc	req of the k (Hz)	Charges for Deviation(paisa/Kwh)					
Below	Not below	ACP=0	ACP=190.47	ACP=300	ACP=500	ACP=800	ACP>=900
	50.05	0	0	0	0	0	0
50.05	50.04	0	38.095	60	100	160	160
50.04	50.03	0	76.190	120	200	320	320
50.01	50.00	0	190.476	300	500	800	800
50.00	49.99	50	228.571	331.25	518.75	800	800
49.99	49.98	100	266.666	362.5	537.5	800	800
49.87	49.86	700	723.809	737.5	762.5	800	800
49.86	49.85	750	761.904	768.75	781.25	800	800
49.85		800	800	800	800	800	800

Deviation Rate Vector:

Existing DSM Rate Vs Proposed DSM Rate



ACP for different Months of 2018



Cap Rate for Generators

Existing	Fourth Amendment (w.e.f. 01.01.2019)
1. Generators under APM Fixed Cap rate of 303.04 p/u	1. The CAP rate for CERC regulated Generators shall be equal to its prev. months energy charges billed.
2. No cap rate for other generators	Fixed Cap rate for all generators irrespective of fuel source of 303.04 p/u

BUYER/SELLER:

1. Over injection/Under drawl

- Charges for deviation receivable for over injection/ under drawl by seller/buyer in excess of 12% of schedule or 150MW whichever is less shall be 0
- When schedule <= 400MW volume capping is fixed at 48MW
- When frequency is 50.05Hz and above
 - Additional deviation charges payable for over injection/ under drawl in any time block when f>=50.05 Hz at ACP.

BUYER/SELLER:

2. Under injection/Over drawl

- Charges for deviation payable for over drawl/ under injection by seller/buyer within volume limit in a time block in normal deviation charge depending on frequency
- Additional deviation charges payable for over drawl/under injection beyond the volume capping
- When schedule <= 400MW volume capping is fixed at 48MW

BUYER/SELLER:

Additional Deviation Charge (Under injection/Over drawl)

- 1. When grid frequency is 49.85 Hz and above
 - When 12% of schedule in a time block <= 150MW
 - When 12% of schedule in a time block > 150MW
- 2. When grid frequency is below 49.85 Hz

Additional Deviation Charge (Over drawl)

1. When grid frequency is 49.85 Hz and above

When 12% <=150 MW	When 12%> 150MW	Additional Charges
12-15%	150-200MW	20 % of Normal Deviation Charge depending on average freq of that block
15-20%	200-250MW	40 % of Normal Deviation Charge depending on average freq of that block
Above 20%	Above 250 MW	100 % of Normal Deviation Charge depending on average freq of that block

Additional Deviation Charge (Under injection)

1. When grid frequency is 49.85 Hz and above

When 12% <=150 MW	When 12%> 150MW	Additional Charges
12-15%	150-200MW	20 % of MIN (Cape rate, Deviation Charge of that time block)
15-20%	200-250MW	40 % of MIN (Cape rate, Deviation Charge of that time block)
Above 20%	Above 250 MW	100 % of MIN (Cape rate, Deviation Charge of that time block)

Additional Deviation Charge

- 2. When grid frequency is below 49.85 Hz
 - Deviation Charge is payable at 800 p/u
 - Additional Deviation Charge is levied at 800 p/u

For generators

- Under CERC regulated—
 - Deviation Charge is payable at ECR of previous month
 - Additional Deviation Charge is levied at ECR of previous month
- Other generators --
 - Deviation Charge is payable at 303.04 p/u
 - Additional Deviation Charge is levied at 303.04 p/u

INFIRM POWER:

1. Injection

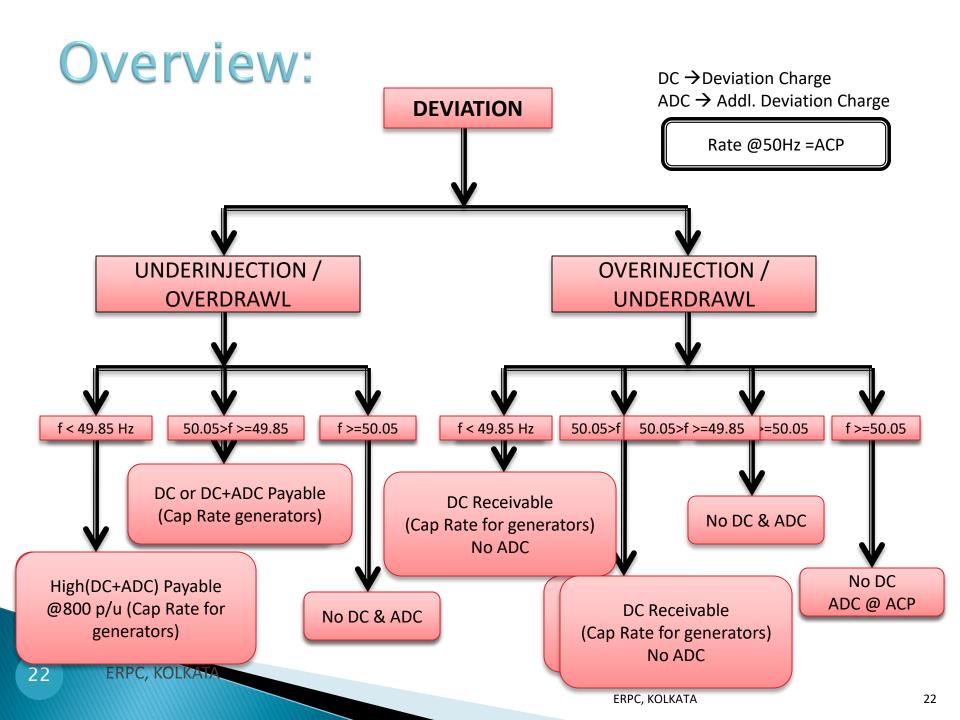
- Domestic coal/lignite/hydro: Capped at 178 p/u
- Imported coal: Capped at 303 p/u
- RLNG: At 800 p/u
- Exemption from volume limit
- Exemption from sign change violation

2. Drawl

- Exemption from volume limit
- No additional charge
- Exemption from sign change violation

Deviation Charge for Wind/Solar

Absolute Error (%)	Under injection (Payable)	Over injection (Receivable)
<=15%	At the Fixed Rate up to 15%	At the Fixed Rate up to 15%
>15% but <=25%	At the fixed rate up to 15% + 110% of Fixed Rate for balance energy >15% but <=25%	At the Fixed Rate up to 15% + 90% of fixed rate for balance energy >15% but <=25%
>25% but <=35%	At the fixed rate up to 15% + 110% of fixed rate for balance energy >15% but <=25% + 120% of the Fixed Rate for balance energy >25% but <=35%	At the fixed rate up to 15% + 90% of fixed rate for balance energy >15% but <=25% + 80% of the Fixed Rate for balance energy >25% but <=35%
>35%	At the fixed rate up to 15% + 110% of fixed rate for balance energy >15% but <=25% + 120% of the Fixed Rate for balance energy >25% but <=35% + 130% of the Fixed Rate for balance energy >35%	At the fixed rate up to 15% + 90% of fixed rate for balance energy >15% but <=25% + 80% of the Fixed Rate for balance energy >25% but <=35% + 70% of the Fixed Rate for balance energy >35%



Addl. DC on sustained unidirectional deviation:

Existing	<u>4th Amendment</u>
1. In the event of sustained deviation from schedule in one direction (positive or negative) by any regional entity, such regional entity (buyer or seller) shall have to make sign of their deviation from schedule changed, at least once, after every 12 time blocks.	1. In the event of sustained deviation from schedule in one direction (positive or negative) by any regional entity, such regional entity (buyer or seller) shall have to make sign of their deviation from schedule changed, at least once, after every 6 time blocks.
2. No additional charge for above violation.	2. Addl. Charges of 20% of the daily base DSM payable/receivable shall be applicable in case of each said violation.

Summary:

4 th Amendment (w.e.f. 01.01.2019)	Existing(Before 4 th Amendment)
1 . Definition of ACP and DAM has been introduced.	1. NIL
 2. Frequency band tightened, range being 49.85 Hz to 50.05 Hz 	2. Frequency band was 49.7 Hz to 50.1 Hz
3. Deviation charge @ 50 Hz linked to ACP; ceiling being 800 p/u	3. Deviation charge @50.00 Hz was 178 p/u (median value of 6 months avg. energy charge of coal/lignite plants)
4. Max deviation charge is 800 p/u (Below 49.85 Hz)	4. Max deviation charge is 824.04 p/u (Below 49.7 Hz)

4 th Amendment (w.e.f. 01.01.2019)	Existing(Before 4 th Amendment)
5. DSM rate vector will have a dynamic daily slope due to linking with ACP.	5. Slope was predefined.
6. The CAP rate for the DSM charges of generating stations regulated by CERC shall be equal to its prev. months energy charges billed.	6. Fixed Cap rate of 303.04 paisa/Unit for APM generating stations regulated by CERC.
7. The CAP rate for the DSM charges of other generating stations (irrespective of fuel sources) shall be 303.04 paisa/unit.	7. No cap rate for other generators.
8. OD/UD by buyer or OI/UI by seller shall not exceed 12% or 150 MW whichever is lower when freq is 49.85 Hz and above and below 50.05Hz.	8. OD/UD by buyer or OI/UI by seller shall not exceed 12% or 150 MW whichever is lower when freq is 49.7 Hz and above and below 50.1Hz.
9. No OD by buyer or UI by seller when grid frequency is below 49.85 Hz and no UD by buyer or OI by seller when grid frequency is 50.05 Hz and above.	9. No OD by buyer or UI by seller when grid frequency is below 49.7 Hz and no UD by buyer or OI by seller when grid frequency is 50.1 Hz and above.

Summary:

4th Amendment (w.e.f. 01.01.2019) Existing(Before 4th Amendment)

10. In the event of sustained deviation from schedule in one direction (positive or negative) by any regional entity, such regional entity (buyer or seller) shall have to make sign of their deviation from schedule changed, at least once, after every 6 time blocks. Addl. Charges of 20% of the daily base DSM payable/receivable shall be applicable in case of said violation. **10.** In the event of sustained deviation from schedule in one direction (positive or negative) by any regional entity, such regional entity (buyer or seller) shall have to make sign of their deviation from schedule changed, at least once, after every 12 time blocks. No such additional charge.

Buyers (Under drawl/Over drawl)

	Sch (MWH)	Act (MWH)	Dev (MWH)	Freq (Hz)	New Dev <u>Rate if ACP is</u> <u>300 p/u</u> (Rs/MWH)	DC Receivable (+)/Payable(-) (Rs.)	Quantum of Deviation for ADC(MWH)	ADC Payable (Rs.)
1	-200	-160	40	49.95	4562.50	24*4562.5	0	0
2	-200	-250	-50	50.00	3000.00	-50*3000	26	<u>-45600</u>
3	-200	-280	-80	49.98	3625.00	-80*3625	56	-163850
4	-200	-250	-50	49.64	8000.00	-50*8000	50	-50*8000
5	-200	-160	40	50.07	0	0	40	-40*3000
6	-200	-250	-50	50.08	0	0	0	0
7	-50	-30	20	49.84	8000.00	12*8000	0	0
8	-30	-50	-20	49.83	8000	-20*8000	20	-20*8000

Sellers (Under injection/Over injection)

	Sch (MWH)	Act (MWH)	Dev (MWH)	Freq (Hz)	New Dev Rate if ACP is 300 p/u (Rs/MWH)	Dev Rate Applicabl e (Rs/MWH) (Cap Rate)	DC Receivable (+)/Payable(-) (Rs.)	Quantum of Deviation for ADC(MW H)	ADC Payable (Rs.)
1	1000(C ERC Regulat ed)	1100	100	49.8 5	7687.50	2484	37.5*2484	0	0
2	1000	920	-80	49.9 0	6125	2484	-80*2484	42.5	<u>-62100</u>
3	1000	1100	100	50.0 6	0	0	0	0	-100*3000
4	1000 (Other generato rs)	950	-50	49.9 5	4562.50	3030.4	-50*3030.4	12.5	<u>-7576</u>
5	1000	950	-50	50.0 5	0	0	0	0	0
6	1000	920	-80	49.8 0	8000.00	3030.40	-80*3030.40	80	-80*3030.4

Infirm Power (Injection/ Drawl)

	Sch (MWH)	Act (MWH)	Dev (MWH)	Freq (Hz)	Dev Rate If ACPis 300P/U(Rs/MWH)	Dev Rate Applicable (Rs/MWH) (for APM)	DC Receivable (+)/Payable(-) (Rs.)	Quantum of deviation for ADC(MWH)	ADC Payable (Rs.)
1	0	10	10	49.95	4562.50	1780.00	10*1780	0	0
2	0	-10	-10	49.91	5812.50	5812.50	-10*5812.50	0	0
3	0	10	10	50.04	600	600	10*600	0	0

Solar (Over injection/ Under injection)

	Sch (MWH)	Act (MWH)	Dev (MWH)	Dev (MW)	Absolute Error(%) (ABS(Dev)/10))*100	Fixed Dev Rate (Rs/MWH)	DC Receivable (+)/Payable(-) (Rs.)
1	2	1.99	-0.01	-0.04	0.4	9350	-0.01*9350
2	2	2.5	0.5	2	20	9350	4558.13
3	4	2.5	-1.5	6	60	9350	<u>-16479.38</u>

DC & ADC Calculation for Buyer

Schedule = -200 MWHActual = -250 MWHAnnex-IDeviation = -250-(-200) = -50 MWHFreq = 50.00 Hz, Dev Rate = 3000 Rs/MWHMin (12% of sch=24, 37.5) = 24 MWH (So here 12% of sch <150MW or 37.5MWH)</td>DC payable=-50x3000=-150000Over drawl allowed without levy of ADC= 24 MWHQuantum of Over drawl on which ADC to be levied = 50-24 = 26 MWH

12-15%	15-20%	Above 20%
3% of sch*20% of Dev	5% of sch*40% of Dev	(26-8% of sch)*100% of
Rate of that time block=	Rate of that time block=	Dev Rate of that time
0.03*200*0.2*3000= Rs	0.05*200*0.4*3000= Rs	block= (26-16)*1*3000=Rs
3600	12000	30000

So total ADC= 3600+12000+30000=Rs 45600

DC & ADC Calculation for CERC Regulated Generators

Schedule = 1000 MWHActual = 920 MWHAnnex-IIDeviation = 920-1000 = -80 MWHFreq = 49.90 Hz, Dev Rate = 6125.00 Rs/MWH, Applicable rate=EC of FSTPP I&II=2484 Rs/MWH(Oct'18)Min (12% of sch=120, 37.5) = 37.5 MWH (Here 12% of sch >150MW or 37.5MWH)DC Payable=-80x2484 =-198720Under injection allowed without levy of ADC= 37.5 MWHQuantum of Linder Injection on which ADC to be levied = 80-37.5 = 42.5 MWH150-200 MW200-250 MW

150-200 MW	200-250 MW	Above 250 MW
(200-150)/4*20% of MIN	(250-200)/4*40% MIN	(42.5-12.5-12.5)*100%
(248.4p/u, Deviation	(303.04p/u, Deviation	MIN (303.04p/u,
Charge of that time	Charge of that time	Deviation Charge of that
block)= 12.5*0.2*2484=	block)= 12.5*0.4*2484=	time block)=
Rs 6210	Rs 12420	17.5*1*2484=Rs 43470

So total ADC= 6210+12420+43470=Rs 62100

Schedule = 1000 MWHActual = 950 MWHAnnex-IIIDeviation = 950-1000 = -50 MWHFreq = 49.90 Hz, Dev Rate = 4562.50 Rs/MWH, Applicable rate=3030.4Rs/MWH(Fixed for other generators)Min (12% of sch=120, 37.5) = 37.5 MWH (Here 12% of sch >150MW or 37.5MWH)DC Payable=-50x3030.4 =-151520Under injection allowed without levy of ADC= 37.5 MWHQuantum of Under Injection on which ADC to be levied = 50-37.5 = 12.5 MWH

150-200 MW

(200-150)/4*20% of MIN (248.4p/u, Deviation Charge of that time block)= 12.5*0.2*3030.4= Rs 7576

So total ADC= =Rs 7576

Schedule = 50 MWHActual = 20 MWHDeviation = 50-20 = -30 MWHFreq = 50.00 Hz, Dev Rate = ACP = 3000 Rs/MWH (say)Here sch <= 400MW or 100 MWH</td>

So volume limit is fixed at 48 MW or 12 MWH

DC Payable=-30x3000=-90000

Under injection allowed without levy of ADC= 12 MWH

Quantum of Over drawl on which ADC to be levied = 30-12 = 18 MWH

12-15%	15-20%	Above 20%
3% of sch*20% of Dev	5% of sch*40% of Dev	(18-8% of sch)*100% of
Rate of that time block=	Rate of that time block=	Dev Rate of that time
0.03*(400/4)*0.2*3000=	0.05*(400/4)*0.4*3000=	block= (18-8)*1*3000=Rs
Rs 1800	Rs 6000	30000

So total ADC= 1800+6000+30000=37800Rs.

Annex-IV

Schedule = 4 MWHActual = 2.5 MWHAnnex-VDeviation = 2.5-4 = -1.5MWH or -6 MWFixed Dev Rate = 9350 Rs/MWHAbsolute error (%) = ABS(-6MW/10MW)*100=60Quantum of under injection at FR= 0.15*2.5=0.375 MWHQuantum of under injection at 110% of the FR= 2.5*0.1 = 0.25 MWHQuantum of under injection at 120% of the FR= 2.5*0.1 = 0.25 MWHQuantum of under injection at 130% of the FR= 1.5-0.375-0.25-0.25 = 0.625 MWH

<=15%	>15% but <=25%	>25% but <=35%	>35%
0.375*9350= Rs	0.25*1.1*9350=	0.25*1.2*9350=	0.625*1.3*9350=
3506.25	Rs 2571.25	Rs 2805	Rs 7596.875

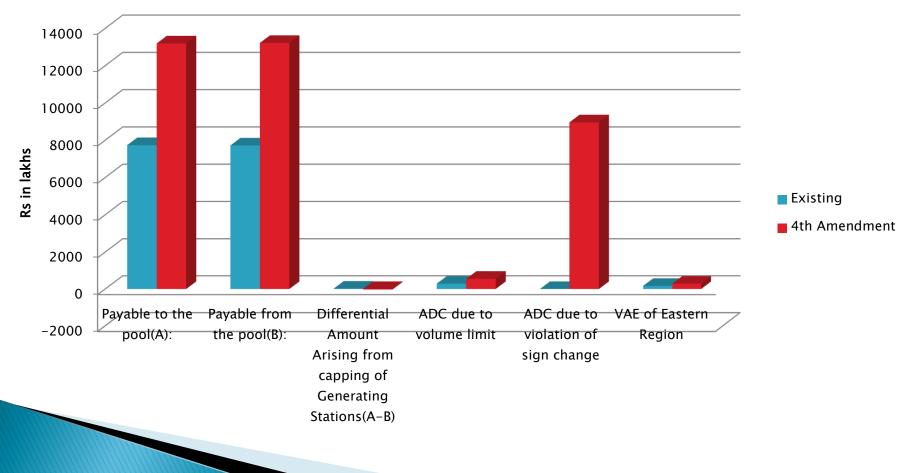
So total DC= 3506.25+2571.25+2805+7596.875=16479.38 Rs.

Comparative DSM A/c for week 191118-251118

	DSM Account for 191118-251118			
	Existing Regulation(Rs in Lakhs)	4 th Amend regulation(Rs in Lakhs)		
Payable to the pool(A):	7737.540336	13192.56983		
Payable from the pool(B):	7719.881431	13220.32048		
Differential Amount Arising from capping of Generating Stations(A-B)	17.6589049	-27.7506511		
ADC due to volume limit	289.1063323	555.86881		
ADC due to violation of sign change	0	8960.20119		
VAE of Eastern Region	168.2082154	288.860182		

Comparative DSM A/c for week 191118–251118

Existing DSM A/c Vs 4th Amendment DSM A/c for week 191118–251118

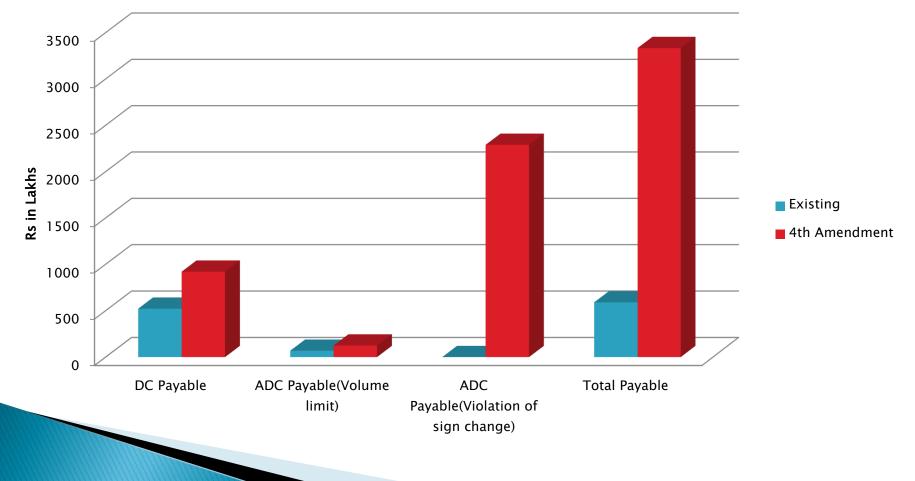


Comparative DSM A/c of GRIDCO, DVC & JUVNL for week 191118-251118

	GRIDCO		DVC		JUVNL	
	Existing	4 th Amendment	Existing	4 th Amendment	Existing	4 th Amendment
DC Payable	521.5930805	920.12527	483.9197059	855.80299	17.37564029	14.96939
ADC Payable(Volume Limit)	68.37199826	124.8002271	103.2919273	193.959021	3.930195068	16.66033544
ADC Payable(Violation of	0	2280 020246	0	2475 021	0	169 041195
Sign Change)	0	2289.029246	0	2475.021	0	168.941185
Total Payable	589.9650788	3333.954743	587.2116333	3524.783011	21.30583536	200.5709104

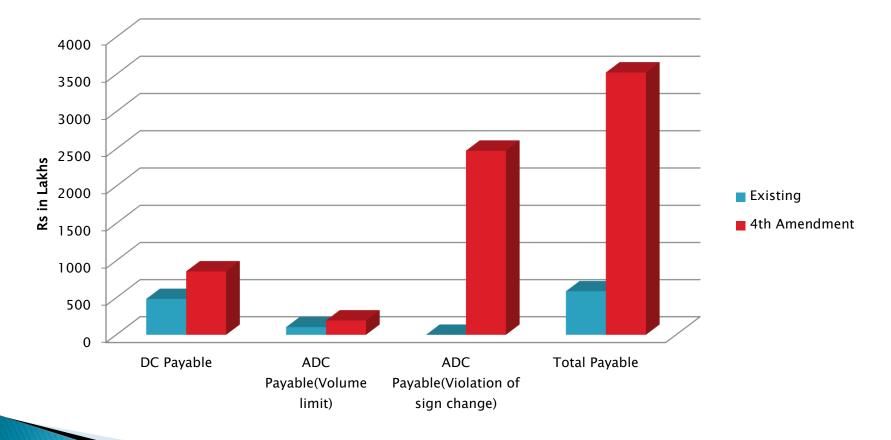
Comparative DSM A/c of GRIDCO for week 191118-251118

GRIDCO



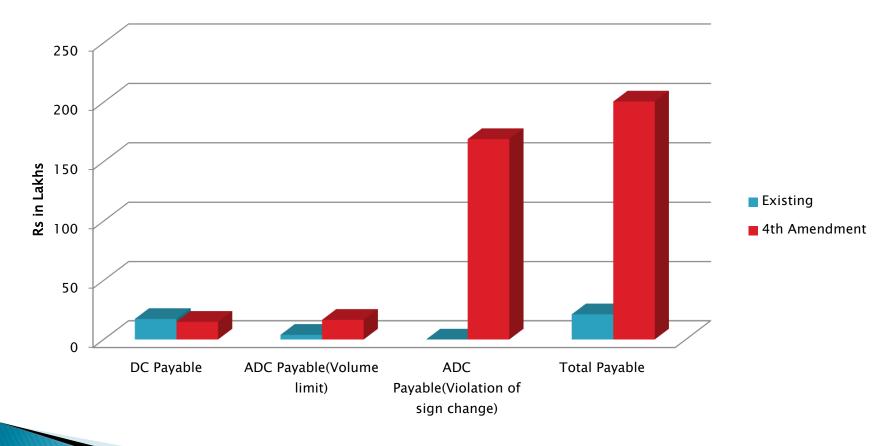
Comparative DSM A/c of DVC for week 191118-251118

DVC



Comparative DSM A/c of JUVNL for week 191118-251118

JUVNL

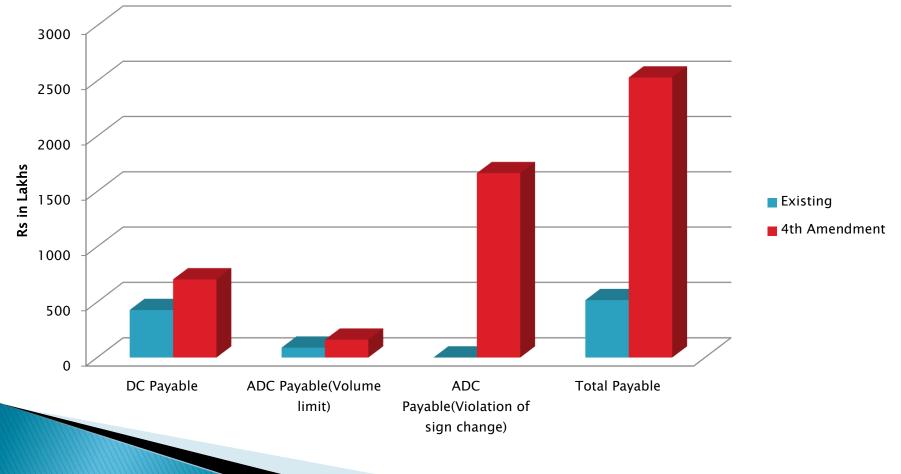


Comparative DSM A/c of WBSETCL & BSPHCL for week 191118-251118

	WI	BSETCL	BSPHCL			
	Existing	4 th Amendment	Existing	4 th Amendment		
DC Payable	428.4524282	704.60565	-111.1994556	-217.7278		
ADC Payable(Volume Limit)	88.83031976	160.525613	3.201627669	22.24788956		
ADC Payable(Violation of Sign Change)	0	1665.470171	0	563.2800298		
Total Payable	517.2827479	2530.601434	-107.9978279	367.8001193		

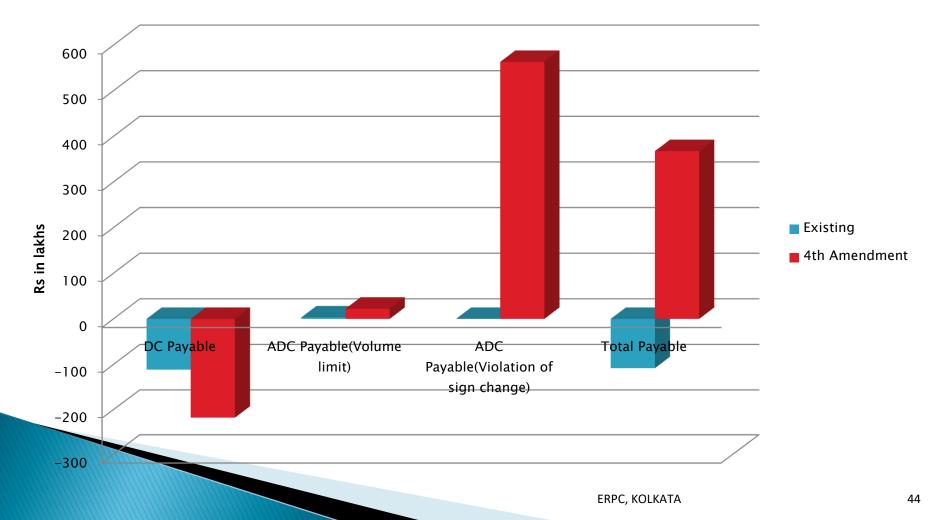
Comparative DSM A/c of WBSETCL for week 191118–251118

WBSETCL



Comparative DSM A/c of BSPHCL for week 191118-251118

BSPHCL

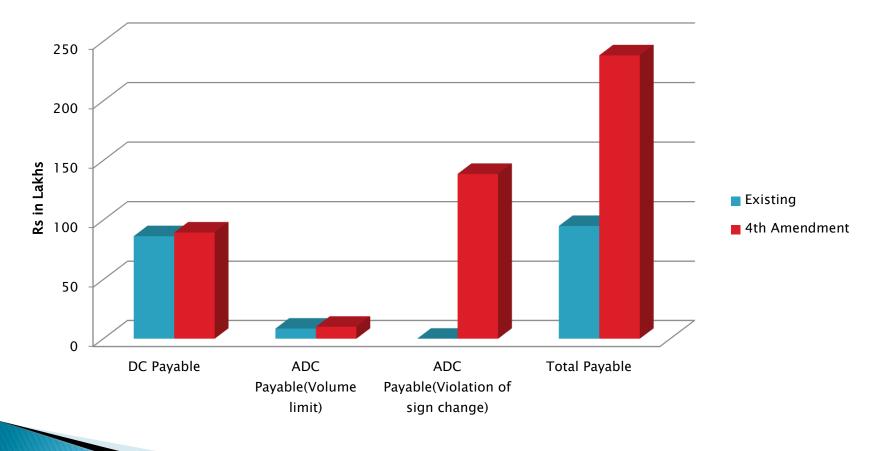


Comparative DSM A/c of FSTPP I&II, TEESTA-V GMRKEL & JORETHANG HEP for week 191118-251118

		CER	CERC REGULATED GENERATORS				OTHER GENERATORS			
		FSTPP I&II		TEESTA-V		<u>GMRKEL</u>		JORETHANG HEP		
		Existing	4 th Amendment	Existing	4 th Amendment	Existing	4 th Amendment	Existing	4 th Amendment	
	DC Payable	86.43926	89.4901673	-64.3404	-30.2519	48.72793903	79.26821	4.012864	8.30667	
	ADC Payable(Volume Limit)	8.541664	10.0937557	0.156154	1.609847	0.016228937	0.065548613	0.02791	0.067948	
	ADC Payable(Violation		128 600118	0	F2 00700	0	120 925510	0	7 2225 41	
	of Sign Change)	0	138.699118	0	53.09799	0	139.825519	0	7.232541	
	Total Payable	94.98092	238.283041	-64.1842	24.45598	48.74416797	219.1592777	4.040774	15.60716	
		ERPC, KOLKATA					45			

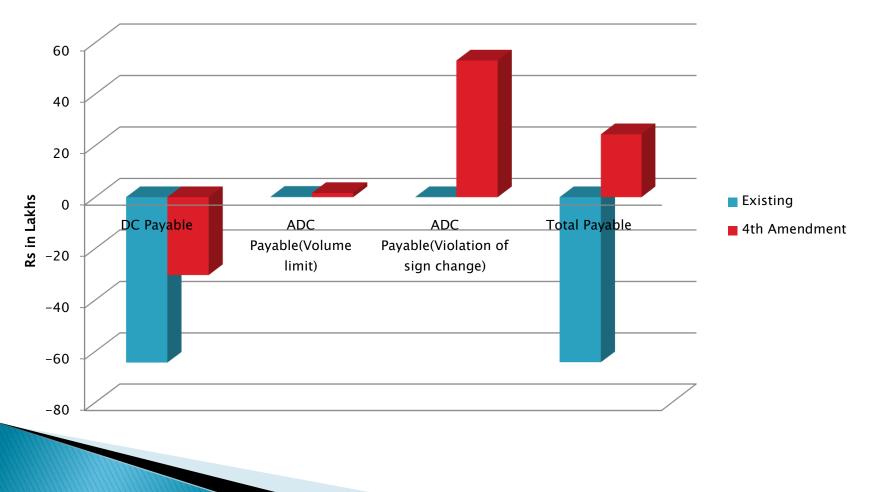
Comparative DSM A/c of FSTPP I&II for week 191118-251118

FSTPP I&II



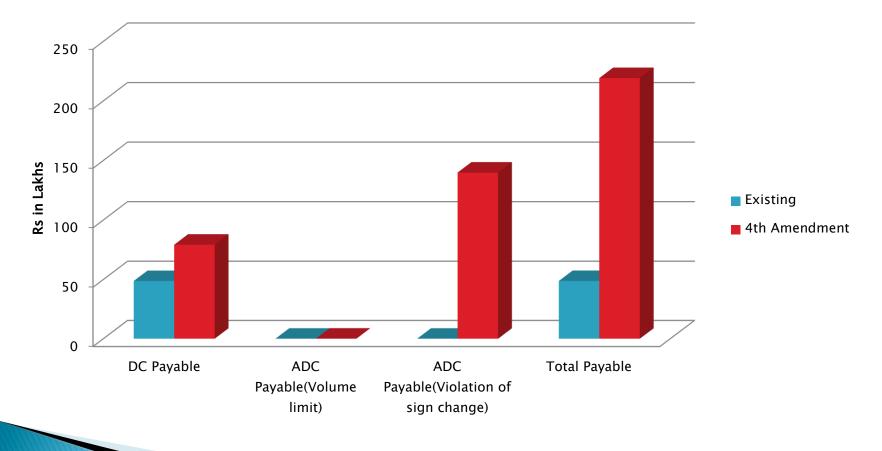
Comparative DSM A/c of TEESTA–V for week 191118–251118

TEESTA-V



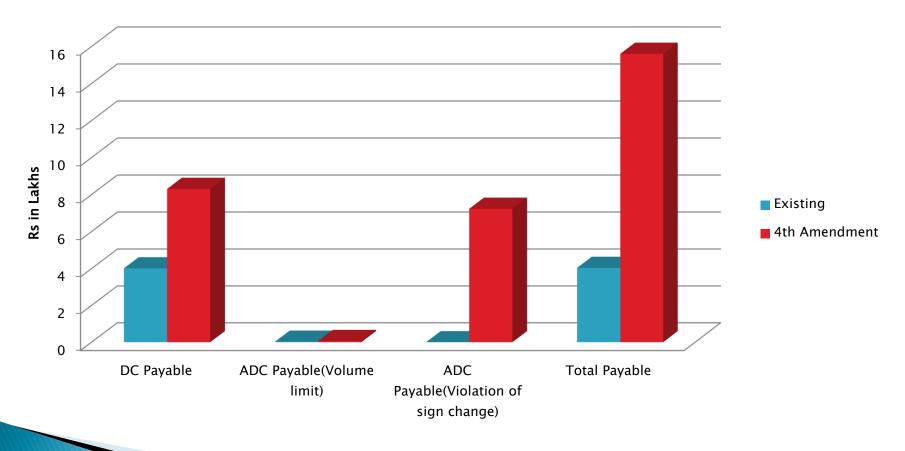
Comparative DSM A/c of GMRKEL for week 191118-251118

GMRKEL



Comparative DSM A/c of JORETHANG HEP for week 191118-251118

JORETHANG HEP





THANK YOU

ERPC, KOLKATA