

## **Explanatory Memorandum**

### **Central Electricity Regulatory Commission (Deviation Settlement Mechanism and related matters) (Fourth Amendment) Regulations, 2018**

#### **Introduction:**

The Central Electricity Regulatory Commission (hereafter referred to as “the Commission”) notified the Central Electricity Regulatory Commission (Deviation Settlement Mechanism and related matters) Regulations, 2014 in January 2014, which were thereafter amended via the first amendment (notified in December 2014), the second amendment (notified in August 2015) and the third amendment (notified in May, 2016). The objective of these regulations is to “maintain grid discipline and grid security as envisaged under the Grid Code through the commercial mechanism for Deviation Settlement through drawal and injection of electricity by the users of the grid”.

2. Analysis of the grid frequency, which is a primary indicator of the health of the grid, suggests that the frequency has stabilized closer to 50 Hz over time. Progressive tightening of the frequency band, volume limits on deviation along with other deterrents and enforcement of DSM regulations have contributed to this improvement in frequency profile. Currently as per the existing volume limits for deviation, the States may deviate from schedule up to 150 MW or 12% of schedule, whichever is lower, when the frequency is between 49.7 Hz and 50.1 Hz with a minimum of deviation allowed as 48 MW under CERC Order dated 20.1.2015 in Petition No. 6/RP/2015. For RE rich States, the deviation limit has been relaxed. Beyond these frequency limits, no deviations are permitted. The evolution of Deviation Price (erstwhile Unscheduled Interchange (UI)) Vector over the years is provided below.

Period	Operational Frequency Band	Ceiling Rate (paise/kWh)	Benchmarking of Ceiling Rate	Slope (paise/kWh)	Step size
1 <sup>st</sup> July 2002 – 31 <sup>st</sup> March 2004	49.0 Hz – 50.5 Hz	420	DG set	5.6	0.02 Hz
1 <sup>st</sup> April 2004 – 30 <sup>th</sup> Sept 2004	49.0 Hz – 50.5 Hz	600	DG set	8	
1 <sup>st</sup> October 2004 – 29 <sup>th</sup> April 2007	49.0 Hz – 50.5 Hz	570	DG set	9	
30 <sup>th</sup> April 2007- 6 <sup>th</sup> Jan 2008	49.0 Hz – 50.5 Hz	745	Domestic Naphtha (Liquid Fuel)	6 (50.5-49.8)	
				9 (49.8-49.5)	
				16 (49.5-49.0)	
7 <sup>th</sup> Jan 2008 – 31 <sup>st</sup> March 2009	49.0 Hz – 50.5 Hz	1000	Combined cycle plants -Naphtha/RLNG	8 (50.5-49.8)	
				18 (49.8-49.0)	
1 <sup>st</sup> April 2009 – 2 <sup>nd</sup> May 2010	49.2 Hz – 50.3 Hz	735	RLNG based generating station with variation in fuel prices of around 5%	12 (50.3-49.8)	
3 <sup>rd</sup> May 2010 to 16 <sup>th</sup> Sep 2012	49.5 Hz – 50.2 Hz	873	Gas/liquid fuel based thermal generating stations of NTPC & NEEPCO	15.5(50.2-49.7)	
				47 (49.7-49.5)	
17 <sup>th</sup> Sep 2012 to 16 <sup>th</sup> Feb 2014	49.7 Hz – 50.2 Hz	900	Highest cost of generation is 896.02 Paise/kWh @Auraiya CCGT Station	16.5 (50.2-50.0)	
				28.5 (50.0-49.8)	
				28.12 (49.8-49.5)	
17 <sup>th</sup> Feb 2014 onwards	49.90 Hz - 50.05 Hz	824	Highest cost of generation is 8.24 Rs/kWh @ Auraiya Gas Power Station	20.84 (49.70 - 50.00)	0.01 Hz
				35.60 (50.01 - 50.05)	

3. The present Deviation Settlement Mechanism in India came into force with effect from 17th February, 2014. The salient features, include,

- Operational Frequency Band has been specified as 49.90 - 50.05 Hz.
- Step size is 0.01 Hz.
- The charges for deviation for each 0.01 Hz step are 35.60 Paise/kWh in the frequency range of 50.05 - 50.00 Hz, and 20.84 Paise/kWh in frequency range 'below 50 Hz' to 'below 49.70 Hz' as per the methodology specified in the Regulations.
- The volume of deviation from scheduled to actual injection/drawal is 150MW or of 12% of the schedule, whichever is low. Relaxed volume limit for RE rich States.
- Continuous over drawal / under drawal has also been prohibited.
- Within 12 time blocks, the polarity of deviation should be reversed (in case of over drawal to under drawal and vice versa).
- The Cap Rate for the Generating stations regulated by CERC using coal / lignite / APM gas has been set at 303.04 p / kWh irrespective of frequency.

- There are no charges for Under-drawal or Over-injection (except infirm generation) in excess of 150MW or 12% of schedule, whichever is less in a time block.
- Additional Charges for Deviation for Over-drawl by any buyer or Under-injection by any seller has been stipulated.
- Limit on Deviation Volume has been imposed.
  - Over-drawal by Buyer, Under-injection by Seller below 49.70 Hz and Over-injection by Seller at 50.10 Hz & above is not permitted.
  - Deviation of only 12 % of the Schedule or 150 MW, whichever is less has been allowed for Over-drawal by Buyer, under-drawal by buyer Under-injection by Seller at 49.70 Hz & above and Over-injection by Seller below 50 Hz.
  - Any infirm injection of power by a generating station prior to COD of a unit during testing and commissioning activities shall be exempted from the volume limit specified above for a period not exceeding 6 months or the extended time allowed by the Commission in accordance with Connectivity Regulations.
  - In case of start-up drawal power exemption from volume limits for frequency greater than or equal to 49.70 Hz has been allowed.

4. The DSM Regulations as notified in 2014 provide for revision of DSM price vector. A number of developments have taken place in the power sector since 2014. In this backdrop, the Commission considered it necessary to review the existing operational band of frequency with due regard to the need for safe, secure and reliable operation of the grid and review the principles of deviation settlement mechanism (DSM) rates, including their linkage with frequency in the light of the emerging market realities. Accordingly, the Commission vide its Office Order No. 1/2/2017/Exp.Group/CERC dated 27.04.2017, constituted an Expert Group (EG) under

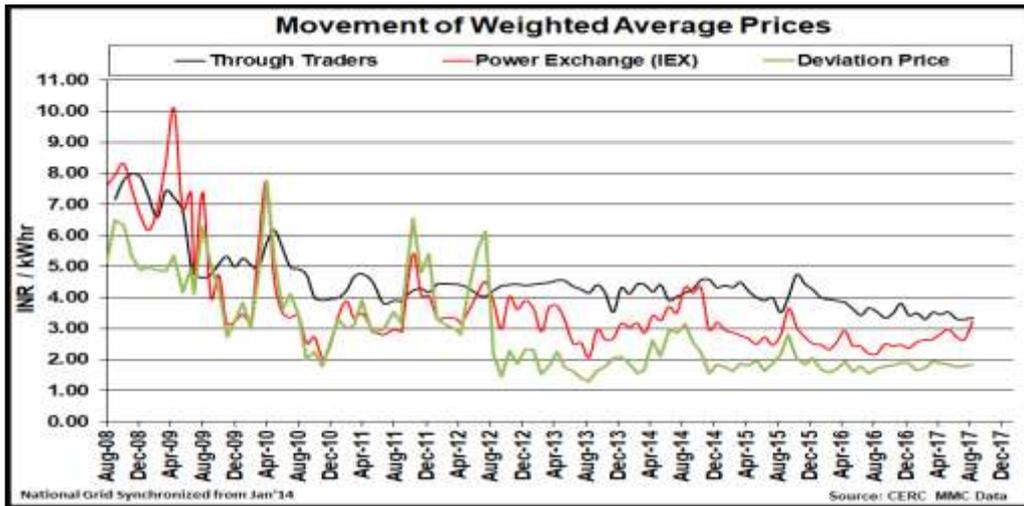
the Chairmanship of Shri A.S. Bakshi, Member, CERC and with representatives from CEA, POSOCO, CTU and CERC.

5. The Expert Group deliberated upon the issues related to grid operation and its existing operational band of frequency and brought out its first volume of the report discussing “review and suggestive measures for bringing power system operation closer to National Reference Frequency” in November, 2017 which has since been approved by the Commission. The Expert Group came up with its second volume of the report titled “Review of the Principles of Deviation Settlement Mechanism (DSM), Including Linkage with Frequency, in the Light of Emerging Markets”. In this Report, the Expert Group deliberated upon “Drivers for Review of DSM Price Vector”, “Limitations of the Present DSM Price Vector” and came up with its recommendations. The Report of the Expert Group is available on the website of the Commission.

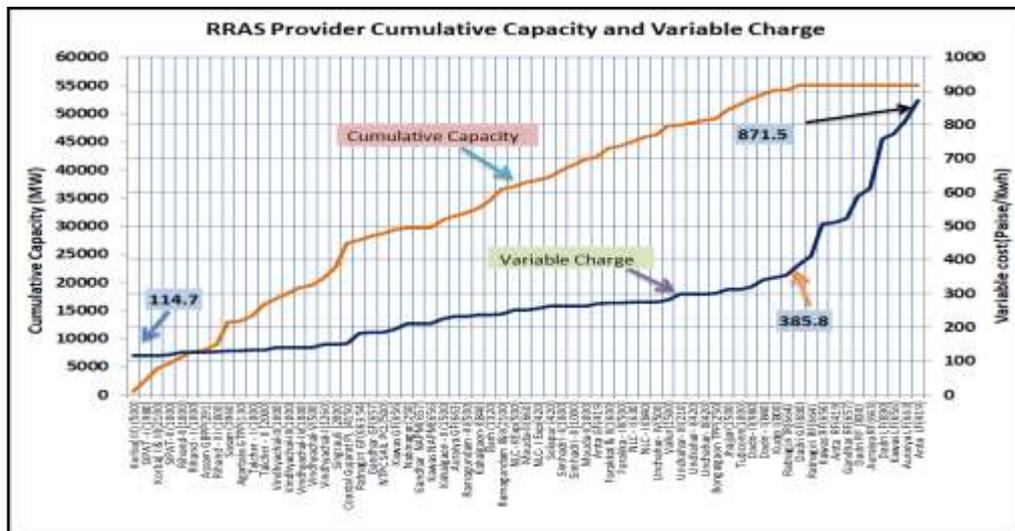
#### **Drivers for Review of DSM Price Vector:**

6. The Expert Group examined various features of inadvertent / unscheduled interchange in India and other international markets. The EG examined the different market segments (as shown in **Figure-1** below). Additionally, the cumulative capacity and variable charges of RRAS (Ancillary Services introduced since April, 2016) were also examined (as shown in **Figure-2** below). Expert Group observed that the highest variable cost generator dispatched in Ancillary Services on daily basis during the period April 2016 to October 2017 (as shown in **Figure-3** below) has crossed the mark of more than Rs. 8 per unit on multiple occasions.

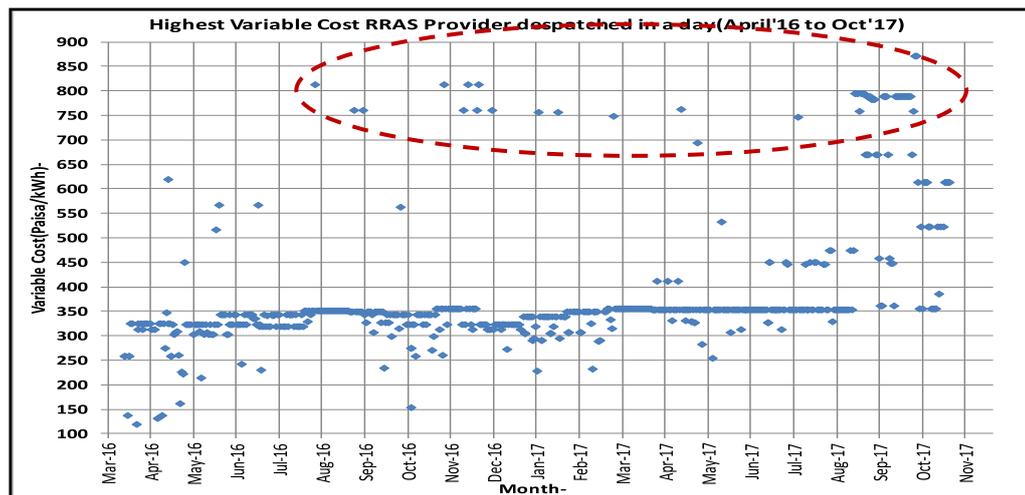
**Figure 1: Weighted Average Prices in Different Market Segments**



**Figure 2: RRAS Provider Cumulative Capacity and Variable Charge**



**Figure 3: Highest Variable Cost Generation Dispatched under Ancillary**



7. Accordingly, the Expert Group noted that the Deviation Price is the lowest amongst bilateral, Power Exchange (DAM), DSM Prices and the Ancillary Services. From a design perspective, the prices for deviation from schedules are the real real-time prices and should be such that they provide enough incentive to the market participants to plan and procure adequately in the market in advance. Interplay between different market segments may encourage participants to lean on the system (grid) and this has the propensity to disrupt in terms of grid security issues. Hence, the Expert Group felt that there is a need to review the present DSM Rates.

### **Critical Issues Identified in the Present DSM:**

8. The Expert Group examined the present DSM for inherent design limitations, so that corrective measures could be suggested to make the DSM prices capture the market realities. It was observed that,

- a. The present DSM price vector is decided by CERC. The rates presently applicable were decided by CERC in 2014. Although Regulation 5(4) facilitates review of DSM charges, the process takes time under the regulatory

process and does not catch up with the pace of changes in prices in other market segments, thereby increasing the interplay.

- b. The present DSM rates at 50 Hz (178 paise/unit) are linked to the variable charges of a pit-head thermal (coal fired) station whereas the highest DSM rate (824 paise/unit) is linked to the variable charges of the costliest generator (liquid fired). Ideally, the DSM price should capture the Value of Lost Load (VoLL) so that utilities procure adequately in advance so as to meet their universal service obligations.
- c. The deviations in real time for an entity lead to balancing of its actual supply-demand and should be priced in a way which encourages participant's behaviour to move towards organized markets. Presently, the DSM prices are much below the market prices and this is providing a contrary price signal. With frequency remaining close to 50 Hz, the applicable DSM rate with 100% surcharge is providing an inadequate price signal and this also poses a threat to the grid security.
- d. The current DSM prices do not capture the difference between the peak and the off-peak value of electricity, whereas the market prices clearly present this in terms of different prices discovered for different time periods in a day. The present DSM prices are constant over very long periods. There is a need for some mechanism to capture the time value of electricity.
- e. Pricing unscheduled flows of electricity on a locational basis could be effectively used for congestion management. The present deviation settlement mechanism is based on the premise that a congestion free transmission network exists and any amount of power can flow. In reality, this is not the case. The day-ahead market in the Power Exchange(s) discovers transmission congestion one-day in advance and manages this through an implicit auction and market splitting. This provides a price signal regarding the valuation of transmission. DSM prices are the real-time prices and these must factor

transmission congestion or in other words, capture the geography in terms of price differential.

- f. Presently, close to the real time, a day-ahead collective market through Power Exchange operates and this is used for balancing the system. Although, day-ahead bilateral and contingency category contracts are available during the intra-day, there is a need for more iterations of the collective market so as to provide more opportunities to balance the system.
- g. There is a need for introduction of gate closure concept in the scheduling process so that system operator has the clarity of the quantum of reserve and resources at hand at any given point of time. Such mechanism is expected to facilitate better optimization of the scheduled despatches and formulation of real time ancillary despatch.

9. Accordingly, the Expert Group felt the need to link DSM price factor with the prices discovered under an organized electricity market which operates close to the real-time.

### **Measures proposed by the Expert Group:**

10. In this context, the Expert Group deliberated upon the design considerations for the proposal viz, reference prices, size of market segments, multiple power exchange prices, Unconstrained market Clearing Price (MCP) or Area Clearing Price (ACP), granularity/periodicity of prices to be linked, frequency band, slope of the DSM Rate Vector along with the Ceiling and Floor, volume limits & cap rates, single or dual imbalance pricing: Different rates for drawl and injection and establishment of true inadvertency in deviations. After detailed deliberations and analysis, the expert group recommended the following:

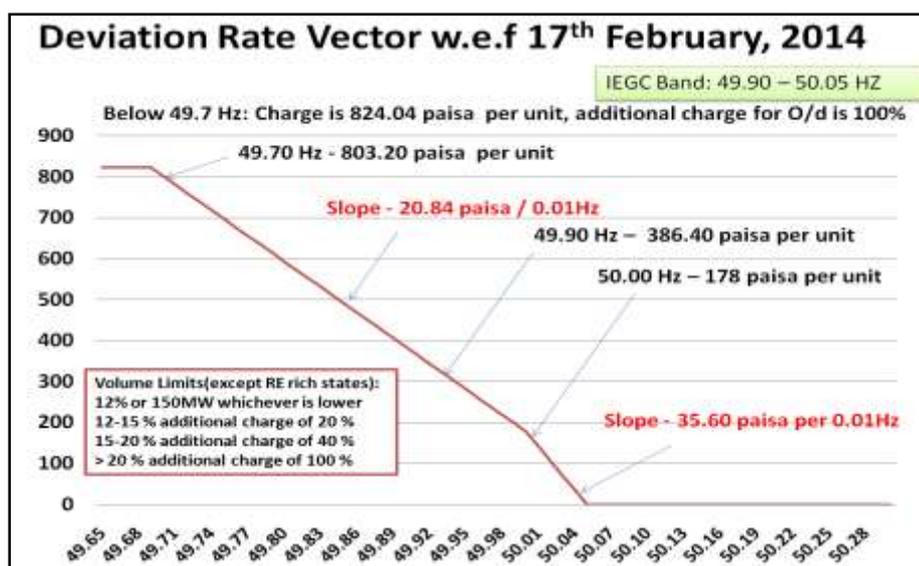
- a. There is a need for improved forecasting and planning for procurement by the utilities. The quantum of reserves mentioned in the CERC Roadmap for Reserves dated 13<sup>th</sup> October 2015 need to be implemented.
- b. More iterations of the Electricity Market in Power Exchanges should be implemented so as to provide adequate opportunities to the market participants to balance their portfolio for example, evening market, four/six-hour ahead market in the Power Exchange. This would also facilitate moving to real time markets gradually in a phased manner.
- c. Presently, only deviations are being monitored. In addition, the ‘Area Control Error (ACE)’ also need be monitored.
- d. There is need for introduction of gate closure concept in the scheduling process so that system operator has the clarity of the quantum of reserve and resources at hand at any given point of time. This will facilitate better optimization of the scheduled despatches and the real time ancillary despatch.
- e. The DSM price vector is presently administered by CERC and needs to be reviewed in view of the changing electricity market conditions. The Expert Group recommended that the DSM Price Vector should be linked to the existing market discovered prices (day-ahead market). The details of the design aspects associated with market-linked DSM price vector are as follows:
  - i. Under the present circumstances, it is felt prudent to use the price discovered in the day-ahead market as a reference for the DSM price vector. In future, when market based procurement of ancillary services matures and robust discovery of prices takes place, other alternatives may be examined.
  - ii. The linking of prices in DAM and DSM market segments may be considered.
  - iii. The Area Clearing Price (ACP) should be linked to the DSM Price so as to factor geography and transmission congestion.

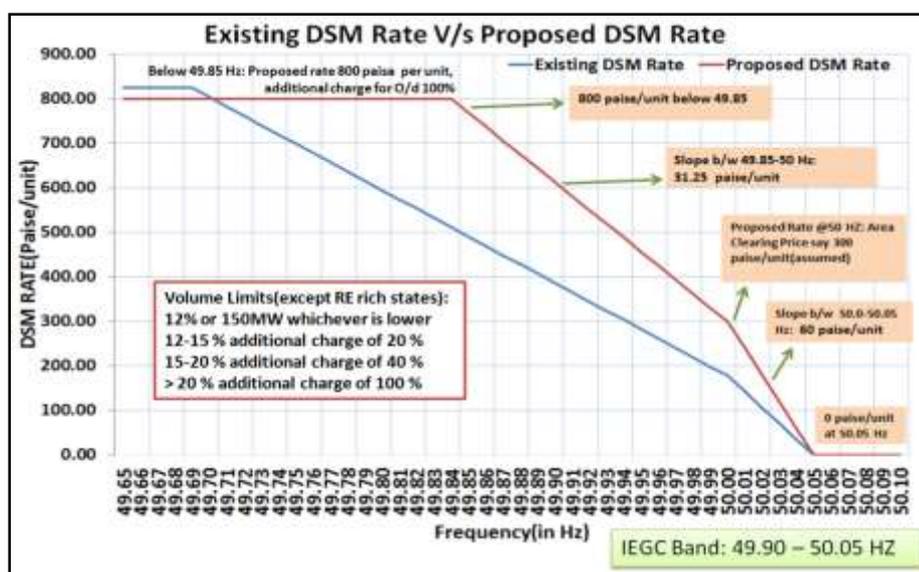
- iv.** It is proposed that day-ahead market price of the Power Exchange having a market share of 80% or more in energy terms on a daily basis be linked to the DSM price. If there is no single Power Exchange having a market share of 80% or more, the weighted average day-ahead price should be used for linking to the DSM price.
- v.** The daily average area clearing prices in the day-ahead market should be used as the basis for market linked DSM price for the time being and not the time block ACP which could have high volatility.
- vi.** The frequency band for the purposes of the DSM price vector may be taken as 49.85-50.05 Hz to begin with.
- vii.** A time period of 6 months may be given as an advance notice period to the utilities to gear up. At the end of 6-month period, the frequency band for DSM price vector should be changed to 49.90-50.05 Hz so as to align with the IEGC mandated operational frequency band (as amended from time to time).
- viii.** The average daily ACP should be used as a reference and linked to the DSM rate at 50 Hz.
- ix.** The DSM rate vector should be dynamic and slope determined by joining the identified price points at 50 Hz. (daily average ACP modified to include transmission charges and losses), low frequency of 49.85 Hz (Rs. 8 per unit) and 50.05 Hz (zero) on a daily basis i.e. dual pricing, bringing in the desired hysteresis..
- x.** The present methodology of DSM rates for the renewable should be continued as of now.
- xi.** In the interest of secure grid operation, all the volume limits along with associated surcharge/additional surcharge should be retained in the new market linked DSM price mechanism for the time being and tightened progressively in line with the international practice.

- xii.** The cap rates for generators should be linked to the variable charges for that generator as billed for the previous month.
- xiii.** The sign of the deviation must change once every 6 time blocks and an appropriate commercial provision to ensure compliance should be introduced. Further, in energy terms, the total deviation from schedule should not be in excess of 3% of the total demand met for the drawee entities and 1% for the generators.

11. The linking of DSM prices to DAM prices may be implemented for a period of 6-months and based on the experience, CERC may consider refining the market linked imbalance pricing mechanism.

12. A comparison of the existing DSM price vector vis-à-vis the DSM price vector as recommended by the Expert Group is depicted below.





## Consideration of the Recommendations of Expert Group:

13. The Commission considered and approved the recommendations of the Expert Group and has decided to initiate amendments to the DSM Regulations. Salient features of the proposed amendments are as follows:-

- a. Revised DSM Price Vector linking it to the daily average Area Clearing Price is proposed.
- b. Revised reference frequency band (viz. 49.85 Hz to 50.05 Hz) is proposed for the purpose of DSM Price Vector.
- c. The Deviation Settlement Mechanism (DSM) rate vector is proposed to have a dynamic slope determined by joining the identified price points at 50 Hz. (daily average ACP), low frequency of 49.85 Hz (Rs. 8 per unit) and 50.05 Hz (zero) on a daily basis.
- d. The maximum ceiling limit applicable for average Daily ACP discovered in the DAM segment of Power Exchange at 50.00 Hz is proposed to be 800 Paise/kWh.
- e. The Day-ahead market price of the Power Exchange having a market share of 80% or more in energy terms on a daily basis is proposed to be taken into

- consideration for linking to the DSM price vector. If there is no single Power Exchange having a market share of 80% or more, the weighted average day-ahead price is proposed to be used for linking to the DSM price.
- f. It is proposed to link the cap rates for generators using coal / lignite / APM gas to the energy charges as billed for previous month is proposed.
  - g. Reduction in number of time blocks (from 12 to 6 time blocks) for change of sign in case of sustained deviation in one direction is proposed.
  - h. Levy of an additional sur-charge of 20% on the daily base DSM payable / receivable in case of violation of the stipulation regarding change in sign.
  - i. It is proposed that the total deviation from schedule during a day should not be in excess of 3% of the total schedule for the drawee entities and 1% for the generators and in case of violation 20% of the daily base DSM payable / receivable be levied.
  - j. In addition, consequential changes are also proposed.