

MINUTES OF THE 57TH MEETING
OF THE
FORUM OF REGULATORS (FOR) HELD AT RAIPUR

Venue : **Jade Conference Hall
Courtyard Marriot
Raipur (Chhattisgarh)**

Day / Date : **Friday, the 16th December, 2016**

List of Participants : **At Annexure-I (Enclosed)**

The meeting was chaired by Shri Gireesh B. Pradhan, Chairperson, Central Electricity Regulatory Commission (CERC) and Forum of Regulators (FOR). The Chairperson, CERC / FOR welcomed the Members of the Forum to the Meeting.

INAUGURAL SESSION

**DR. RAMAN SINGH, HON'BLE CHIEF MINISTER OF CHATTISGARH
JOINED THE INAGURAL SESSION OF THE "FOR" MEETING**

Shri Narayan Singh, Chairperson, CSERC in his welcome address extended a warm welcome to the Hon'ble Chief Minister of Chhattisgarh and thanked the Hon'ble Chief Minister for accepting the invitation to inaugurate the 57th Meeting of "FOR". He stated that during the last 13 years, approximately Rs.13,000 Cr. have been invested in the State of Chhattisgarh for expanding the power infrastructure. Even though the State is currently power surplus, works

are underway on an effective work plan so that the State remains power surplus in future as well.

In his keynote address, Chairperson, CERC/FOR expressed gratitude on behalf of the Members of the Forum, to the Hon'ble Chief Minister, Chhattisgarh for accepting the invitation to inaugurate and address the Electricity Regulators. He stated that despite being a new State, Chhattisgarh has grown to be a power hub with an installed generating capacity which equals four times the power demand in the State. He also underlined the significant steps taken by the CSERC in the field of renewable energy sources. Chhattisgarh has set an example by developing power infrastructure in a short span of time. While appreciating the support from the State Government through payment of subsidy, he lauded the regulatory support provided by CSERC through Regulations on Availability Based Tariff, Deviation Settlement Mechanism, Demand Side Management, Roof Top Solar PV / Net-Metering, Open Access etc. He also highlighted the role of ERCs and the "FOR" in taking various initiatives in line with the mandate given in the Electricity Act, 2003 to streamline issues in Renewable Energy, MYT Regulations, TOD tariff etc. Chairperson, CERC/FOR also detailed various reports/Model Regulations being brought out by "FOR" for the benefit of all stakeholders.

Dr. Raman Singh, Hon'ble Chief Minister in his address to the Forum stated that he was delighted to inaugurate the meeting of Regulators, which is taking place for the third time in the capital city of Chhattisgarh. During his address, he recalled the growth trajectory achieved by the State in power sector. Power infrastructure was identified as the key to success and as a result of the continued efforts, the generation capacity has exceeded 16.5 GW and the per capita consumption increased from 650 units to 1670 units. He appreciated the role played by the electricity regulators in maintaining a fine balance between protecting the consumer interests and recovery of costs of the utilities. While referring to the task of electrifying un-electrified areas, he stated that the State has initiated necessary steps towards electrifying all un-electrified villages and hamlets. He wished, the Forum would have fruitful discussions during the course of the meeting.

On conclusion of the Inaugural Session, Secretary, CERC/FOR proposed vote of thanks. She thanked the Hon'ble Minister for inaugurating the meeting and also for interacting with the Members of the Forum.

Thereafter, the Forum took up the agenda items for consideration.

BUSINESS SESSION

**AGENDA ITEM NO. 1: CONFIRMATION OF THE MINUTES OF
THE 56TH MEETING OF THE FORUM OF
REGULATORS HELD ON 30TH
SEPTEMBER, 2016 AT NEW DELHI.**

The Forum endorsed the minutes of the 56th Meeting of "FOR", held on 30th September, 2016 at New Delhi.

**AGENDA ITEM NO. 2: "FOR" TECHNICAL COMMITTEE
UPDATE AND RECOMMENDATIONS ON
'MODEL REGULATIONS ON DEVIATION
SETTLEMENT MECHANISM (DSM) FOR
STATES'.**

Joint Chief (RA), CERC informed the Forum that a Technical Committee was constituted by "FOR" on 18th November, 2015 to evolve a roadmap for implementation and ensure timely action on the deployment and implementation of framework on forecasting, scheduling and deviation settlement of wind & solar generating stations at the State level and introduction / implementation of Availability Based Tariff (ABT) framework at the State level as mandated in the National Electricity Policy and Tariff Policy. The Forum in its 55th Meeting held on 22.7.2016 approved the Technical Committee report on Model System on Scheduling, Accounting, Metering and Settlement of Transactions in Electricity (SAMAST), which also provided for design of workflow, infrastructure and

human resource requirement for implementation of SAMAST at the State level. Implementation aspects of DSM and Forecasting & Scheduling framework at State level included development of Model DSM Regulations at State level.

A presentation was made by the consultant on Model Regulations on Deviation Settlement Mechanism (DSM) for States, which is **enclosed** as **Annexure-II**.

DISCUSSION :

Some of the specific issues discussed included the volume limit, price vector, concept of zero crossing etc. The model regulations provide for deterrent against deviation by bringing in the concept of ‘Zero Crossing’, which implies that an entity deviating within the permissible volume limits will be required to change the sign of deviation within six time-blocks. This is aimed at ensuring that no one deviates even within the permissible limit persistently in only one direction. The need for aligning the State-level volume limit with that at the Inter-State level was reiterated. As regards price vector, it was felt that the deviation charges should be so designed as to discourage pool participants from deliberate deviation.

CONSENSUS :

After discussion, the Forum agreed on the following:-

1. The State-level framework should provide for a non-zero-sum deviation pool.
2. The deviation charges at the State-level should be aligned with those at the Inter-State level.
3. Keeping in view the volume limit for deviation at the Inter-State level, each State Regulator should specify volume limits for the State Pool participants.
4. The State-level Deviation Settlement Mechanism framework should provide for the concept of 'Zero Crossing', thereby discouraging persistent deviation on any one direction.
5. Further studies should be carried out to bring in the concept of Area Control Error (ACE), which can form the basis for setting deviation limit in future.
6. Other provisions of the model regulations were also noted.

With these observations, the Forum endorsed the Model Deviation Settlement Mechanism Regulations.

AGENDA ITEM NO. 3: "FOR" STUDY ON 'COMPETITIVE TARIFF VIS-À-VIS COST PLUS TARIFF – CRITICAL ANALYSIS'.

Joint Chief (RA), CERC informed the Forum that during the 53rd "FOR" meeting held on 18th March 2016, the Forum decided to conduct a study on “Competitive Tariff Vis-À-Vis Cost Plus Tariff - Critical Analysis”. Accordingly, through a bidding process, M/s. CRISIL was selected as consultant to assist the Forum in carrying out the study. A presentation was made by the consultants, which is **enclosed** as **Annexure-III**.

DISCUSSION :

- The Forum was informed about the scope of the study which included reviewing the generation tariffs adopted through competitive bidding and that determined based on cost plus models across the country since introduction of bidding guidelines. The scope also included preparation of trend analysis by tracing back the components of tariff, evolving parameters for comparison of both the approaches of tariff determination, comparison of tariff discovered through bidding with the tariff determined by CERC under Cost Plus approach and to critically analyze the findings.
- To undertake this analysis, a sample of competitively bid projects were chosen depending upon comparable parameters and availability of basic

project details which were then critically analyzed with comparable projects under the cost plus regime.

- The parameters included, category (i.e., Case-1/Case-2), location, technology employed, fuel source, unit size, vintage (i.e., original scheduled CoD), developer, availability of data etc. As part of the study, four competitively bidded projects were compared with similarly placed cost plus projects.
- Four sets of comparisons were made between competitively bid projects and cost plus project which included fuel source, unit size, vintage and availability of data etc., under routes of Case-1 (Lanco Babandh Vs. Sipat St-1 & Essar Mahan Vs. Udupi) and Case-2 (Talwandi Sabo Vs. Sipat St-1 & CLP Jhajjar Vs. IGSTPP Jhajjar).
- A detailed risk profiling of the projects was carried out, which included risks associated with fuel, un-contracted power, adequacy of transmission capacity, market behavior, policy, financing costs, forex, financial health of discom, other uncontrollable factors (viz. environmental, political) etc.
- The study observed that :
 - ✓ viability of a competitive bid project is sensitive to variety of risk factors,
 - ✓ the extent to which the risk parameters are factored in the quoted tariff are difficult to assess,

- ✓ bidders also include part of fixed cost into variable charges & vice versa
- ✓ competitive bid tariff approach does not allow most of the uncontrollable factors to pass through to the buyer.
- The study for the two sets of illustrations drawn under Case-1 category have shown that tariff under cost-plus approach is less than that discovered under competitive bidding route. However, illustrations drawn under Case-2 category have indicated that tariff arrived at through competitive bidding route is less than those determined under cost-plus approach.

CONSENSUS :

1. The objective of the study was to understand the distinctive features of tariff determination under cost plus method (section 62) and competitive bidding route (section 63). The study has concluded that comparison poses challenge because of the inherent differences in the tariff parameters, risk factors etc.
2. The objective of study was not to establish efficiency and precedence of one method of tariff determination over the other.
3. The study has analyzed in detail the risk profiling and carried out sensitivity analysis on project viability and the resultant cost implications reflected through tariff under both the routes.

4. The comparison has been based on certain assumptions and could serve as good reference point for further detailed analysis by the Regulators in the process of tariff determination under section 62 as also for policy makers for designing bidding guidelines in future. The Members, however, felt that larger sample size of the competitively bid projects could have made the comparison all the more representative.

The Forum, after detailed discussion, endorsed the study report in principle.

AGENDA ITEM NO. 4: REFERENCES RECEIVED FROM INDIAN SMART GRID FORUM (ISGF).

Representatives of India Smart Grid Forum made a presentation on “Regulatory Support for Electric Vehicles Rollout”. The presentation is **enclosed** as **Annexure-IV**. The presentation essentially covered the aspects related to

- Electric vehicles eco-system
- Supply of electric vehicle equipment
- Bottlenecks for electric vehicle roll-out
- Standards & communication protocols for Electric vehicle systems
- Regulatory Support

The Forum appreciated the presentation.

AGENDA ITEM NO. 5: REFERENCES RECEIVED FROM THE JOINT ELECTRICITY REGULATORY COMMISSION (JERC) FOR MANIPUR & MIZORAM.

The Forum of Regulators (FOR) received a request from JERC for Manipur & Mizoram on issues related to formulating ways to make Roof Top Solar PV more attractive for public/consumers as installation requires access to rooftops particularly in eastern and north-Eastern States, achievement of renewable purchase obligation in the Eastern and North-Eastern States where solar irradiation is limited. The JERC (M&M) also raised the issue related to inclusion of Chairperson/Members, in Order of Precedence of the State.

DISCUSSION & CONSENSUS :

The Forum decided that the matter raised by JERC (M&M) on RPO target may first be examined by the "FOR" Working Group on “Renewable Energy”. The "FOR" Secretariat may seek relevant data regarding generation capacity from NE States to facilitate discussion in the Working Group and representatives of NE States may also be invited for discussion with the Working Group.

As regards, inclusion of Chairperson/Members, in Warrant / Order of Precedence in Mizoram, the Forum was informed that the State Government has already issued a notification in this context (**enclosed as Annexure-V**).

AGENDA ITEM NO. 6(a): REFERENCES RECEIVED FROM FORUM OF EASTERN & NORTH-EASTERN STATES (FORENS) REGARDING LONG TERM RPO GROWTH TRAJECTORY OF SOLAR AND NON-SOLAR.

The Forum noted that the subject matter is similar to the one raised by the JERC (M&M) and can be deliberated by the "FOR" Working Group on Renewable Energy.

AGENDA ITEM NO. 6(b): PRESENTATION ON “ACCOMMODATION OF RE POWER BY 2022” BY THE CHAIRPERSON, WEST BENGAL ELECTRICITY REGULATORY COMMISSION.

Shri R.N. Sen, Chairperson, WBERC made a presentation on “Accommodation of RE Power by 2022”. The presentation is **enclosed as Annexure-VI**. In order to meet the revised Solar RPO target of 4223 MW for 2021-22 and to accommodate the RE generation, the conventional thermal generation is required to be flexed in the following manner:-

- Putting 25 year old thermal units on two shift operation
- Backing down the 15 years old plants to 55% of full load capacity during day peak

- Reducing the PLF of generating stations which are less than 15 years age, to 70% during solar peak generation.

It was stated that the above measures to accommodate RE power impact the power purchase cost. The increased power purchase cost result in escalation of average distribution tariff by 45.25 paise per unit.

The Forum felt that the subject matter needs to be examined in detail and therefore referred it to the "FOR" Technical Committee for deliberations and recommendations for consideration of the "FOR".

AGENDA ITEM NO. 7: EXEMPTION TO SERCs UNDER SECTION 10 OF THE INCOME TAX ACT, 1961.

A reference was received from Chhattisgarh State Electricity Regulatory Commission inviting attention of "FOR" to correspond with Ministry of Finance, GOI to allow the incomes of all SERCs to be exempted from Tax under Section 10 of the Income Tax Act, 1961 on the same lines as exemption given to CERC.

DISCUSSION:

Joint Chief (RA), CERC informed the Forum that CERC was granted exemption under section 10(23) (BBG) of the Income Tax Act, 1961 (i.e., under Finance Act, 2007) with effect from Assessment Year starting 01-04-2008.

CERC has also written to the Secretary (Revenue), Ministry of Finance and the Secretary (Power), Ministry of Power on 22.12.2008, requesting for grant of exemption to SERCs in context to section 10(23)(BBG) of the Income Tax Act, 1961 (wherein CERC has been exempted). Subsequently, a new section 10(46) was included in the Income Tax Act, 1961, providing for exemption in respect of any specified income arising to a body or authority or Board or Trust or Commission. Thereafter, CERC again requested Secretary (Revenue), Ministry of Finance on 17.01.2012 giving reference to the newly inserted section 10(46) in the Income Tax Act, 1961, to include exemption of SERCs in the said section.

Few SERCs such as Kerala, Sikkim, Bihar have already received Income Tax exemptions under above clause.

CONSENSUS :

The Forum decided that in continuation to the earlier references made to Ministry of Power with regard to exemption of income tax for the SERCs, CERC may refer the matter to the Ministry of Power seeking to take up the matter with Ministry of Finance. While referring the matter to Ministry of Power, the issue related to exemption of income tax for the previous years with retrospective effect may also be placed.

AGENDA ITEM NO. 8: ANY OTHER ITEM WITH THE PERMISSION OF THE CHAIR.

The Chairperson, Bihar Electricity Regulatory Commission sought permission of the Chair for placing the proposal relating to parity of pay and service conditions of the State Electricity Regulators with the Central Electricity Regulators before the Forum.

The Forum deliberated upon the issues raised in the context and felt that in view of similarity in the nature of duties and responsibilities, it would be desirable for the States to bring uniformity in pay packages for the State Electricity Regulators with those of CERC Chairperson and Members.

The concern raised by the Ministry of Power regarding the pendency of petitions before the ERCs and the need for transparency / information dissemination through website in this regard was brought to the notice of the Members of the Forum. It was informed that CERC displays status of disposal of petitions in its website. The Members noted the concern / suggestion and agreed to take necessary action in this regard.

At the end of the meeting, Chairperson, CERC/FOR on behalf of the Members of the Forum conveyed deep gratitude to Shri Basharat Ahmed Dhar, Chairperson, Jammu & Kashmir State Electricity Regulatory Commission, who

was due to retire on 24th December, 2016, for his outstanding contribution to the Forum.

On conclusion of the meeting, Chairperson, CERC/FOR thanked the Chairperson, Members and staff of the Chhattisgarh State Electricity Regulatory Commission (CSERC) for their painstaking efforts to host the 57th Meeting of "FOR" at Raipur. He also thanked all the dignitaries present in the meeting. He conveyed to the Members of Forum that the next "FOR" Meeting will be held in New Delhi. Secretary, CERC / FOR thanked the staff of "FOR" Secretariat for their arduous efforts in organizing the meeting.

The meeting ended with a vote of thanks to the Chair.

LIST OF PARTICIPANTS ATTENDED THE 57TH MEETING
OF

FORUM OF REGULATORS (FOR)

HELD ON 16TH DECEMBER, 2016 AT RAIPUR (CHHATTISGARH).

S. No.	NAME	ERC
1.	Shri Gireesh B. Pradhan Chairperson	CERC – in Chair.
2.	Justice (Retd.) Shri G. Bhavani Prasad Chairperson	APERC
3.	Shri R.P. Singh Chairperson	APSERC
4.	Shri S.K. Negi Chairperson	BERC
5.	Shri Narayan Singh Chairperson	CSERC
6.	Shri Anand Kumar Chairperson	GERC
7.	Shri Jageet Singh Chairperson	HERC
8.	Shri S.K.B.S. Negi Chairperson	HPERC
9.	Shri Basharat Ahmed Dhar Chairperson	J&KSERC
10.	Justice (Retd.) Shri N.N. Tiwari Chairperson	JSERC
11.	Shri R.K. Kishore Singh Chairperson	JERC for Mizoram and Manipur
12.	Shri M.K. Shankaralinge Gowda Chairperson	KERC
13.	Shri T.M. Manoharan Chairperson	KSERC
14.	Dr. Dev Raj Birdi Chairperson	MPERC
15.	Shri Imlikumzuk Ao Chairperson-cum-Member	NERC

16.	Shri Vishwanath Hiremath Chairperson	RERC
17.	Shri Ismail Ali Khan Chairperson	TSERC
18.	Shri Niharendu Chakraborty Chairperson	TERC
19.	Shri Desh Deepak Verma Chairperson	UPERC
20.	Shri Subhash Kumar Chairperson	UERC
21.	Shri R.N. Sen Chairperson	WBERC
22.	Shri B.P. Singh Member	DERC
23.	Smt. Neerja Mathur Member	JERC for Goa & All UTs except Delhi
24.	Shri Aswini Kumar Das Member	OERC
25.	Smt. Shubha Sarma Secretary	CERC/FOR
26.	Dr. Sushanta K. Chatterjee Joint Chief (RA)	CERC
SPECIAL INVITEES		
27.	Shri A.K. Singhal Member	CERC
28.	Shri A.S. Bakshi Member	CERC
29.	Dr. M.K. Iyer Member	CERC
30.	Shri Arun Kumar Sharma Member	CSERC
31.	Smt. Jyoti Arora Joint Secretary (R&R)	MOP

MODEL DSM REGULATIONS AT STATE LEVEL (DRAFT)
_____(STATE)ELECTRICITY REGULATORY COMMISSION

__December, 2016

NOTIFICATION

No. __/__/2016/xERC.- In exercise of the powers conferred under Section 181 of the Electricity Act, 2003 (36 of 2003), and all other powers enabling it in this behalf, and after previous publication, the _____[State]Electricity Regulatory Commission hereby makes the following regulations, namely:

1. Short title and commencement

- (1) These regulations may be called the _____[State]Electricity Regulatory Commission (Deviation Settlement Mechanism and related matters) Regulations, 2016.
- (2) These regulations shall come into force from the date of notification in the official Gazette/[_____, 2016].

2. Definitions and Interpretation

- (1) In these regulations, unless the context otherwise requires -

(a) **Act'** means the Electricity Act, 2003 (36 of 2003);

(aa) **'Absolute Error'** shall mean the absolute value of the error in the actual generation of wind or solar generators which are regional entities or state entities with reference to the scheduled generation and the 'Available Capacity' (AvC), as calculated using the following formula for each 15 minute time block:

$$\text{Error (\%)} = 100 \times [\text{Actual Generation} - \text{Scheduled Generation}] / (\text{AvC})$$

(b) **'Actual drawal'** in a time-block means electricity drawn by a buyer, as the case may be, measured by the interface meters;

(c) **'Actual injection'** in a time-block means electricity generated or supplied by the seller, as the case may be, measured by the Interface meters;

(d) **'Available Capacity (AvC)'** for wind or solar generators which are regional entities or state entities, as the case may be, is the cumulative capacity rating of the wind turbines or solar inverters that are capable of generating power in a given time-block.

(e) **'Beneficiary'** means a person purchasing electricity generated from a generating station;

- (f) **'Buyer'** means a person, including beneficiary, purchasing electricity through a transaction scheduled in accordance with the regulations applicable for short-term open access, medium-term open access and long-term access;
- (g) **'Connectivity Regulations'** means the _____[State]Electricity Regulatory Commission (Grant of Connectivity, Long Term Access and Medium Term Access in inter-State Transmission) Regulations as amended from time to time and shall include any subsequent amendment thereof.
- (h) **'Commission'** means the _____[State]Electricity Regulatory Commission referred to in sub-section (1) of section 82 of the Act;
- (i) **'Deviation'** in a time-block for a seller means its total actual injection minus its total scheduled generation and for a buyer means its total actual drawal minus its total scheduled drawal.
- Provided that deviation shall be calculated for the Regional Entities by the concerned RLDC/RPC which shall be attributed to various entities embedded within the State by SLDC.
- (j) **'Gaming'** in relation to these regulations, shall mean an intentional mis-declaration of declared capacity by any seller in order to make an undue commercial gain through Charge for Deviations;
- (k) **'Grid Code'** means the Grid Code specified by the Commission under clause (h) of sub-section (1) of Section 86 of the Act.
- (l) **'Interface meters'** means interface meters as defined by the Central Electricity Authority under the Central Electricity Authority (Installation and Operation of Meters) Regulations, 2006, as amended from time to time.
- (m) **'Load Despatch Centre'** means National Load Despatch Centre, Regional Load Despatch Centre or State Load Despatch Centre, as the case may be, responsible for coordinating scheduling of the buyers and the sellers in accordance with the provisions of Grid Code;
- (n) **'Open Access Regulations'** means the _____[State]Electricity Regulatory Commission (Open Access in intra-State Transmission) Regulations as amended from time to time and shall include any subsequent amendment thereof.
- (o) **'Scheduled Generation'** at any time or for a time block or any period means schedule of generation in MW or MWh ex-bus given by the concerned Load Despatch Centre;
- (p) **'Scheduled Drawal'** at any time or for a time block or any period time block means schedule of despatch in MW or MWh ex-bus given by the concerned Load Despatch Centre;
- (q) **'Seller'** means a person, including a generating station, supplying electricity through a transaction scheduled in accordance with the regulations applicable for short-term open

access, medium-term open access and long-term access;

- (r) **'Time-Block'** means a time block of 15 minutes, for which specified electrical parameters and quantities are recorded by special energy meter, with first time block starting at 00.00 hrs;

(2) Save as aforesaid and unless repugnant to the context or the subject-matter otherwise requires, words and expressions used in these regulations and not defined, but defined in the Act, or the Grid Code or any other regulations of this Commission shall have the meaning assigned to them respectively in the Act or the Grid Code or any other regulation.

3. Objective

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.

4 Scope

These regulations shall be applicable to sellers and buyers involved in the transactions facilitated through short-term open access or medium-term open access or long-term access in intra-State or inter-state transmission of electricity, as the case may be.

5. Charges for Deviations:

(1) The charges for the Deviations for all the time-blocks shall be payable for over drawal by the buyer and under-injection by the seller and receivable for under-drawal by the buyer and over-injection by the seller, except for wind and solar generators which are regional entities or state entities, and shall be worked out on the average frequency of a time-block at the rates specified in the table below as per the methodology specified in clause (2) of this regulation:

Average Frequency of the time Block (Hz)		Charges for Deviation
Below	Not Below	Paise/kWh
	50.05	0
50.05	50.04	50
50.04	50.03	150
50.03	50.02	200
50.02	50.01	250
50.01	50.00	300
50.00	49.99	350
49.99	49.98	400
49.98	49.97	450
49.97	49.96	500
49.96	49.95	550

Average Frequency of the time Block (Hz)		Charges for Deviation
Below	Not Below	Paise/kWh
49.95	49.94	600
49.94	49.93	650
49.93	49.92	700
49.92	49.91	750
49.91	49.9	800

(Charges for deviation for each 0.01 Hz step is equivalent to 50 Paise/kWh in the frequency range of 50.05-49.9 Hz)

A change in sign of the deviation should be made once every 6 time blocks. A violation of this provision should attract additional charges @10% of the deviation charges applicable for the duration of continuance of violation.

Provided that–

(i) The charges for the Deviation for the generating stations regulated by Commission using coal or lignite or gas supplied under Administered Price Mechanism (APM) as fuel, when actual injection is higher or lower than the scheduled generation, shall not exceed the Cap Rate of ¹[303.04]Paise/kWh as per the methodology specified in clause (3) of this regulation:

(ii) Provided that no cap rate shall be applicable with effect from [the date of revision of price of APM gas by the Government of India] on the charges for the Deviation for the generating stations regulated by [the Central Commission] using gas supplied under Administered Price Mechanism (APM) as the fuel.

(iii) The charges for the Deviation for the under drawals by the buyer in a time block in excess of 12% of the schedule or ²[10]MW, whichever is less, shall be zero;

Provided that in case schedule of a buyer in a time block is less than or equal to ³[40]MW, the charges for the deviation for the under-drawal in excess of ⁴[5]MW shall be zero;

(iv) The charges for the deviation for the over-injection by the seller in a time block in excess of 12% of the schedule or [10] MW, whichever is less, shall be zero, except in case of injection of infirm power, which shall be governed by clause (5) of this regulation:

Provided that in case schedule of a seller in a time block is less than or equal to [40] MW, the charges for the deviation for the over-injection in excess of [5]MW shall be zero:

¹ Present Rate of imported coal

² Cap may vary with no. of pool entities in the state

³ May vary with size of entities in the state

⁴ Cap may with size of entities in the state

Provided also that charges for deviation for wind and solar generators which are regional entities or state entities undertaking inter-state transactions, shall be governed by sub-clauses (v) to (vii) of this regulation.

(v) The wind or solar generators which are regional entities or state entities undertaking inter-state transactions shall be paid as per schedule. In the event of actual generation being less than the scheduled generation, the deviation charges for shortfall in generation shall be payable by such wind or solar generator which are regional entities to the Regional DSM Pool and by wind or solar generator which are state entities into State DSM Pool as given in Table – I below:

Table – I: Deviation Charges in case of under injection

S. No.	Absolute Error in the 15-minute time block	Deviation Charges payable to Regional DSM Pool or State DSM Pool (as applicable)
1	$\leq 15\%$	At the Fixed Rate for the shortfall energy for absolute error upto 15%
2	$>15\%$ but $\leq 25\%$	(At the Fixed Rate for the shortfall energy for absolute error upto 15%) + (110% of the Fixed Rate for balance energy beyond 15% and upto 25%)
3	$>25\%$ but $\leq 35\%$	(At the Fixed Rate for the shortfall energy for absolute error upto 15%) + (110% of the Fixed Rate for balance energy beyond 15% and upto 25%) + (120% of the Fixed Rate for balance energy beyond 25% and upto 35%)
4	$>35\%$	(At the Fixed Rate for the shortfall energy for absolute error upto 15%) + (110% of the Fixed Rate for balance energy beyond 15% and upto 25%) + (120% of the Fixed Rate for balance energy beyond 25% and upto 35%) + (130% of the Fixed Rate for balance energy beyond 35%)

Where the Fixed Rate is the PPA rate as determined by the Commission under section 62 of the Act or adopted by the Commission under section 63 of the Act. In case of multiple PPAs, the weighted average of the PPA rates shall be taken as the Fixed Rate. The wind and solar generators shall furnish the PPA rates on affidavit for the purpose of Deviation charge account preparation to concerned SLDC supported by copy of the PPA.

Fixed Rate for Open Access participants selling power which is not accounted for RPO compliance of the buyer, and the captive wind or solar plants shall be the Average Power Purchase Cost (APPC) rate at the National level, as may be determined by the Commission from time to time through a separate order. A copy of the order shall be endorsed to all RPCs.

(vi) The wind or solar generators which are regional entities or state entities undertaking

inter-state transactions shall be paid as per schedule. In the event of the actual generation being more than the scheduled generation, the Deviation Charges for excess generation shall be payable to the wind or solar generators which are regional entities from the Regional DSM Pool and for state entities undertaking inter-state transactions from State DSM Pool as given in Table – II below:

Table – II: Deviation Charges in case of over injection

S. No.	Absolute Error in the 15-minute time block	Deviation Charges payable from Regional DSM Pool or State DSM Pool (as applicable)
1	<= 15%	At the Fixed Rate for the excess energy upto 15%
2	>15% but <=25%	(At the Fixed Rate for the excess energy upto 15%) + (110% of the Fixed Rate for excess energy beyond 15% and upto 25%)
3	>25% but <=35%	(At the Fixed Rate for the excess energy upto 15%) + (110% of the Fixed Rate for excess energy beyond 15% and upto 25%) + (120% of the Fixed Rate for excess energy beyond 25% and upto 35%)
4	>35%	(At the Fixed Rate for the excess energy upto 15%) + (110% of the Fixed Rate for excess energy beyond 15% and upto 25%) + (120% of the Fixed Rate for excess energy beyond 25% and upto 35%) + (130% of the Fixed Rate for excess energy beyond 35%)

Where the Fixed Rate is the PPA rate as determined by the Commission under section 62 of the Act or adopted by the Commission under section 63 of the Act. In case of multiple PPAs, the weighted average of the PPA rates shall be taken as the Fixed Rate. The wind and solar generators shall furnish the PPA rates on affidavit for the purpose of Deviation charge account preparation to concerned SLDC supported by copy of the PPA.

Fixed Rate for Open access participants selling power which is not accounted for RPO compliance of the buyer, and the captive wind or solar plants shall be the Average Power Purchase Cost (APPC) rate at the National level, as may be determined by the Central Commission from time to time through a separate order. A copy of the order shall be endorsed to all RPCs.

(vii) In reference to clauses (v) and (vi) of this Regulation, for balancing of deemed renewable purchase obligation (RPO) compliance of buyers with respect to schedule, deviations by all wind and solar generators which are regional entities shall first be netted off for the entire pool on a monthly basis and any remaining shortfall in renewable energy generation must be balanced through purchase of equivalent solar and non-solar Renewable Energy Certificates (RECs), as the case may be, by NLDC by utilising funds from the Pool Account. For positive balance of renewable energy generation, equivalent notional RECs shall be credited to the DSM Pool and carried forward for settlement in future.”

(2) The Charge for Deviation, except for wind and solar generators which are state entities, shall be determined in accordance with the following methodology:

- (a) The Charge for Deviation shall be zero at grid frequency of 50.05 Hz and above.
- (b) The Charge for Deviation corresponding to grid frequency interval of 'below 50.01 Hz and not below 50.0 Hz' shall be based on the median value of the average energy charge of coal/lignite based generating stations regulated by the Central Commission for any six month period preferably from July to December of previous year or from January to June for the year or any other six month period if deemed necessary and suitably adjusted upward to coincide with the Deviation Price Vector.
- (c) The Deviation Price Vectors shall accordingly, be in steps for a frequency interval of 0.01 Hz between grid frequency of (i) 50.05 Hz and 'below 50.01 Hz and not below 50.0 Hz' and (ii) 'below 50.01 Hz and not below 50.0 Hz' and below 49.90 Hz.
- (d) The Charge for Deviation at grid frequency "below 49.90 Hz" shall be based on the highest of the average energy charges of generating stations regulated by Central Commission on RLNG for any six month period preferably from July to December of previous year or from January to June for the year or any other six month period if deemed necessary and suitably adjusted upward to coincide with the Deviation Price Vector.

(3) The Cap rate for the charges for the Deviation for the generating stations regulated by Central Commission using coal/lignite or gas supplied under Administered Price Mechanism (APM) as the fuel, shall be the value coinciding with the energy charges on imported coal on Deviation Price Vector.

(4) The Charges for Deviation may be reviewed by the Commission from time to time and as and when Deviation Price Vector is revised by Central Commission and shall be re-notified accordingly.

(5) The infirm power injected into the grid by a generating unit of a generating station during the testing, prior to COD of the unit shall be paid at Charges for Deviation for infirm power injected into the grid, consequent to testing, for a period not exceeding 6 months or the extended time allowed by the Commission in the ____/[State]Electricity Regulatory Commission (Grant of Connectivity, Long-term Access and Medium-term Open Access and related matters) Regulations, as amended from time to time, subject to ceiling of Cap rates corresponding to the ⁵[main fuel] used for such injection as specified below:

Domestic coal/ Lignite/Hydro	- [1.78] / kWh sent out
APM gas as fuel	- [2.82]/ kWh sent out up to the date of

⁵Present rates of main fuel

	<i>revision of price of APM gas by Government of India and thereafter, at the rate to be notified by the Commission separately</i>
Imported Coal	- [3.03] / kWh sent out
RLNG	- [8.24] / kWh sent out

6. Declaration, scheduling and elimination of gaming

- (1) The provisions of the State Grid Code and the ____/[State]Electricity Regulatory Commission (Open Access in inter-State Transmission) Regulations, as amended from time to time, shall be applicable for declaration of capacity, scheduling and elimination of gaming.
- (2) The generating station, as far as possible, shall generate electricity as per the day-ahead generation schedule finalized by the State Load Despatch Centre in accordance with the State Grid Code.

Provided that the revision in generation schedule on the day of operation shall be permitted, in accordance with the procedure specified under the Grid Code and ____/[State]Electricity Regulatory Commission (Open Access in inter-State Transmission) Regulations, as the case may be.

- (3) The Commission, either suo motu or on a petition made by SLDC, or any affected party, may initiate proceedings against any generating company or seller on charges of gaming and if required, may order an inquiry in such manner as decided by the Commission. When the charge of gaming is established in the above inquiry, the Commission may, without prejudice to any other action under the Act or regulations thereunder, disallow any Charges for Deviation received by such generating company or the seller during the period of such gaming."

7. Limits on Deviation volume and consequences of crossing limits

- (1) The over-drawals / under drawals of electricity by any buyer during a time block shall not exceed 12% of its scheduled drawal or X MW, whichever is lower, when grid frequency is '49.90 Hz and above and below 50.05 Hz.'

Where, Volume Limit of X MW for Intra-State DISCOMs / Buyers shall be determined as under:

- (a) Min (12% of schedule , (Peak Demand / Σ NCPD) x State Volume Limit)
- (b) State Volume Limit shall be linked to Volume Limit (L) applicable to the State as per CERC DSM Regulations and its amendments thereof

Provided that no over drawal of electricity by any buyer shall be permissible when grid frequency is "below 49.90 Hz" and no under drawal of electricity by any buyer shall be

permissible when grid frequency is "50.05 Hz and above".

(2) The under-injection / over-injection of electricity shall not exceed following when grid frequency is "49.90 Hz or above and below 50.05 Hz":

- a) 12% of the scheduled injection or [10 MW,] whichever is lower for a seller

Provided that:

- a. In case schedule of a seller, in a time block, is less than or equal to [40]MW, under-injection / over-injection in a time-block shall not exceed [5]MW, when grid frequency is "49.90 Hz or above and below 50.05 Hz".
- b. Provided that the limits on deviation volume and consequences for crossing these limits (including the additional charges for deviation) as stipulated under Regulation 7 shall not apply to wind and solar generators which are regional entities or state entities.
- c. No under injection of electricity by a seller shall be permissible when grid frequency is "below 49.90 Hz" and no over injection of electricity by a seller shall be permissible when grid frequency is "50.05 Hz and above".
- d. 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.
- e. Any drawal of power by a generating station prior to COD of a unit for the start up activities shall be exempted from the volume limit specified above when grid frequency is "49.90 Hz and above".

(3) In addition to Charges for Deviation as stipulated under Regulation 5 of these regulations, Additional Charge for Deviation shall be applicable for over-drawal as well as under-injection of electricity for each time block in excess of the volume limit specified in Clause (1) and (2) of this regulation when average grid frequency of the time block is "49.90 Hz and above" at the rates specified in the Table I and Table II as the case may be below in accordance with the methodology specified in clause (7) of this regulation:

Provided that –

(i) Additional Charge for Deviation for under-injection of electricity, during a time-block in excess of the volume limit specified in clause (1) and (2) of this regulation when grid frequency is "49.90 Hz and above", by the generating stations regulated by the Commission using coal or lignite or gas supplied under Administered Price Mechanism (APM) as the fuel

shall be at the rates specified in Table II below in accordance with the methodology specified in clause (9) of this regulation;

(ii) Any drawal of power by a generating station prior to COD of a unit for the start-up activities shall be exempted from the levy of additional Charges of Deviation.

TABLE –I (for Seller/Buyer)

(A) When 12% of the Schedule is less than or equal to [10] MW		
1	For over drawal of electricity by any buyer in excess of 12% and upto 15% of the schedule in a time block	Equivalent to 20% of Charge for Deviation corresponding to average grid Frequency of the time-block
2	For over drawal of electricity by any buyer in excess of 15% and upto 20% of the schedule in a time block	Equivalent to 40% of Charge for Deviation corresponding to average grid Frequency of the time-block
3	For over drawal of electricity by any buyer in excess of 20% of the schedule in a time block	Equivalent to 100% of Charge for Deviation corresponding to average grid Frequency of the time-block
4	For under injection of electricity by any seller in excess of 12% and upto 15% of the schedule in a time block	Equivalent to 20% of Charge for Deviation corresponding to average grid Frequency of the time-block
5	For under injection of electricity by any seller in excess of 15% and upto 20% of the schedule in a time block	Equivalent to 40% of Charge for Deviation corresponding to average grid Frequency of the time-block
6	For under injection of electricity by any seller in excess of 20% of the schedule in a time block	Equivalent to 100% of Charge for Deviation corresponding to average grid Frequency of the time-block
(B) When 12% of the Schedule is more than [10] MW		
1	For over drawal of electricity by any buyer is above X MW and upto X+[10] MW in a time block	Equivalent to 20% of Charge for Deviation corresponding to average grid Frequency of the time-block
2	For over drawal of electricity by any buyer is above X+[10] MW and upto X + [20]MW in a time block	Equivalent to 40% of Charge for Deviation corresponding to average grid Frequency of the time-block
3	For over drawal of electricity by any buyer is above X + 20 MW in a time block	Equivalent to 100% of Charge for Deviation corresponding to average grid Frequency of the time-block

(A) When 12% of the Schedule is less than or equal to [10] MW		
4	For under injection of electricity by any seller is above [10] MW and upto [20] MW in a time block	Equivalent to 20% of Charge for Deviation corresponding to average grid Frequency of the time-block
5	For under injection of electricity by any seller is above [20] MW and upto [25] MW in a time block	Equivalent to 40% of Charge for Deviation corresponding to average grid Frequency of the time-block
6	For under injection of electricity by any buyer is above [25] MW in a time block	Equivalent to 100% of Charge for Deviation corresponding to average grid Frequency of the time-block

TABLE – II

(A) When 12% of the Schedule is less than or equal to [10] MW		
1	For over drawal of electricity by any buyer in excess of 12% and upto 15% of the schedule in a time block	Equivalent to 20% of Charge for Deviation corresponding to average grid Frequency of the time-block
2	For over drawal of electricity by any buyer in excess of 15% and upto 20% of the schedule in a time block	Equivalent to 40% of Charge for Deviation corresponding to average grid Frequency of the time-block
3	For over drawal of electricity by any buyer in excess of 20% of the schedule in a time block	Equivalent to 100% of Charge for Deviation corresponding to average grid Frequency of the time-block
(A) When 12% of the Schedule is more than [10] MW		
1	For over drawal of electricity by any buyer is above X MW and upto X+[10] MW in a time block	Equivalent to 20% of Charge for Deviation corresponding to average grid Frequency of the time-block
2	For over drawal of electricity by any buyer is above X+[10] MW and upto X + [20] MW in a time block	Equivalent to 40% of Charge for Deviation corresponding to average grid Frequency of the time-block
3	For over drawal of electricity by any buyer is above X + [20] MW in a time block	Equivalent to 100% of Charge for Deviation corresponding to average grid Frequency of the time-block

Provided that when the schedule is less than or equal to [40] MW, the additional charges for deviation shall be based on percentage of deviation worked out with reference to schedule of [40] MW as per Table-I and Table-II above.

(4) In addition to Charges for Deviation as stipulated under Regulation 5 of these regulations,

Additional Charge for Deviation shall be applicable for over-injection/under drawal of electricity for each time block by a seller/buyer as the case may be when grid frequency is "50.05 Hz and above" at the rates equivalent to charges of deviation corresponding to the grid frequency of "below 50.01 Hz but not below 50.0 Hz".

(5) Methodologies for the computation of Charges for Deviation and Additional Charges for deviation for each regional entity or state entity as the case may be for crossing the volume limits specified for the under-drawal /over-injection and for over-drawal and under-injection in clause (3) of this regulation shall be as per Annexure I, Annexure I-A and Annexure-II, Annexure-II-A of these Regulations respectively.

(6) In addition to Charges for Deviation as stipulated under Regulation 5 of these Regulations, Additional Charge for Deviation shall be applicable for over-drawal or under-injection of electricity when grid frequency is "below 49.90 Hz" in accordance with the methodology specified in clause (8) of this regulation and the same shall be equivalent to 100% of the Charge for Deviation of 800Paise/kWh corresponding to the grid frequency of "below 49.90 Hz".

Provided further that Additional Charge for Deviation for under-injection of electricity by a seller, during the time-block when grid frequency is "below 49.90 Hz", by the generating stations regulated by CERC using coal or lignite or gas supplied under Administered Price Mechanism (APM) as the fuel in accordance with the methodology specified in clause 8 of this regulation shall be equivalent to 100% of the Cap Rate for Deviations of [303.04] Paise/kWh(*indicative, to be linked to variable cost for imported coal price*).

(7) The Additional Charge for Deviation for over-drawal and under-injection of electricity for each time block in excess of the volume limit specified in clause (1) and (2) of this Regulation when grid frequency is "49.90 Hz and above" shall be as specified by the Commission as a percentage of the charges for the Deviation corresponding to average grid frequency of the time block with due consideration to the behavior of the buyers and sellers towards grid discipline:

Provided that the Commission may specify different rates for additional Charges for Deviation for over drawals and under injections depending upon different % deviation from the schedule in excess of the volume limit specified in clause (1) and(2) of this Regulation.

(8) The additional Charge for Deviation for over-drawals and under-injection of electricity for each time block when grid frequency is "below 49.90 Hz" shall be as specified by the Commission as a percentage of the charges for the Deviation corresponding to average grid frequency of the time block with due consideration to the behavior of the buyers and sellers towards grid discipline:

Provided that the Commission may specify different rates for Additional Charges for Deviation for over drawls and under injections and for different ranges of frequencies "below 49.90 Hz".

(9) The Additional Charge for Deviation for under-injection of electricity during the time-block in excess of the volume limit specified in Clause (2) of this regulation when grid frequency is '49.90 Hz and above', by the generating stations regulated by SERC using coal/ lignite or gas supplied under Administered Price Mechanism (APM) as the fuel shall be as specified by the Commission as a percentage of the Cap Rate or the Charges for Deviation corresponding to the grid frequency of the time block, or both with due consideration to the behavior of the generating stations regulated by SERC towards grid discipline:

(10) In the event of sustained deviation from schedule in one direction (positive or negative) by any regional entity or state entity, such regional entity or state entity (buyer or seller) shall have to make sign of their deviation from schedule changed, at least once, after every 6 time blocks. To illustrate, if a regional entity has positive deviation from schedule from 07.30 hrs to 9.00 hrs, sign of its deviation from schedule shall be changed in the 7th time block i.e. 9.00 to 9.45 hrs from positive to negative or negative to positive as the case may be.

(11) Payment of Charges for Deviation under Regulation 5 and the Additional Charges for Deviation under Clauses (3) and (4) of this regulation, shall be levied without prejudice to any action that may be considered appropriate by the Commission under Section 142 of the Act for contravention of the limits of over-drawal/ under drawal or under-injection /over-injection as specified in these regulations, for each time block or violation of provision of clause 10 of these regulations.

(12) The charges for over-drawal/ under-injection and under-drawal/ over-injection of electricity shall be computed by the respective State Power Committee in accordance with the methodology used for preparation of 'State Energy Accounts'.

(13) The State Load Despatch Centre shall, on monthly basis, prepare and publish on its website the records of the Deviation Accounts, specifying the quantum of over-drawal/ under-injection and corresponding amount of Charges for Deviation payable/receivable for each buyer and seller for all the time-blocks when grid frequency was "49.90Hz and above" and "below 49.90" Hz separately.

8. Compliance with instructions of Load Despatch Centre

Notwithstanding anything specified in these Regulations, the sellers and the buyers shall strictly follow the instructions of the State Load Despatch Centre on injection and drawal in the interest of grid security and grid discipline.

9. Accounting of Charges for Deviation

(1) A statement of Charges for Deviations including Additional Charges for Deviation levied under these regulations shall be prepared by the Secretariat of the State Power Committee on

weekly basis based on the data provided by SLDC by the Thursday of the week and shall be issued to all constituents by next Tuesday, for seven day period ending on the penultimate Sunday mid-night.

(2) All payments on account of Charges for Deviation including Additional Charges for Deviation levied under these regulations and interest, if any, received for late payment shall be credited to the funds called the "State Deviation Pool Account Fund", which shall be maintained and operated by the concerned State Load Despatch Centre in accordance with provisions of these regulations.

Provided that –

(i) the Commission may by order direct any other entity to operate and maintain the respective "State Deviation Pool Account Fund":

(ii) separate books of accounts shall be maintained for the principal component and interest component of Charges for Deviation and Additional Charges for Deviation by the Secretariat of the respective State Power Committee.

(3) All payments received in the "State Deviation Pool Account Fund" shall be appropriated in the following sequence:

- (a) First towards any cost or expense or other charges incurred on recovery of Charges for deviation.
- (b) Next towards over dues or penal interest, if applicable.
- (c) Next towards normal interest.
- (d) Lastly, towards charges for deviation and additional charges for deviation.

10. Schedule of Payment of Charges for Deviation

(1) The payment of charges for Deviation shall have a high priority and the concerned constituent shall pay the indicated amounts within 10 (ten) days of the issue of statement of Charges for Deviation including Additional Charges for Deviation by the Secretariat of the State Power Committee into the "State Deviation Pool Account Fund".

(2) If payments against the Charges for Deviation including Additional Charges for Deviation are delayed by more than two days, i.e., beyond twelve (12) days from the date of issue of the statement by the Secretariat of the State Power Committee, the defaulting constituent shall have to pay simple interest @ 0.04% for each day of delay.

(3) All payments to the entities entitled to receive any amount on account of charges for Deviation shall be made within 2 working days of receipt of the payments in the "State Deviation Pool Account Fund".

Provided that –

(i) in case of delay in the Payment of charges for Deviations into the State Deviation Pool

Account Fund and interest there on if any, beyond 12 days from the date of issue of the Statement of Charges for Deviations the State entities who have to receive payment for Deviation or interest thereon shall be paid from the balance available if any, in the State Deviation Pool Account Fund. In case the balance available is not sufficient to meet the payment to the State Entities, the payment from the State Deviation Pool Accounts Fund shall be made on pro rata basis from the balance available in the Fund.

(ii) the liability to pay interest for the delay in payments to the "State Deviation Pool Account Fund" shall remain till interest is not paid; irrespective of the fact that constituents who have to receive payments have been paid from the "State Deviation Pool Account Fund" in part or full.

(4) All State entities which had at any time during the previous financial year failed to make payment of Charges for Deviation including Additional Charges for Deviation within the time specified in these regulations shall be required to open a Letter of Credit (LC) equal to 110% of its average payable weekly liability for Deviations in the previous financial year, in favour of the SLDC within a fortnight from the date these Regulations come into force.

Provided that –

(i) if any State entity fails to make payment of Charges for Deviation including Additional Charges for Deviation by the time specified in these regulations during the current financial year, it shall be required to open a Letter of Credit equal to 110% of weekly outstanding liability in favour of State Load Despatch Centre within a fortnight from the due date of payment.

(ii) LC amount shall be increased to 110% of the payable weekly liability for Deviation in any week during the year, if it exceeds the previous LC amount by more than 50%.

Illustration: If the average payable weekly liability for Deviation of a State entity during 2015-16 is `2.0 crore, the State entity shall open LC for 2.2 crore in 2016-17. If the weekly payable liability during any week in 2016-17 is `3.5 crore which is more than 50% of the previous financial year's average payable weekly liability of Rs 3.0 Crore, the concerned regional entity shall increase the LC amount to `3.85 Crore (1.1×3.50) by adding 1.65 Crore.

(5) In case of failure to pay into the "State Deviation Pool Account Fund" within the specified time of 12 days from the date of issue of statement of charges for Deviations, the SLDC shall be entitled to encash the LC of the concerned constituent to the extent of the default and the concerned constituent shall recoup the LC amount within 3 days.

11. Application of fund collected through Deviations

The surplus amount, if any in the Deviation Pool Account Fund as on last day of the month, shall be transferred to a separate fund namely "Power Systems Development Fund" specified by the Commission in the first week of the next month and shall be utilized, for the purpose specified by the Commission.

12. Power to Relax.

The Commission may by general or special order, for reasons to be recorded in writing, and after giving an opportunity of hearing to the parties likely to be affected by grant of relaxation, may relax any of the provisions of these regulations on its own motion or on an application made before it by an interested person.

13. Power to issue directions:-

If any difficulty arises in giving effect to these regulations, the Commission may on its own motion or on an application filed by any affected party, issue such directions as may be considered necessary in furtherance of the objective and purpose of these regulations.

Annexure-I

Methodologies for the computation of Charges of Deviation and Additional Charges for deviation for each regional/state entity for crossing the volume limits specified for the over-drawal/under injection by Buyer/Seller

1. When the grid frequency is 49.9 Hz and above

- A. When D_{tb} i.e. Deviation from schedule in a time block in MW is less than (+/-) 12% of the schedule in MW or [10] MW whichever is lower in each time block, D_{tb} to be payable by the regional entity at normal Charges for Deviation;
- B. When D_{tb} i.e. Deviation from schedule in a time block in MW is more than (+/-) 12% of the schedule in MW or [10] MW whichever is lower in each time block
- (1) $D_{tb} = D_0 + D_{12}/[10]$
Where
 $D_0 = (+/-) 12\%$ of Scheduled Generation (SG) or [10] MW whichever is lower,
 $D_{12/150} =$ Deviation in excess (+/-) 12% of the SG or [10] MW, whichever is lower in each time block
- (2) $D_{12/10} = D_{tb} - D_0$
- (3) The Charges of Deviation corresponding to D_{tb} shall be payable by the regional entity at normal Charges of Deviation; In addition, graded Additional Charges for the Deviation for $D_{12/10}$ shall be payable by the regional entity for over drawal/under injection for crossing the volume limit on the basis of percentage termor MW terms as the case may @ 20%, 40%, 100% of Charge of Deviation for the incremental deviation in each slab. The same is illustrated as under: .

Illustrations "A" - When 12% of Schedule is less than or equal to [10] MW

Category	Additional Charges for Deviation
D_{tb} is above 12% and up to 15% of schedule in MW	$50 \times (D_{tb} - 12\% \text{ of schedule}) \times \text{Charge for Deviation corresponding to average grid frequency of the time block}$
D_{tb} is above 15% and up to 20% of schedule in MW	$(100 \times (D_{tb} - 15\% \text{ of schedule}) + 1.50 \times \text{schedule}) \times \text{Charge for Deviation corresponding to average grid frequency of the time block}$
D_{tb} is above 20%	$(250 \times (D_{tb} - 20\% \text{ of schedule}) + 6.50 \times \text{schedule}) \times \text{Charge for Deviation corresponding to average grid frequency of the time block}$

Provided that when the schedule is less than or equal to [40] MW, the additional charges for deviation shall be based on percentage of deviation worked out with reference to schedule of [40] MW.

Illustrations "B" - When 12% of Schedule is more than [10] MW

Category	Additional Charges for Deviation
D_{tb} is above X MW and up to X + [10] MW	$50 \times (D_{tb} - [10]) \times \text{Charge for Deviation corresponding to average grid frequency of the time block}$
D_{tb} is above X + [10]MW and up to X + [20]MW	$(100 \times (D_{tb} - [20]) + 250) \times \text{Charge for Deviation corresponding to average grid frequency of the time block}$
D_{tb} is above X + [20]MW	$(250 \times (D_{tb} - [25]) + 750) \times \text{Charge for Deviation corresponding to average grid frequency of the time block}$

Note: The Additional Charge for Deviation for under-injection of electricity, during the time block in excess of the volume limit specified in clause 7 (1) and (2) of the Regulation when grid frequency is "49.90 Hz and above", by the generating stations regulated by the CERC using coal or lignite or gas supplied under Administered Price Mechanism (APM) as the fuel shall be calculated with the Cap Rate for Deviations of [303.04] Paise/kWh or the Charge for Deviation corresponding to average grid frequency of the time block, whichever is less.

2. When the grid frequency is below 49.9 Hz

The charges for deviation corresponding to D_{tb} shall be payable by the regional entity at [800]Paise/kWh. In addition, additional deviation charges for deviation for D_{tb} shall be payable by the regional entity at [800]Paise/kWh.

Note: The charges for Deviation and the additional charges for Deviation for under injection, during the time block when grid frequency is below 49.90 Hz, by the generation station regulated by the Commission using coal or lignite or gas supplied under Administrative Price Mechanism (APM) as the fuel shall be calculated corresponding to the cap rate for deviations of [303.04] Paise/kWh.

Annexure-II

Methodologies for the computation of Charges of Deviation and Additional Charges for deviation for each regional entity for crossing the volume limits specified for the under drawal/ over-injection by buyer/Seller

- A. When D_{tb} i.e. Deviation from schedule in a time block in MW is less than $(+/-)12\%$ of the schedule in MW or $[10]$ MW, whichever is lower in each time block, D_{tb} to be receivable by the regional entity at normal Charges for Deviation;
- B. When D_{tb} i.e. Deviation from schedule in a time block in MW is more than $(+/-)12\%$ of the schedule in MW or $[10]$ MW, whichever is lower in each time block
- (1) $D_{tb} = D_0 + D_{12}/[10]$
Where
 $D_0 = (+/-) 12\%$ of Scheduled Generation (SG) or $[10]$ MW whichever is lower,
 $D_{12/10}$ = Deviation in excess $(+/-) 12\%$ of the SG or $[10]$ MW, whichever is lower in each time block
- (2) $D_{12/10} = D_{tb} - D_0$
- (3) The Charges for Deviation corresponding to D_0 shall be receivable by the regional entity at normal Charges of Deviation or the ceiling rate whichever is lower; the regional entity shall not be entitled to any receivable for $D_{12/10}$.
- Provided that when the schedule is less than or equal to $[40]$ MW, 12% of schedule will be considered as $[5]$ MW for the purpose of this clause.

Additional Charges for the Deviation D_{tb} shall be payable by the regional entity for under drawal/ over injection when grid frequency is 50.05 Hz or above in accordance with clause 7 (4) of this Regulation.

Model Regulations on Deviation Settlement Mechanism (DSM) for States

*For discussion during 57th Meeting of
FORUM OF REGULATORS at Raipur, Chhattisgarh*

16-Dec-2016

Overview of Technical Committee deliberations

- SAMAST framework and development of Implementation Roadmap
(Fifth meeting of Technical Committee)
- Model Forecasting & Scheduling framework at State level
(Fifth & Sixth meeting of Technical Committee)
- Model DPR for implementation of SAMAST at state level
(Sixth meeting of Technical Committee)
- **Model DSM Regulations at State level**
(Seventh & Eighth meeting of Technical Committee)

Comparison of ABT framework at State level – 1/3

Parameter	Gujarat	Maharashtra	Madhya Pradesh	Delhi	West Bengal
Notification/Order	Order No. 3 of 2006 dt. 11.08.2006	Case 42 of 2006 dt. 17.05.2006	2299/MPERC/2009 Balancing & Settlement Code Regulations	F.17(115)/Engg./DERC/20 06-07/ dt. 31.03.2007 (Order for Assignment of PPA, pursuant to second transfer scheme)	No. 48/WBERC/ Tariff Regulations, 2011
Applicability	- Generators - DISCOMs - OA Users	- DISCOMs - TOA Users (Generators excluded)	- Generators - DISCOMs - OA Users	- Generating Stations - DISCOMs	- WBPDC and Gen. stations >50 MW - DISCOMs/ Deemed Licensees
Generator Tariff Design	- Capacity charge linked to availability - Energy Charge linked to Schedule (for hydro-actual) - UI charge	- Capacity charge linked to availability and incentive linked to PLF - Energy Charge linked to Actual	- Capacity Charges linked to availability - Energy Charges linked to schedule energy - UI charges	- Capacity Charges linked to availability - Energy Charges linked to schedule energy - UI charge	- Capacity Charge - Energy Charge - UI charge
Deviation/ Imbalance	Actual - Schedule	Increment /Decrement Contract – Actual plus allocation of Regional UI	Actual - Schedule	Actual – Schedule	Actual - Schedule

Comparison of ABT framework at State level – 2/3

Parameter	Gujarat	Maharashtra	Madhya Pradesh	Delhi	West Bengal
Scheduling and Despatch framework	- Generators, DISCOMs and OA Users (excluding wind, mini hydel and generating stations having total capacity 5-15 MW) connected to the grid shall schedule and despatch as per SLDC. - Scheduling of hydro in consultation with beneficiaries - De-Centralised scheduling and Despatch Model	- SLDC Responsible for scheduling, despatch and MOD. Done as per 15 minute time blocks as per load forecast schedules from state pool participants. - Centralised MoD based Despatch Model	- Scheduling shall be done on 15-minutes Time Block. - Generation Schedules and Drawal Schedules issued / revised by SLDC shall become effective from designated Time Block - Scheduling of hydro to be finalized by SLDC based on DCs - De-Centralised scheduling and Despatch Model	- Discoms to adhere to grid discipline. - Under frequency relays to be kept in operation. - STU/SLDC shall exercise necessary control in transmission/load dispatch as specified in the Act, IEGC, Regulations of CERC, CEA, Rules etc - Surplus adjustment amongst state DISCOMs on day-ahead	All the Scheduling shall be done on 15-minutes Time Block basis. De-Centralised scheduling and Despatch Model
Pricing Framework	- Linked to frequency - As per CERC deviation charges.	- Linked to Wt. Avg. System Marginal Price (WASMP) - Allocation of Regional UI	- Linked to frequency - UI rates as per CERC 2007 Regulation and amendments thereof.	- UI rates as per CERC UI/DSM Regulations - Inter-DISCOM exchange at PX rate+10 paise	UI rates linked to frequency.

Comparison of ABT framework at State level – 3/3

Parameter	Gujarat	Maharashtra	Madhya Pradesh	Delhi	West Bengal
Limits on Deviation / Other conditions	- Var and Voltage control at limits of 97% and 103% of voltage level. - Generating stations generating 105% in a time block and averaging 101%, not considered as gaming.	- DISCOMs entitled to schedule/draw upto contracted capacity - Despatch governed as per centralised MOD principles	- Var and Voltage control at limits of 97% and 103% of voltage level. - Generating stations generating 105% in a time block and averaging 101%, not considered as gaming.	Not stipulated in the Order	- Generating stations generating 105% in a time block and averaging 101%, not considered as gaming. - Drawal less than 95% of the scheduled drawal in a block construed as gaming.
DSM Pool	The UI Payable is adjusted to make it equal after equal to UI receivable. - Zero-sum DSM Pool - Some delays in pool account settlements	- State level Imbalance Pool under operation since 2009 - Zero-sum DSM Pool - Some delays in pool account settlements	Payable/ receivable by each Intra-State Entity and Regional UI payable/ receivable for MP to be matched with the average of total payables and total receivables.	UI pool account under operation since 2013.	Any mismatch amount after UI energy accounting is done, such amount shall be distributed on prorata basis of actual energy injected or drawn by the entities and net balance of the accounts of UI charge is zero.
Institutional Arrangement	Entry and exit points defined by STU. Billing and settlement of 'UI charge' and 'reactive charge' prepared by SLDC.	- Governance structure in place through Maharashtra State Power Committee. - MSLDC-OD and MSLDC-CD would see 'day to day' functioning, - UI settlement and form Maharashtra State Power Pool	SLDC to perform accounting. Discoms to pay energy and capacity charges to generators (through MP Trading Co.)	- Operation Coordination Committee (OCC) for issues relating operating of the system. - Delhi Transco Limited (DTL) looks after the ABT meter reading - STU to identify non-critical feeders.	Generators, discoms and SLDC. SLDCs perform the task of energy accounting and settlement.

Need for harmonisation state level DSM framework

Overview of CERC DSM Regulations, 2014 (incl. amendments)

Salient features of CERC DSM Regulations – 1/2

Parameter	Description
Notification	CERC (Deviation Settlement Mechanism and Related Matters) Regulations, 2014 <i>(includes third amendment, 30.05.2016)</i>
Objective	To maintain grid discipline and grid security as envisaged under Grid Code through commercial mechanism for Deviation Settlement through drawal and injection of electricity by users of the grid.
Applicability	Buyers and Sellers involved in transactions facilitated through short term / medium term / long term open access in inter-state transmission of electricity.
Deviation	- Total Actual Injection – Total Scheduled Generation <i>(for Seller)</i> - Total Actual Drawal – Total Scheduled Drawal <i>(for Buyer)</i>
Absolute Error	Error (%) = $100 \times [\text{Actual Generation} - \text{Scheduled Generation}] / (\text{AvC})$ <i>(Applicable for Wind/Solar Regional Entities)</i>
Pricing Framework	- Charges payable (overdrawal/under-injection) and receivable (under-drawal/over-injection) for each time-block - Linked to average frequency for each time block (15 min duration) in steps of 0.01 Hz over range from 49.7 Hz to 50.05 Hz

Salient features of CERC DSM Regulations – 2/2

Parameter	Description
Other Conditions for Deviation Charges	• Capping of Deviation Charges for Generating Stations regulated by CERC • Cap Rate of Paise 303.04/ unit • Volume Cap of 150 MW or 12% of Schedule [Different volume caps for RE Rich States] • Additional Charges for exceeding Volume Cap
Infirm power injection	• Upto 6 months or as per time extension allowed by Commission • Priced at 178 Paise/unit (coal/lignite/hydro), 282 Paise/unit (APM Gas), 303 Paise/unit (imported coal), 824 Paise/unit (RLNG). • Subject to ceiling of Cap Rate for Main fuel
Limits for Deviation	• Volume Cap of 150 MW or 12% of Schedule [Different volume caps for RE Rich States] • No over-drawal/under-injection when Frequency below 49.7 Hz • Additional Charges at rate of 20%, 40%, 100% of Applicable Deviation Charges in steps of deviation 12%-15%, 15%-20%, > 20% or 150-200 MW, 200-250 MW, > 250 MW
DSM Pool	• Regional Deviation Pool Account to be operated by RLDC and Accounts by RPCs • Surplus to be transferred to 'Power System Development Fund' at the end of month.
Institutional Arrangement	• Regional Power Committee to prepare Statement for Deviation Charges on Weekly basis • Regional Load Despatch Centres to operate & maintain 'Regional Deviation Pool Account Fund'

State specific considerations for DSM framework – 1/2

- **State experiences**

- Identification of Intra-State Entities, interface boundary limits (inter-utility and intra-utility, G<>T and T<>D) is cumbersome and evolving process.
- Significant time (over 2 yrs), efforts and coordination necessary for implementation of metering and communication infrastructure.
- Different Treatment of Open Access transactions (TOA, DOA/Embedded, Full/Partial OA) is necessary under DSM framework.
- Centralised Despatch or De-centralised Despatch Model has close links to status of power market reforms at state level and power scenario (surplus/deficit) at state level.
- Managing deviations of intra-State entities within volume cap of (12%, 150 MW to 250 MW), without flexible resources / demand response is challenge.

State specific considerations for DSM framework – 2/2

- **Payment mechanism for Generators**

- Operation of Two part/ Multi-part for Generators is necessary.
- Whether Energy Payment to Generators to be linked to (Actual v/s schedule)?
- Modification to PPA (IPPs and SGS) and Amendments to Tariff Regulations may be necessary.
- Hydro generation is used as balancing resource (single part payment operation in place)

- **Market developments in the country**

- Power Supply scenario has improved significantly.
- Regional and National power market operation are growing rapidly. With emergence of Multiple entities viz. traders, open access entities, volume of merchant transactions are expected to grow.
- Reference market price discovery through market mechanism (thru Power Exchanges) is available.
- With conducive policy and Grid Integration of RE, share of RE transactions (inter/intra-state) is expected to grow further.

With this background, Key Design Parameters for DSM framework at state level needs to be discussed.

Model DSM Regulations : Key Design issues – 1/2

1. Pre-condition for introduction of DSM – Applicability of Multi-part tariff design
2. Applicability and coverage of DSM at state level
3. Definition of DSM and Error
4. Principle for Pricing of Deviations
5. DSM Price Vector
6. Identification of State Entity
7. DSM Pool design
8. Governance structure and Institutional arrangement
9. State Energy Accounting and Settlement Accounting
10. Reactive Energy accounting

Model DSM Regulations : Key Design issues – 2/2

11. DSM Fund Operationalisation : Utilisation rules, Application of residual fund
12. Treatment for Gaming / Curtailment / Despatch
13. Treatment for infirm power
14. Metering & AMR infrastructure
15. Detailed Implementation procedures – Nodal Agency, Roles & responsibility of stakeholders

1. Pre-conditions for introduction of DSM at state level

- Pre-conditions for introduction of DSM at state level

- Identification of State Entities
- [Identification of interface boundaries \(G<>T and T<>D\)](#)
- Ensuring Metering Infrastructure and Communication links covering interface points

- Summary of Discussions:

- STU, through the state level committees (say, Grid Coordination Committee) should evolve **Action Plan** with clear identification of milestones under each stage of Implementation **alongwith timelines for implementation of SAMAST at state level.**
- Such Action Plan could be approved by concerned SERC.
- SERCs to guide and monitor the implementation through coordination and support of state power committee or state advisory committee.

2. Applicability and Coverage of DSM at state level

- **Applicability and Coverage**

- Generating Stations – Thermal, Hydel, Renewable
- Distribution Licensees
- Deemed Distribution Licensees (SEZs, Railways) and Exempt Licensees (RESCOs)
- Open Access Users (TOAUs / DOAUs) and (Full OA Users and Partial OA Users)
- Captive Users (Captive Wheeled, In-Situ)

Key Discussion Points	Provision in Draft Regulations
Distinction to be made between Existing v/s New Generating Stations	Applicable for all generating stations
Treatment of existing Banking and Wheeling arrangements	Provision of state specific OA Regulations to be made applicable
Minimum threshold Installed Capacity	Buyer and Seller are defined in the Draft. Threshold limit to be in line with respective State Grid Code and OA Regulations

3. Definition of DSM and Error

- Deviation and Error

- **Deviation** = Actual – Schedule (to be computed for Injection and Drawal)
- Deviation to be computed for each state entity separately
- **Error (%)** = Deviation / Av. Capacity x 100 (relevant only for Wind/Solar)

- Key considerations

Parameters	Provision in the draft Regulation
Compatibility of State DSM Regulations with regional/national level	Definition of Deviation and Error is aligned with CERC DSM Regulations

4. Volume Cap : key considerations – 1/2

- **Volume Cap for Time-block:**

- Over-drawal limit for each intra-State Entity to be determined
- For entire frequency range or only for the low frequency period

- **Daily Variation Cap:**

- Limit for particular time-block or daily limit in MWh terms or both

- **Zero Crossing:**

- Number of times deviation (over-drawal/under-drawal) or (over-injection/under-injection) changes sign from positive to negative and vice-versa over specified duration.

- **Area Control Error (ACE)**

$$ACE = (P_{tie} - P_{sch}) + B_f \Delta f = \Delta P_{tie} + B_f \Delta f$$

where P_{tie} and P_{sch} are **tie-line power** and **scheduled power** through tie-line respectively and the constant B_f is called the **frequency bias constant**.

Volume Cap : key considerations – 2/2

- **Influencing Factors for defining Deviation Volume Limit for Intra-State Entities**
 - [Number of Intra-State Entities](#)
 - [Deviation Volume Limit for State](#)
 - [Availability of Variable RE Generation and Flexible Generation \(Hydel /Gas\) within State](#)
 - [Contribution/Share of ISGS to State's Load Generation Balance](#)
 - [Diversity in Size/ Capacity of Intra-state Entities \(Minimum and Maximum Capacity / Load\)](#)

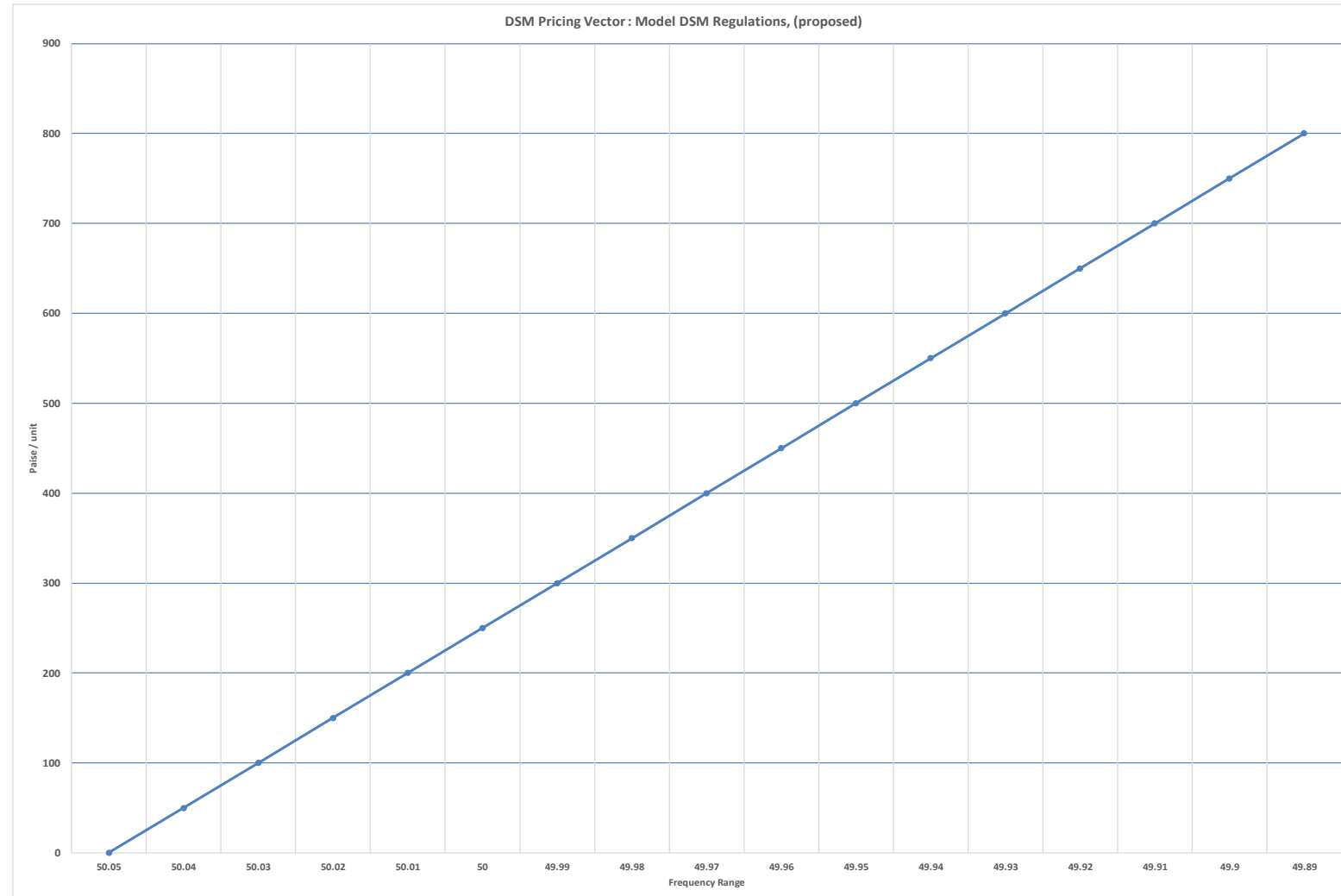
Model DSM Regulations at state level – (draft provisions)

Parameter	Description
Limits for Deviation	• No over-drawal/under-injection when Frequency below 49.9 Hz • No under-drawal / over-injection when frequency is above 50.05 Hz • Volume Cap for Intra-state Entities proposed as under: • For Generators /Sellers : 10 MW or 12% of Schedule, whichever lower • For DISCOMs/Buyers: X Limit or 12% of Schedule, whichever lower • In case of schedule is less than 40 MW, Volume cap of 5 MW or 12% of schedule, whichever higher. • Additional Charges at rate of 20%, 40%, 100% of Applicable Deviation Charges in steps of deviation 12%-15%, 15%-20%, > 20% or X+10 MW, X+ 20 MW, > X+ 20 MW
Declaration, Scheduling and elimination of gaming	• Provisions of State Grid Code and State OA Regulations shall be applicable

DSM Pricing Vector : Proposed (Model DSM Regulations)

Charges of Deviation (proposed):

- Linked to frequency range of 49.9 Hz to 50.05 Hz in steps of 0.01 Hz
- Slope of 50 Paise/unit for each 0.01 Hz
- Additional Deviation Charges for exceeding volume limits
- at rate of 20%, 40%, 100% of Applicable Deviation Charges in steps of deviation 12%-15%, 15%-20%, > 20% or X+10 MW, X+20MW, > X+20 MW
- Change in sign of deviation once every 6 time blocks- violation attracts additional charges @10% of deviation charges applicable for the continuance of violation



Model DSM Regulations at state level – (draft provisions)

Parameter	Description
Pricing Framework for State Entity	- Charges payable (over-drawal/under-injection) and receivable (under-drawal/over-injection) for each time-block with slope of 50 paise/unit per 0.01 Hz - Linked to average frequency for each time block (15 min duration) in steps of 0.01 Hz over range from 49.9 Hz to 50.05 Hz - Change in sign of deviation once every 6 time blocks- violation attracts additional charges @10% of deviation charges applicable for the continuance of violation - Capping of Deviation Charges for Generating Stations regulated by SERC - Cap Rate of Paise 303.04/ unit (indicated- to be linked through imported coal power plant) - Charges for over injection by seller or under drawal by buyer in a time block in excess of 12% of the schedule or 10 MW shall be zero.

6. Identification of state entities

- State Entities to be Imbalance Pool Participants

- Identifying a State Entity to be an entity under SLDC control area and whose metering and energy accounting is done at the State level.
- Generating Stations (Thermal, Hydel, RE thru QCAs), DISCOMs, CPPs/Captive Users, OA Users (TOAUs/DOAUs, Full/Partial OA Users)

- Key Considerations

- Identification as State Entity **to be distinct** from being a Pool Participant.
- Rules for Membership of Imbalance Pool to be devised by SLDC/State Power Committee
- To be guided by State Grid Code, State DSM Regulations and TOA/DOA Regulations to be aligned.

Suggestion:

- Procedure for Mapping/Accreditation/Registration of State Entities to be approved.
- Rules/principles for Membership of Pool Participation to be devised.
- Imbalance handling of State Entities who are not Pool Participant to be addressed through OA Regulations.

Model DSM Regulations at state level – (draft provisions)

Parameter	Description
DSM Pool	• State Deviation Pool Account to be operated by SLDC and Accounts by SPCs • Surplus to be transferred to 'State Power System Development Fund' at the end of month.
Institutional Arrangement	• State Power Committee to prepare Statement for Deviation Charges on Weekly basis • State Load Despatch Centres to operate & maintain 'State Deviation Pool Account Fund'

Thank You

Competitive Tariff vis-a-vis Cost plus Tariff – Critical Analysis

Forum of Regulators (FOR)

16 December, 2016

CRISIL Infrastructure Advisory is a leading advisor to regulators and governments, multilateral agencies, investors, and large public and private sector firms. It is a division of CRISIL Risk and Infrastructure Solutions Limited, a wholly owned subsidiary of CRISIL Limited, an S&P Global Company.

Agenda

Background

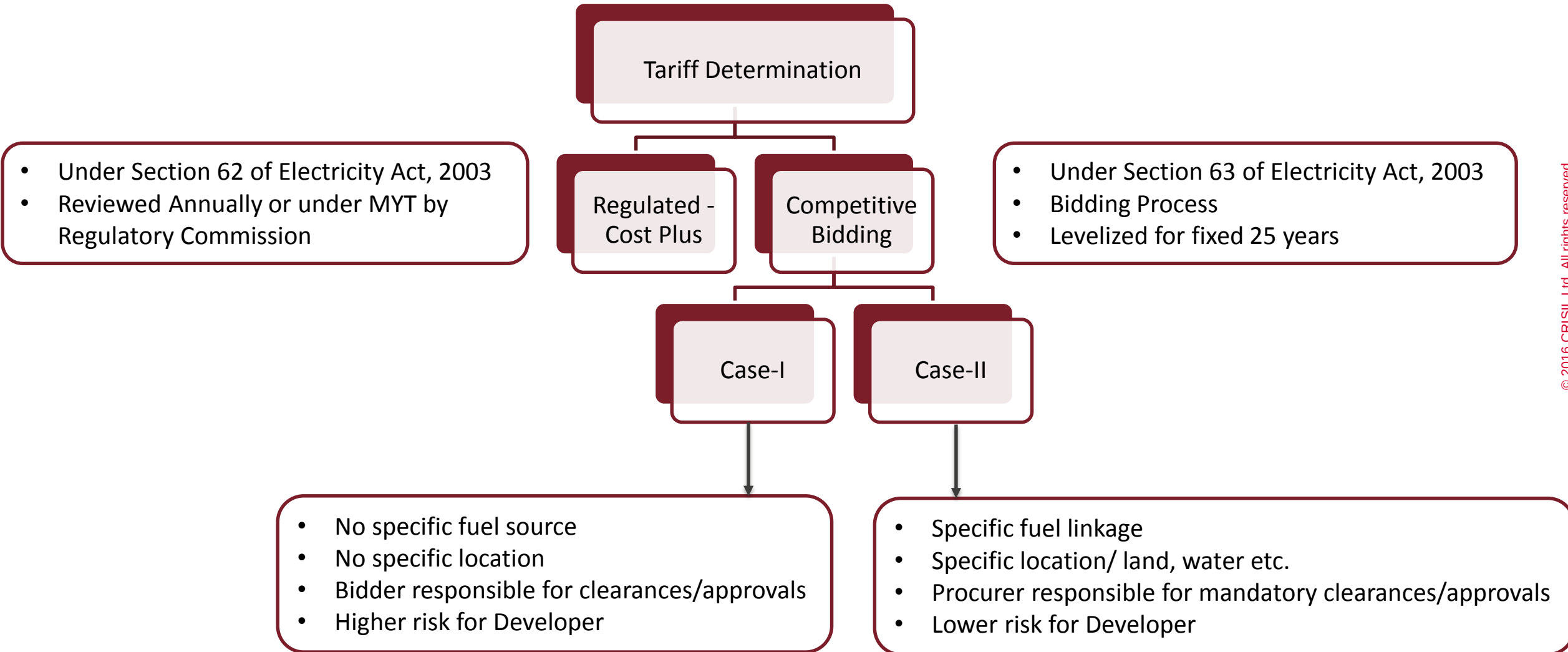
Key Findings

Approach and Methodology

Detailed Study

Background

Power Procurement Routes



Agenda

Background

Key Findings

Approach and Methodology

Detailed Study

Key Findings... 1/2

Comparison between projects under competitive tariff and cost plus tariff: A challenge

- Multiple variables for decision making
- Limited information available regarding considerations and strategy followed by bidders.
- Association with uncontrollable risk factors which are difficult to be quantified.
- Small sample size to reach to a concrete inference on comparison.

Trend of increasing quotes under Case – I bids: Due to risk premium

- Quoted tariffs have seen an increasing trend in the recent years.
- Attributed to the risk factors and inclusion of higher risk premium.

Major risk under Case – I projects is un-contracted capacity

- Around 29,000 MW of commissioned generation capacity is lying un-contracted in the country.

Case – I projects are exposed to fuel risks

- Reduction in operating PLF by 5% from the normative levels may lead to reduction in returns by around 1% to 3% depending upon project specifications.

Quoted Tariffs under Case – II projects may be comparable and in some cases lower than tariff determined under cost plus approach

- Some of the matters on compensatory tariff are still sub-judice and the fair comparison can only be made on the outcomes of same.

Key Findings... 2/2

PPA signing & adoption of tariff even after discovery of L-1 tariff is delayed and doubtful

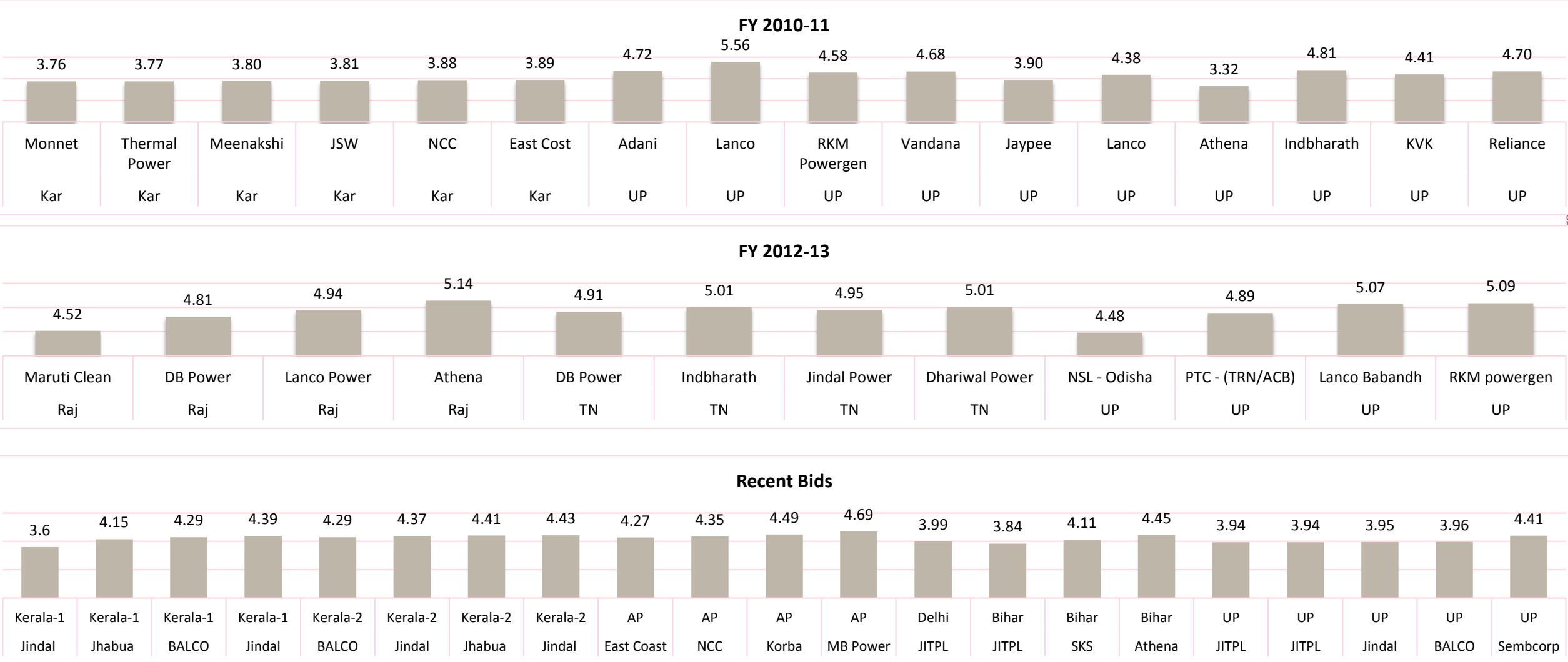
- Recent Case – 1 Bids in Rajasthan, Kerala, Andhra Pradesh and Uttar Pradesh are examples.

Viability of a competitive bid project is sensitive to variety of risk factors

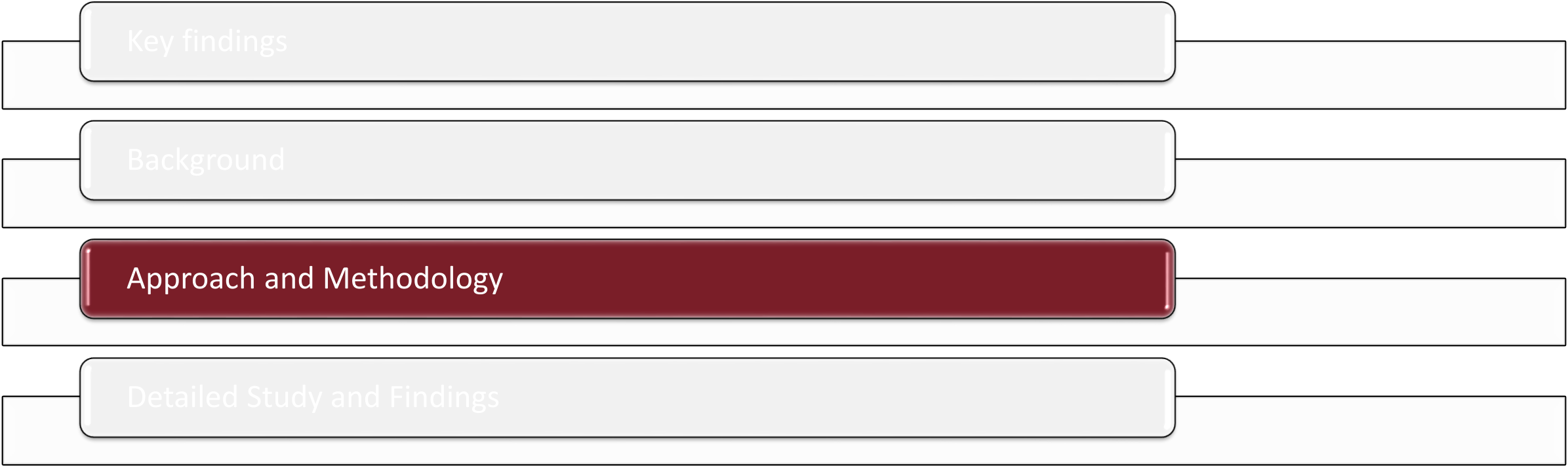
- Delay in project commissioning,
- Quality of equipment procured,
- Adequacy & quality of fuel,
- Adequacy & availability of transmission corridor for power evacuation,
- Less power off-take by buyer,
- Financial health of discoms along with
- Market movement and
- Changes in the policy environment

Bidders also include part of fixed cost into variable charges & vice versa

Recent Case – 1 Bids have seen increasing trend

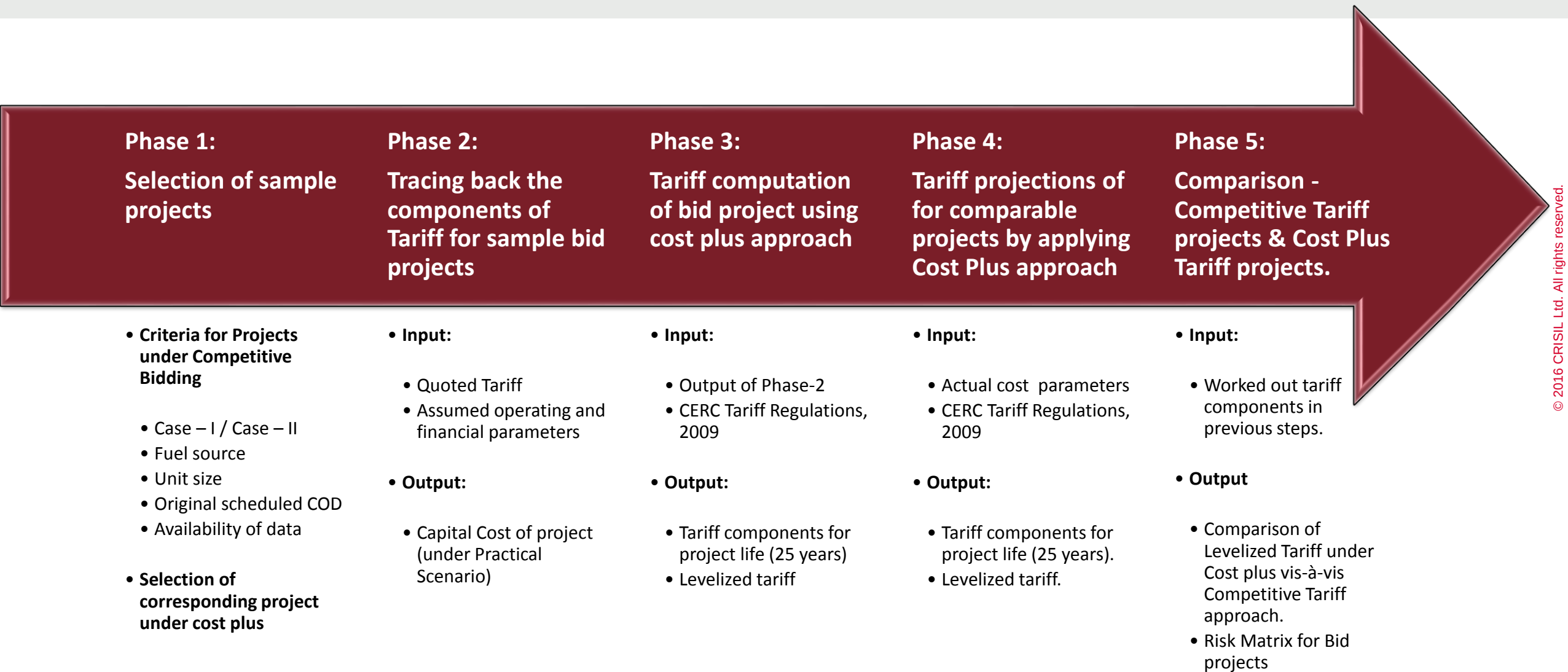


Agenda

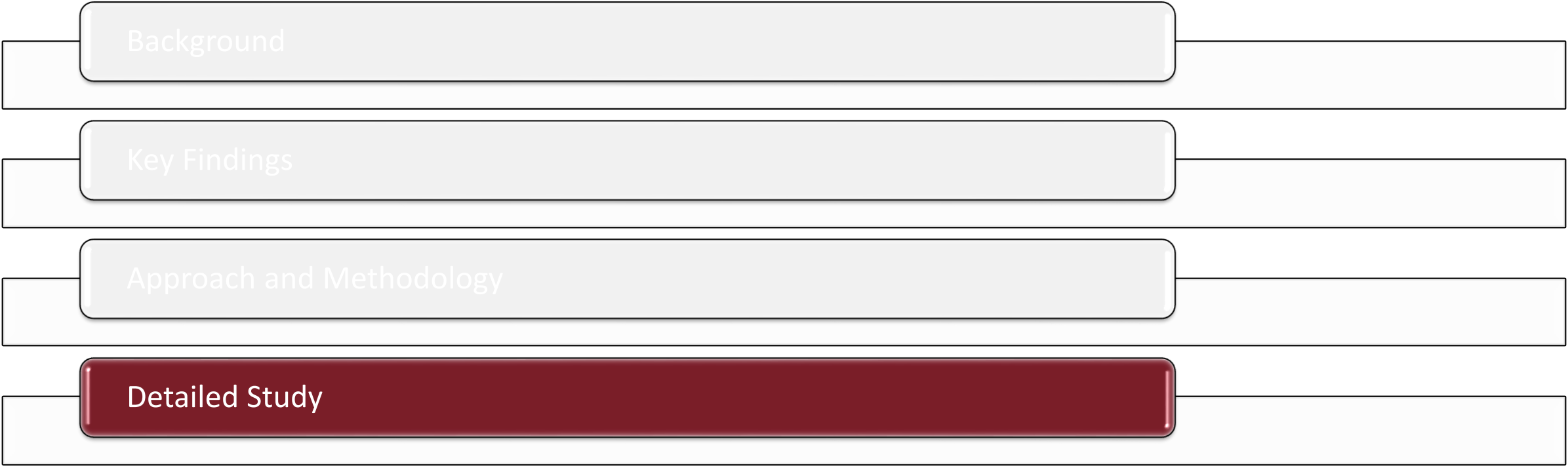


© 2016 CRISIL Ltd. All rights reserved.

Approach and Methodology



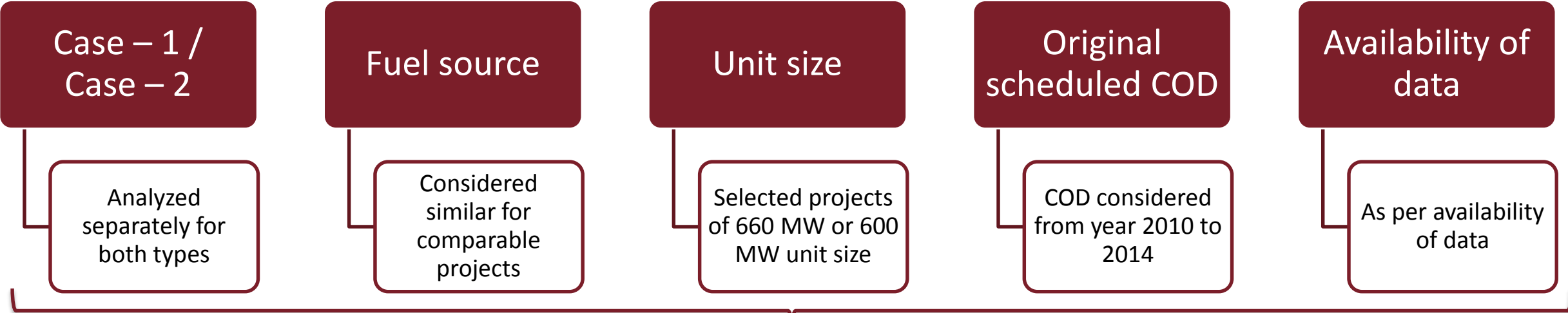
Agenda



© 2016 CRISIL Ltd. All rights reserved.

Selection of Sample Projects

Criteria and Selected Projects



(Case – I / Case – II)	Project with Competitive Bid Approach	Project with Cost Plus Approach
Case I	Lanco Babandh Fuel: Domestic Unit size: 660 MW	Sipat Stage – 1 Fuel: Domestic Unit size: 660 MW
Case I	Essar Mahan Fuel: Imported & Domestic Unit size: 600 MW	Udupi Fuel: Imported & Domestic Unit size: 600 MW
Case II	Talwandi Sabo Fuel: Domestic Unit size: 660 MW	Sipat Stage – 1 Fuel: Domestic Unit size: 660 MW
Case II	CLP Jhajjar Fuel: Blended Unit size: 660 MW	IGSTPP Jhajjar Fuel: Domestic Unit size: 500 MW

Detailed Analysis – Case I

Sample project – Lanco Babandh & Sipat Stage – 1

Sample project – Lanco Babandh & Sipat Stage – 1 (Case – I)

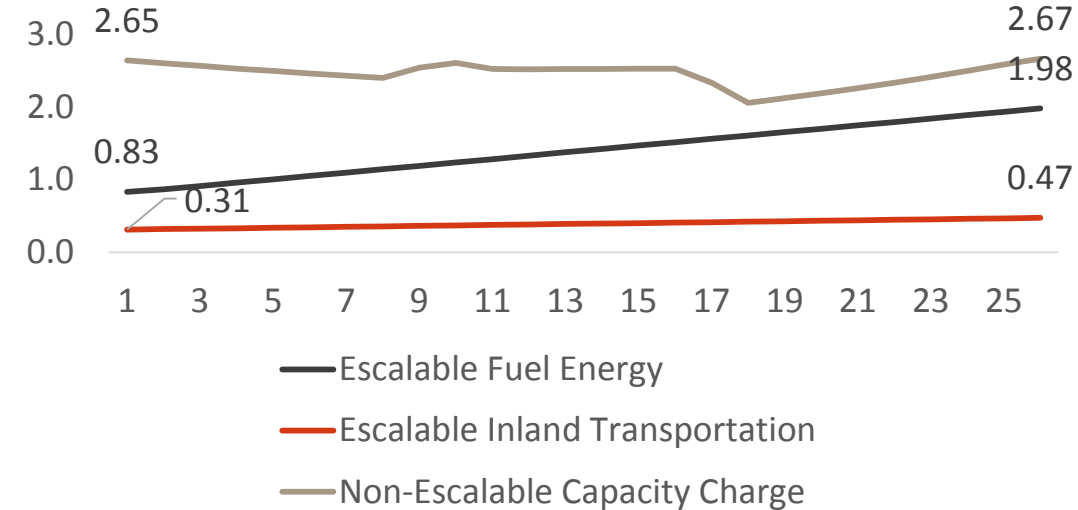
Projects Profiling

Particulars	Lanco Babandh	Sipat Stage – 1
Developer	Lanco	NTPC
Case 1 / Case 2 / Cost Plus	Case 1	Cost plus
Location	Odisha, Dhenkanal	Bilaspur, Chhattisgarh
Procurer	Uttar Pradesh (424 MW) – Competitive & Odisha (330 MW) – Cost Plus	Chhattisgarh, M.P, Maharashtra, Gujarat, Goa, Daman & Diu, Dadra & Nagar Haveli.
Fuel type	Domestic Coal (MCL)	Domestic Coal (ECL & SECL)
Capacity of Plant / Unit Size	2 x 660 MW	3 x 660 MW
Boiler Make	Dongfang (Chinese)	Doosan (Korea)
Turbine Make	Harbin (Chinese)	OJSC Power Machines(Russia)
Original Scheduled COD		
Unit 1	01-12-2013	31-01-2011
Unit 2	01-04-2014	30-07-2011
Unit 3	NA	31-01-2012
Actual COD		
Unit 1	Yet to be Commissioned	01-Oct-11
Unit 2	Yet to be Commissioned	25-May-12
Unit 3	NA	01-Aug-12

Sample project – Lanco Babandh & Sipat Stage – 1 (Case – I)

Detailed Analysis

Quoted tariff (Rs. / kWh)



- ❖ Assumed Expected return on capital cost: 14%
- ❖ Scenarios
 - ❖ Pessimistic: strict Op. parameters resulting in High project cost
 - ❖ Optimistic: Relaxed Op. parameters resulting in Low project cost &
 - ❖ **Practical: Intermediate Op. parameters & project cost**

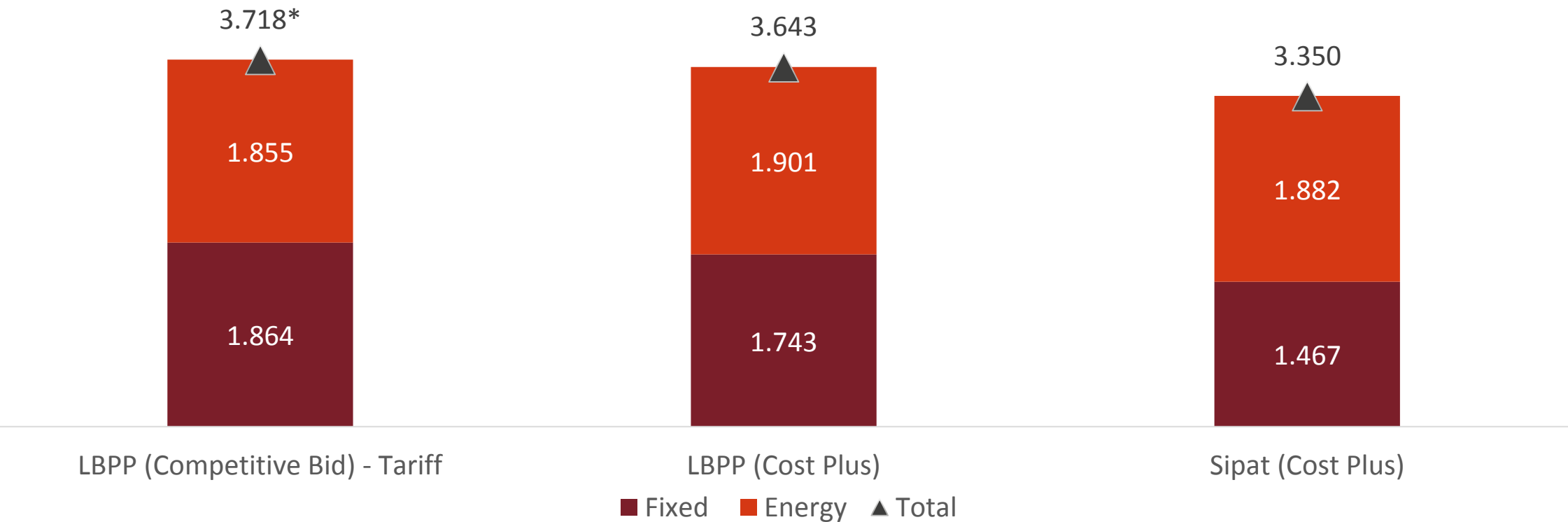
Scenario Analysis		Units	Pessimistic	Optimistic	Practical
Operational Parameters					
Assumed Annual availability/PLF	%		85%	75%	80%
Auxiliary Power	%		7.0%	8.0%	7.5%
Inter-state transmission losses	%		2.80%	3.00%	2.90%
Gross Station Heat Rate	kcal/kWh		2,300	2,325	2,310
Annual Heat Rate degradation	%		0.80%	0.90%	0.85%
Loss of GCV from receiving end to firing end	%		1.00%	2.00%	1.80%
Transit Loss	%		0.80%	0.80%	0.80%
Specific Fuel Oil	ml / kWh		0.80	1.00	0.90
O&M expenses (base year)	(Rs. Lakh / MW)		12.00	13.00	12.50
O&M Escalation	%		4.00%	5.50%	5.00%
Interest on Working Capital					
- Fuel Cost @ target availability	Days		25 Days	30 Days	30 Days
- Secondary Fuel oil	Days		25 Days	30 Days	30 Days
- O&M Expenses	Days		25 Days	30 Days	30 Days
- Maint. Spares % of O&M Cost	%		12.00%	15.00%	15.00%
- Receivables @ target availability	Days		60 Days	60 Days	60 Days
Interest Rate for Working Capital Loan	%		13.50%	14.00%	13.75%
Loan					
Interest Operation period	%		12.00%	13.00%	12.50%
No of Instalments (quarterly)	Nos.		42	42	42
Moratorium (from Plant CoD)	Months		6 months	6 months	6 months
Terminal Value	%		20%	10%	15%
Fuel Details					
Base Coal Price	Rs. / Tonne		1000.00	1100.00	1050.00
Base Fuel oil Price (landed)	Rs. / Tonne		42000.00	42000.00	42000.00
GCV of coal	kcal / kg		4000.00	4000.00	4000.00
GVC of Fuel oil	kcal / litre		10000.00	10000.00	10000.00
Base Price Inland Transportation	Rs. / Tonne		300.00	320.00	310.00

Sample project – Lanco Babandh & Sipat Stage – 1 (Case – I)

Comparison

Particulars	Units	Pessimistic	Optimistic	Practical
Equity IRR	%	13.98%	13.91%	13.95%
Capital Cost	Rs. Crore	9,100	4,890	6,900
Per MW cost	Rs. Crore/MW	6.89	3.70	5.23

Detailed Comparison (per unit in Rs./kWh)



* Quoted levelized tariff for Lanco Baband for U.P. is Rs. 5.07 / kWh, however as part of capacity is tied up under MoU route (Odisha) and rest merchant therefore avg. levelized tariff of project is working out as Rs. 3.718 / kWh

Sample project – Lanco Babandh & Sipat Stage – 1 (Case – I)

Risk profiling: Impact Assessment for Lanco Babandh project

(1/2)

Parameter	Associated Risk Factors	Variation (Absolute)	Variation (%)	Impact on Equity IRR (Absolute)
Annual Availability/PLF	Offtake risk, Adequacy of fuel supply, Equipment quality, and Transmission adequacy/availability risk	-4%	-5%	-3.81%
Aux Power	Equipment quality and Fuel quality risk	0.4%	5%	-0.26%
Gross Station Heat Rate (kcal/kWh)	Offtake risk, Quality of fuel, Equipment quality, and Generation Risk	116	5%	-1.87%
Terminal Value	Equipment quality, Regulatory risk, Cost associated Re-modernisation or life extension, Obsolete equipment, and Environmental risk	1%	5%	0.01%
Loss of GCV from receiving end to firing end	Regulatory Risk and Theft risk	0.09%	5%	-0.03%
Sp. Fuel Consumption (ml/kWh)	Equipment quality, Price risk and Generation risk	0.05	5%	-0.07%
Total Project Cost (Rs. Crore)	Market risk (Price of equipment), Risk in delay of project, Lending policy risk, Tax & Duty, FERV Risk, Contracting issues, Environmental risk and Political risk	345	5%	-1.20%

© 2016 CRISIL Ltd. All rights reserved.

Sample project – Lanco Babandh & Sipat Stage – 1 (Case – I)

Risk profiling: Impact Assessment for Lanco Babandh project

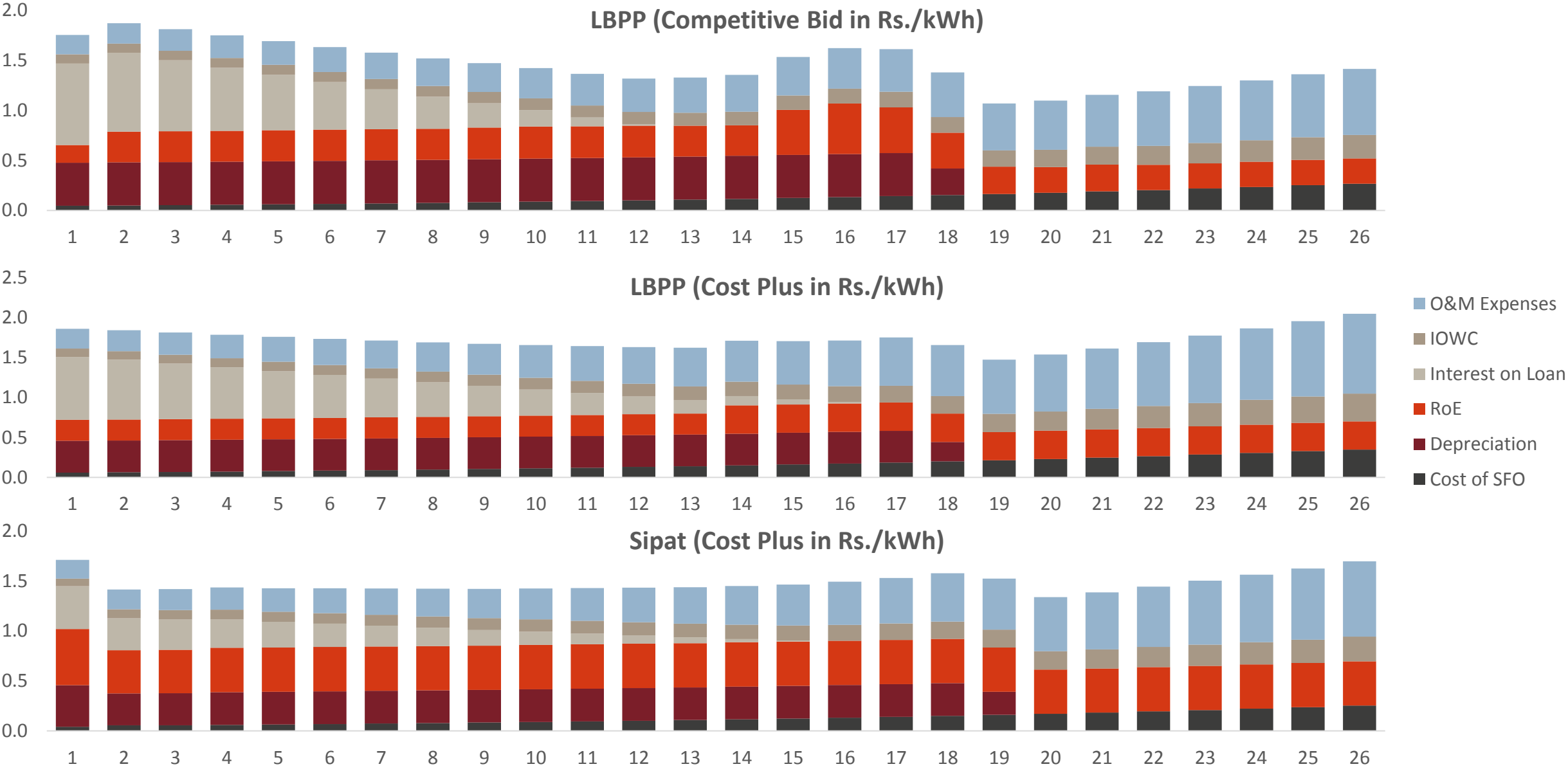
(2/2)

Parameter	Associated Risk Factors	Variation (Absolute)	Variation (%)	Impact on Equity IRR (Absolute)
Interest Rate Domestic	Lending policy risk, FERV Risk, Cost of capital / Leverage risk and Cash flow / Repayment risk	0.63%	5%	-0.39%
Interest Rate Foreign	Lending policy risk, FERV Risk, Cost of capital / Leverage risk and Cash flow / Repayment risk	0.63	5%	-0.26%
O&M expenses (Rs. Lakh / MW)	Manpower risk, Quality of equipment, Fuel quality and Inflationary risk	0.25%	5%	-0.11%
O&M Escalation	Manpower risk, Quality of equipment, Fuel quality and Inflationary risk	1.5 Days	5%	-0.02%
Coal inventory	Fuel availability risk, Transportation risk, and Mine production risk	1.5 Days	5%	0.00%
Secondary Fuel Inventory	Market price risk, Supply risk, Import policy risk, and Coal quality risk	1.5 Days	5%	0.00%
Working capital requirement for O&M	Manpower risk, Quality of equipment, Inflationary risk, and Fuel quality	0.75%	5%	-0.01%
Inventory of Spares (% of O&M Expenses)	Manpower risk, Quality of equipment, Inflationary risk, and Fuel quality	3.0 Days	5%	-0.07%
Receivables	Discom financial health	0.69%	5%	-0.10%
Interest rate on Working Capital	Lending policy rate and Cash flow issues	52.50	5%	-1.59%

© 2016 CRISIL Ltd. All rights reserved.

Sample project – Lanco Babandh & Sipat Stage – 1 (Case – I)

Fixed Tariff Components



Detailed Analysis – Case II

Sample project – Talwandi Sabo & Sipat Stage – 1

Sample project – Talwandi Sabo & Sipat Stage – 1 (Case – II)

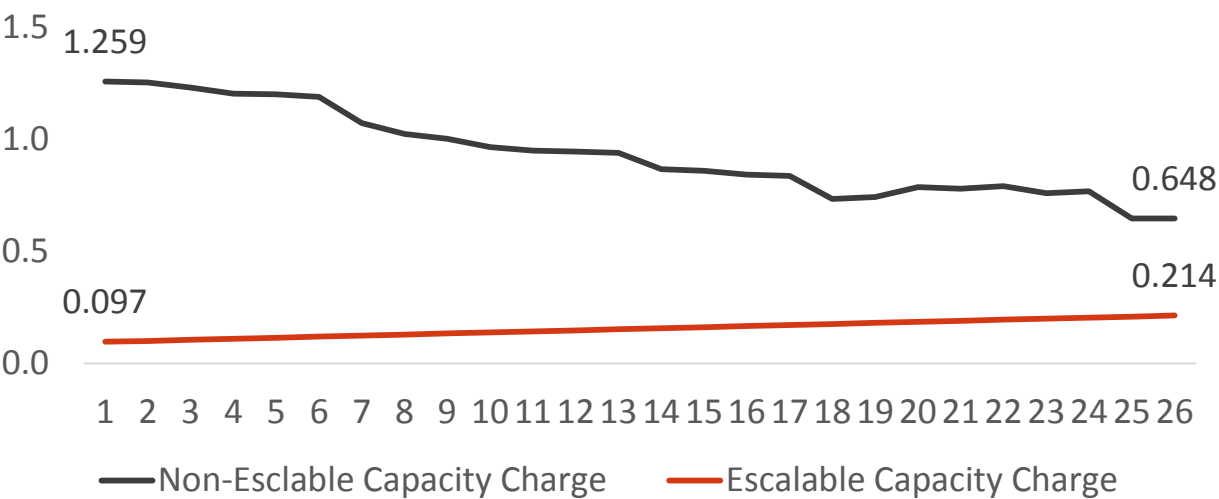
Projects Profiling

Particulars	Talwandi Sabo	Sipat Stage - 1
Developer	Sterlite	NTPC
Case 1 / Case 2 / Cost Plus	Case 2	Cost plus
Location	Punjab, Mansa	Bilaspur, Chhattisgarh
Procurer	PSEB (100%)	Chhattisgarh, M.P, Maharashtra, Gujarat, Goa, Daman & Diu, Dadra & Nagar Haveli
Fuel type	Domestic Coal (MCL, Basundra Coal Fields)	Domestic Coal (ECL & SECL)
Capacity of Plant / Unit Size	3 x 660 MW	3 x 660 MW
Boiler Make	Harbin (Chinese)	Doosan (Korea)
Turbine Make	Dongfang (Chinese)	OJSC Power Machines(Russia)
Original Scheduled COD		
Unit 1	31-08-2012	31-01-2011
Unit 2	31-12-2012	30-07-2011
Unit 3	30-04-2013	31-01-2012
Actual COD		
Unit 1	05-07-2014	01-Oct-11
Unit 2	25-11-2015	25-May-12
Unit 3	Yet to be Commissioned	01-Aug-12

Sample project – Talwandi Sabo & Sipat Stage – 1 (Case – II)

Detailed Analysis

Quoted tariff (Rs. / kWh)



- ❖ Quoted Net Heat Rate (Kcal/Kwh) : 2400
- ❖ Assumed Expected return on capital cost: 14%
- ❖ Scenarios
 - ❖ Pessimistic: strict Op. parameters resulting in High project cost
 - ❖ Optimistic: Relaxed Op. parameters resulting in Low project cost &
 - ❖ **Practical: Intermediate Op. parameters & project cost**

Advisory

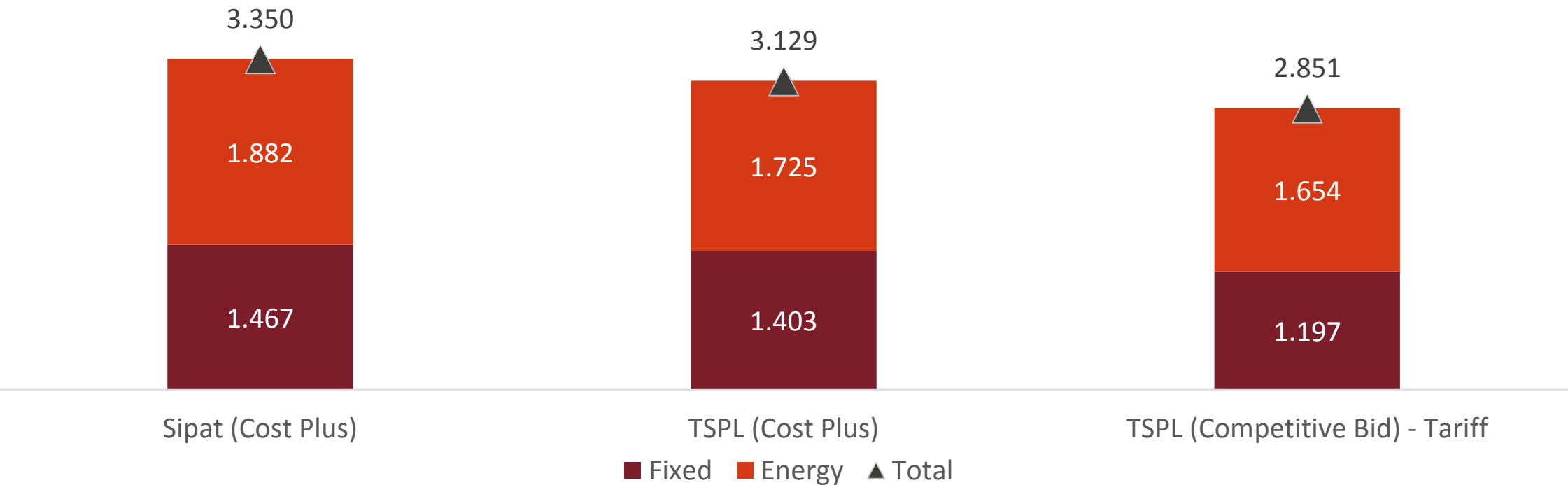
Scenario Analysis	Units	Scenario 1 (Pessimistic)	Scenario 2 (Optimistic)	Scenario 3 (Practical)
Operational Parameters				
Assumed Annual availability/PLF	%	90%	80%	85%
Auxiliary Power	%	6.2%	7.0%	6.5%
Gross Station Heat Rate	kcal/kWh	2,180	2,232	2,200
Annual Heat Rate degradation	%	0.2%	0.4%	0.3%
Terminal Value	%	20%	10%	15%
Loss of GCV from receiving end to firing end	%	1.00%	1.80%	1.50%
Specific fuel consumption	ml/kWh	0.30	0.50	0.40
Domestic Loan				
Interest rate	%	11.00%	11.00%	11.00%
No of Instalments (quarterly)	Nos.	42.00	42.00	42.00
Moratorium (from Plant CoD)	Months	6 months	3 months	6 months
Foreign Loan				
Interest rate	%	8.00%	8.00%	8.00%
No of Instalments (quarterly)	Nos.	60.00	60.00	60.00
Moratorium (from Plant CoD)	Months	12	3	12
O&M expenses (base year)	Rs. lakh/MW	10.00	11.00	10.50
O&M escalation	%	4.00%	4.98%	4.50%
Interest on Working Capital				
- Fuel Cost @ target availability	Days	21 Days	30 Days	30 Days
- Secondary Fuel oil	Days	21 Days	30 Days	30 Days
- O&M Expenses	Days	25 Days	30 Days	30 Days
- Maint. Spares % of O&M Cost	%	12.00%	15.00%	15.00%
- Receivables @ target availability	Days	60 Days	60 Days	60 Days
Interest rate on Working Capital loan	%	12.00%	12.50%	12.50%

Sample project – Talwandi Sabo & Sipat Stage – 1 (Case – II)

Comparison

Particulars	Units	Pessimistic	Optimistic	Practical
Equity IRR	%	14.01%	14.00%	13.99%
Capital Cost	Rs. Crore	10,780	7,850	9,270
Cost per MW	Rs. Crore / MW	5.44	3.96	4.68

Detailed Comparison (per unit in Rs./kWh)



Sample project – Talwandi Sabo & Sipat Stage – 1 (Case – II)

Risk profiling: Impact Assessment for Talwandi Sabo project

(1/2)

Parameter	Associated Risk Factors	Variation (Absolute)	Variation (%)	Impact on Equity IRR (Absolute)
Annual Availability/PLF	Offtake risk, Adequacy of fuel supply, Equipment quality, and Transmission adequacy/availability risk	-4%	-5%	-2.31%
Aux Power	Equipment quality and Fuel quality risk	0.3%	5%	-0.41%
Gross Station Heat Rate (kcal/kWh)	Offtake risk, Quality of fuel, Equipment quality, and Generation Risk	110	5%	-3.37%
Terminal Value	Equipment quality, Regulatory risk, Cost associated Re-modernisation or life extension, Obsolete equipment, and Environmental risk	-1%	-5%	-0.01%
Loss of GCV from receiving end to firing end	Regulatory Risk and Theft risk	0.08%	5%	-0.05%
Sp. Fuel Consumption (ml/kWh)	Equipment quality, Price risk and Generation risk	0.02	5%	-0.04%
Total Project Cost (Rs. Crore)	Market risk (Price of equipment), Risk in delay of project, Lending policy risk, Tax & Duty, FERV Risk, Contracting issues, Environmental risk and Political risk	464	5%	-1.73%

© 2016 CRISIL Ltd. All rights reserved.

Sample project – Talwandi Sabo & Sipat Stage – 1 (Case – II)

Risk profiling: Impact Assessment for Talwandi Sabo project

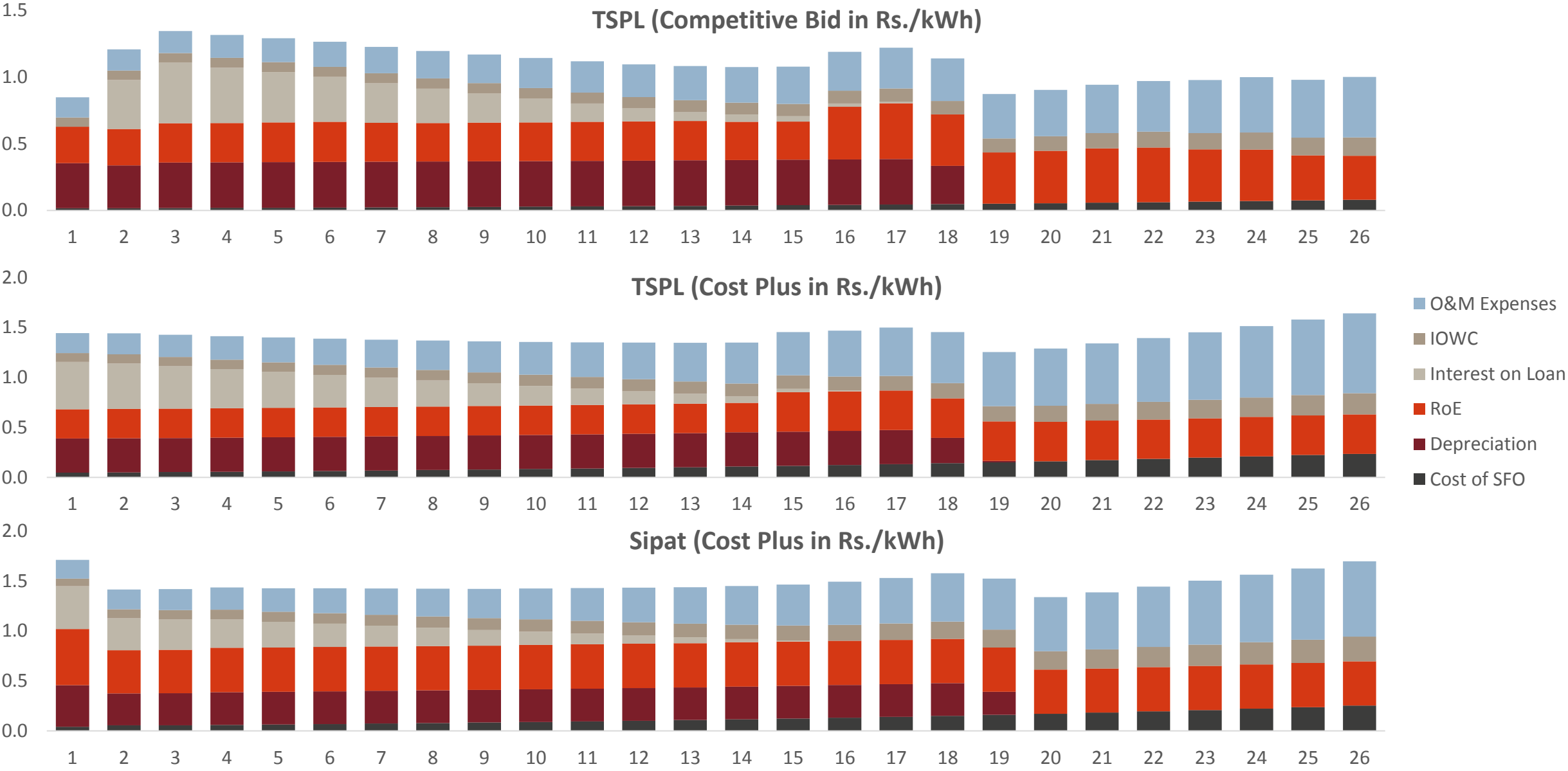
(2/2)

Parameter	Associated Risk Factors	Variation (Absolute)	Variation (%)	Impact on Equity IRR (Absolute)
Interest Rate Domestic	Lending policy risk, FERV Risk, Cost of capital / Leverage risk and Cash flow / Repayment risk	0.55%	5%	-0.52%
Interest Rate Foreign	Lending policy risk, FERV Risk, Cost of capital / Leverage risk and Cash flow / Repayment risk	0.40%	5%	-0.52%
O&M expenses (Rs. Lakh / MW)	Manpower risk, Quality of equipment, Fuel quality and Inflationary risk	0.53	5%	-0.42%
O&M Escalation	Manpower risk, Quality of equipment, Fuel quality and Inflationary risk	0.23%	5%	-0.14%
Coal inventory	Fuel availability risk, Transportation risk, and Mine production risk	1.5 Days	5%	-0.03%
Secondary Fuel Inventory	Market price risk, Supply risk, Import policy risk, and Coal quality risk	1.5 Days	5%	0.00%
Working capital requirement for O&M	Manpower risk, Quality of equipment, Inflationary risk, and Fuel quality	1.5 Days	5%	0.00%
Inventory of Spares (% of O&M Expenses)	Manpower risk, Quality of equipment, Inflationary risk, and Fuel quality	0.75%	5%	-0.01%
Receivables	Discom financial health	3.0 Days	5%	-0.11%
Interest rate on Working Capital	Lending policy rate and Cash flow issues	0.63%	5%	-0.16%

© 2016 CRISIL Ltd. All rights reserved.

Sample project – Talwandi Sabo & Sipat Stage – 1 (Case – II)

Fixed Tariff Components



Thank you

CRISIL Infrastructure Advisory is a leading advisor to regulators and governments, multilateral agencies, investors, and large public and private sector firms. It is a division of CRISIL Risk and Infrastructure Solutions Limited, a wholly owned subsidiary of CRISIL Limited, an S&P Global Company.

**Infrastructure
Advisory**

CRISIL
An **S&P Global** Company

Back-up Slides

Detailed Analysis – Case I

Sample project – Essar Mahan & Udupi Power Project

Sample project – Essar Mahan & Udupi Power Project (Case – I)

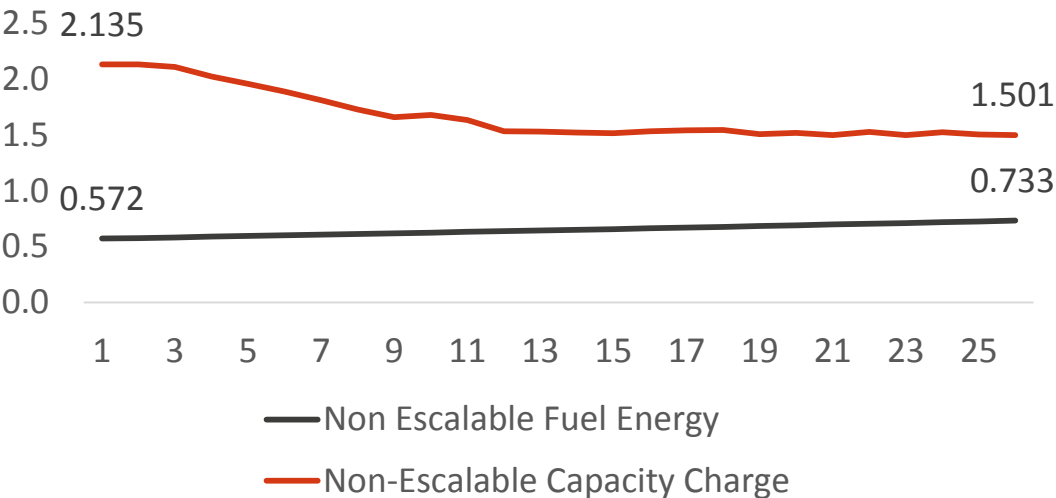
Projects Profiling

Particulars	Essar Mahan	Udupi
Developer	Essar	Lanco Infratech
Case 1 / Case 2 / Cost Plus	Case 1	Cost plus
Location	Madhya Pradesh, Singrauli	Udupi Karnataka
Procurer	Madhya Pradesh (150 MW) – Competitive & Madhya Pradesh (5%)– Cost Plus	Karnataka & Punjab
Fuel type	Imported & E-auction / Captive mine (Tokisud North)	Imported Coal
Capacity of Plant / Unit Size	2 x 600 MW	2 x 600 MW
Boiler Make	Harbin (Chinese)	Dongfang (Chinese)
Turbine Make	Harbin (Chinese)	Dongfang (Chinese)
Original Scheduled COD		
Unit 1	31-05-2013	25-02-2010
Unit 2	30-11-2013	25-06-2010
Actual COD		
Unit 1	29-04-2013	11-11-2010
Unit 2	Yet to be Commissioned	19-08-2013

Sample project – Essar Mahan & Udupi Power Project (Case – I)

Detailed Analysis

Quoted tariff (Rs. / kWh)



- ❖ Assumed Expected return on capital cost: 14%
- ❖ Scenarios
 - ❖ Pessimistic: strict Op. parameters resulting in High project cost
 - ❖ Optimistic: Relaxed Op. parameters resulting in Low project cost &
 - ❖ **Practical: Intermediate Op. parameters & project cost**

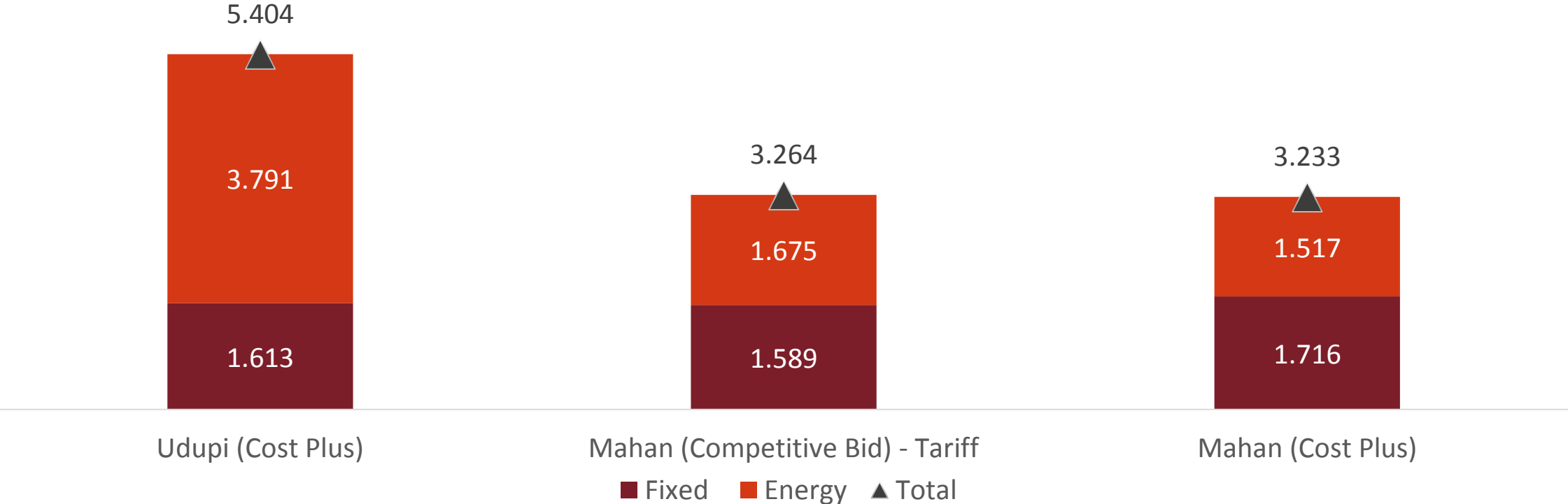
Scenario Analysis	Units	Pessimistic	Optimistic	Practical
Operational Parameters				
Assumed Annual Availability / PLF	%	90%	80%	85%
Auxiliary Power	%	6.0%	7.5%	6.5%
Gross Station Heat Rate	kcal/kWh	2300	2400	2325
Annual Heat Rate Degradation	%	0.3%	0.5%	0.4%
Loss of GCV from receiving end to firing end	%	1%	2%	2%
Transit Loss	%	0.30%	0.80%	0.50%
Specific Fuel Oil	ml / kWh	0.50	1.00	0.70
O&M expenses (base year)	Rs. Lakh / MW	11.00	13.00	12.00
O&M Escalation	%	4.00%	5.78%	4.25%
Interest on Working Capital				
- Fuel Cost @ target availability	Days	21 Days	30 Days	30 Days
- Secondary Fuel oil	Days	21 Days	30 Days	30 Days
- O&M Expenses	Days	25 Days	30 Days	30 Days
- Maint. Spares % of O&M Cost	Days	12.00%	15.00%	13.00%
- Receivables @ target availability	Days	60 Days	60 Days	60 Days
Interest Rate on Working Capital	%	12.00%	13.25%	12.75%
Interest Rate for capex loan	%	11.00%	13.00%	12.00%
No of Instalments (quarterly)	Nos.	42	42	42
Moratorium (from Plant CoD)	Months	6 months	6 months	6 months
Terminal Value	%	20%	5%	15%
Fuel Details				
Base Coal Price	Rs. / Tonne	1100.00	1275.00	1125.00
Base Fuel oil Price (landed)	Rs. / Tonne	42000.00	43000.00	42000.00
GCV of coal	kcal / kg	4200.00	4200.00	4200.00
GCV of fuel oil	kcal / L	10000.00	10000.00	10000.00

Sample project – Essar Mahan & Udupi Power Project (Case – I)

Comparison

Particulars	Units	Pessimistic	Optimistic	Practical
Equity IRR	%	13.96%	13.99%	13.93%
Capital Cost	Rs. Crore	8,250	4,700	7,050
Cost per MW	Rs. Crore / MW	6.88	3.92	5.88

Detailed Comparison (per unit in Rs./kWh)



Sample project – Essar Mahan & Udupi Power Project (Case – I)

Risk profiling: Impact Assessment for Essar Mahan project

(1/2)

Parameter	Associated Risk Factors	Variation (Absolute)	Variation (%)	Impact on Equity IRR (Absolute)
Annual Availability/PLF	Offtake risk, Adequacy of fuel supply, Equipment quality, and Transmission adequacy/availability risk	-4%	-5%	-0.94%
Aux Power	Equipment quality and Fuel quality risk	0.3%	5%	-0.07%
Gross Station Heat Rate (kcal/kWh)	Offtake risk, Quality of fuel, Equipment quality, and Generation Risk	116.25	5%	-0.28%
Terminal Value	Equipment quality, Regulatory risk, Cost associated Re-modernisation or life extension, Obsolete equipment, and Environmental risk	1%	5%	0.00%
Loss of GCV from receiving end to firing end	Regulatory Risk and Theft risk	0.1%	5%	0.00%
Sp. Fuel Consumption (ml/kWh)	Equipment quality, Price risk and Generation risk	0.04	5%	-0.01%
Total Project Cost (Rs. Crore)	Market risk (Price of equipment), Risk in delay of project, Lending policy risk, Tax & Duty, FERV Risk, Contracting issues, Environmental risk and Political risk	352.5	5%	-0.41%

© 2016 CRISIL Ltd. All rights reserved.

Sample project – Essar Mahan & Udupi Power Project (Case – I)

Risk profiling: Impact Assessment for Essar Mahan project

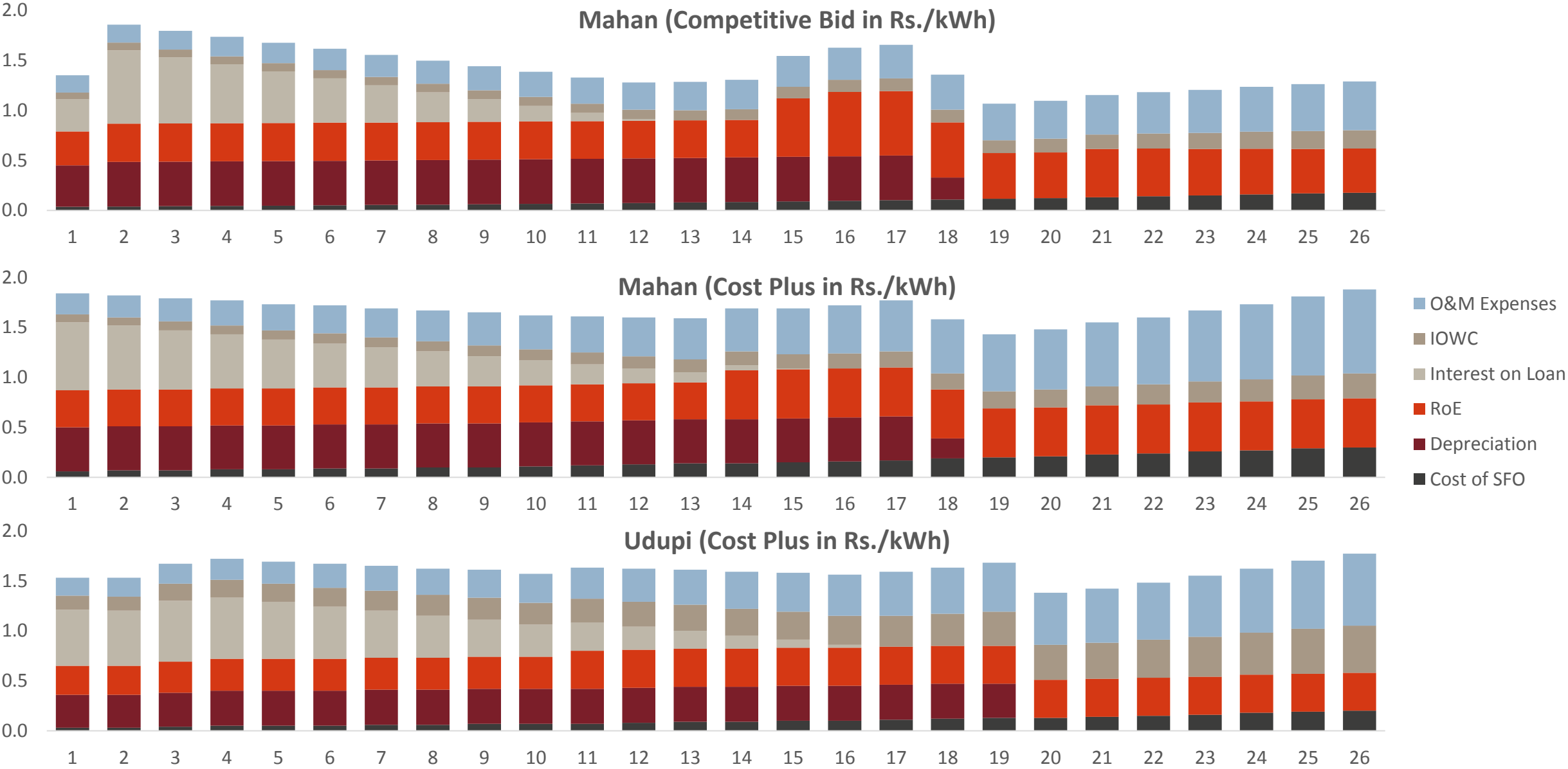
(2/2)

Parameter	Associated Risk Factors	Variation (Absolute)	Variation (%)	Impact on Equity IRR (Absolute)
Interest Rate Domestic	Lending policy risk, FERV Risk, Cost of capital / Leverage risk and Cash flow / Repayment risk	0.60%	5%	-0.10%
Interest Rate Foreign	Lending policy risk, FERV Risk, Cost of capital / Leverage risk and Cash flow / Repayment risk	0.60	5%	-0.06%
O&M expenses (Rs. Lakh / MW)	Manpower risk, Quality of equipment, Fuel quality and Inflationary risk	0.21%	5%	-0.02%
O&M Escalation	Manpower risk, Quality of equipment, Fuel quality and Inflationary risk	1.5 Days	5%	0.00%
Coal inventory	Fuel availability risk, Transportation risk, and Mine production risk	1.5 Days	5%	0.00%
Secondary Fuel Inventory	Market price risk, Supply risk, Import policy risk, and Coal quality risk	1.5 Days	5%	0.00%
Working capital requirement for O&M	Manpower risk, Quality of equipment, Inflationary risk, and Fuel quality	0.65%	5%	0.00%
Inventory of Spares (% of O&M Expenses)	Manpower risk, Quality of equipment, Inflationary risk, and Fuel quality	3.0 Days	5%	-0.02%
Receivables	Discom financial health	0.64%	5%	-0.02%
Interest rate on Working Capital	Lending policy rate and Cash flow issues	56.25	5%	-0.28%

© 2016 CRISIL Ltd. All rights reserved.

Sample project – Essar Mahan & Udupi Power Project (Case – I)

Fixed Tariff Components



Detailed Analysis – Case II

Sample project – CLP Jhajjar & IGSTPP Jhajjar

Sample project – CLP Jhajjar & IGSTPP Jhajjar (Case – II)

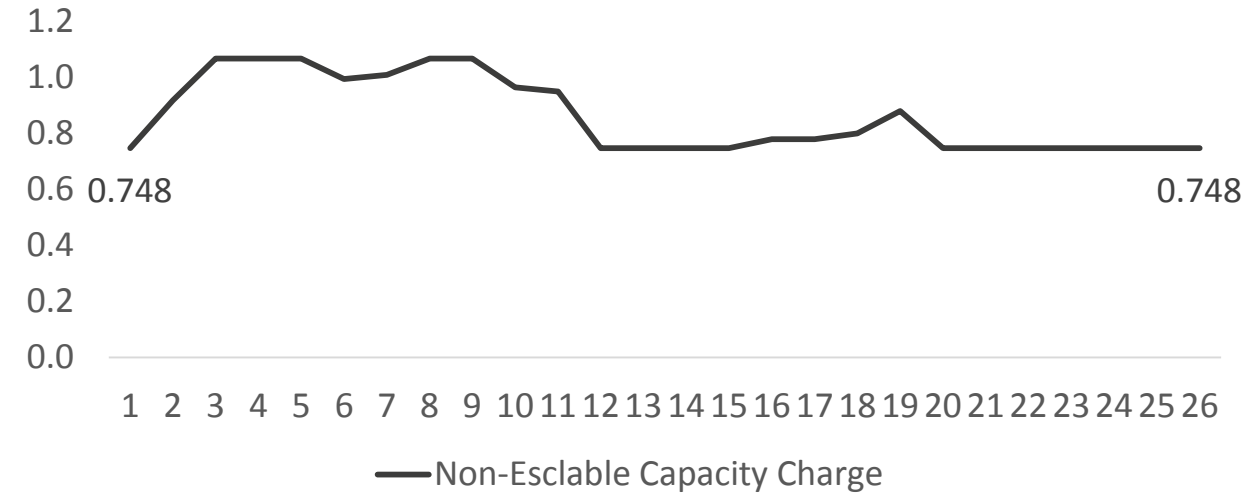
Projects Profiling

Particulars	CLP Jhajjar	IGSTP Jhajjar
Developer	CLP	JV of NTPC, HPGCL & IPGCL
Case 1 / Case 2 / Cost Plus	Case 2	Cost plus
Location	Haryana, Jhajjar	Haryana, Jhajjar
Procurer	Haryana (90%) & Delhi (10%)	Chandigarh, Delhi, H.P., Haryana, J&K, Rajasthan, Telangana, Uttarakhand, U.P
Fuel type	Blended coal (North Karanpura& Imported)	Blended coal
Capacity of Plant / Unit Size	2 x 660 MW	3 x 500 MW
Boiler Make	Harbin (Chinese)	BHEL (Indian)
Turbine Make	Dongfang (Chinese)	BHEL (Indian)
Original Scheduled COD		
Unit 1	02-10-2011	21-01-2011
Unit 2	02-02-2012	21-04-2011
Unit 3	NA	21-07-2011
Actual COD		
Unit 1	29-03-2012	05-03-2011
Unit 2	19-07-2012	21-04-2012
Unit 3	NA	26-04-2013

Sample project – CLP Jhajjar & IGSTPP Jhajjar (Case – II)

Detailed Analysis

Quoted tariff (Rs. / kWh)



- ❖ Quoted Net Heat Rate (Kcal/Kwh) : 2396
- ❖ Assumed Expected return on capital cost: 14%
- ❖ Scenarios
 - ❖ Pessimistic: strict Op. parameters resulting in High project cost
 - ❖ Optimistic: Relaxed Op. parameters resulting in Low project cost &
 - ❖ Practical: Intermediate Op. parameters & project cost

Advisory

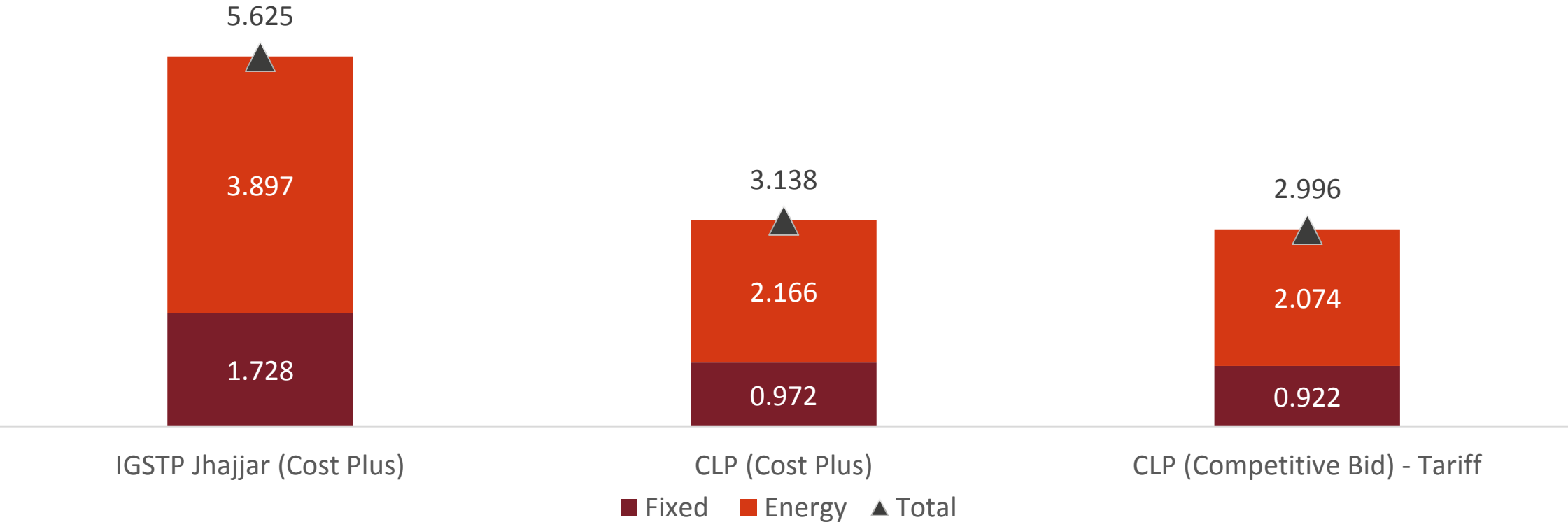
Scenario Analysis	Units	Pessimistic	Optimistic	Practical
Operational Parameters				
Assumed Annual availability/PLF	%	90%	80%	85%
Auxiliary Power	%	6.0%	6.3%	6.1%
Gross Station Heat Rate	kcal/kWh	2,180	2,246	2,200
Annual Heat Rate degradation	%	0.1%	0.2%	0.15%
Terminal Value	%	20%	15%	18.00%
Loss of GCV from receiving end to firing end	%	0.00%	0.00%	0.00%
Specific fuel consumption	ml/kWh	0.15	0.25	0.20
Domestic Loan				
Interest rate	%	11.00%	11.00%	11.00%
No of Instalments (quarterly)	Nos.	42.00	42.00	42.00
Moratorium (from Plant CoD)	Months	3 months	3 months	3 months
Foreign Loan				
Interest rate	%	7.00%	7.00%	7.00%
No of Instalments (quarterly)	Nos.	60.00	60.00	60.00
Moratorium (from Plant CoD)	Months	3 months	3 months	3 months
O&M expenses (base year)	Rs. lakh/MW	9.30	9.50	9.40
O&M escalation	%	3.80%	4.00%	3.90%
Interest on Working Capital				
- Fuel Cost @ target availability	Days	21.0 Days	30.0 Days	25.0 Days
- Secondary Fuel oil	Days	21.0 Days	30.0 Days	25.0 Days
- O&M Expenses	Days	21.0 Days	30.0 Days	25.0 Days
- Maint. Spares % of O&M Cost	%	12.00%	15.00%	12.00%
- Receivables @ target availability	Days	45.0 Days	60.0 Days	45.0 Days
Interest rate on Working Capital loan	%	12.00%	12.00%	12.00%

Sample project – CLP Jhajjar & IGSTPP Jhajjar (Case – II)

Comparison

Particulars	Units	Pessimistic	Optimistic	Practical
Equity IRR	%	13.97%	13.94%	13.93%
Capital Cost	Rs. Crore	5,800	4,310	5,130
Cost per MW	Rs. Crore / MW	4.39	3.27	3.89

Detailed Comparison (per unit in Rs./kWh)



Sample project – CLP Jhajjar & IGSTPP Jhajjar (Case – II)

Risk profiling: Impact Assessment for CLP Jhajjar project

(1/2)

Parameter	Associated Risk Factors	Variation (Absolute)	Variation (%)	Impact on Equity IRR (Absolute)
Annual Availability/PLF	Offtake risk, Adequacy of fuel supply, Equipment quality, and Transmission adequacy/availability risk	-4%	-5%	-1.72%
Aux Power	Equipment quality and Fuel quality risk	0.3%	5%	-0.35%
Gross Station Heat Rate (kcal/kWh)	Offtake risk, Quality of fuel, Equipment quality, and Generation Risk	110	5%	-3.84%
Terminal Value	Equipment quality, Regulatory risk, Cost associated Re-modernisation or life extension, Obsolete equipment, and Environmental risk	-1%	-5%	-0.01%
Loss of GCV from receiving end to firing end	Regulatory Risk and Theft risk	0.01	5%	-0.01%
Sp. Fuel Consumption (ml/kWh)	Equipment quality, Price risk and Generation risk	257	5%	-1.30%
Total Project Cost (Rs. Crore)	Market risk (Price of equipment), Risk in delay of project, Lending policy risk, Tax & Duty, FERV Risk, Contracting issues, Environmental risk and Political risk	-4%	-5%	-1.72%

© 2016 CRISIL Ltd. All rights reserved.

Sample project – CLP Jhajjar & IGSTPP Jhajjar (Case – II)

Risk profiling: Impact Assessment for CLP Jhajjar project

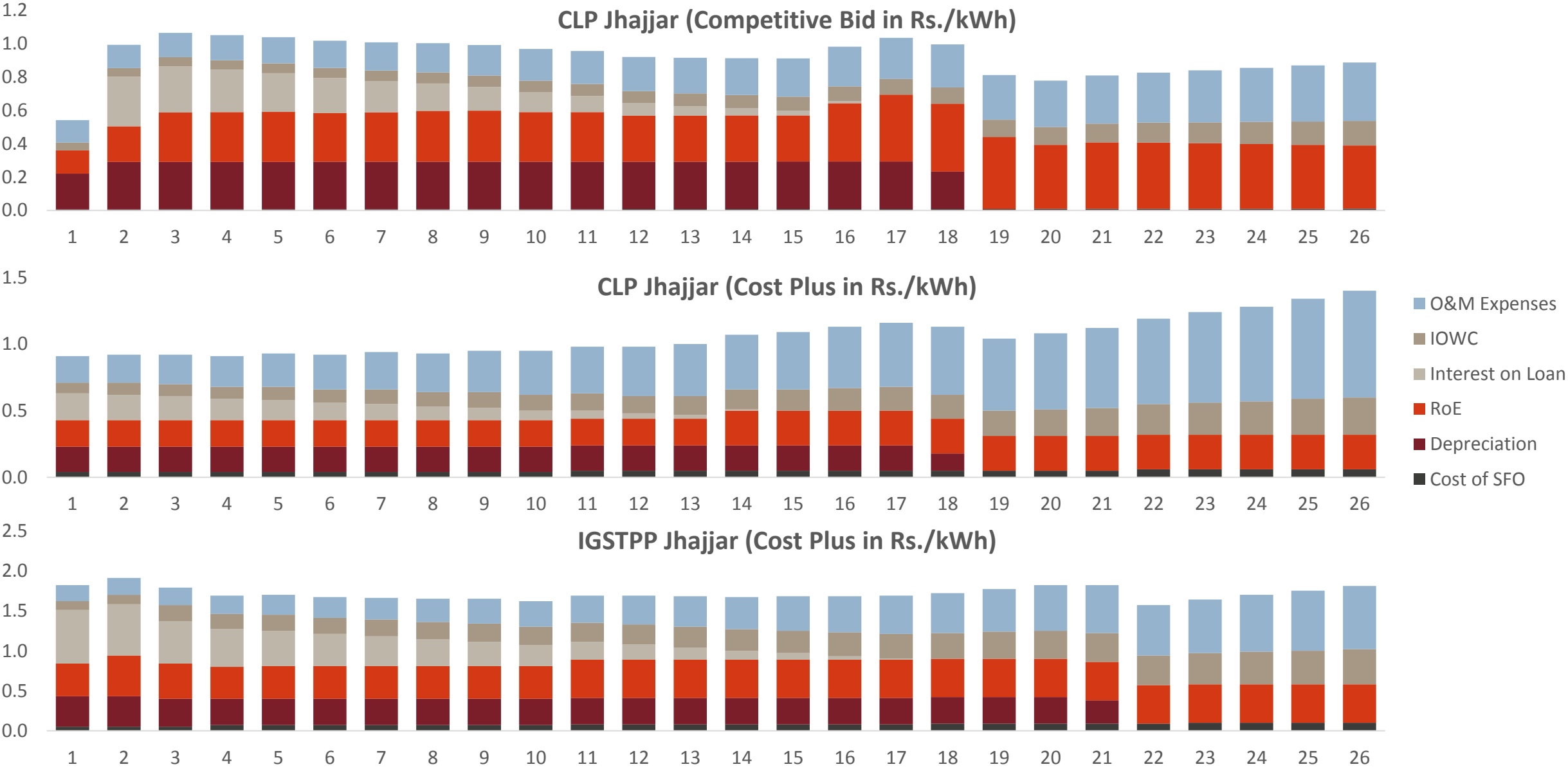
(2/2)

Parameter	Associated Risk Factors	Variation (Absolute)	Variation (%)	Impact on Equity IRR (Absolute)
Interest Rate Domestic	Lending policy risk, FERV Risk, Cost of capital / Leverage risk and Cash flow / Repayment risk	0.55%	5%	-0.31%
Interest Rate Foreign	Lending policy risk, FERV Risk, Cost of capital / Leverage risk and Cash flow / Repayment risk	0.35%	5%	-0.31%
O&M expenses (Rs. Lakh / MW)	Manpower risk, Quality of equipment, Fuel quality and Inflationary risk	0.47	5%	-0.32%
O&M Escalation	Manpower risk, Quality of equipment, Fuel quality and Inflationary risk	0.20%	5%	-0.09%
Coal inventory	Fuel availability risk, Transportation risk, and Mine production risk	1.3 Days	5%	-0.03%
Secondary Fuel Inventory	Market price risk, Supply risk, Import policy risk, and Coal quality risk	1.3 Days	5%	0.00%
Working capital requirement for O&M	Manpower risk, Quality of equipment, Inflationary risk, and Fuel quality	1.3 Days	5%	0.00%
Inventory of Spares (% of O&M Expenses)	Manpower risk, Quality of equipment, Inflationary risk, and Fuel quality	0.60%	5%	0.00%
Receivables	Discom financial health	2.3 Days	5%	-0.08%
Interest rate on Working Capital	Lending policy rate and Cash flow issues	0.60%	5%	-0.11%

© 2016 CRISIL Ltd. All rights reserved.

Sample project – CLP Jhajjar & IGSTPP Jhajjar (Case – II)

Fixed Tariff Components



Capacity contracted under competitive bidding

State wise – Case I & Case II contracted capacity

State	Case 1	Case 2 #	Total
Chhattisgarh	0	1320	1320
Gujarat	5010	1805	6815
Haryana	1724	1948	3672
Maharashtra	5365	2872	9437
Madhya Pradesh	1350	1815	3165
Punjab	0	4791	4791
Rajasthan	1450	2294	3744
Uttar Pradesh	4660	6875	11535
Andhra Pradesh	900	1584	2484
Tamil Nadu	1400*	792	2192
Bihar	1010	1122	2132
Karnataka	1230	3249	4479
Delhi	0	446	446
Uttarakhand	0	99	99
Kerala	300	0	300
Total	24399	31011	55410

Including contracted capacity of Sasan UMPP (3960 MW), Mundra UMPP (3800 MW) and Krishnapatnam UMPP (4000 MW), Tilayia UMPP has not been considered, as developer has terminated the contract. This also includes some of the medium term tie-ups.

* Recently tariff for 3300 MW capacity has been adopted by the TNERC under Case – 1 Bidding: Quantum needs to be reconciled.

ISGF Presentation to FOR on

Regulatory Support for Electric Vehicles Rollout, Smart Grid Foundation Course for Regulators & Policy Makers; and India Smart Grid Week 2017

16 December 2016, New Raipur

Reji Kumar Pillai

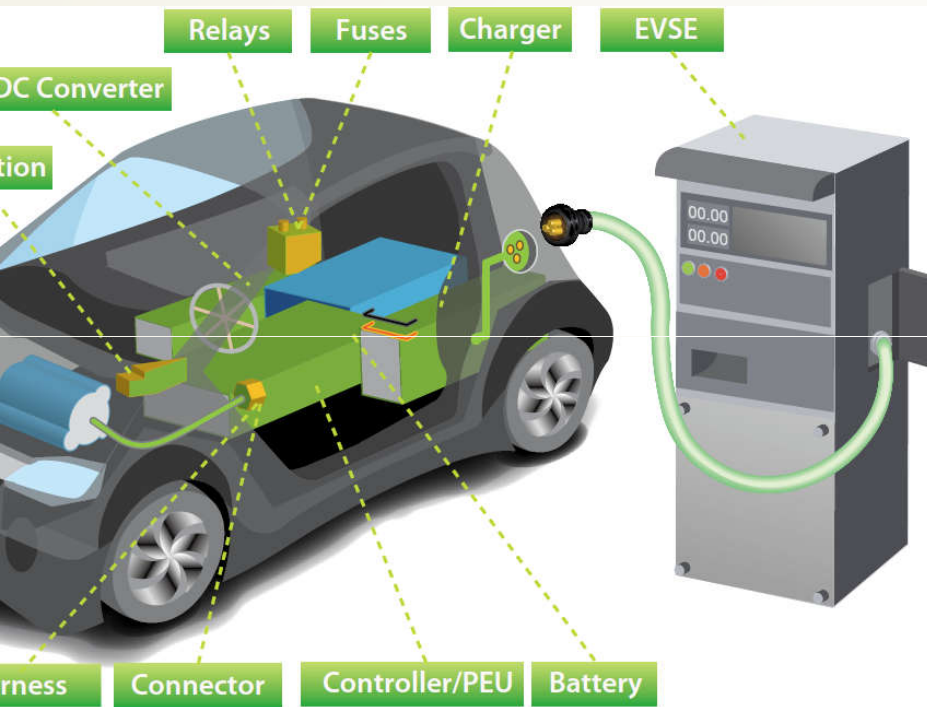
President - India Smart Grid Forum

Chairman – Global Smart Grid Federation

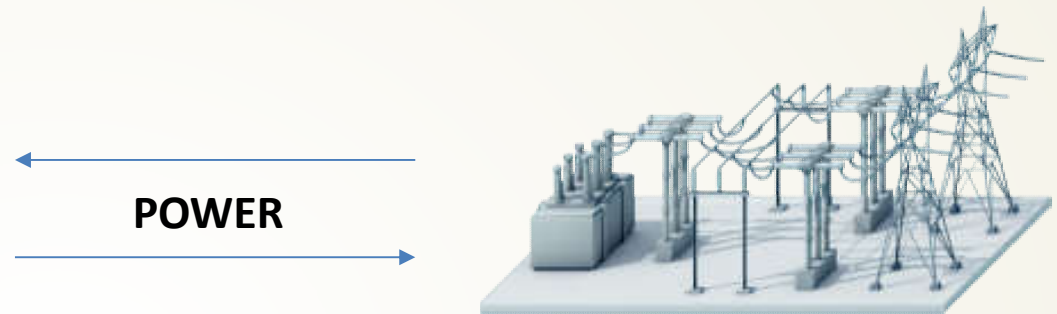
Contents:

- Regulatory Support for Electric Vehicle Rollout in India
- Smart Grid Foundation Course for Regulators & Policy Makers
- India Smart Grid Week 2017

Electric Vehicle Ecosystem



UTILITY



Type of EVSE

AC Charging
Home, Fleet and Public Use

DC Fast Charging
Public and Large Fleet Use

The faster the charging speed, the cost and complexity increases

Electric Vehicles Mission in India

MoI has launched the National Mission on Electric Mobility in 2013 with a target of 6 million EVs by 2020 in order to meet various international and national targets related to greenhouse gas emission reduction

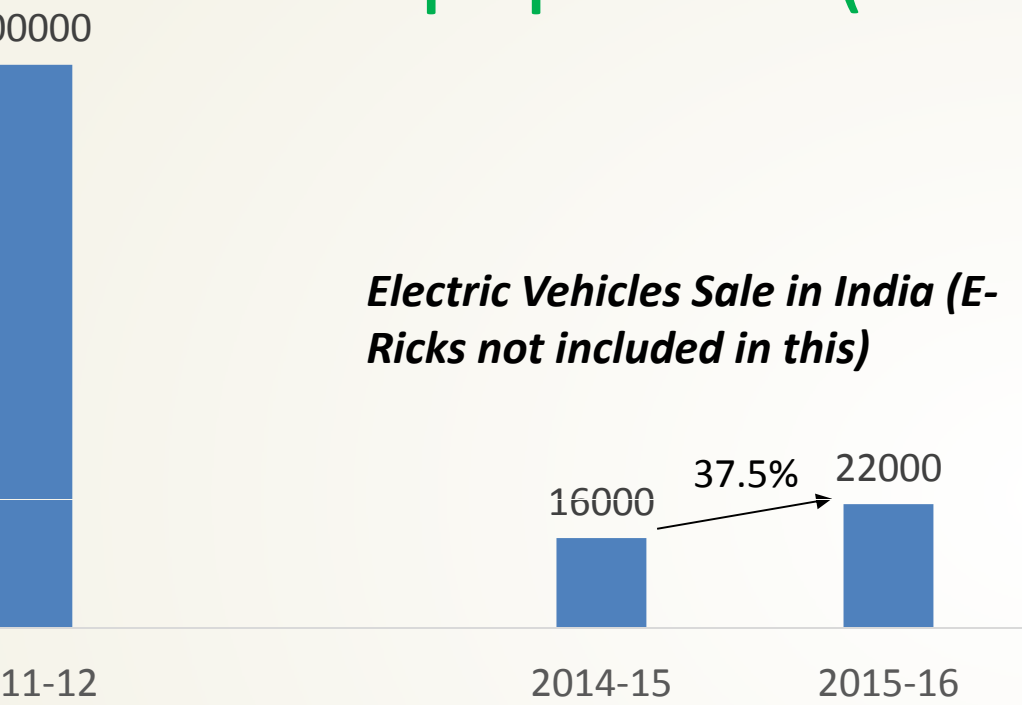
Large scale EV rollout can have huge impact on the electricity distribution network and it needs to be planned meticulously to avoid distribution grid overloading/failures

With rapid proliferation of rooftop PV, perhaps EV penetration could support decentralized electricity distribution grids

Successful rollout of EVs require cooperation of all stakeholders: MoI, MoP, Ministry of Environment and Forests, NRE, DST, DISCOMs, Electricity Regulators, State Transport Departments, BIS, EV Manufacturers, EVSE Makers and Operators, Research and Academia, Skill Development Agencies

The transportation sector is a major contributor to the deteriorating air quality in Indian urban cities

Electric Vehicles (EV) and Electric Vehicle Supply Equipment (EVSE) Scenario in India



Source: Society of Manufacturers of Electric Vehicles (SMEVs)



Mahindra Reva has Installed total of 74 Charging Stations all over India which provides charging to its customers

Source: Mahindra Reva

- Figures for 2011-12 is high as MNRE used to give some subsidies
- Past few years we are witnessing explosive growth in electric three wheelers (E-Rick) in many cities in India which are not manufactured in organized sector

ISGF along with CSTEP is preparing an Implementation Plan on “Electrification of Public Transportation in Kolkata and Bangalore” supported by Shakti Sustainable Energy Foundation

Bottlenecks for Electric Vehicle Rollout

- Lack of Charging Infrastructure: EVs first or EVSE first? – early public investment required
- Standards for EVSE:
 - AC Slow Charging
 - AC Fast Charging
 - DC Fast Charging (DCFC): CHADeMO or CCS or GB/T - three types are popular in different geographies; and these are not interoperable
- Lack of clarity on EVSE Business Models: Re-sale of electricity by third parties not permitted under existing Electricity Act, though DISCOMS allow commercial connections to install charging stations
- Not many EV choices in India
- Range Anxiety

ISGF Recommendations: Priority Sectors and Range per Single Charge for Electrification of Transportation

On behalf of MoP, ISGF conducted a stakeholder workshop in May 2016 and made following recommendations for which there were consensus:

Public Transportation:

- Mini Buses (20-25 seating capacity): at least 50 km per single charge
- Buses (50+ seating capacity): at least 60-70km per single charge
- Taxis: at least 100km per single charge

Government Vehicles:

- Cars owned or leased by Central and State Governments: at least 50-60 km per single charge

Private Vehicles:

- Medium and Heavy Duty Cars: at least 100 -150 km per single charge
- Buses and Shuttles: at least 60-70 km per single charge
- Two Wheelers: at least 60-70 km per single charge

ISGF Recommendations: Locations of Charging Station



Image Source: <http://canva>

ISGF Recommendations: EVSE Types

Automotive Research Association of India (ARAI) has issued draft standards (AIS 138) for both AC and DC Charging Infrastructure

Two Wheelers

- Normal AC slow charging is recommended – initially with socket/plug compatible with latest standard (AIS 138 - Part 1-DRAFT) may be used for slow charging

Three Wheelers and Four Wheelers (Cars, Mini Buses and Light Commercial Vehicles)

- AC Normal Charging (230V, 15 Amp; about 3.3 kW) for slow charging: 4 hours for Reva (11kWh)
- Level-2 (415 V, less than or equal to 63 Amp) for AC fast charging: 1 hour for Reva
- Direct Current Fast Chargers (DCFC): (CHADeMO, GB/T or CCS): 400V to 800V and 120 Amps; 500V CCS can charge a Nissan Leaf (24 kWh) in less than 30 minutes: **one among the 3 popular standards will be selected**

Buses

- Direct Current Fast Chargers (DCFC) – **one among the 3 popular standard will be selected** (CHADeMO, GB/T or CCS)

ISGF Recommendations: EVSE Standards and Communication Protocols

All charging outlets and charging stations must be supported by the standard communications with the vehicle and grid interfaces

The recommended standards are:

- Charging Station (EVSE) and EV: **IEC 61851**
- EVSE Network and Utility/Grid-Operators (GRID): Open Automated Demand Response (**OpenADR**) or **IEEE 2030.5**
- Communication between EVSE and Remote Management and Payment System
Open Charge Point Protocol (OCPP)

Need for Enabling Regulations for EV Rollout

Encourage third parties to install Electric Vehicle Supply Equipment (EVSE) and sell electricity to Electric Vehicle (EV) for charging/energy storage purposes: Per EA 2003, a charging station owner cannot buy electricity from a DISCOM and sell to an EV Owner; though DISCOMs are permitting installation of EV charger to commercial connections

Creation of separate tariff category and electricity market for EVs: Tariffs for EV charging may be viewed from a different perspective. Although it is a commercial use per some interpretation a separate tariff for EVs may be introduced that promotes faster adoption of EVs particularly during off-peak hours

Mandating proper Standards for Grid Connectivity and EVSE Integration: Regulations to mandate types of charging stations and batteries conforming to applicable standards and grid code

Promote Vehicle to Grid Integration: EV Battery can act as load as well as a generation resource that can pump electricity back to the grid. Large pool of grid-connected EVs can be aggregated as Virtual Power Plant (VPP) which need to be recognized in the regulations. EVs could be great support for distribution grid balancing with penetration of rooftop PVs

Re-use of EV Batteries for Stationery Applications: At end of life of an EV Battery may still have >70% capacity and can be used for stationery applications such as Energy Storage, Street Lighting, Inverters etc

SMART GRID FOUNDATION COURSE FOR REGULATORS & POLICY MAKERS

Smart Grid Foundation Course for Regulators & Policy Makers

DOPE:

Development of training modules on smart grid technologies/applications for Regulators and Policy Makers (17 modules and an Appendix) – this will be published as a **HAND BOOK ON SMARTGRIDS**

Conducting two regional courses (four days each) and one national course (two days)

Contents of the Hand Book:

- Module 1: 21st Century Grids – Evolving Trends in Grid Modernization
- Module 2: Introduction to Smart Grids
- Module 3: Advanced Metering Infrastructure (AMI)
- Module 4: Communication and Cyber Security
- Module 5: Standards, Architecture and Interoperability
- Module 6: Distributed Generation Resources and Renewable Energy Integration
- Module 7: Modern Loads and Power Quality
- Module 8: Microgrids
- Module 9: Energy Storage
- Module 10: Electric Vehicles

ISGF Training for Regulators

Module 11: Demand Response and Energy Efficiency

Module 12: Use Cases, Lessons Learned – Pilot Project Experiences

Module 13: Electricity Act 2016 and UDAY

Module 14: Smart Grid Regulations

Module 15: Smart Grid Business Models and Cost Benefit Analysis

Module 16: New Tariff Structures

Module 17: Smart Grids for Smart Cities

APPENDIX: Fundamentals of Electric Power Systems

(This initiative is supported through a grant from Shakthi Sustainable Energy Foundation)

ISGF & ISGW

ISGF Initiatives

India Smart Grid Knowledge Portal launched in Jan 2013 (www.indiasmartgrid.org) – most popular smart grid portal in the world today

Smart Grid Bulletin - **Circulation: 2,500** print copies to key decision makers in Indian power sector; > **55,000** electronic copies to power sector professionals around the world

White Papers on important topics

Regular Webinars on technical topics

Training and Capacity Building Programs:

- **Workshop on Cyber Security for Power Systems (3 Days)** in collaboration with NCIIPC – now moved to an E-learning platform
- **Foundation Course on Smart Grids (3 Days)**
- **Smart Grid Bootcamp for Students (1 Day)**
- **Smart Grid Foundation Course for Regulators & Policy Makers (4 Days)**
- **Certificate Course on Smart Grids (10 Weeks)**

Latest Publications of ISGF:

- **AMI Rollout Strategies and Cost Benefit Analysis for India**
- **Indian Manual on Cyber Security for Power Systems (Draft under review by MoP)**
- **White Paper & Video on Future of Transportation**





India **SMART GRID** Week 2017

07 - 10 March 2017

Manekshaw Center, New Delhi, India

www.isgw.in



www.isgw.in

 [@isgw2017](https://twitter.com/isgw2017)

ISGW 2017: EVENT STRUCTURE

Day-1 06 March 2017 Tuesday Technical Tours and Smart Grid Tutorial (Optional)	Day-2 08 March 2017 Wednesday Conference and Exhibition <u>Welcome Reception and Cultural Programs</u>	Day-3 09 March 2017 Thursday Conference and Exhibition <u>Awards Night and Gala Dinner</u>	Day-4 10 March 2017 Friday Conference and Exhibition <u>Musical Evening (Optional)</u>	Day-5 11 March 2017 Saturday Cultural Tour Delhi & Taj Mahal (Optional)
--	--	--	--	--

ISGW 2017: OTHER PARALLEL EVENTS

ISGAN ExCo Meeting 06-07 March 2017	IEC and IEEE Workshop on Smart Energy Standards 07 March 2017	Fourth EU-India Smart Grid Workshop 08 March 2017	Round Tables on: 1. Cyber Security; 2. Last Mile Communication 10 March 2017	GSGF Annual Meeting 10 March 2017
--	---	---	--	--------------------------------------

ISGW 2017: Draft Agenda

ISGF SMART UTILITY MASTER CLASS SERIES

7 MARCH 2016 (TUESDAY): ISGF SMART UTILITY MASTER CLASS SERIES

Time	Session	Speaker	Venue
09.30 ~ 13.30	Tutorial 1: Leading Grid Modernization & Customer Engagement		Ashoka
	Tutorial 2: Leading Transition to a Smart City – A 360° perspective on planning for the future		Shamsh
	Tutorial 3: Leading Transformation with Smart Energy – A 360° perspective on Energy Efficiency, DER and Transactive Energy		Taber
13.30 ~ 14.30	Lunch		
14.30 ~ 18.30	Tutorial 4: Smart Metering - Advanced Applications & Advanced Analytics		Ashoka
	Tutorial 5: E-Mobility		Shamsh
	Tutorial 6: Power System Flexibility – Demand Response, Energy Storage and Microgrids; Innovative Business Models & Benefits		Taber

ISGW 2017: Draft Agenda

8 MARCH 2016 (WEDNESDAY): CONFERENCE DAY 1

Time	Session	Speaker	Venu
10.00 ~ 12.30	Inauguration of ISGW 2017 Conference		Zorawar
12.30 ~ 12.50	Special Address: Dan Ton, Program Manager of Smart Grid R&D, US Department of Energy and Announcement of US-India Joint Clean Energy Research & Development Centre Contracts Signing Ceremony		Zorawar
12.50 ~ 13.00	Inauguration of ISGW 2017 Exhibition		
13.00 ~ 14.00	Lunch		
14.00 ~ 15.30	Plenary-1: Grid Modernization (3 Speakers * 25 mins each + 15 mins Q&A)		Zorawar
15.30 ~ 17.30	Theme-1: Grid Modernization & AMI Project Experiences and Lessons for India (5 speakers * 20 mins each + 20 mins for Q&A) 4th India – EU Smart Grid Workshop		Ashoka Shamshe

ISGW 2017: Draft Agenda

SMART CITIES & E-MOBILITY

9 MARCH 2016 (THURSDAY): CONFERENCE DAY 2

Time	Session	Speaker	Venue
10.00 ~ 12.30	Plenary 2: Smart Cities (6 speakers * 20 mins each + 30 mins for Q&A)		Zorawar
12.30 ~ 14.00	Lunch		
14.00 ~ 15.30	Plenary-3: E-Mobility (3 Speakers * 25 mins each + 15 mins)		Zorawar
15.30 ~ 17.30	Theme-2: Smart Cities & E-Mobility - Project Experiences and Recommendations for India (5 speakers * 20 mins each + 20 mins for Q&A)		Ashoka
	2nd India – Canada Workshop		Shams

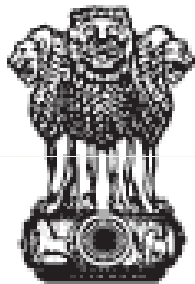
ISGW 2017: Draft Agenda

10 MARCH 2016 (FRIDAY): CONFERENCE DAY 3

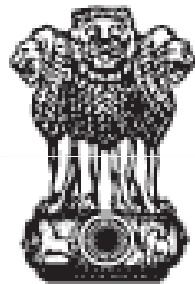
Time	Session	Speaker	Venu
10.00 ~ 12.30	Plenary 4: Renewable Integration (6 speakers * 20 mins each + 30 mins for Q&A)		Zorawar
	Session on Gas and Water Utilities		Shamsh
12.30 ~ 14.00	Lunch		
14.00 ~ 16.00	Theme-3: RE Integration, Energy Storage & Microgrids - Project Experiences and Recommendations for India (5 speakers * 20 mins each + 20 mins for Q&A)		Zorawar
16.00 ~ 17.30	VALIDICTORY SESSION		Ashoka

ISGW 2017: GOVT SUPPORT

SUPPORTING MINISTRIES



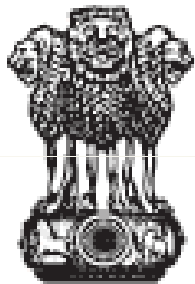
सत्यमेव जयते
Ministry of Power
Government of India



सत्यमेव जयते
Ministry of New & Renewable Energy
Government of India



सत्यमेव जयते
Ministry of Science & Technology
Government of India



सत्यमेव जयते
Ministry of External Affairs
Investment & Technology
Promotion Division
Government of India

ISGW2017: INNOVATION AWARDS

On 9th March 2017 (during Gala Dinner)

Awards Categories

Best Smart Grid Pilot Project in India

Best RAPDRP Part A implementation in India - Utility

Best RAPDRP Part A implementation in India - System Integrator

Most Progressive Smart City in India

Innovative Policies and Regulations Promoting Renewables and Smart Grids in India

A. Smart Startup of the Year 2016

B. Smart Startup by Woman Entrepreneur in 2016

C. Smart Startup by Young Entrepreneur (below 25 years of age) in 2016

Smart Incubator of the Year 2016

Best Energy Efficiency Programs/Projects of the Year 2016

Smart Technology of the Year 2016

ISGF President's Award for the best contribution towards growth of Smart Grids in India

ISGW 2017: COMPETITIONS

20 – 22 January 2017 at NSIT, Dwarka, Delhi

HACKATHON

- Topic: **SECURING THE GRID**
- Prize: **INR5,00,000**

INNOTHON

- Topic: **INNOVATING THE GRID**
- Prize: **INR2,50,000**

APPATHON

- Topic: **APP DEVELOPMENT FOR SMART GRIDS AND SMART CITIES**
- Prize: **INR3,00,000**

Thank you for your kind attention



For discussions/suggestions/queries email:
reji@rejikumar.com

@rejipillai

www.indiasmartgrid.org
www.isgw.in
www.globalsmartgridfederation.org

[Home](#)[About Mizoram](#)[About Govt.](#)[More Info](#)[Related Links](#)

d December 2016

[Information](#)[Technology](#)[Download forms](#)[Govt. Holiday List](#)[Feedback](#)[Site Map](#)[State Dept Website](#)

ATI
 Assembly
 AH Vety
 Economic & Statistics
 Election Department
 Disaster Management &
 Rehabilitation

About Government ->Table of Precedence[Download in PDF format](#)

The Mizoram Gazette
 EXTRA ORDINARY
 Published by Authority

Vol. XIX Aizawl Wednesday, 5. 9. 1990. Bhadra 14, S.E. 1912 Issue No. 93

NOTIFICATION

No. J-17011/1/83-POL, the 28th August 1990. In super session of all previous notifications issued on the subject, the Governor of Mizoram is pleased to order that the following Table of Precedence shall be observed at all State functions in the State of Mizoram :-

Article of the Warrant	Name of Posts
1	President
2	Vice-President
3	Prime Minister
4	Governor
5	Former Presidents
6	Chief Justice of India, Speaker of Lok Sabha
7	Cabinet Ministers of the Union, Chief Minister, Deputy Chairman, Planning Commission, Leaders of Opposition in the Lok Sabha and Rajya Sabha.
8	Judges of Supreme Court.
9	Deputy Chairman, Rajya Sabha, Deputy Speaker, Lok Sabha, Members of Planning Commission, Ministers of State of the Union.
10	Attorney General of India, Cabinet Secretary, Comptroller and Auditor General of India.
11	Chiefs of Staffs holding the ranks of full General or equivalent.
12	Chief Justice of High Court, Speaker of Legislative Assembly.
13	Cabinet Ministers in States, Deputy Ministers of the Union, Vice-Chairman, Planning Board.

14	Officiating Chiefs of staff holding the rank of Lt. General or equivalent.
15	Chairman, Minorities Commission, Chairman, Scheduled Castes and Scheduled Tribes Commission, Chairman, UPSC, Chief Election Commissioner, Puisne Judges of High Courts (within their jurisdiction).
16	Chairman, Monopolies and Restrictive Trade Practices Commission, Ministers of State within the State, Deputy Speaker of State within the State.
17	Members of Parliament.
18	Members of Legislative Assembly State Chief Information Commissioner
19	Army Commanders/Vice-Chief of the Army staff or equivalent ranks in other Services. Chief Secretary Commissioner, Linguistic Minorities Commission for Scheduled Castes and Scheduled Tribes. Members, Minorities Commission; Members, Scheduled Castes and Scheduled Tribes Commission. Officers of the rank of full General or equivalent rank. Secretary to the Govt. of India (including holding ex-officio). Secretary, Minorities Commission; Secretary, Scheduled Castes and Scheduled Tribes Commission. Secretary to the President; Secretary to the Prime Minister; Secretary, Rajya Sabha/Lok Sabha; Solicitor General of India; Secretary, North Eastern Council.
20	Officers of the rank of Lt. General, Chairman, MPSC State Information Commissioner
21	Principal Secretary to Govt. of Mizoram; Addl. Secretaries to the Govt. of India; Addl. Solicitor General of India; Advocate General of Mizoram. Chairman, Tariff Commission; Deputy Comptroller and Auditor General; Members, MPSC. Director, Central Bureau of Intelligence; Director General, BSF; Director General, CRPF; Director, Intelligence Bureau; Members, UPSC. Members, Monopolies and Restrictive Trade Practices Commission.

22	Commissioners/Secretaries of the super-time scale of IAS; Inspector General of Police/Officers of the rank of Maj. General and equivalent rank; Accountant General; Principal Chief Conservator of Forest; Adviser, NEC holding the rank of Jt. Secretary to the Govt. of India or equivalent; Vice Chancellor of NEHU.
23	Secretaries to the Govt. of Mizoram, Legal Remembrancer; Secretary, Legislative Assembly; Deputy Commissioners holding the rank of Deputy Secretary to the Govt. of India within their districts; Secretary, State Information Commission, Mizoram; CEM/EM/Chairman/Vice-Chairman/MDCs of Autonomous Districts Councils Chief Executive Officer, Aizawl Municipal Council/Chairman and Members of JERC, M&M
24	Addl. Secretaries to the Govt. of Mizoram; Chief Conservator of Forest; Managing Director, ZIDCO; Chief Controller of Accounts; Commissioner, Excise; Deputy Commissioners other than IAS officers holding the rank of Deputy Secretary to the Govt. of India within their districts. Brigadier or equivalent rank in other services stationed in Mizoram; Deputy Inspector General of Police; Commandant General, MRHG; Pro Vice-Chancellor, NEHU; Chief Engineer, Project Pushpak; Chief Engineers; Registrar, Guwahati High Court.
25	Jt. Secretaries to the Govt. of Mizoram; Jt. Legal Remembrancer; Director, Postal Services Mizoram holding the rank of selection grade of Indian Postal Services. Addl, Chief Engineers; Sr. Superintendent of Police; Colonel in the army or equivalent in other service; Directors and other officers holding the rank of selection Grade of MCS officers.
25(a)	Deputy Secretaries to the Govt. of Mizoram and other officers of the rank of MCS in the scale of JAG; Superintendents of Police; Assitant Inspector General of Police; Commandants, MAP/CRPF/BSF; OSD Special Bureau; Jt Directors and other officers of the rank of Jt.

	Director. Station Director, AIR; Conservator of Forest; Superintending Engineers; Senior Architect; Principals of Govt. Colleges, Protocol Officer; Director, Sports & Youth Services; Lt. Colonel of the army and equivalent rank in other services; Deputy Registrar, Guwahati High Court.
26	Under Secretaries to the Govt. of Mizoram; Deputy Registrar (Coop); Sub-Divisional Officers (C); Private Secretary to the Chief Minister; Deputy Protocol Officer; Executive Engineers; Deputy Directors and others holding the rank of Deputy Director/Under Secretary; Extra Assistant Commissioner; Deputy Commandants of Police; Analyst, DP & AR; Major in the army or equivalent rank in other Services; Deputy Conservator of Forest; Functional Managers, DIC; Civil Surgeon; Assistant Commissioner of Excise; Project Officers, DRDA; Exploratory Geologist; Assistant Registrar, Guwahati High Court.
27	Superintendents of Excise/Taxation/Sericulture; Public Relations Officers; District Employment Officer; District Social Welfare Officer; Sub-Divisional Officers of PWD/PHE/P&E and equivalent rank; Captain of the army and equivalent rank; Deputy Superintendents of Police; Assistant Commandants; Assistant Registrar of Co-operation; District Statistical Officer; Assistant Directors and other officers holding the equivalent rank; Office Superintendents/Private Secretaries and equivalent; Pool Officer; Committee Officers of Legislative Assembly. Tourism Information Officer; Works Manager, Transport; Transport Officer; Finance & Accounts Officer; Treasury Officer; Dist. Local Administration Officer; District Industries Officer; Physical Education Officer;

	Youth Welfare Officer; Chief Coach; Judicial Officer I; Principal, ITI; Asst. Manager(Tech); Asst. Settlement Officer II; Asst. Project Officer; President, District Council Court; Research Officers (Planning); Dist. Fisheries Development Officer; Sanitation Officer; Superintendent of Jails; Asst. to Deputy Commissioner; Asst. Town & Country Planner; Health Education Officer; Asst. Soil Conservation Officer; Asst. Conservator of Forest; Asst. Geologist; Block Development Officers; other Officers of equivalent rank of this Article 27.
--	--

NOTE-I The Table of Precedence is meant for ceremonial occasions and has nothing to do with day-to-day functioning of the Government.

NOTE-II The order in which posts are mentioned in any one article is not the basis for determining the seniority inter-se. Persons in the Table of Precedence will take rank in order of the number of the articles. Those included in the same article will take precedence inter-se according to date of entry into that article. However, where the dignitaries of different States/ Union Territories included in the same articles are present and there is difficulty in ascertaining their dates of entry, they may be assigned precedence inter-se in the alphabetical order of the name of States and Union Territories concerned after those whose precedence is determined according to date of entry into that article.

NOTE-III Chief Minister of the State will take precedence above all others included in the article 7 in a function organised within the State.

NOTE-IV Among the members of Legislative Assembly, the following will take precedence over other members. They will take rank in the following order :

- Leaders of Parties
- Ex-Chief Minister
- Ex-Speaker
- Chairman/Vice Chairman of various statutory Boards/Corporations of Govt. under takings.
- Ex-Ministers.
(Other members of Legislative Assembly will be given seniority in the alphabetical order).

NOTE-V In article 13 Cabinet Ministers of the State will rank above Deputy Ministers of the Union.

NOTE-VI Elected Representatives of the people viz. Chief Executive Member, Chairman, Deputy Chairman, Executive Member and Members of District Councils although not included in the main warrant or precedence will take precedence above article number 24 when invited for State and Ceremonial functions. (Separate executive instruction will be issued).

NOTE-VII Non-Elected and Non-official Chairman/Vice-Chairman of Boards/Corporation of Government undertaking (State) have not figured in the main warrant of precedence, when

invited to such functions will be assigned precedence after persons at article 23.(separate executive instruction will be issued).

NOTE-VIII Dignitaries of equal status from other States will be preceded by dignitaries of the State Government.

NOTE-IX All ladies/gentlemen unless by virtue of holding an appointment themselves who are entitled to a higher position in the table, shall take place according to the rank assigned to their respective husbands/spouses.

NOTE-X Some posts, e.g. Political Assistant to Chief Minister, are not entered in the table as the posts seem to be temporary in nature. When invited to State and ceremonial functions Political Assistant to Chief Minister will be assigned to article number 24 (separate executive instruction will be issued).

NOTE-XI Managing Director, ZIDCO, Commissioner, Excise and Chief Controller of Accounts are placed in the article 24 along with the Additional Secretaries to the Government of Mizoram keeping in view the seniority of the present incumbents in their own services. The article will not be applicable as and when the incumbent is changed depending on the seniority of the next incumbent when changed. (separate executive instruction will be issued).

M. Lalmanzuala,
Chief Secretary to the Govt. of Mizoram

Ministry of Communication & Information Technology
National Informatics Centre, Mizoram State Centre
Annex-II, Civil Secretariat, Aizawl - 796001



Accommodation of RE Power by 2022





Requirements to manage peak demand as well as accommodate RE power

- * Conventional coal based generation modulation to be done at the best possible way
- * Evening peak demand to be curtailed by implementation of energy efficient lighting and electrical appliances.
- * Pump storage facility like Purulia to be increased to support evening peak demand
- * Hydro to optimize generation by ramping up during evening peak
- * Bio-mass generation to be designed to meet evening peak
- * Battery back up / storage facilities to be installed in a limited way





Expected Evening peak demand of WB will be 12084 MW
& Day peak demand will be around 8240 MW by 2022

WB's revised target for minimum solar RPO for 2021-22 is 4223 MW. [Ref. Letter dated 30-03-2016 of Sri Tarun Kapoor, Joint Secretary, MNRE]

Conventional generators to be backed down to 4017 MW to accommodate 4223MW peak solar generation during day time.

To meet evening peak 12084 MW conventional generators to ramp up 6000 MW after addressing balance 1000 MW by energy efficient lights & appliances & 1067 MW by Purulia pump storage & other source of generation.





Modulation of conventional thermal generating station to accommodate 4223 solar peak generation

1. Putting 25 year old thermal units for two shift operation. The following units will be more than 25 years old by 2022

a) WBPDCCL's units at Bandel (455 MW) and Kolaghat (1260 MW)

b) DPL's 110 MW unit

c) CESC's units at Titagarh (240MW), Southern Generating Station (135MW), One unit at Budge Budge (250MW)

d) DVC's unit at DTPS 350 MW, one 210 MW unit at MTPS

Total :3010 MW. These units with 85% availability 2558 MW can be put on bar before evening peak





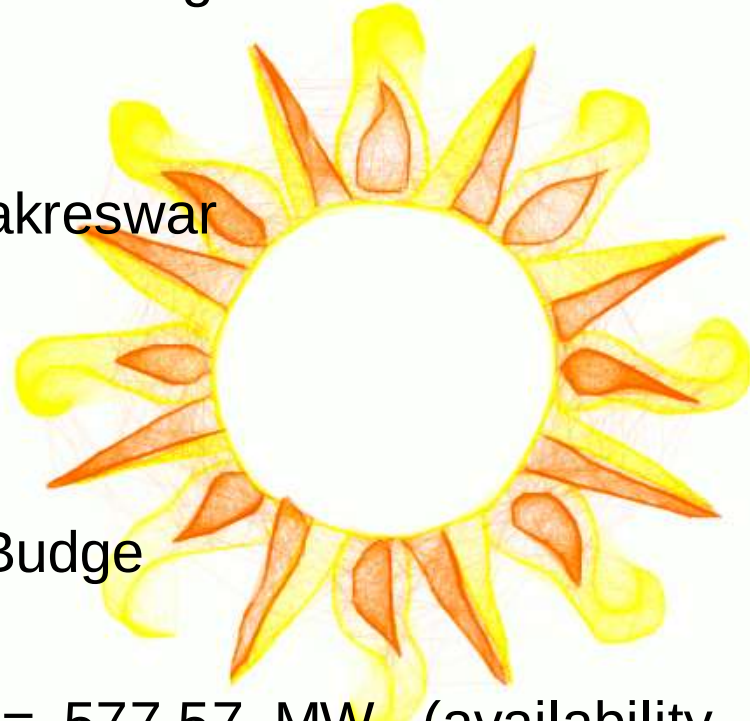
2. More than 15 years old plant can be backed down to 55% of full load capacity during day peak. The following units will be more than 15 years old

a) WBPDC's 3 X 210 MW units at Bakreswar

b) DVC's 3 X 210 MW units at MTPS

c) CESC's 1X250 MW unit at Budge Budge

Total = 1510 MW, 45% off loading = 577.57 MW. (availability 85%)





3. Other new generating station (less than 15 years old) can be reduced to 70% of its capacity to accommodate peak solar power at its full capacity during solar peak generation. Rest units are as follows:

- a) WBPDC's 2 X 210 MW units at Bakreswar, 2 X 250 units at Santaldih, 2 X 300 MW + 2 X 500 MW units at Sagardighi.
- b) DPL's 1X250 & 1X300 MW Units
- c) CESC's 1X250 MW unit at Budge Budge
- d) Haldia Energy Limited 2 X 300 MW
- e) IPCL's 12 MW unit at Dishergarh, 3 X 150 MW at Haldia



Total = 4382, 30% offloading = 1117.41 MW (availability 85%)

Total Solar peak power can be accommodated = $(3010 + 577.57 + 1117.41)$ MW = 4704.98 MW whereas State's expected Solar RPO can be met with 4223 MW Solar Plant by 2022





Generation during Evening peak by 2022

1. 25/15 years old plant capacity	= 4520 MW
2. New plants capacity	= 4382 MW
3. Purulia pump storage plant	= 900 MW
4. Central sector thermal allocation to WBSEDCL	= 777 MW
5. Future Central sector Thermal allocation to WBSEDCL	= 1650 MW
6. Biomass/Co-generation + MSW	= 320 MW

Total generation with availability factor of 85% = 10667 MW

Expected evening peak demand by 2022 = 12084 MW

Reduction in peak demand using energy efficient
Lights and Appliances = 1000 MW

Net Demand = 11084 MW

Back Up Hydel Generation without firm commitment

• Existing Hydel generating units	= 777 MW
• Future Hydel allocation expected by FY2022	= 586 MW
• Future Small Hydro Plant	= 120 MW





Issues need to be addressed to accommodate RE Power

1. Up gradation of conventional thermal units more than 25 years old is required for handling two shift operation.
2. Up gradation of conventional thermal units to operate without oil support upto 20% of its capacity.
3. Up gradation of units for quick start up and ramp up.
4. To fix up Operation and Maintenance strategy, to ensure highest reliability and low load operation for two shift operation.
5. CERC and SERCs need to fix up operative norms for two shift operation as well as to run the machines at 20% to 55% of its capacity on regular basis.





Impact on tariff to accommodate solar power @8% and non solar power @6%

WBSEDCL's sales to consumers in 2016-17

Excluding Hydel & RE Power :	: 21847.79 MU
Solar power obligation would be	: 1747.82 MU
Non solar RE power obligation would be	: 1310.87 MU
Total RPO would be	: 3058.69 MU

To accommodate 3058.69 MU RPO the following steps has to be taken

- 1) 455 MW Bandel and 2 nos 210 MW units of Kolaghat Thermal Power Station have to be operated for two shift operation (5hrs on bar)
- 2) 4 nos. 210 MW units of Kolaghat Thermal Power Station will be backed down from 840MW to 462MW (55%) for 10 hrs in a day
- 3) New units will be operated from 20% to 100% depending on the situation





Change in Energy charge of Kolaghat Thermal Power Station due to 5 Hrs operation

			Kolaghat TPS, (6X210) MW at normative		2 units 5 hrs. operation
(1)	(2)	(3)	(4)	(5)	(6)
1	Generation	MU	7997.79		689.85
2	AUC rate	%	9.60%	up by 150%	24.00%
3	AUC in Units	MU	767.79		165.56
4	Ex bus generation (4=1-3)	MU	7230.00		524.29
5	Station heat rete normative	Kcal/kWh	2700.00	up by 10%	2970.00
6	Total heat rate required (6=1X5)	M.kcal	21594033.00		2048854.50
7	Heat value of oil	Kcal/lt	9689.65		9689.65
8	Specific Oil consumption	ml/kWh	2.00	up by 500%	12.00
9	Oil consumption (9=1X8)	KL	15995.58		8278.20





सत्यमेव जयते

			Kolaghat TPS, (6X210) MW at normative		2 units 5 hrs. operation
10	Heat from oil [10=(7X9)/1000]	M.kcal	154991.57		80212.86
11	Heat from coal (11=6-10)	M.kcal	21439041.43		1968641.64
12	Heat value of coal	kcal/kg	3549.79		3549.79
13	Coal consumption [13=(11/12)X1000]	MT	6039523.87		554579.75
14	Coal requirement with permissible transit loss	MT	6088229.70		559052.16
15	Average cost of oil	Rs/kL	61291.50		61291.50
16	Average price of coal	Rs/MT	2754.05		2754.05
17	Cost of oil [17=(9X15)/100000]	Rs.lakh	9803.93		5073.83
18	Cost of coal [18=(14X16)/100000]	Rs.lakh	167672.89		15396.58
19	Cost of fuel (19=17+18)	Rs.lakh	177476.82		20470.41
20	Average Fuel cost /kWh	Paise/kWh	245.47		390.44





सत्यमेव जयते

Change in Energy charge of Kolaghat Thermal Power Station due to 45% B/D

			Kolaghat at normative		4 units 45% BD for 10 hrs
(1)	(2)	(3)	(4)	(5)	(6)
1	Generation	MU	7997.79		5270.19
2	AUC rate	%	9.60%	up by 41.6%	13.59%
3	AUC in Units	MU	767.79		716.41
4	Ex bus generation (4=1-3)	MU	7230.00		4553.78
5	Station heat rete normative	Kcal/kWh	2700.00	up by 2.5%	2767.50
6	Total heat rate required (6=1X5)	M.kcal	21594033.00		14585250.83
7	Heat value of oil	Kcal/lt	9689.65		9689.65
8	Specific Oil consumption	ml/kWh	2.00		2.00
9	Oil consumption (9=1X8)	KL	15995.58		10540.38





सत्यमेव जयते

			Kolaghat at normative		4 units 45% BD for 10 hrs
10	Heat from oil [10=(7X9)/1000]	M.kcal	154991.57		102132.59
11	Heat from coal (11=6-10)	M.kcal	21439041.43		14483118.23
12	Heat value of coal	kcal/kg	3549.79		3549.79
13	Coal consumption [13=(11/12)X1000]	MT	6039523.87		4079992.97
14	Coal requirement with permissible transit loss	MT	6088229.70		4112896.14
15	Average cost of oil	Rs/kL	61291.50		61291.50
16	Average price of coal	Rs/MT	2754.05		2754.05
17	Cost of oil [17=(9X15)/100000]	Rs.lakh	9803.93		6460.36
18	Cost of coal [18=(14X16)/100000]	Rs.lakh	167672.89		113271.22
19	Cost of fuel (19=17+18)	Rs.lakh	177476.82		119731.57
20	Average Fuel cost /kWh	Paise/kWh	245.47		262.93





Change in Energy charge of Bandel Thermal Power Station due to 5 hrs operation

			Bandel at normative		Bandel 5 hrs. operation
(1)	(2)	(3)	(4)	(5)	(6)
1	Generation	MU	2949.49		747.34
2	AUC rate	%	9.70%	up by 150%	24.25%
3	AUC in Units	MU	286.10		181.23
4	Ex bus generation (4=1-3)	MU	2663.39		566.11
5	Station heat rete normative	Kcal/kWh	2725.00	up by 10%	2997.50
6	Total heat rate required (6=1X5)	M.kcal	8037365.70		2240144.16
7	Heat value of oil	Kcal/ltr	9656.00		9656.00
8	Specific Oil consumption	ml/kWh	2.15	up by 500%	12.90
9	Oil consumption (9=1X8)	KL	6341.41		9640.65





Change in Energy charge of Bandel Thermal Power Station due to 5 hrs operation

			Bandel at normative		Bandel 5 hrs. operation
10	Heat from oil [10=(7X9)/1000]	M.kcal	61232.63		93090.15
11	Heat from coal (11=6-10)	M.kcal	7976133.07		2147054.00
12	Heat value of coal	kcal/kg	3504.00		3504.00
13	Coal consumption [13=(11/12)X1000]	MT	2276293.68		612743.72
14	Coal requirement with permissible transit loss	MT	2294650.89		617685.20
15	Average cost of oil	Rs/kL	59702.00		59702.00
16	Average price of coal	Rs/MT	2972.00		2972.00
17	Cost of oil [17=(9X15)/100000]	Rs.lakh	3785.95		5755.66
18	Cost of coal [18=(14X16)/100000]	Rs.lakh	68197.02		18357.60
19	Cost of fuel (19=17+18)	Rs.lakh	71982.97		24113.27
20	Average Fuel cost /kWh	Paise/kWh	270.27		425.95





सत्यमेव जयते	As per 2016-17 tarif order				To accommodate RE Power			
	Energy MU	cap ch Rs in lakh	E. Ch p/kWh	Amount Rs in lakh	Energy MU	cap ch Rs in lakh	E. Ch p/kWh	Amount Rs in lakh
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Kolaghat	7230	54674.02	245.47	232148.83	491	54674.20	390.44	192466.53
					4511		262.93	
Bakreswar	7634	85349.07	216.33	250495.39	7634	85349.07	216.33	250495.39
Bandel	1361	8786.15	270.27	45569.90	530	8786.15	425.95	31355.54
Santalidih	2344	32944.51	217.05	83821.03	2344	32944.51	217.05	83821.03
Sagardighi	9341	106880.43	217.23	309794.98	9341	106880.43	217.23	309794.98
		288634.18		921830.1		288634.36		867933.47





सत्यमेव जयते

Energy from Kolaghat is down by (MU)		2227.55		
Energy from Bandel is down by (MU)		831.14		
Total		3058.69		
			Rate P/kWh	Rs in lakh
Solar RE Power (MU)		1747.82	704	123046.753
Non Solar RE Power (MU)		1310.87	500	65543.37
Total				188590.123
Total power purchase cost from WBPDC & RE power(Rs. In lakh)				1056523.59
Total increase in power purchase cost (Rs. In Lakh)				134693.5





Revised power purchase cost of WBSEDCL for the year 2016 – 2017 Ref page no 12

		Energy (MU)	Amount Rs in lakh	
1	Power purchase cost from WBPDC as per order	42965.13	1470304.52	
2	Increased power purchase cost due to RE power	42965.13	1604998.02	
3	Revised quantum of power purchase due to RPO	35364.18	1321058.24	
4	Earlier power purchase cost as per tariff order (Rs in lakh)		1210197.60	Rs in lakh
5	Increase in power purchase cost (Rs. In Lakh) (5=4-3)		110860.64	Rs in lakh
6	Revenue recoverable from sale of power to the consumers		1688843.51	Rs in lakh
7	Revised Revenue recoverable with RPO (7=6+5)		1799704.15	Rs in lakh





Revised power purchase cost of WBSEDCL for the year 2016 – 2017 Ref page no 12						
7	Revised Revenue recoverable with RPO (7=6+5)				1799704.15	Rs in lakh
8	Projected quanta of energy for sale to consumers				24500.00	MU
9	Average tariff for the consumers for the year 2016 with RPO (9=7/8)				734.57	P/kWh
10	Average tariff without RPO				689.32	P/kWh
11	Increase in average tariff (11=9-11)				45.25	P/kWh





Thank you
for
Listening

