

**BEFORE THE GUJART ELECTRICITY REGULATORY COMMISSION
GANDHINAGAR**

In the matter of:

Study on biomass availability and determination of biomass prices in the six districts of Gujarat carried out by TERI as an Independent Consultant by GERC.

CORAM:

Shri Anand Kumar, Chairman

Shri K.M. Shringarpure, Member

Shri P.J. Thakkar, Member

Date: 09/02/2018

ORDER

Background:

1. The Commission has initiated this proceeding by engaging an Independent Agency, The Energy and Resources Institute (TERI) as consultant to carry out a study to assess the availability of biomass and determination of price of biomass in different districts of the State of Gujarat.
- 1.1. The aforesaid study was entrusted by the Commission to TERI in compliance to the decision and direction of the Hon'ble APTEL in Appeal No. 132 & 133 of 2012 and upheld by the Hon'ble Supreme Court vide its Judgment/Order dated 05.07.2016 in Civil Appeal No. 1973 & 1974 of 2014. The relevant portion of the Judgment dated 2.12.2013 in Appeal No. 132 & 133 of 2012 of the Hon'ble APTEL is reproduced below:

“31. Considering all the above factors, we feel that this is an appropriate case where the State Commission should examine and consider to re-determine the biomass fuel price. It should not be considered as a review of its earlier order dated 17.5.2010. In fact this should be considered as re-determination of tariff invoking the powers of the State Commission under the Electricity Act, 2003 to review the tariff in the circumstances of the case to avert closure of the biomass fuel based projects in the State.

32. In view of above, we remand the matter to the State Commission for consideration of re-determination of biomass fuel price and consequently the tariff. However, we want to make it clear that we are not rendering any specific finding about what should be the price of biomass fuel. But the revised price of biomass fuel shall be applicable prospectively.

34. Summary of our findings:

The State Commission has the powers to reconsider the price of biomass fuel and consequently revise the tariff of the biomass based power plants in the State in view of the circumstances of the case as the biomass plants in the State are partially closed and operating at suboptimal Plant Load Factor due to substantial increase in the price of biomass fuel and in order to avert their closure. In our opinion in the circumstances of the case, this is a fit case for the State Commission to reconsider and re-determine the biomass fuel price.

35. In view of above, the Appeals are allowed and the matter is remanded to the State Commission for re-consideration of the biomass fuel price and consequently re-fixing of the tariff of Biomass Based Power Projects. The State Commission is directed to pass the consequential order within four months from the date of communication of this judgment. No order as to costs.”

As per the aforesaid directive of Hon’ble APTEL, the Commission is mandated to re-determine the price of Biomass fuel and consequently the tariff taking into

consideration the availability of biomass and its price prevailing in the State based on the scientific study. Accordingly, the Commission has assigned the aforesaid task to TERI.

- 1.2. TERI has carried out the study in six districts of the State of Gujarat namely, Amreli, Bhavnagar, Junagadh, Bharuch, Vadodara and Sabarkantha. The existing biomass power plants which are located in the districts of Amreli, Junagadh and Bhavnagar have executed Power Purchase Agreements (PPAs) with GUVNL for supply of electricity generated from biomass at the tariff agreed between the parties as per the Generic Tariff determined by the Commission vide Order No. 5 of 2010 dated 17.05.2010.
- 1.3. TERI has collected the primary data by visiting various agricultural fields and industries associated with the biomass utilization in aforesaid six districts and ascertained the availability of biomass and its utilization by interacting with the farmers and the agencies/organizations/industries.
- 1.4. TERI has also collected the secondary data from various Departments of the State Government as recorded in the report.
- 1.5. TERI has also evaluated the availability of biomass taking into consideration cultivation of various crops and availability of residue from such crops in the form of husk, stalks, straw, shell, bagasse etc.

- 1.6. Based on their study TERI has derived the price of various biomass available in the State and also determined various parameters like its GCV, moisture content, dust/sand content etc. in different districts of the State as a part of the aforesaid study and compiled it in their report.
- 1.7. TERI has studied the agriculture scenario and crop patterns in different parts of the State for the period from 2012-13 to 2016-17. However, TERI has based their study report considering the availability of data of Directorate of Agriculture, Gandhinagar, Gujarat.
- 1.8. TERI has in its study verified the availability of biomass and its use for alternative purposes also. The study has been carried out specifically for six districts including Junagadh, Amreli and Bhavnagar Districts where the biomass based power plants have been set up by the project developers who have signed PPAs with GUVNL to supply the power generated from their power plants. The details of biomass availability, its utilisation and cost of such biomass with consideration of the farmers' remuneration, labour charges, shredding cost, transportation, moisture content, dust/sand/stone percentage in the biomass and weight loss due to such factors, loading and unloading cost, etc. have been worked out by them. Based on such details, TERI has determined the cost of biomass in the aforesaid districts of the State. Similar methodology is also adopted by them while

determining the biomass availability and price of the biomass in other districts namely, Sabarkantha, Bharuch and Vadodara.

2. The report of TERI was uploaded on the Commission's website and public notice was also issued in the following newspapers inviting comments and suggestions from the stakeholders:

- 1) Business Standard dated 17.06.2017
- 2) Divya Bhaskar News Paper dated 17.06.2017
- 3) Sandesh News Paper dated 17.06.2017

In response to above the Commission received objections and suggestions from the following stakeholders.

- (i) Abellon Clean Energy Limited
- (ii) Gondal Chamber of Commerce & Industry
- (iii) Gujarat Urja Vikas Nigam Limited
- (iv) Junagadh Power Projects Private Limited
- (v) Amreli Power Projects Limited
- (vi) Utility Users' Welfare Association

- 2.1. Hearing was held on 07.07.2017. The submissions made by the Stakeholders/Objectors during the hearing as well as vide their written submissions on the discussion paper are dealt with in the following paragraphs.

Objections by Stakeholders

3. Shri A. Mohan Reddy, on behalf of M/s Amreli Power Projects Limited and M/s Junagadh Power Projects Limited submitted as under:

- 3.1. The observation of TERI in respect of Cotton Stalk for Amreli district that “the reason for burning this stalk is due to cost involved in uprooting it from the field with no alternative use of the stalk thereafter” is not correct. In some cases, the farmers supply the stalk to the power plants which will be in wet form having moisture of 50-60%. In majority cases the Agents would supply cotton stalk in the form of stalks or the material is chipped in the field and chipped material is supplied to the power plant. It is not possible for the power plants to collect the material directly from the farm as it would involve 200-300 tractors. These facts are not captured by TERI in their Report.
- 3.2. TERI has indicated that the farmers are paid remuneration of Rs. 300-500 per ton which is far from truth. It is minimum Rs. 1000/ton.
- 3.3. Groundnut shell is always supplied by the agents and not by the oil mills directly. The agents have a strong network and have arrangements with oil mills.
- 3.4. At table 3.7 of it’s Report, TERI has considered selling price of ground nut shell from oil mills to power plant at Rs. 2.50 to Rs. 4.00 (Avg. Rs. 3.25) per kg. whereas selling price by contractor to the power plant is Rs. 3.00 to Rs. 4.50 (Avg. Rs. 3.75) per kg. However, while calculating the estimated cost of groundnut shell as stated at Table 3.15 of the report it has considered Rs. 2,500 to 3,000 per ton or an average of Rs. 2,750 per ton i.e. Rs. 2.75 per kg.

- 3.5. When it is a fact that ground nut shell is supplied by agents only and they have estimated a price of Rs. 3.00 to Rs. 4.50 per kg., the average price should have been Rs. 3,750 per ton. It is always experienced that in reality the price of groundnut shell varies from Rs. 3,500 per ton to Rs. 5,500 in off-season.
- 3.6. TERI has not made serious attempt for collection of facts. No evidence is furnished in the report in respect of the prices considered for determination of fuel cost. TERI did not speak to the power plant developers to seek any clarification on the data collected by them. There is contradiction between prices provided in the tables and final determination of cost.
- 3.7. In Junagadh, price of Groundnut shell during season starts at Rs. 3,800 and goes up to Rs. 5,500 (average Rs. 4,650/-). TERI has not brought out these facts anywhere in the report and considered the price of Rs. 3.5 to Rs. 4.5 (Avg. Rs. 4) per kg. and while arriving at the weighted avg. cost of fuel, has considered groundnut shell price as Rs. 2,750 which is contrary to their own price assumptions of Rs. 3.5 to Rs. 4.5 per kg and actual facts when the price was ranging from Rs. 3,800 to 5,500/ton.
- 3.8. TERI has stated that groundnut shell is packed in gunny bags and transported to users, which is not correct. The groundnut shell while being sold to the power plants and other end users is filled into trucks loosely, compacted and covered for transportation.

3.9. Further, for cotton stalk, when farmers supply the material directly from the field, the moisture content varies from 40% to 60%. Even when it is supplied by the agents in the form of stalk or chips, the moisture content remains at 40-50%. TERI has simply assumed it at 15% without any basis.

3.10. GCV of cotton stalk as per TERI report is 4472 kCal/kg., which cannot be this high. It is not known how the sample was selected and what part of the sample was delivered to lab. Under no circumstances GCV will be higher than 3400 kCal/kg. and in support of their arguments, they submitted a lab report indicating GCV as 3240 kCal/kg. Also, when the sample was tested by TERI at Noida lab, most probably 7-8 days would have passed since it was uprooted and the moisture level would have significantly dropped by then.

4. Shri Tarun Rokadiya, on behalf of M/s Abellon Clean Energy Limited submitted as under:

4.1. TERI has used a combination of primary and secondary data while developing the report.

4.2. TERI has stated that one of the key limitations was that “there is no commercial use and no established supply chain mechanism for field residues” and consequently “price determination is largely based on inputs from farmers”. It implies that TERI has relied heavily on the inputs received from farmers and did

not independently validate the farm-to-gate supply chain or the process steps required from sourcing to receipt of biomass and post-process steps of biomass.

- 4.3. Though TERI has assumed the remuneration to farmer, the price expectation of farmer is much higher if approached by a company and/or trader.
- 4.4. TERI in the report, at 'Section 2.5 - Biomass Cost Analysis', has stated that "the cost of man-day is around Rs. 200 as per the interaction with farmer groups", which is incongruent with the prevailing minimum labour wages of around Rs. 350-375/day.
- 4.5. TERI has considered only the operational expenses (fuel, labour) as a part of the shredding cost but not considered the owning cost of such pre-processing equipment. Pre-processing equipment is expensive and not generally owned by the farmers as it is not part of their core farm equipment. Such equipment has to be supplied by the biomass power plant operator, which adds to the overall cost of biomass. This has not been considered by TERI.
- 4.6. Reaching out to individual farms level for arranging collection & transportation of waste is not possible and there are traders/entrepreneurs that organise collection of biomass. Accordingly, there is a trader margin of about Rs. 125-150/Ton, which has not been captured by TERI in the cost build-up.

- 4.7. Transportation cost has been assumed for 25 kms. only, whereas in reality the biomass is being transported as far as 50 kms. This additional cost needs to be considered. TERI has not captured the actual transportation cost from any farm to any of the biomass power plants in the region but only made assumptions.
- 4.8. TERI has considered the cost-build up during single season and that too at the time of its survey. Cost of biomass is substantially higher as the harvesting seasons come to a close. The demand for cotton stalks remains constant but the supply starts shrinking. Farmers/traders take advantage of this and increase the price. TERI should have considered the average price during peak/off-peak supply season in its report and accordingly taken a weighted average.
- 4.9. TERI has not detailed the sampling methodology and apparently represents a totally unscientific approach. Only one sample of each type of biomass was analysed as evident from Annexure XII of TERI's report, which is insufficient considering their visit to several farms across six districts in Gujarat. Enough samples should have been drawn to create a database and run statistical analysis to arrive at average GCV with some measure of confidence.
- 4.10. Only 16-40 grams of biomass sample was submitted to lab for analysis, which is highly insufficient to derive conclusion. Sample should have been taken as-is from farm level and also it is unclear what part of the biomass was submitted for analysis. The data therefore cannot be considered reliable/representative.

- 4.11. There is no data on the age of the sample and source from where it was taken as this has significant impact on the moisture content and hence heat value. Cotton stalk has high moisture (30-40%) when it is uprooted from the field. Moisture of biomass at the farm level is not captured.
- 4.12. TERI has not made any efforts to cross-reference or validate its submission on GCV of biomass considering that it is only significantly out of range with what has been approved by GERC in previous control order and proposed (3400 Kcal/kg) in this control period but also with respect to biomass heat value considered by other leading States in India.
- 4.13. TERI has not interacted with the biomass power developers or visited the plants or captured biomass sample from plants, but has interacted with Sugar mills, briquette manufacturers and oil companies during the field study and has ignored capturing data/info from the important stakeholders.
- 4.14. He also made representation on the commercial aspects as proposed in the Discussion Paper, such as waiver of CSS, EHV/PF rebate, applicability of proposed commercial aspect to all the projects including existing, etc.
5. Shri V. T. Patel, on behalf of Gujarat Urja Vikas Nigam Limited submitted as under:

- 5.1. TERI has analysed Biomass fuel price and other parameters mainly on the basis of interactions with few farmers and other industries. These numbers are too small to be considered as representative figures for respective district as a whole to arrive at any decision on that basis.
- 5.2. It is submitted that there is a large variation in the district wise price of cotton stalk considered in the report which is unusual as all the districts except Vadodara and Bharuch are having geographic similarities and having more or less similar crop patterns i.e. predominantly cotton and groundnut.
- 5.3. In the Report it is stated that cotton stalks do not have much commercial uses and are often disposed of by burning it in Agricultural field or ploughed back to soil and also at present there are no transactions with respect to cotton stalk. No details are provided about the farmer's remuneration but the same is assumed based on the interactions with the farmers. It will not be appropriate or prudent to consider remuneration to farmers on the assumption basis at Rs. 200-500 per Tonne based on interactions with farmers during survey and more particularly when the report itself states that there is no alternative use of cotton stalk and farmers are willing to sell at labour cost.
- 5.4. Also in the absence of organized market, consideration of higher remuneration will lead to vicious cycle wherein higher cost consideration will result into further

request for increase in biomass price and so on. Hence, average remuneration to farmers should not be considered more than Rs. 200/Ton.

5.5. In the report, district wise different labour cost towards uprooting, bundling and loading has been considered at Rs. 800-1200 per Ton (Avg. Rs. 1000/Ton) on the basis of interaction with few farmers. However, the report ignores that the activities related to uprooting, bundling and collection of cotton stalk are carried out manually involving labour only on small scale/individual basis, otherwise activities on large scale basis such as collection of cotton stalk as a biomass fuel for power generation will involve mechanized work with very less manual intervention and less time consuming. Accordingly, cost towards uprooting, bundling and collection of cotton stalk involving mechanised work may not be more than 700 Rs. /ton.

5.6. Report considers the shredding cost at Rs. 350/ton on assumption basis, however, shredding is carried out using the shredding machine which is part of Biomass project itself under Plant & Machineries and its operating cost is part of O&M cost. No further cost is required to be considered as a part of biomass fuel cost.

5.7. Report considers the cost of transportation at Rs. 300-500/Ton (Avg. Rs 450/Ton), with transportation being carried out through tractors and for upto 25 kms. For Tractors having capacity of approx. 5 tonne, the transportation cost works out at Rs. 45/km, which is excessive and far from reality and may not be

more than Rs. 30 per km. Accordingly, cost of transportation should not be more than Rs. 300 per Ton. Also no extra cost of unloading biomass should be considered in the age of hydraulic tractors.

- 5.8. It is not correct to consider the weight loss merely on the basis of statement of biomass power producers. Lab test certificate on GCV analysis of cotton stalk states 7.70% whereas in the report it is taken at 15% on assumption basis. Weight loss due to storage/dust etc. taken as 5% is on higher side and is without any basis. The weight loss on this account may not be more than 2%. Accordingly, overall weight loss for cotton stalk may not be more than 10%. Commission may, therefore, consider average landed price of cotton stalk not more than Rs. 1350 per tonne, uniformly across all 6 districts.
- 5.9. As per the report when groundnut shell is to be purchased from oil mills, there is no logic to consider the cost component in the name of farmers' remuneration.
- 5.10. As per the test certificate attached with the Report, the GCV of Groundnut shell is 4315 kCal/kg as against GCV of 4472 kcal/kg of cotton stalk. Since equivalent heat value of groundnut shell is lower than cotton stalk, there is no justification to consider higher cost for groundnut shell. It should not be more than Rs. 2500/Tonne for all three districts including the cost of loading and unloading.
- 5.11. Transportation of Groundnut shell should not be more than Rs. 350/Ton as Trucks being the transportation mode with 10 tonne capacity and fare of Rs. 35/km.

- 5.12. Dry groundnut shells are generated in the oil mill during crushing process, hence, it is not correct to consider moisture content for such dry by-product at 5%. The weight loss due to dust/storage etc. may not be more than 2% and accordingly overall weight loss may not be more than 2%. Thus, landed cost of groundnut shell should not be more than Rs. 2900/Ton for all three districts.
- 5.13. It is stated in the report that apart from cotton, sugarcane crop is predominant in Bharuch District. Since the bagasse based power project is envisaged to be set up as co-located, co-generation power project, in the various orders of the Commission, there is no requirement to consider overheads such as transportation, loading, unloading and traders margin etc. for sugarcane bagasse. Therefore, the Commission may consider the average cost of bagasse as not more than Rs. 1750 per Tonne being average of Rs. 1600-1900.
- 5.14. As inferred from the Report, Castor stalk is predominant in Vadodara and Sabarkantha districts and Paddy straw in Vadodara district. There is not much difference in the characteristics of castor stalk/paddy straw as a biomass fuel in comparison to cotton stalk in terms of alternative use of these fuels and other related costs. Hence, average landed price of castor stalk and paddy straw in line with the average landed price of cotton stalk should not be more than Rs. 1350/Ton.

5.15. Proportion of various types of biomass fuels considered in the report is inconsistent and contrary. For certain districts, say Junagadh and Amreli, though it is stated that ample quantity of cotton stalk is available, its proportion is considered on lower side (35%) whereas for other districts higher proportion of cotton stalk is considered (80%- Bhavnagar, 90% - Bharuch and 100%-Vadodara) disregarding the stated difficulties of storage, self-heating etc. If higher proportion of cotton stalk is considered for certain districts, there is no logic and justification for considering the proportion of cotton stalk at lower side for other districts on the basis of stated difficulties, specifically when surplus cotton stalk is said to be available in ample quantity for these three districts also.

5.16. Consideration of higher proportion of groundnut shell in case of Junagadh and Amreli is contrary to the findings in the report itself. Given the availability of large quantum of cotton stalk and limited surplus generation of groundnut shell from oil mills and its higher landed cost with lower GCV in comparison to cotton stalk, it is prudent and reasonable to consider utilization of cotton stalk proportion for Amreli, Junagadh and Bhavnagar at 90% cotton stalk and 10% groundnut shell.

5.17. The determination of price for Biomass fuel in the report may be made applicable prospectively.

6. Shri Chetan Bundela, on behalf of Torrent Power Limited submitted that he has nothing to comment on the Report of TERI. The Commission may validate the Report and take appropriate view in this regard. However, other aspects relating to Biomass/Bagasse projects as proposed in the Discussion paper may not be considered in the present proceedings but separately, if any.

7. Utility Users' Welfare Association has submitted as under:
 - 7.1. It is stated in the report that "Bio-Coal Industries are buying groundnut shell at Rs. 3.50 to 4.50 per kg and selling bio coal at Rs. 5 to 6 per kg. Looking to the current scenario of price of indigenous and imported coal, which range in Rs. 1700-1900 with GCV of 4800-5000 Kcal/Kg and Rs. 2000-2500 with GCV of 5800-6000 Kcal/Kg respectively, who is going to pay the rate of Bio-Coal of Rs. 5000-6000 per ton and vice versa. Moreover, which Bio-Coal industry will buy groundnut shell at Rs. 3.50-Rs. 4.50 per kg, when coal itself is cheaper than the groundnut shell. So the sanctity of the report as long as the price of groundnut shell and cotton stalk is concerned is required to be verified.

 - 7.2. Also, when the Bio-Coal manufacturers can manage to get 54000 tons of only groundnut shell per year as stated by TERI, it is the responsibility of the power project developers to arrange the required quantum of biomass at the least price.

- 7.3. As per the GCV and price of Biomass considered in TERI Report, with 15% of conventional fossil fuel allowed, the fuel price will be lower than that determined by the Commission in generic Order No. 5 of 2010 dated 17.5.2010.
- 7.4. TERI has not approached the Agricultural University in Anand, Junagadh and Dantiwada for the collection of proper data and to discover the real price of the biomass.
- 7.5. Transportation charges, loading and unloading charges considered in TERI Report inflate the biomass prices.
- 7.6. The biomass power project developers have failed to manage and procure the biomass for required quantum and at reasonable prices.
- 7.7. Challenge of disposal of biomass waste is the social responsibility of all the stakeholders and a need of hour but it should not be the case that such social responsibilities and the need is converted into the greed and business of windfall gain at the cost of society and consumers.
- 7.8. Fixing the price of biomass fuel is a key question to be considered as price of different types of biomass is not stable and is varying as per the phenomenon of economics i.e. demand and supply.

- 7.9. The Commission vide its Order No. 5/2010 dated 17.5.2010 directed all the Biomass project developers to submit monthly details of the category of fuel used duly certified by Chartered Accountant to GEDA as nodal agency. Hence, it is necessary to call for and verify such details of biomass fuel used by these power project developers submitted to GEDA in compliance with the Order.
8. Gondal Chambers of Commerce & Industry has requested the Commission to apply the biomass prices as stated by TERI in its Report.

Commission's Observation:

9. We have considered the submissions made by various stakeholders and shared the same with TERI. Taking into consideration the comments/suggestions from various stakeholders TERI has since carried out the necessary changes wherever required and has revised their report which is now available on the Commission's website (www.gercin.org). The Commission has decided the price including GCV of different biomass based on final report as well as the suggestions of the stakeholders.
- 9.1. The major contention of the stakeholders with diversified views is on the cost of the biomass and its GCV. The project developers stated that the cost of biomass considered by TERI in its report is quite lower than the actual price of biomass prevailing in the market. While utilities and consumers' organisation have stated that the price of biomass considered by TERI is quite high.

9.2. We note that TERI has evaluated the availability of various types of biomass based on the cropping pattern in various parts of the State, land used for agriculture purpose in the different districts, harvesting time, cultivation of various types of crops, quantum of residue available from such crops received from the Director of Agriculture, Government of Gujarat etc. Moreover, it has also evaluated the residues available from various crops and the total quantum of different types of biomass generated in the State. TERI has also considered different uses of biomass like (i) utilisation as fodder to animals, (ii) cooking purpose, (iii) industrial purpose, (iv) utilisation for other products like Bio-Coal manufacturing, (v) captive use by Oil Mills etc. TERI has also considered the use of different types of biomass by the mid-day meal institutions etc. and derived the quantum of biomass availability in different districts of the State for power generation.

9.3. As far as the cost of biomass is concerned, TERI has interacted with the farmers about the labour cost payable for uprooting the crops from the farms, remuneration to the farmers for the biomass specifically cotton stalks, castor stalk etc., loading charges and transportation charges. The market price of biomass during different periods of the years i.e. during the season when crops are available in plenty and during off season when no crops are available has been evaluated by TERI. TERI has also considered the cost for shredding of cotton stalks, loading and unloading cost of biomass.

- 9.4. While deriving the biomass price, TERI has considered percentage of moisture content in different types of biomass, and weight loss due to moisture content. It has also considered the percentage of dust and sand/stone content in the biomass and weight loss in Kg/tonne on account of the same. TERI has also considered the additional cost towards the additional quantum of biomass needed on account of loss due to moisture content and dust/sand particles in the biomass. TERI has evaluated different types of biomass availability and has derived the cost of biomass as fuel for the power plants in six different districts of the State.
- 9.5. A summary of different types of biomass in six districts as a crop residue, its GCV, moisture content, weight loss due to moisture, weight loss due to dust, sand/stone, total weight loss and net surplus availability of biomass and the cost of such biomass is stated in the table below:

Junagadh

Table 9.1: Estimated surplus of Cotton stalk in the district

A	Total cotton stalk generated in the district (K.M.T)	360.56
B	Estimated demand of cotton stalk in domestic cooking and other works (K.M.T)	72.11
C	Estimated demand of cotton stalk in Bio coal industries (K.M.T)	18.03
D	Total annual demand of cotton stalk (K.M.T) [B+C]	90.14
E	Estimated net surplus cotton stalk (K.M.T) [A – D]	270.42

Table 9.2: Estimated surplus of Groundnut shell in the district

A	Total groundnut shell generated in the district (K.M.T)	195.86
B	Total groundnut shell consumed by bio coal industries (K.M.T)	54.00
C	Estimated annual groundnut shell consumed by oil mills (K.M.T)	13.50
D	Estimated annual groundnut shell lost while groundnut eating (K.M.T)	39.17
E	Total annual consumption of groundnut shell (K.M.T) [B+C+D]	106.67
F	Estimated surplus groundnut shell (K.M.T) [A-E]	89.19
G	Potential surplus of groundnut shell (K.M.T) [A-C-D]*	143.19

* Potential surplus includes the quantity of groundnut shell which is currently consumed by bio coal industries but can be potentially available for alternate competitive use.

Table 9.3 Biomass Production (Generation), Consumption, and Surplus (K.M.T/annum)

Type of crop residue	Production	Consumption/Demand House Hold/Bio-coal	Surplus
Cotton stalk	360.56	90.14	270.42
Groundnut shell	195.86	52.67	143.19

Table 9.4: Estimated cost of Cotton stalk

Particulars	Average cost (Rs./Ton)	Reference
Farmer's remuneration	350 (200-500)*	Farmer's interview
Labour charges for uprooting, bundling and loading	900 (800-1000)*	Farmer's interview
Shredding cost	350	Farmer's interview
Transportation cost (0–25 km)	350	Local source
Unloading cost	100	Local source
Average Landed cost	2,050	

* Figures in brackets give the price range during the year

Table 9.5: Cost of Groundnut shell

Particulars	Average cost (Rs./Ton)	Reference
Cost of groundnut shell charged by oil mill	3,100 (2,800–3,400)*	From oil mill
Loading and Unloading	200	From oil mill
Transportation cost (0 – 50 km)	450	From oil mill
Average Landed cost	3,750	

* Figures in brackets give the price range during the year

Table 9.6: Final cost of Groundnut shell and Cotton stalk considering losses

Description	Biomass Price/ton	Moisture		Dust/sand/stone		Total Weight losses in kg per ton	Biomass Price Per ton considering losses
		%	Weight loss in kg per ton	%	Weight loss in kg per ton		
GN Shell	3750	5*	50	-	-	50	3947
Cotton Stalk	2050	15	150	5	50	200	2563

* In case of GN shell, moisture and handling losses together have been considered at 5%.

Amreli

Table 9.7: Estimated surplus of Cotton stalk in the district

A	Cotton stalk generated in district (K.M.T)	1569.22
B	Estimated demand of cotton stalk in domestic cooking and other works (K.M.T)	313.84
C	Estimated net surplus cotton stalk (K.M.T) [A-B]	1255.38

Table 9.8: Estimated surplus of Groundnut shell in the district

A	Groundnut shell produced in the district (K.M.T)	29.49
B	Ground nut shell used by oil mills for their captive use (K.M.T)	2.43
C	Ground nut shell lost while eating groundnut (K.M.T)	5.89
D	Estimated potential surplus groundnut shell (K.M.T) [A-B-C]*	21.17

* Although all the surplus groundnut shells are currently consumed by bio-coal industries but it can be considered as potential surplus as it can be utilised for other competitive use.

Table 9.9: Estimated cost of Cotton stalk

Particulars	Average cost (Rs./Ton)	Reference
Farmers Remuneration	400 (300–500)*	Farmers' interview
Collection cost (Labour charges for uprooting, bundling and loading)	900 (800–1000)*	Farmers' interview
Transportation cost 0–25 km.	400 (300–500)*	Local source
Unloading cost	200	From farmers
Processing cost (Shredding cost)	350	Farmers' interview
Average landed cost	2,250	

*Figures in brackets give the price range during the year

Table 9.10: Estimated cost of Groundnut shell

Particulars	Average cost (Rs./Ton)	Reference
Crop residue cost from oil mills (including loading and unloading)	2,750 (2,500–3,000)*	From oil mills
Transportation 0–50 km.	400	From oil mills
Average landed cost	3,150	

* Figures in brackets give the price range during the year

Table 9.11: Final cost of Groundnut shell and Cotton stalk considering losses

Description	Crop residue Price/ton	Moisture		Dust/sand/stone		Total Weight losses per unit	Crop residue Price Per ton considering losses
		%	Weight loss per unit	%	Weight loss per unit		
GN Shell	3,150	5*	50	-	-	50	3,316
Cotton Stalk	2,250	15	150	5	50	200	2,813

* In case of GN shell, the moisture and handling losses have together been considered at 5%.

Bhavnagar

Table 9.12: Estimated surplus of Cotton stalk in the district

A	Cotton stalk generated in Bhavnagar (K.M.T)	800.91
B	Estimated demand of cotton stalk in domestic cooking (K.M.T)	200.23
C	Estimated demand of cotton stalk in Bio-coal industries (K.M.T)	40.04
D	Total annual demand of cotton stalk (K.M.T) (B+C)	240.27
E	Estimated net surplus cotton (K.M.T.) (A-D)	560.64

Table 9.13: Estimated surplus of Groundnut shell in the district

A	Total Generation of groundnut shell in Bhavnagar district (K.M.T)	34.12
B	Total estimated annual groundnut shell consumption in bio-coal industries (K.M.T)	10.13
C	Total estimated annual groundnut shell consumption for local consumptions (K.M.T)	6.82
D	Ground nut shell consumed by oil mills (K.M.T)	2.83
E	Total annual utilization of groundnut shell (K.M.T) [B+C+D]	19.78
F	Net availability of groundnut shell (K.M.T) [A-E]	14.34
G	Potential availability of groundnut shell in the district (K.M.T) [A-C-D]*	24.47

* Potential availability includes groundnut shell consumption in bio-coal industries. Although, it is consumed in bio-coal industries but it is potentially available for competitive uses if other competitive demand exists in future.

Table 9.14: Biomass Production (Generation), Consumption, and Surplus (K.M.T/annum)

Type of crop residue	Production	Demand	Potential Surplus
Cotton stalk	800.91	240.27	560.64
Groundnut shell	34.12	9.65	24.47

Table 9.15: Estimated cost of Cotton stalk

Particulars	Average Cost (Rs/Ton)	Reference
Farmer's remuneration	400 (300-500)*	Interaction from farmer
Labour charges for uprooting, bundling and loading	1000 (800-1,200)*	Farmer's interview
Shredding cost	350	Farmer's interview
Transportation cost (0-25 km)	500	Local source
Unloading cost	100	From farmers
Average Landed cost	2,350	

* Figure in brackets gives the price range during the year

Table 9.16: Estimated cost of Groundnut shell

Particulars	Average Cost (Rs./Ton)	Reference
Cost of groundnut shell charged by oil mill	2,750 (2,500-3,000)*	From oil mill
Loading and unloading cost	200	From oil mill
Transportation (0-50 km)	450	From oil mill
Average Landed cost	3,400	

* Figure in brackets gives the price range during the year

Table 9.17: The final cost of Groundnut shell and Cotton stalk considering losses

Description	Crop residue Price/ton	Moisture		Dust/sand/stone		Total Weight losses per unit	Crop residue Price Per ton considering losses
		%	Weight loss per unit	%	Weight loss per unit		
GN Shell	3,400	5*	50	-	-	50	3,579
Cotton Stalk	2,350	15	150	5	50	200	2,938

* In case of GN shell, the moisture and handling losses have together been considered at 5%.

Bharuch

Table 9.18: Major crop residue generated in Bharuch District

Crop Residue	Quantity (K.M.T)	Consumption (K.M.T)				Net surplus (K.M.T)
		Household Cooking	Fodder	Industry	Manure	
Cotton Husk	42.67	-	-	-	42.67	-
Cotton Boll Shell	42.67	-	-	-	42.67	-
Groundnut Shell	0.29	-	-	-	0.00	0.29
Groundnut stalk	1.95	-	1.95	-	-	-
Wheat Pod	14.64	-	-	-	14.64	-
Bajra Stalk	1.47	1.47	-	-	-	-
Bajra Husk	0.22	-	-	-	0.22	-
Bajra Cob	0.24	-	-	-	0.24	-
Sugarcane bagasse	82.81	-	-	82.81	-	-
Sugarcane tops & leaves	12.55	-	-	-	-	12.55
Rice Straw	38.80	-	38.80	-	-	-
Rice Stalk	38.80	-	-	-	38.80	-
Rice Husk	5.17	-	-	5.17	-	-
Maize Stalk	2.20	-	2.20	-	-	-
Maize Cob	0.33	-	0.33	-	-	-
Cotton Stalk	310.73	-	-	-	93.22**	-
Castor Stalk	67.20	48.47*	-	-	-	386.99
Pigeon Pea Stalk	136.11	-	-	-	-	-
Wheat Stalk	73.22	-	-	-	58.58**	-
Aggregate	872.07	49.94	43.28	87.98	291.04	399.83

* Explained in Table 2.22

** Explained in Table 2.21

Table 9.19: Total crop residue generation of bagasse in Bharuch District

Sugar Industry	Bagasse generated (tons per day)	No. of days the industry is functional in a year	Total Bagasse generated at each unit (K.M.T)
Shree Ganesh Khand Udyog Sahakari Mandli Ltd.	1,120	180	201.60
Shree Khedut Sahakari Khand Udyog Mandli Ltd.	1,200	180	216.00
Aggregate			417.60

Table 9.20: Consumption and estimated surplus analysis for sugarcane bagasse in Bharuch District

Sugar Industry	Bagasse generated (tons/day)	Bagasse used by sugar industry (tons/day)	Surplus bagasse (tons/day)	No. of days industry is functional in a year	Surplus bagasse (K.M.T)
Shree Ganesh Khand Udyog Sahakari Mandli Ltd.	1,120	850	270	180	48.60
Shree Khedut Sahakari Khand Udyog Mandli Ltd.	1,200	750	450	180	81.00
Aggregate					129.60

Table 9.21: Generation of different stalks in the district

Different stalks	Total production (K.M.T)	Stalk ploughed back into the field (K.M.T)	Remaining stalk (K.M.T)
Cotton Stalk	310.73	93.22 @ 30%	217.51
Wheat Stalk	73.22	58.58 @ 80%	14.64
Pigeon pea stalk	136.11	-	136.11
Castor stalk	67.20	-	67.20
Aggregate	587.26	151.80	435.46

Table 9.22: Estimated annual crop residue cooking consumption and surplus in District

A	Particulars	Values
B	Remaining stalk after ploughing back (K.M.T)	435.46
C	Total household in Bharuch District	335,098
D	Households using crop residue as a fuel for cooking	22,134
E	Per day per household cooking requirement (kg)	6
F	Estimated annual crop residue demand for cooking in Bharuch District (K.M.T)	48.47
G	Estimated surplus stalk in the district (K.M.T) [B-F]	386.99

Table 9.23: Estimated cost of Sugarcane bagasse in Bharuch District

Particulars	Average Cost (Rs/Ton)	Reference
Material cost of bagasse purchased from Sugar industries	1,750 (1,600–1,900)*	Sugar industries
Transportation 0–50 km.	350 (300–400)*	Bio-coal industries
Loading and unloading	200 (160–240)*	Bio-coal industries
Trader's margin	200	Bio-coal industries
Average landed cost	2,500	

* Figures in brackets give the price range during the year

Table 9.24: Estimated cost of stalks in Bharuch District

Particulars	Average Cost (Rs/Ton)	Reference
Farmers Remuneration	500	Farmers
Uprooting cost	775 (750–800)*	Agricultural officers in extension offices
Loading cost	90 (80–100)*	Agricultural officers in extension offices
Transportation cost 0 – 25 Kms.	400	Bio-coal industries

Particulars	Average Cost (Rs/Ton)	Reference
Unloading cost	90 (80–100)*	Agricultural officers in extension offices
Processing cost (Shredding)	350	Local source
Average landed cost	2,205	

* Figures in brackets give the price range during the year

Table 9.25: Final cost of Sugarcane bagasse and stalks considering losses

Description	Crop residue Price/ton	Moisture		Dust/sand/stone		Total Weight losses per unit	Crop residue Price Per ton considering losses
		%	Weight loss per unit	%	Weight loss per unit		
Sugarcane bagasse	2,500	25	250	5	50	300	3,571
Stalks of crop residues	2,205	15	150	5	50	200	2,756

Vadodara

Table 9.26: Estimated annual cooking consumption and availability of all stalks in district

A	Total Stalks (Cotton, Castor and Pigeon pea) generated in the district (K.M.T)	555.55
B	Total household in Vadodara district	418,851
C	Households using crop residue as a fuel for cooking	53,126
D	Per day per household cooking requirement (kg)	6
E	Estimated annual consumption of stalks for cooking (K.M.T)	116.34
F	Estimated amount of stalks ploughed back into the field (K.M.T) (30%)	166.67
G	Estimated available stalks of cotton, castor and pigeon pea (K.M.T) [A-E-F]	272.54

Table 9.27: Data of the midday meal cooking pattern

District	Total no. of Institutions	Mode of cooking (No. of Schools)			
		LPG	Solar Cooker	Fire wood	Others
Vadodara	1297	1297	0	0	0

Source: MDM office, Gandhinagar

Table 9.28: Biomass production, consumption, and surplus (K.M.T/annum)

Biomass	Production	Consumption	Surplus
Stalks of cotton, castor and pigeon pea	555.55	283.01	272.54
Paddy husk	12.64	12.64	12.64*
Sugarcane bagasse	8.14	8.14	0
Total	576.33	303.79	285.18

*currently consumed in brick kilns but potentially available for competitive use

Table 9.29: Cost of stalks of Cotton, Castor and Pigeon pea

Particulars	Stalks of cotton, castor and pigeon pea (Rs/Ton)
Labour charges for uprooting, bundling and loading	1,100 (1,000-1,200)*
Shredding cost	350
Farmer's remuneration	500
Transportation cost (0-25 Kms)	450
Unloading cost	125
Average Landed cost	2,525

* Figure in bracket shows price range

Table 9.30: Cost of Paddy husk

Particulars	Paddy husk (Rs/Ton)	References
Processing cost	1,500	From rice mill owner
Loading, unloading and packing cost	900	From rice mill owner
Transportation (0-50 km)	800	From rice mill owner
Average Landed cost	3,200	

Table 9.31: Final cost of Paddy husk and Stalk of Cotton, Castor & Pigeon pea considering losses

Description	Biomass Price/ton	Moisture		Dust/sand/stone		Total Weight losses per unit	Biomass Price Per ton considering losses
		%	Weight loss per unit	%	Weight loss per unit		
Stalk of cotton, castor and pigeon pea	2,525	15	150	5	50	200	3,156
Paddy husk	3,200	-	-	5	50	50	3,368

Sabarkantha

Table 9.32: Total estimated annual stalks consumption in Sabarkantha District

A	Stalks of castor and cotton generated in Sabarkantha (K.M.T)	579.79
B	Total no of households using crops residue as cooking fuel	69022
C	Per day per household fuel consumption (Kg)	6
D	Annual demand of stalks for cooking (K.M.T)	151.16
E	Amount of stalks ploughed back into the field (K.M.T) [30% of A]	173.94
F	Demand of stalks in bio-coal industries (K.M.T) [10% of A]	57.98
G	Total annual demand of stalks [D+E+F]	383.08
H	Estimated surplus stalks (K.M.T) [A-G]	196.71

Table 9.33: Estimated surplus of Groundnut shell in the district

A	Total groundnut shell generated in the district (K.M.T)	36.44
B	Total groundnut shell consumed in bio-coal industries (K.M.T)	4.05
C	Estimated annual groundnut shell consumed by oil mills (K.M.T)	0.45
D	Estimated annual groundnut shell lost while ground nut eating (K.M.T)	7.29
E	Total annual consumption of groundnut shell (K.M.T) [B+C+D]	11.79
F	Estimated surplus groundnut shell (K.M.T) [A-E]	24.65
G	Potential surplus of groundnut shell (K.M.T) [A-C-D]*	28.70

* Potential surplus includes the quantity of groundnut shell which is currently consumed by bio-coal industries but can be potentially available for alternative competitive use.

Table 9.34: Cost of Cotton stalk

Particulars	Cotton stalk (Rs/Ton)	Reference
Farmer's remuneration	500	From farmer
Labor charges for uprooting, bundling and loading	900 (800-1,000)*	From farmers
Shredding cost	350	From farmers
Transportation cost (0-25 Kms)	500	Local sources
Unloading cost	100	From farmers
Av. Landed cost	2,350	

* Figures in brackets give the price range during the year

Table 9.35: Cost of Castor stalk

Particulars	Castor stalk (Rs/Ton)	Reference
Farmers' remuneration	500	From farmers
Labour charges for uprooting, bundling, and loading	700 (600-800)*	From farmers
Shredding cost	350	From farmers
Transportation cost (0-25 km)	500	From farmers
Unloading cost	100	From farmers
Av. Landed cost	2,150	

* Figures in brackets give the price range during the year

Table 9.36: Cost of Groundnut shell

Particulars	Average Cost (Rs./Ton)	Reference
Cost of groundnut shell	2,875 (2,725-3,025)*	From oil mill
Loading and unloading cost	200	From oil mill
Transportation (0-50 km)	475 (450-500)*	From oil mill
Average Landed cost	3,550	

* Figure in brackets gives the price range during the year

Table 9.37: Final cost of cotton stalk, castor stalk and groundnut shell considering losses

Description	Biomass Price/ton	Moisture		Dust/sand/stone		Total Weight losses per unit	Biomass Price Per ton considering losses
		%	Weight loss per unit	%	Weight loss per unit		
Cotton Stalk	2,350	15	150	5	50	200	2,938

Description	Biomass Price/ton	Moisture		Dust/sand/stone		Total Weight losses per unit	Biomass Price Per ton considering losses
		%	Weight loss per unit	%	Weight loss per unit		
Castor Stalk	2,150	15	150	5	50	200	2,688
Groundnut shell	3,550	5*	50	-	-	50	3,737

* In case of GN shell, the moisture and handling losses have together been considered at 5%.

9.6. We note that in six districts of the State which were considered for study, the biomass available are cotton stalks, groundnut shell, sugarcane bagasse, paddy husk, castor stalk and pigeon pea. The details of different biomass available in percentage terms in all the six districts of the State, GCV, moisture content, dust/sand/stone content, surplus available and cost inclusive of losses, on account of moisture, dust/sand/stones, etc. as per TERI are stated in Table 1 below.

Table -1

Junagadh							
Weight	Crop residues	Cost (Rs./MT)	Moisture (%)	Dust / Sand / Stone (%)	Cost incl. losses (Rs./MT)	GCV (kcal/kg)	Surplus in KMT/Annum
35%	Cotton Stalk	2050	15	5	2563	4472	270.42
65%	Groundnut shell	3750	5	-	3947	4315	143.19
	Weighted Average				3463	4370	

Bhavnagar							
Weight	Crop residues	Cost (Rs./MT)	Moisture (%)	Dust / Sand / Stone (%)	Cost incl. losses (Rs./MT)	GCV (kcal/kg)	Surplus in KMT/Annum
65%	Cotton Stalk	2350	15	5	2938	4472	560.64
35%	Groundnut shell	3400	5	-	3579	4315	24.47
	Weighted Average				3066	4441	

Amreli							
Weight	Crop residues	Cost (Rs./MT)	Moisture (%)	Dust / Sand / Stone (%)	Cost incl. losses (Rs./MT)	GCV (kcal/kg)	Surplus in KMT/Annum
35%	Cotton Stalk	2250	15	5	2813	4472	1255.38

65%	Groundnut shell	3150	5	-	3316	4315	21.17
	Weighted Average				3140	4370	

Bharuch							
Weight	Crop residues	Cost (Rs./MT)	Moisture (%)	Dust / Sand / Stone (%)	Cost incl. losses (Rs./MT)	GCV (kcal/kg)	Surplus in KMT/Annum
-	Stalks	2205	15	5	2756	4472	386.99
-	Sugarcane Bagasse	2500	25	5	3571	2250	129.60

Sabarkantha							
Weight	Crop residues	Cost (Rs./MT)	Moisture (%)	Dust / Sand / Stone (%)	Cost incl. losses (Rs./MT)	GCV (kcal/kg)	Surplus in KMT/Annum
43.5%	Cotton Stalk	2350	15	5	2938	4472	98.355
43.5%	Castor Stalk	2150	15	5	2688	3876	98.355
13%	Groundnut shell	3550	5	-	3737	4315	28.700
	Weighted Average				2933	4192	

Vadodara							
Weight	Crop residues	Cost (Rs./MT)	Moisture (%)	Dust / Sand / Stone (%)	Cost incl. losses (Rs./MT)	GCV (kcal/kg)	Surplus in KMT/Annum
90%	* Cotton Stalk, Castor and Pigeon Pea'	2525	15	5	3156	4273.67	272.54
10%	Paddy Husk	3200	-	5	3368	3737.00	12.64
	Weighted Average				3177	4220	

* Considering equal weightage (i.e. 1/3) of stalks of Cotton, Castor and Pigeon Pea for GCV purpose i.e. Cotton Stalk (4472), Castor Stalk (3876) and Pigeon Pea (4473)

9.7. Submissions/objections made by the different stakeholders, findings of TERI and Commission's decision in respect of different kinds of biomass are dealt with hereunder:

9.7.1. Cotton Stalk:

- (i) Farmer's remuneration in Table 2.11 of the Report is stated as Rs. 200-500, while in final calculations it is considered as Rs. 300-500. However, the actual remuneration is about Rs. 1000 per MT.

- (ii) The labour cost is considered in the report @ Rs. 200 per day. The minimum labour charges payable as per the Government Notification is about Rs. 300 per day.
- (iii) The shredding cost considered as processing cost of Rs. 350 per MT. However, the cost for hiring such machines is not considered which is about Rs. 350-375 per day.
- (iv) The moisture content in cotton stalk is considered as 15% and dust content as 5% only, while actually the same is about 40% to 50%. Some of the objectors contended that moisture content and dust content considered by TERI is on higher side. It is negligible, hence the same is required to be considered less than 20%.
- (v) Cost of cotton stalks considered as Rs. 2050 in Table 2.11 and Rs. 2250 in Table 3.14 of the report are itself contradictory with each other.
- (vi) Cotton stalks are not directly available to the project developers but the same are available only through agents who are arranging the biomass as mediators between the users and suppliers and charge about Rs. 150/MT to Rs. 200/MT as commission.
- (vii) Cost of cotton stalks is about Rs. 5000 to Rs. 5200 per MT, which is ignored by TERI.
- (viii) No person from TERI approached the project developers, who are having their plants in the State.
- (ix) Transportation cost needs to be considered for 50 km distance

- (x) The capacity of tractor used for transportation of cotton stalk be considered as 5 MT and accordingly the transportation cost needs to be evaluated.
- (xi) The size of sample sent to the laboratory by TERI for evaluation of the GCV of the Cotton stalk was quite low i.e. 16 gram only and the same was also sent after many days after collection from the field. As a result, the sample became dry and therefore the GCV of cotton stalk is not reflecting correct value, which is in the range of 3000 to 3300 Kcal/Kg.

9.7.2. Commission's Analysis and Decision:

9.7.2 (i) The aforesaid contentions of the objectors are without any supporting documents. TERI has carried out ground survey and also obtained sample from the field during their visit to different districts of the State. They have interacted with the farmers, Government officials, private entrepreneurs and also interacted with the local people associated with the subject matter of biomass. They have also interacted with the industries who are using the biomass for different purposes. TERI has also mentioned about alternate uses of biomass.

9.7.2 (ii) Some of the objectors have contended that the cost of cotton stalk may be higher and it may vary from Rs. 800 to Rs. 1000/MT. While some of the objectors contended that no cost is paid to the farmers. Hence, the cost of

cotton stalks payable to farmers is not correct. The farmers are demanding higher price for the biomass once the biomass utilisation is started by the project developers in their plants and demand goes up. The objectors contended that as stated in the report that, farmers are charging Rs. 300 - Rs. 500 per MT as remuneration, for cotton stalk is not correct. We note that TERI has considered the cost of cotton stalks payable to the farmers as Rs. 300 to Rs. 500 per metric tonne. It is an admitted fact that when the cotton stalks is not used for purposes other than as fodder or as fuel for domestic purpose / cooking, then the same is burnt in the farm by the farmers. Moreover, they need to pay to the labourers for uprooting the same from the farm or alternatively, they themselves uproot the same. Therefore, the contention of the objectors, that the cost of cotton stalk may vary from Rs. 800 to Rs. 1000 per MT does not seem to be valid, because if the alternate use of cotton stalks is available then there is no need to burn the same in the farm by the farmers. It is an additional income available to the farmers from the purchaser who bears the cost of uprooting the cotton stalks from the farm and also removes the same from the farm. Hence, the contention of the objector is not acceptable and the same is rejected.

9.7.2 (iii) The Commission has also considered the remuneration to farmers for cotton stalks as Rs. 400 per MT though as per TERI report the farmers are burning such biomass in their farms. There is uprooting cost to the farmer.

Hence, the Commission decided to consider the above cost as a remuneration to the farmers.

9.7.2 (iv) We note that the project developer needs to ensure the availability of biomass for the project with proper planning. It is also contended by objectors that there are agents who arrange such biomass for the project developers from the farmers and are charging commission of Rs. 150 per MT to Rs. 250 per MT, which is not considered by TERI. We note that TERI has carried out the ground survey and interacted with the farmers, industries etc. They have also studied about the alternative uses of the biomass available in different districts of the State. As far as cotton stalk is concerned, it is recorded by TERI that it has limited other uses. The farmers are burning the cotton stalks in their farms. They are not receiving any amount for such cotton stalks from the industries or the persons who use the same. They need to pay for the uprooting of the cotton stalk, if not purchased by any persons. Thus, instead of receiving the amount for cotton stalks, the farmers are compelled to pay for uprooting of the same from their fields. However, TERI has considered Rs. 300 to Rs. 500 per MT as remuneration to farmers, which is reasonable.

9.7.2 (v) We further note the contention of objectors that the labour charges considered as Rs. 200 per day per labourer is lower than the minimum

wages payable as per the Government Notification. We note that the cost of labour considered by TERI is based on the interactions with the farmers who are availing the services of labour as per their requirement from time to time. The cost is paid by the farmers to labourers based on the prevailing rate in the villages. Moreover, the labour charges in the villages may vary depending upon the demand and supply of labourers. Therefore, the contention of the objectors that the labour charges need to be considered based on the Government Notification for minimum wages payable to the labourers is unfounded in the aforesaid case. The labour charges paid by the farmers to such labourers depends upon the bargaining. Such labourers are working in unorganised manner and it is possible that the Government Notification/Rules may not be followed strictly in such places. Sometimes it may also vary from season to season and demand and supply of labour during different seasons. Moreover, there is no document provided by the objectors in support of their claim that the labourers are receiving the minimum wages from the farmers. TERI has considered the labour charges in their report based on the interaction with the farmers and others. However, we are of the view that the labourers who carry out the uprooting of the cotton stalk in the farm must be paid the minimum wages, as per Govt. Notification 1/13(1)2017-LS-II dated 20.04.2017 which works out to Rs. 308 for 'C' class area and accordingly, the cost of labour would work out to Rs.1540/MT. The Commission is of the view that Rs.1540/MT is a

reasonable cost for labour charges in compliance of Government Notification for payment of minimum wages.

9.7.2 (vi) It is contended by some of the objectors that the transportation cost considered by TERI is lower than the actual cost required to be incurred by the project developers. The transportation cost for cotton stalk has been considered limited to 25 Kms while biomass at times is required to be transported for 50 Kms or more. Moreover, some of the objectors have raised the issue of capacity of tractors used for transportation of the cotton stalks, i.e. approximately 5 tonne and accordingly the transportation cost works out to Rs. 300 instead of Rs. 500 per tonne considered in the report. We note that availability of biomass within the area of 0 to 25 kms is recorded in the report by TERI and accordingly, the cost of transportation is considered between Rs. 300 to 500 per MT. However, it may be possible that some times the cotton stalk may be either available at a distance beyond 25 kilometres or at a distance shorter than 25 kms. TERI has considered the availability of biomass and transportation distance at an average radius range of 0-25 kms and accordingly the cost of transportation is factored in the cost of cotton stalk. Since there is no certainty about the distance for transportation of the cotton stalks, we decide an average distance of 0-50 kms. for transportation of cotton stalk as a part of the cost of biomass as suggested by the objectors and the cost of transportation as

Rs. 450/MT. Though capacity of tractor may be 5 MT but cotton stalk being voluminous the capacity is to be considered in volume and not in weight.

9.7.2 (vii) The Commission has also considered the cost of loading/unloading at the rate of Rs. 125 per MT wherever the same is applicable. In case of the cotton stalks, etc. the cost for uprooting, shredding, bundling etc. is considered with the consideration that the man power for aforesaid work would be used for loading the biomass for transportation from the farm. Therefore, the cost of unloading only at power plant is considered in such cases.

9.7.2 (viii) Some of the objectors have raised the issue that TERI has not considered the rental cost for equipment utilised for shredding, cutting and bundling of cotton stalks. They have considered only processing cost and not the capital cost of equipment. Thus, the cost of biomass, specifically for the cotton stalks is considered less by TERI. The aforesaid contention of the objectors is not valid and not acceptable because while determining the biomass tariff the Commission considers the cost of various equipments utilised for shredding, cutting, and bundling of biomass as a part of the capital cost and the operating cost of such equipment as part of the O & M cost. The cost stated in the report by TERI is pertaining to the cost of

utilisation of various equipments for shredding of the cotton stalks etc. and the cost of manpower for operating of the said equipment. The same cannot, therefore, be allowed while determining the cost of biomass otherwise there will be duplication of cost and higher impact on the final tariff payable by the distribution licensee and ultimately the consumers. Hence, the aforesaid objection is not acceptable and the same is rejected.

9.7.2 (ix) Some of the objectors have contended that GCV of cotton stalks considered by TERI is not appropriate and valid because the moisture content and dust/sand/stone in the cotton stalk is about 40% to 50%, while in calculation the same has been considered as 20%. Thus, the weight loss of 200 kg. considered is quite low as compared to the actual total weight loss of about 450 to 500 kg. Some of the objectors have contended that the moisture content and weight loss due to dust, sand and stone considered is not warranted because the cotton stalks are cut, shred and bundled in the farm, and therefore, the moisture content is negligible. Moreover, there is no dust, sand and stone with such biomass. We note that the biomass is uprooted from the field and the same is shredded, cut and bundled in the field itself prior to transporting it to the power plant. Therefore, the moisture content present in the cotton stalks get reduced drastically once it is shredded, cut and bundled as it takes some time to complete the process. However, some amount of moisture might still be present in cotton stalks

along with sand/dust and stones. Some weight loss occurs due to moisture and other impurities and the same needs to be factored in the cost of cotton stalks. TERI has carried out ground survey and derived the price of cotton stalks after considering weight loss due to moisture content as about 15% and percentage of impurities like sand, dust, stone as 5%. We, therefore, note that the contentions raised by the objectors are not valid and the same are rejected.

9.7.2 (x) While determining the cost of the cotton stalks the Commission has decided the moisture content of cotton stalk as 15% as stated by TERI in its report because the moisture content is derived based on scientific testing. Further the Commission has also decided to allow additional quantity of the biomass to compensate for the loss which may occur due to moisture and allow the cost of such additional quantity of biomass to provide comfort to the project developers. The moisture content may also vary from season to season. Moreover, during the period from collection of cotton stalks till its actual utilisation the moisture content may reduce drastically than what is stated in the report by TERI. However, the contention of the objectors that it is about 40% to 50% is not admissible and acceptable. The Commission is of the view that the loss due to 15% moisture and 5% dust/sand/stone need to be factored in the tariff by allowing additional quantum of cotton stalk and cost of such additional

quantum to be included in the total cost of cotton stalk in tariff determination.

9.7.2 (xi) We also note that the loss due to moisture content or dust/sand in the biomass leads to requirement of additional quantum of fuel. TERI has therefore, while deciding the cost of biomass with consideration of loss due to moisture, dust sand/stones and GCV of such biomass added additional quantum of 20% of cotton stalks to arrive at the total cost of cotton stalks. Once, the loss due to moisture and dust/sand particles has been factored in as the loss on this account, the contention of the objectors is not sustainable and the same is rejected.

9.7.2 (xii) Some of the objectors have disputed the test certificate submitted with the report by TERI in which GCV of the cotton stalks has been certified as 4472 kcal/kg which is quite high as compared to the actual GCV, the sample size is very small as only 16 gram sample was tested and the same has been tested after lapse of some days since collection of sample from the field. It is contended that as the sample was submitted to the laboratory after lapse of some days, it may have dried and the moisture content may not be present at that time as the moisture content is found to be 7.78% only, which is substantially lower than actual. Further, the cotton stalks whenever collected as biomass and utilised for generation of electricity at

power plant, it has GCV of about 3000 kcal/kg to 3300 kcal/kg. Thus, the GCV considered based on test report by the TERI is not correct. We note that the test certificate has been issued by AES Laboratories (P) Ltd., which is accredited by NABL. As per the certificate a sample of 16 gram cotton stalk was tested by AES Laboratories (P) Ltd. The test results are stated below:

TEST CERTIFICATE

*Issued To: The Energy and Resource Institute (TERI)
Darbari Seth Block, I H C Complex,
Loadhi Raod, New Delhi, Delhi 110 003*

Description: Said to be Cotton Stalk, Sample Qty 16 g in paper envelope.

RESUTLS

<i>Particular Units</i>	<i>Test Method</i>	<i>Results</i>
<i><u>Chemical Analysis</u></i>		
<i>Moisture</i>	<i>ASTM D3173-87(1996)</i>	<i>7.78 %</i>
<i><u>Physical Analysis</u></i>		
<i>Gross Calorific Value (As Such Basis)</i>	<i>ASTM D5865-99a</i>	<i>4472 cal/gm</i>

Total Parameters: 2

9.7.2 (xiii) From the aforesaid test report it is clear that the moisture content found is 7.78% and the GCV of the cotton stalks sample is found as 4472 cal/gm. Thus, the test report though confirms about the existence of the moisture content, the same is found to be to the extent of 7.78% during the testing of the sample. Further, the GCV has been evaluated on per gram

basis. The contention of the objectors that the sample may have dried because the cotton stalk may have been sent for testing after 7 or 8 days and during that period the moisture content may have evaporated and the testing would have been carried out on dried sample. We note that the biomass which includes cotton stalks is procured by the project developers and the same is stored in the stockyard so as to ensure uninterrupted availability of biomass to the power plant. Further, the Commission allows interest on working capital on one month's stocks of the biomass. The biomass of cotton stalks purchased by the project developer remains for few days in the stockyard of the project developer before it is utilised as a fuel for power generation. In such a situation the cotton stalks may be as good as the sample provided to laboratory for testing by TERI. It is also possible that the biomass used from the stockyard of the project developer for generation of electricity may not be completely dry and there may be some percentage of the moisture content and GCV equivalent to what is found in the test report i.e. 7.78% and 4472 Kcal/Kg. All the contentions of the objectors in this regard are not acceptable.

9.7.2 (xiv) Based on above, and considering the availability of Cotton stalk, Castor stalk and Pigeon Pea stalk in different districts of the State, the GCV and cost of such biomass are determined by the Commission as stated below:

Table -2

	Moisture Content in %	Sand/Dust /Stone in %	Farmers Remuneration OR Supplier cost as applicable in Rs./Ton	Labour Charges for uprooting, bundling and loading charges in Rs./Ton	Shredding cost in Rs./Ton	Transportation cost in Rs. / Ton	Unloading cost in Rs./Ton	Agent Charges / Traders Margin in Rs./Ton	Average landed Cost in Rs./Ton	Addl. Amount arising on account of weight loss due to moisture, dust, sand in Rs./Ton	Price after considering losses in Rs./Ton
				@ 5 mandays x Rs. 308 per manday		0 - 50 kms					
1	2	3	4	5	6	7	8	9	10	11	12
Stalks of Cotton, Castor, Pigeon Pea	15%	5%	400	1540	350	450	125	125	2990	748	3738

Table -3

District	Weightage	Crop residues	Cost (Rs./ton)	GCV (kcal/kg)	Surplus-Availability in KMT/Annum
Junagadh	35%	Cotton Stalk	3738	4472.00	270.42
Bhavnagar	65%	Cotton Stalk	3738	4472.00	560.64
Amreli	35%	Cotton Stalk	3738	4472.00	1255.38
Bharuch	-	Cotton Stalk	3738	4472.00	386.99
Sabarkantha	43.5%	Cotton Stalk	3738	4472.00	98.355
Vadodara	90%	Cotton Stalk, Castor and Pigeon Pea'	3738	4273.67*	272.54
		Weighted Average	3738	4453.00	

* Considering equal weightage (i.e. 1/3) of stalks of Cotton Stalk (4472), Castor Stalk (3876) and Pigeon Pea (4473)

9.7.3 Groundnut Shells:

- (i) Some of the objectors have stated that TERI in Table 2.12 of the report stated that the groundnut shell price as charged by the oil millers range between Rs, 2800 to Rs. 3400 per MT while in Table 3.15 it is stated that the price of groundnut shell available from the oil millers including the loading and unloading cost ranges between Rs. 2500 to Rs. 3000. Moreover, the loading and unloading cost may be about Rs. 200 as per Table 2.12 of the report. Further, additional cost of transportation within the radius of 0 to 50 kilometers of about Rs. 450 is considered in Table 2.12 whereas the same is considered as Rs. 400 in Table 3.15 and thus, the price of groundnut shell has been worked out as Rs. 3750 per MT in Table 2.12 and Rs. 3150 in Table 3.15. Thus, in the report itself there is difference in the price of biomass considered by TERI.

- (ii) Some of the objectors contended that the cost of groundnut shell stated in the report is not correct because the groundnut shell is not available directly from the oil millers to the project developers but the same is available only through agents/traders. They need to pay about Rs. 150 to Rs. 250 per MT to agents as commission/remuneration. Further, TERI report says that the groundnut shell is supplied at site of the plant or consumption place in gunny bags which is not correct as the same is supplied in open truck or tractor.
- (iii) Some of the objectors have contended that as per TERI report the moisture content of groundnut shell is 5% while the project developers who are using the groundnut shells have observed the same to be about 15%. Thus, the moisture content considered in the report is quite low and it is reflected in the cost of the groundnut shell.
- (iv) Sales tax at the rate of 5% applicable on the groundnut shell is not considered by TERI which is required to be factored.
- (v) Sample size sent for testing of GCV was very small and highly insufficient to derive conclusion. The GCV of groundnut found in the test report as 4315 cal/gm apparently represents a totally unscientific approach of sampling.

9.7.4 Commission's Analysis and Decision:

9.7.4 (i) We note that Table No. 2.12 of Chapter 2 of the Report is pertaining to cost of groundnut shell in Junagadh district while Table 3.15 of Chapter 3 is pertaining to cost of groundnut shell in Amreli district. Thus, the cost considered by TERI in aforesaid two tables is based on the price prevailing in the respective districts. We note that TERI while considering the crop residue cost from oil mills in Table 3.15 pertaining to Amreli district has taken the same in the range of Rs. 2500 – 3000 and has also mentioned that the same is including the loading and unloading cost, which is considered about Rs. 200 in the report by TERI for other districts, i.e. Junagadh and Bhavnagar districts. We note that the loading and unloading cost needs to be factored in while deciding the price of groundnut shell as the groundnut shell is required to be loaded at oil mill and unloaded at the place of consumption, i.e. at power plant.

9.7.4 (ii) TERI has considered the price of ground nut shell in Junagadh district as Rs. 2800 – 3400 per MT. The average of the said range works out to Rs. 3100 per MT. In Amreli district it is stated to be in the range of Rs. 2500 – 3000 per MT which includes loading and unloading charges while in Bhavnagar district it is stated in the range of Rs. 2500 – 3000 per MT. The availability of groundnut shell in the Junagadh district was found to be 143.19 KMT., which is highest in the State. The comparative quantum of

groundnut shell available in Amreli District is 21.17 KMT, while in Bhavnagar the same is 24.47 KMT. The Commission has decided the cost of groundnut shell as Rs. 3100 per MT considering the highest quantum of groundnut shell available in the Junagadh district.

9.7.4 (iii) The Commission has also considered the cost of loading/unloading at the rate of Rs. 125 per MT, wherever the same is applicable. The groundnut shells are loaded at Oil Miller's place and unloaded at power stations by two different sets of labourers. Therefore, the loading and unloading cost is applied at both places at the rate of Rs. 125 per MT.

9.7.4 (iv) As far as the cost of agent, i.e. Rs. 150 to Rs. 250 per metric tonne is concerned, it may be noted that when any project is set up by the project developer he needs to operate it for 25 years and for the uninterrupted operation of the plant, it is the duty of the project developer to ensure availability of fuel, its quantum and price. There is no reason to involve the agents for procuring the groundnut shells from oil millers or any other persons. However, if any agent or trader is required to be involved, the cost of such agent must be as low as possible because such agent carries out only trading or arranges the supply of biomass from the oil millers without any investment. However, in order to have assured supply of groundnut shells, we decide to consider the cost of agent as Rs. 125/MT to work out the total cost of groundnut shells as suggested by the objectors.

9.7.4 (v) We note that the moisture content considered for groundnut shell is disputed by some of the project developers. However, it is undisputed that there may be some moisture content in the groundnut shell.

9.7.4 (vi) We note that TERI has considered additional quantum of groundnut shells to take care of the loss due to moisture and handling loss and accordingly factored the additional cost of the same.

9.7.4 (vii) In case of groundnut shells the Commission has considered the moisture content as 5% as stated by TERI in its report. The moisture content in the groundnut shells also varies in different seasons. We clarify that the contention of the objectors that moisture content of the groundnut shells is higher than 5% is not acceptable. Further, the aforesaid contention is also not correct and admissible because the groundnut shells are available from the oil mills where the groundnuts are crushed for oil manufacturing after due process of separation of the groundnut from shells. In the absence of valid data with regard to moisture content of groundnut shell provided by the objectors to prove that the moisture content of the groundnut shell is higher than 5%, it is not appropriate to accept such contention. However, the Commission is of the view that the loss which may occur due to moisture content of the groundnut shells needs to be factored in while determining the biomass price. The Commission decides

that the additional quantity of the groundnut shells is required to take care of the loss due to moisture content and also the cost of such additional quantity of groundnut shells is required to be allowed for determining the cost of groundnut shells as biomass fuel. Hence, we decide to consider additional quantity of 5% of groundnut shells while determining the total cost of groundnut shells and GCV so as to promote generation from biomass as laid down by the Act and Policy.

9.7.4 (viii) Based on above, and considering the availability of Groundnut shells in different districts of the State, the GCV and cost are determined by the Commission as stated below:

Table - 4

	Moisture Content in %	Sand/Dust/Stone in %	Farmers Remuneration OR Supplier cost as applicable in Rs./Ton	Labour Charges for uprooting, bundling and loading charges in Rs./Ton	Shredding cost in Rs./Ton	Transportation cost in Rs. / Ton	Unloading cost in Rs./Ton	Agent Charges / Traders Margin in Rs./Ton	Average landed Cost in Rs./Ton	Addl. Amount arising on account of weight loss due to moisture, dust, sand in Rs./Ton	Price after considering losses in Rs./Ton
						0 - 50 kms					
1	2	3	4	5	6	8	9	10	11	12	13
Groundnut Shell	5%	0%	3100	125	0	450	125	125	3925	207	4132

Table – 5

District	Weight	Crop residues	Cost (Rs./ton)	GCV (kcal/kg)	Surplus-Availability KMT/Annum
Junagadh	65%	Groundnut shell	4132	4315	143.19
Bhavnagar	35%	Groundnut shell	4132	4315	24.47
Amreli	65%	Groundnut shell	4132	4315	21.17
Bharuch	-	-	-	-	-
Sabarkantha	13%	Groundnut shell	4132	4315	28.70
Vadodara	-	-	-	-	-
		Weighted Average	4132	4315	

9.7.5 Castor Stalk, Pigeon Pea Stalk, Sugarcane Bagasse, Paddy Straw and Paddy

Husk:

9.7.5 (i) In case of stalk of castor, stalk of pigeon pea, bagasse, paddy straw/husk etc. the Commission has considered the availability of aforesaid biomass, GCV, moisture content, cost etc. as recorded by TERI in its report, which is not objected by any objectors.

9.7.5 (ii) We note that the cost of transportation of paddy husk in the radius of 0 – 50 kms. is stated as Rs. 800 per MT by TERI in its report which seems valid due to low weight and higher volume for the same weight in comparison to other biomass transportation for a distance of 0-50 kms. Therefore, Commission decides to accept the same as Rs. 800 per MT. The cost of loading/unloading of paddy husk at the rate of Rs. 450/MT is worked out considering the requirement of manpower for handling voluminous quantum and low weight as compared to the manpower required for other biomass with same weight. Hence, the

Commission decides to adopt the labour cost for loading and unloading of paddy husk as considered by TERI.

9.7.5 (iii) Further, we also note that TERI has conducted study of the Biomass which includes Bagasse available in various districts like Bharuch, Surat, Navsari, Tapi, Valsad, Narmada, Gir Somnath, Vadodara etc. TERI has considered the average landed cost of Bagasse as Rs. 2500 per tonne considering the material cost of bagasse as Rs. 1750 per MT, transportation (0-50 kms) cost of Rs. 350 per MT, loading and unloading cost of Rs. 200 per MT and Trader's Margin of Rs. 200 per MT, while the GCV of Bagasse is stated by TERI as 2250 Kcal/Kg, which is not disputed by any stakeholders/objectors. TERI has considered labour and handling charges of Rs. 200 per tonne, transportation cost of Rs. 350 per tonne and traders' margin of Rs. 200 per tonne. However, considering the activities involved in removing the bagasse from the sugar factory, spreading it on the ground for drying, stacking the dried bagasse, loading it on tractor trolley for transportation to the power plant and unloading at the plant, the Commission decides to consider Rs. 325 per tonne for all the above activities. We, also, decide to accept the GCV of bagasse as 2250 Kcal/Kg as per TERI. The cost of bagasse is arrived at Rs. 2075/MT inclusive of Rs. 325 per MT towards traders' margin, loading, unloading, transportation etc.

9.7.5 (iv) The availability of Castor Stalks, Paddy Husk, and Bagasse in different districts of the State, its quantum, price, GCV, etc. are stated in the following Tables.

Table – 6

District	Weightage	Crop residues	Cost (Rs./ton)	GCV (kcal/kg)	Surplus-Availability in KMT/Annum
Bharuch	-	Sugarcane Bagasse	2075	2250	129.60

Table – 7

District	Weightage	Crop residues	Cost (Rs./ton)	GCV (kcal/kg)	Surplus-Availability in KMT/Annum
Sabarkantha	43.5%	Castor Stalk	3738	3876	98.355

Table – 8

District	Weightage	Crop residues	Cost (Rs./ton)	GCV (kcal/kg)	Surplus-Availability in KMT/Annum
Vadodara	10%	Paddy Husk	3368	3737	12.64

9.7.5 (vi) Based on the above and considering the availability of Castor Stalk, Pigeon Pea Stalk, Paddy Husk & Sugarcane Bagasse in different districts of the State, their GCV and cost are determined by the Commission as stated in the table below:

Table - 9

Various Costs and Parameters for Biomass

	Moisture Content in %	Sand/Dust/Stone in %	Farmers Remuneration OR Supplier cost as applicable in Rs./Ton	Labour Charges for uprooting, bundling and loading charges in Rs./Ton	Shredding cost in Rs./Ton	Transportation cost in Rs. / Ton	Unloading cost in Rs./Ton	Agent Charges / Traders Margin in Rs./Ton	Average landed Cost in Rs./Ton	Addl. Amount arising on account of weight loss due to moisture, dust, sand in Rs./Ton	Price after considering losses in Rs./Ton
						0 - 50 kms					
1	2	3	4	5	6	8	9	10	11	12	13
Castor & Pigeon Pea Stalk	15%	5%	400	1540	350	450	125	125	2990	748	3738
Paddy Husk	0%	5%	1500	450	0	800	450	0	3200	168	3368
Sugarcane Bagasse	0%	0%	1750	325*	0	0	0	0	2075	0	2075

* Includes cost towards activities involved in removing the bagasse from the sugar factor, spreading it on ground for drying, stacking the dried bagasse, loading it on tractor trolley for transportation to the power plant and unloading at the plant.

10. The Commission has determined average availability of different types of biomass in different districts, GCV of different biomass, and average cost of the different biomass based on TERI Report with its decision as stated above.
- 10.1. The percentage of moisture content, sand/dust/stone in such biomass, farmers' remuneration or supplier cost in Rupees Per Tonne, labour charges for uprooting and loading of various biomass, shredding cost, transportation cost, unloading cost etc. as decided are reproduced in the Tables below.

Table -10**Various Costs and Parameters for Biomass**

	Moisture Content in %	Sand / Dust / Stone in %	Farmers Remuneration OR Supplier cost as applicable in Rs./Ton	Labour Charges for uprooting, bundling and loading charges in Rs./Ton	Shredding cost in Rs./Ton	Transportation cost in Rs. / Ton	Unloading cost in Rs./Ton	Agent Charges / Traders Margin in Rs./Ton	Average landed Cost in Rs./Ton	Addl. Amount arising on account of weight loss due to moisture, dust, sand in Rs./Ton	Price after considering losses in Rs./Ton
						0 - 50 kms					
1	2	3	4	5	6	8	9	10	11	12	13
Stalks of Cotton, Castor, Pigeon Pea	15%	5%	400	1540	350	450	125	125	2990	748	3738
Groundnut Shell	5%	0%	3100	125	0	450	125	125	3925	207	4132
Paddy Husk	0%	5%	1500	450	0	800	450	0	3200	168	3368
Sugarcane Bagasse	0%	0%	1750	325*	0	0	0	0	2075	0	2075

* Includes costs towards activities involved in removing the bagasse from the sugar factor, spreading it on ground for drying, stacking the dried bagasse, loading it on tractor trolley for transportation to the power plant and unloading at the plant.

Table -11

Junagadh District				
Weightage	Crop residues	Cost (Rs./ton)	GCV (kcal/kg)	Surplus-Availability KMT/Annum
35%	Cotton Stalk	3738	4472	270.42
65%	Groundnut shell	4132	4315	143.19

Bhavnagar District				
Weightage	Crop residues	Cost (Rs./ton)	GCV (kcal/kg)	Surplus-Availability KMT/Annum
65%	Cotton Stalk	3738	4472	560.64
35%	Groundnut shell	4132	4315	24.47

Amreli District				
Weightage	Crop residues	Cost (Rs./ton)	GCV (kcal/kg)	Surplus-Availability KMT/Annum
35%	Cotton Stalk	3738	4472	1255.38
65%	Groundnut shell	4132	4315	21.17

Bharuch District				
Weightage	Crop residues	Cost (Rs./ton)	GCV (kcal/kg)	Surplus-Availability KMT/Annum
-	Cotton Stalk	3738	4472	386.99
-	Sugarcane Bagasse	2075	2250	129.60

Sabarkantha District				
Weightage	Crop residues	Cost (Rs./ton)	GCV (kcal/kg)	Surplus-Availability KMT/Annum
43.5%	Cotton Stalk	3738	4472	98.355
43.5%	Castor Stalk	3738	3876	98.355
13%	Groundnut shell	4132	4315	28.700

Vadodara District				
Weightage	Crop residues	Cost (Rs./ton)	GCV (kcal/kg)	Surplus-Availability KMT/Annum
90%	Cotton Stalk, Castor & Pigeon Pea	3738	*4273.67	272.54
10%	Paddy Husk	3368	3737.00	12.64

*Considering equal weightage (i.e. 1/3) of stalks of Cotton (4472), Castor (3876) and Pigeon Pea (4473)

Table -12**COST OF COTTON STALK - JUNAGADH DISTRICT**

Particulars	As per TERI Report		Cost considered by GERC (Rs./Ton)
	Cotton Stalk (Rs./Ton)	Reference	
Farmer's remuneration	200-500 (350)	From the farmer	400
Labour charges for uprooting, bundling and loading	800-1000 (900)	From the farmer	1540
Shredding cost	350	From the farmer	350
Transportation cost (0-25 km)	350	Local Source	450
Unloading cost	100	Local Source	125
Agent Charges			125
Average Landed Cost	2050		2990
Moisture in percentage (%)	15%		15%
Weight Loss due to moisture in Kg./Ton	150		150
Percentage of Dust / Sand / Stone (%)	5%		5%
Weight Loss due dust/sand/stone in Kg./Ton	50		50
Total Weight loss in Kg./Ton	200		200
Price considering losses in Rs./Ton	2563		3738

Table -13**COST OF GROUNDNUT SHELL - JUNAGADH DISTRICT**

Particulars	As per TERI Report		Cost considered by GERC (Rs./Ton)
	Groundnut shell (Rs./Ton)	Reference	
Charged by Oil Mill	2800 - 3400 (3100)	From the Oil Mill	3100
Labour charges for loading & unloading	200	From the Oil Mill	250
Transportation cost (0-50 km)	450	From the Oil Mill	450
Agent Charges			125
Average Landed Cost	3750		3925
Moisture in percentage (%)	5%		5%
Weight Loss due to moisture in Kg./Ton	50		50
Percentage of Dust / Sand / Stone (%)	0%		0%

Weight Loss due dust/sand/stone in Kg./Ton	0		0
Total Weight loss in Kg./Ton	50		50
Price considering losses in Rs./Ton	3947		4132

Table -14

COST OF COTTON STALK - BHAVNAGAR DISTRICT

Particulars	As per TERI Report		Cost considered by GERC (Rs./Ton)
	Cotton Stalk (Rs./Ton)	Reference	
Farmer's remuneration	300-500 (400)	From the farmers	400
Labour charges for uprooting, bundling and loading	800-1200 (1000)	From the farmers	1540
Shredding cost	350	From the farmers	350
Transportation cost (0-25 km)	500	Local Source	450
Unloading cost	100	From the farmers	125
Agent Charges			125
Average Landed Cost	2350		2990
Moisture in percentage (%)	15%		15%
Weight Loss due to moisture in Kg./Ton	150		150
Percentage of Dust / Sand / Stone (%)	5%		5%
Weight Loss due dust/sand/stone in Kg./Ton	50		50
Total Weight loss in Kg./Ton	200		200
Price considering losses in Rs./Ton	2938		3738

Table -15

COST OF GROUNDNUT SHELL - BHAVNAGAR DISTRICT

Particulars	As per TERI Report		Cost considered by GERC (Rs./Ton)
	Groundnut shell (Rs./Ton)	Reference	
Charged by Oil Mill	2500-3000 (2750)	From the Oil Mill	3100
Labour charges for loading & unloading	200	From the Oil Mill	250
Transportation cost (0-50 km)	450	From the Oil Mill	450
Agent Charges			125
Average Landed Cost	3400		3925

Moisture in percentage (%)	5%		5%
Weight Loss due to moisture in Kg./Ton	50		50
Percentage of Dust / Sand / Stone (%)	0%		0%
Weight Loss due dust/sand/stone in Kg./Ton	0		0
Total Weight loss in Kg./Ton	50		50
Price considering losses in Rs./Ton	3579		4132

Table -16

COST OF COTTON STALK - AMRELI DISTRICT

Particulars	As per TERI Report		Cost considered by GERC (Rs./Ton)
	Cotton Stalk (Rs./Ton)	Reference	
Farmer's remuneration	300 - 500 (400)	From the farmers	400
Labour charges for uprooting, bundling and loading	800-1000 (900)	From the farmers	1540
Shredding cost	350	From the farmers	350
Transportation cost (0–25 km)	300-500 (400)	Local Source	450
Unloading cost	200	From the farmers	125
Agent Charges			125
Average Landed Cost	2250		2990
Moisture in percentage (%)	15%		15%
Weight Loss due to moisture in Kg./Ton	150		150
Percentage of Dust / Sand / Stone (%)	5%		5%
Weight Loss due dust/sand/stone in Kg./Ton	50		50
Total Weight loss in Kg./Ton	200		200
Price considering losses in Rs./Ton	2813		3738

Table -17

COST OF GROUNDNUT SHELL - AMRELI DISTRICT

Particulars	As per TERI Report		Cost considered by GERC (Rs./Ton)
	Groundnut shell (Rs./Ton)	Reference	
Charged by Oil Mill	2500-3000 (2750)	From the Oil Mill	3100
Labour charges for loading & unloading	*		250
Transportation cost (0–50 km)	400	From the Oil Mill	450

Agent Charges			125
Average Landed Cost	3150		3925
Moisture in percentage (%)	5%		5%
Weight Loss due to moisture in Kg./Ton	50		50
Percentage of Dust / Sand / Stone (%)	0%		0%
Weight Loss due dust/sand/stone in Kg./Ton	0		0
Total Weight loss in Kg./Ton	50		50
Price considering losses in Rs./Ton	3316		4132

(*Labour charges included in cost of G.N. Shell as per TERI Report)

Table -18

COST OF COTTON STALK - BHARUCH DISTRICT

Particulars	As per TERI Report		Cost considered by GERC (Rs/Ton)
	Cotton Stalk (Rs/Ton)	Reference	
Farmer's remuneration	500	From the farmer	400
Labour charges for uprooting, bundling and loading	750-800 (775)	Agricultural Officers	1540
Shredding cost	350	Local Source	350
Transportation cost (0-25 km)	400	Bio-coal Industries	450
Loading cost	80-100 (90)	Agricultural Officers	
Unloading cost	80-100 (90)	Agricultural Officers	125
Agent Charges			125
Average Landed Cost	2205		2990
Moisture in percentage (%)	15%		15%
Weight Loss due to moisture in Kg./Ton	150		150
Percentage of Dust / Sand / Stone (%)	5%		5%
Weight Loss due dust/sand/stone in Kg./Ton	50		50
Total Weight loss in Kg./Ton	200		200
Price considering losses in Rs./Ton	2756		3738

Table -19**COST OF SUGARCANE BAGASSE - BHARUCH DISTRICT**

Particulars	As per TERI Report		Cost considered by GERC (Rs/Ton)
	Sugarcane Bagasse (Rs/Ton)	Reference	
Charged by Sugar Mill	1600-1900 (1750)	From Sugar Industries	1750
Labour charges for loading & unloading	160-240 (200)	Bio-Coal Industries	325*
Transportation cost (0–50 km)	300-400 (350)	Bio-Coal Industries	
Traders Margin/Agent Charges	200	Bio-Coal Industries	
Average Landed Cost	2500		2075
Moisture in percentage (%)	25%		0%
Weight Loss due to moisture in Kg./Ton	250		0
Percentage of Dust / Sand / Stone (%)	5%		0
Weight Loss due dust/sand/stone in Kg./Ton	50		0
Total Weight loss in Kg./Ton	300		0
Price considering losses in Rs./Ton	3571		2075

* Includes cost towards activities involved in removing the bagasse from the sugar factor, spreading it on ground for drying, stacking the dried bagasse, loading it on tractor trolley for transportation to the power plant and unloading at the plant.

Table -20**COST OF STALKS OF COTTON, CASTOR AND PIGEON PEA - VADODARA DISTRICT**

Particulars	As per TERI Report		Cost considered by GERC (Rs/Ton)
	Stalks of Cotton, Castor, Pigeon Pea (Rs/Ton)	Reference	
Farmer's remuneration	500		400
Labour charges for uprooting, bundling and loading	1000-1200 (1100)		1540
Shredding cost	350		350
Transportation cost (0–25 km)	450		450
Unloading cost	125		125
Agent Charges			125
Average Landed Cost	2525		2990
Moisture in percentage (%)	15%		15%
Weight Loss due to moisture in Kg./Ton	150		150
Percentage of Dust / Sand / Stone (%)	5%		5%
Weight Loss due dust/sand/stone in Kg./Ton	50		50

Total Weight loss in Kg./Ton	200		200
Price considering losses in Rs./Ton	3156		3738

Table -21

COST OF PADDY HUSK - VADODARA DISTRICT

Particulars	As per TERI Report		Cost considered by GERC (Rs/Ton)
	Paddy Husk (Rs/Ton)	Reference	
Processing cost	1500	From Rice Mill Owner	1500
Labour charges for loading & unloading	900	From Rice Mill Owner	900
Transportation cost (0-50 km)	800	From Rice Mill Owner	800
Agent Charges			0
Average Landed Cost	3200		3200
Moisture in percentage (%)	0%		0%
Weight Loss due to moisture in Kg./Ton	0		0
Percentage of Dust / Sand / Stone (%)	5%		5%
Weight Loss due dust/sand/stone in Kg./Ton	50		50
Total Weight loss in Kg./Ton	50		50
Price considering losses in Rs./Ton	3368		3368

Table -22

COST OF COTTON STALK - SABARKANTHA DISTRICT

Particulars	As per TERI Report		Cost considered by GERC (Rs/Ton)
	Cotton stalk (Rs/Ton)	Reference	
Farmer's remuneration	500	From the farmers	400
Labour charges for uprooting, bundling and loading	800-1000 (900)	From the farmers	1540
Shredding cost	350	From the farmers	350
Transportation cost (0-25 km)	500	Local Source	450
Unloading cost	100	From the farmers	125
Agent Charges			125
Average Landed Cost	2350		2990
Moisture in percentage (%)	15%		15%
Weight Loss due to moisture in Kg./Ton	150		150
Percentage of Dust / Sand / Stone (%)	5%		5%

Weight Loss due dust/sand/stone in Kg./Ton	50		50
Total Weight loss in Kg./Ton	200		200
Price considering losses in Rs./Ton	2938		3738

Table -23

COST OF CASTOR STALK - SABARKANTHA DISTRICT

Particulars	As per TERI Report		Cost considered by GERC (Rs./Ton)
	Castor stalk (Rs./Ton)	Reference	
Farmer's remuneration	500	From the farmers	400
Labour charges for uprooting, bundling and loading	600-800 (700)	From the farmers	1540
Shredding cost	350	From the farmers	350
Transportation cost (0-25 km)	500	From the farmers	450
Unloading cost	100	From the farmers	125
Agent Charges			125
Average Landed Cost	2150		2990
Moisture in percentage (%)	15%		15%
Weight Loss due to moisture in Kg./Ton	150		150
Percentage of Dust / Sand / Stone (%)	5%		5%
Weight Loss due dust/sand/stone in Kg./Ton	50		50
Total Weight loss in Kg./Ton	200		200
Price considering losses in Rs./Ton	2688		3738

Table -24

COST OF GROUNDNUT SHELL - SABARKANTHA DISTRICT

Particulars	As per TERI Report		Cost considered by GERC (Rs./Ton)
	Groundnut shell (Rs./Ton)	Reference	
Charged by Oil Mill	2725-3025 (2875)	From the Oil Mill	3100
Labour charges for loading & unloading	200	From the Oil Mill	250
Transportation cost (0-50 km)	450-500 (475)	From the Oil Mill	450
Agent Charges			125
Average Landed Cost	3550		3925

Moisture in percentage (%)	5%		5%
Weight Loss due to moisture in Kg./Ton	50		50
Percentage of Dust / Sand / Stone (%)	0%		0%
Weight Loss due dust/sand/stone in Kg./Ton	0		0
Total Weight loss in Kg./Ton	50		50
Price considering losses in Rs./Ton	3737		4132

10.2. The Commission has gone through all objections raised by each stakeholders and has tried to make a balance and considered opinion to reach at final numbers so as to protect the consumers' interest as well as to promote renewable energy in the State in line with objectives of the Act.

Table - 25

NET SURPLUS AVAILABILITY OF DIFFERENT BIOMASS AND ITS COST AND GCV

Based on availability of net surplus in six districts and Weighted Average

Net Surplus	Biomass	Wt. Average Cost	Wt. Average GCV
KMT		Rs./Tonne	Kcal/Kg
2662.63	Cotton Stalk	3738	4472
217.53	Groundnut Shell	4132	4315
189.20	Castor Stalk	3738	3876
90.85	Pigeon Pea Stalk	3738	4473
12.64	Paddy Husk	3368	3737
3172.85	Weighted Average for Gujarat	3764	4423
129.60	Sugarcane Bagasse	2025	2250

Weighted Average Cost for Gujarat in (Rs./Ton)	3764	Weighted Average GCV for Gujarat in (Kcal/Kg.)	4423
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11. Considering above, the derived weightage average GCV of different biomass (except Bagasse) available in the six district of the State is 4423 kcal/kg and the weighted average cost of works out to Rs. 3764 per MT. As the study is conducted in the FY 2017-18, the Commission decides to consider the aforesaid cost and GCV as the base for FY 2017-18, while deciding the energy charge for the project utilising the above fuel. The aforesaid parameters are the base parameters for determination of tariff i.e. energy charge of the biomass project.
12. The Commission further directs the biomass developers to submit the information on monthly consumption of each biomass at the beginning of each quarter to nodal agency and the Discom(s) with whom PPA has been signed. This information should be duly certified by Comptroller and Auditor General empanelled Chartered Accountant.
13. We order accordingly.

Sd/-
[P. J. THAKKAR]
Member

Sd/-
[K. M. SHRINGARPURE]
Member

Sd/-
[ANAND KUMAR]
Chairman

Place: Gandhinagar.
Date: 09/02/2018.