

**RESUBMISSION OF TARIFF REVISION PROPOSAL**  
**JULY 2016 TO JUNE 2019**



**BHUTAN POWER CORPORATION LIMITED**  
**APRIL 2016**

---

---

## Table of Contents

1. Background.....	3
2. Rationale for Tariff Revision.....	3
3. Methodology.....	4
4. Salient features of the tariff proposal .....	4
4.1 Tariff Structure for Medium Voltage and High Voltage Industries.....	4
4.2 Revision of the Miscellaneous Charge .....	5
5. Weighted Average Cost of Capital.....	5
5.1 Cost of Equity.....	5
5.2 Cost of Debt .....	6
5.3 Gearing .....	7
5.4 Tax rate.....	7
6. Operation and Maintenance Costs .....	8
6.1 Historical O&M cost .....	8
6.2 Current Replacement Cost .....	8
6.3 Inflation .....	8
6.4 O&M efficiency gains .....	8
7. Regulatory Fees .....	9
8. Asset Values and Depreciation.....	9
9. System Operator Costs .....	9
10. Investment Plan .....	10
11. Cost of working capital.....	12
11.1 Arrears .....	12
11.2 Inventory .....	12
12. Power Purchase.....	12
12.1 From Generating Companies .....	12
12.2 Import .....	12
12.3 Embedded Generation.....	12
13. Energy Sales Forecast.....	13
14. Losses .....	15
15. Non-Tariff Revenue.....	15
16. Allocation Factor .....	15
17. Subsidy .....	16
18. Cost of Supply .....	16
18.1 Unsubsidized Cost of Supply .....	17

---

---

18.2	Tariff Structure.....	17
19.	Tariff Structure with Subsidy .....	20
20.	Miscellaneous Charges .....	21
21.	Conclusion.....	22
22.	List of Appendices.....	22

## 1. Background

The prevailing tariff of Bhutan Power Corporation Limited (BPC) as shown in Table 1 below was approved by Bhutan Electricity Authority (BEA) for the period 1<sup>st</sup> October 2013 to 30<sup>th</sup> June 2016.

Tariff Structure		1 <sup>st</sup> October 2013- 30 <sup>th</sup> June 2014	1 <sup>st</sup> July 2014 to 30 <sup>th</sup> June 2015	1 <sup>st</sup> July 2015 to 30 <sup>th</sup> June 2016
<b>Low Voltage</b>				
LV Block I (Rural Domestic) (0-100 kWh)	Nu./kWh	0	0	0
LV Block I (Others) (0-100 kWh)	Nu./kWh	0.98	1.12	1.28
LV Block II (Others) (>100- 300 kWh)	Nu./kWh	1.86	2.13	2.45
LV Block I (Others) (> 300 kWh)	Nu./kWh	2.46	2.82	3.23
LV Bulk	Nu./kWh	2.56	3.07	3.68
<b>Medium Voltage</b>				
Energy Charge	Nu./kWh	1.98	2.19	2.43
Demand Charge	Nu./kW/month	155	195	235
<b>High Voltage</b>				
Energy Charge	Nu./kWh	1.67	1.81	1.96
Demand Charge	Nu./kW/month	130	155	180
Wheeling	Nu./kWh	0.114	0.114	0.114

*Table 1: Existing Approved Tariff*

The Tariff Determination Regulation (TDR) 2010 requires the tariff to be filed four months before the expiry of the tariff. Therefore, as per the requirement, the tariff proposal according to the existing Tariff Determination Regulation was submitted on 1<sup>st</sup> March, 2016.

The Domestic Electricity Tariff Policy is approved and as per letter no. BEA/CEO/Tariff/2015-16/717 dated 18<sup>th</sup> March 2016, the tariff application is required to be submitted according to the Domestic Electricity Tariff Policy (DETP). The Tariff Determination Regulation 2010 need to be revised according to the Domestic Electricity Tariff Policy. The revised Tariff Determination Regulation would cover the provisions of the DETP. However, BPC has computed tariff according to the provisions and the basis of calculation or the parameters of the provisions are explained. Therefore, the tariff proposal is being resubmitted.

## 2. Rationale for Tariff Revision

Bhutan Power Corporation Limited has plans to implement the work programs for capital investments in areas of Transmission, Distribution, Smart Grid, Embedded Generation and Corporate services which are in line with the BPC's Five Year Plans (FYP) and the major projects are in line with RGOB's FYP. These capital investments are aimed at strengthening the network, improving reliability through network expansion, improvement and up-gradation of existing transmission and distribution system to cater and replacement of old and obsolete assets. The investments also include the leveraging the smart grid technologies to efficiently manage the grid and internal generation from the embedded generation. Further, with the expansion of the grid and

---

ageing infrastructure and rising human resource costs, BPC is expected to incur additional Operation and Maintenance Costs.

The capital and operation costs are expected to increase BPC's costs and hence tariff revision is proposed to ensure adequate revenues are available to support planned investments and provide desired service delivery to the customers.

### **3. Methodology**

Bhutan Electricity Authority's (BEA) Distribution Tariff model, which is based on the cost of supply methodology, has been used to determine the end user tariff. The following are the major assumptions made:

1. A power purchase cost of Nu 1.39/kWh i.e at present level is assumed. Any revision in the power purchase price will change the proposed tariffs since the Regulation allows power purchase cost to be treated as pass-through cost. The Authority may consider making change in the power purchase price while determining the final domestic tariffs.
2. Energy generation is forecasted based on the average generation of from the existing four plants of Druk Green Power Corporation (DGPC) for past three year, addition of energy generation from Tsibjalumchu and forecast of Dagachu Hydropower Corporation Limited.

### **4. Salient features of the tariff proposal**

#### **4.1 Tariff Structure for Medium Voltage and High Voltage Industries**

BPC currently has two-part tariffs for the HV and MV customers- Energy Charge and Demand Charge. The energy charge is intended to be to be a pass-through cost of the energy charges and the Demand charge is expected to recover the network costs. As presented in the earlier tariff proposals, the main reason for this is to prevent hoarding of demand by the customers, thereby depriving other intending customers of getting load-sanctions and also requiring BPC to augment network to meet the contracted demand when the actual demand is much less.

For the prevailing tariff, for the demand charge, only 60-100% of capacity-related costs from HV, 27-100% of the capacity-related costs from the MV industrial customers, and 50-100% of the capacity-related costs from the MV hydropower is to be recovered by BPC. BPC has consistently requested the Bhutan Electricity Authority (BEA) to allow recovering 100% of capacity-related costs through demand charges for these MV and HV. Therefore, the minimum level of demand, presently being considered by BEA, requires review to consider the full contracted demand to be liable for recovery of the network cost. This, along with fixing the demand charges to cover the network costs would ensure that the customers would not seek for demand much more than their actual requirement and thus preventing hoarding of power.

The principles of preparation of tariff schedules include that the structure should provide signals to consumers that improve efficiency of consumption patterns. Therefore, BPC would like to resubmit the proposal to levy demand charge on kilo volt ampere (kVA) basis and not on kilo watt (kW) basis, which is the current practice. The kVA basis will encourage the industries to maintain the power factor at acceptable range. As per distribution code, a customer should maintain power

factor of 0.85. BPC has been requesting the BEA, to consider the demand charges to be billed on kVA basis (i.e. Nu / kVA / month) with a recommended power factor of 0.85 at the load side. This will not only incentivize the customers to maintain the power-factor but also improve the overall system's voltage regulation. BPC would like to submit the data collected through the Automatic Meter reading which shows the importance of levying demand charge on kVA basis to improve the utilization.

#### 4.2 Revision of the Miscellaneous Charge

BPC proposes to increase miscellaneous charges for some of the miscellaneous services by the demand for such services. The amount charged for services and deposits are currently low and there are changes in the consumption pattern and costs of services. Hence, there is a need to revise the rates in a manner that ensures the cost of services and necessary deposits are adequately covered.

### 5. Weighted Average Cost of Capital

#### 5.1 Cost of Equity

As per the Domestic Electric Tariff Policy, the Cost of Equity shall be based on the average lending rates of the financial institutions. BEA may allow a reasonable premium up to a maximum of 250 basis points on the above rates depending on the domestic market situation and gearing ratio applied.

It is assumed that BPC will fall under the Credit services of the Industrial Loan. The present lending rates for the Industrial/Manufacturing Loan for the Banks in Bhutan is presented in table 2 below:

<b>Banks</b>	<b>Industrial/Manufacturing Loan</b>
Bank of Bhutan	13%
Bhutan National Bank	13%
Druk Punjab National Bank	13%
T Bank	14%
Bhutan Development Bank	13%
<b>Average</b>	<b>13%</b>

*Table 2: Lending rates of Banks*

---

## 5.2 Cost of Debt

The CoD has been calculated as the weighted average interest rate of the interest rates on existing as well as loans that are envisaged to be taken during the tariff period using the loan balance at the end of each year.

For the future loans that are expected to be financed through a mix of debt and equity in the forthcoming tariff period, the BPC has assumed a gearing ratio of 70 % and an interest rate of 10 %. BPC's present loan from NPPF is at 9% and BPC anticipates that the financial institutions may not give loan at 9%. Therefore, BPC has assumed slightly higher interest rate at 10%.

The Rural Electrification Project funding from the Japan International Cooperation Agency (JICA) and Federal Ministry for European and International Affairs of the Republic of Austria (ADA) was closed on 26<sup>th</sup> June, 2015 and 31<sup>st</sup> July, 2015 respectively. The Loan amortization schedule for the two loans has been drawn up with Department of Public Accounts, Ministry of Finance.

For the JICA financing, the total amount of the loan is Japanese Yen 3,237,604,100.00 (Japanese Yen Three Billion Two Hundred thirty Seven Million Six Hundred Four Thousand One Hundred) and for the ADA financing the total amount of the loan is EURO 3,887,741.87 (EURO Three Million Eight Hundred Eighty Seven Thousand Seven Hundred Forty One and Eighty Seven cents). The loans are denominated and recorded in BTN in BPC books of Accounts.

For the earlier loans, the Ministry of Finance has lent to BPC is at interest rate of 6% per annum BTN terms with the same repayment and grace period as the original loan and the foreign exchange risks for both the interest and principal repayment is borne by the Ministry of Finance.

For the present loan, the Ministry of Finance has lent to BPC on the same terms and conditions as given in the original financing agreement signed between Royal Government of Bhutan and JICA/Austria. The JICA loan carries the repayment period of 40 years including 10 years grace period at an interest of 0.01% per annum. The loan from the Govt. of Austria has repayment period of 17 years including grace period of 5 years at an interest rate of 0.7% per annum.

BPC has to assume the foreign exchange risk for both interest payment and principal repayment on the subsidiary loan and will pay interest and principal to RGoB in Ngultrum equivalent as and when the interest/principal is paid to JICA/Austria by the RGoB.

Since the loan amortization schedule is denominated in JYP and EURO, we have to factor in the exchange rate fluctuation risk in the interest component. For this we have taken the BTN trend with respect to JYP and EURO for the first two months of 2016. The percentage change between the highest rate and lowest rate has been taken as the exchange risk factor in arriving at the interest rate per annum in BTN.

The loan agreements along with the subsidiary agreements are attached in *Appendix 1*.

The CoD of the existing and envisaged loan is 2.74%. The details are attached in the "debt" sheet in the Tariff Model. The CoD is also calculated for individual customer category using the proposed allocation factor as given in Appendix 12.

---

### 5.3 Gearing

As per DETP, to ensure competitive and efficient pricing through an optimal capital structure, the gearing ratio for computation of WACC shall be higher than the actual gearing ratio and up to a maximum of 70:30.

BPC's actual overall gearing is 36.87% for 2015. As separate WACC is required to be calculated, the gearing of individual customer category is calculated based on the loan balance and the net asset of the particular customer category. The loan balance and net asset of a particular customer category is calculated by using the proposed allocation factor. Thereafter, the gearing for the customer category is calculated. The detailed calculation is presented in the *Appendix 2*.

### 5.4 Tax rate

BPC proposes a statutory corporate tax rate of 30% as prescribed in Section 45, Chapter 49 of the Income Tax Act of the Kingdom of Bhutan, 2001.

### 5.5 WACC

Using the loan allocation, the actual gearing and Cost of Debt for the customer category is presented below:

	<b>Export</b>	<b>HV</b>	<b>MV&amp;LV</b>
Actual Gearing	9%	5%	64%
Cost of Debt	9.41	9.71	1.34

*Table 3: Actual Gearing and Cost of Debt*

BPC is proposing gearing of 40% which is close to the overall gearing ratio of the company for Export and HV category. By selecting the gearing of 40, CoE is proposed to be 14% (13% plus 100 basis point). For MV and LV, the gearing is selected at 65% and the CoE is proposed to be 15.5% (13% plus 250 basis point). Based on these parameters, the WACC is proposed as follows:

<b>WACC parameters</b>	<b>Export</b>	<b>HV</b>	<b>MV &amp; LV</b>
Gearing:	40.0 %	40.0 %	65.0 %
CoE	14%	14%	15.5%
CoD	9.41%	9.71%	1.34%
Tax	30%	30%	30%
<b>WACC:</b>	<b>15.77%</b>	<b>15.89%</b>	<b>8.62%</b>

*Table 4: WACC for customer categories*

---

## **6. Operation and Maintenance Costs**

### **6.1 Historical O&M cost**

BPC has reported the historical O&M costs in the past tariff period in figures in the “Input Sheet” of the Application. In the application model, the O&M of the average 3 years is calculated for the allowances. BPC had revision in pay and allowances in 2015, hence the average of past three years would be an underestimate. The O&M costs after deducting non allowable costs such as CSR, income from Hiring, license fees etc for 2015 is proposed. O&M cost of the Infocom Division in BPC has been excluded since the c&M budget is provided by Department of Information Technology and Telecom (DITT), Ministry of Information and Communication (MOIC). However, BPC would also like to propose for the inclusion of O&M cost for 6 fibres which is given to be used by BPC. Presently, O&M cost provided by DITT is 2.1% of the OPGW and ADSS assets which amounts to 17.29 million per year for 18 fibres. Therefore, using the same ratio, BPC has included Nu.5.763 million for O&M of the 6 fibres. BPC is proposing for the increase in the O&M % as the present 2.1% with DITT/MOIC to enable Infocomm Division to provide the desired level of service of the OPGW and ADSS network.

The replacement cost has been calculated separately for generation, transmission, distribution, and others and historical O&M costs since 2004 is attached as *Appendix 3*.

### **6.2 Current Replacement Cost**

BPC has estimated the CRC of assets using capital expenditure inflated to current prices using the inflation rates published by National Statistical Bureau of Bhutan. The total CRC of assets as on 31<sup>st</sup> December 2015 works out to Nu 31,761 million. The CRC for each asset category viz., generation, transmission, distribution, and others is attached as *Appendix 2* and as required the CRC of each asset is presented in the “Input Sheet” of the Application Form. BPC would like to indicate that BPC’s CRC of assets is severely underestimated by using the net asset values for the pre-corporatization assets in the absence of gross asset values. Therefore, BPC would like to request BEA to review approved % benchmark O&M allowance for the assets.

### **6.3 Inflation**

The inflation rates based on historical inflation rates as per National Statistical Bureau is considered which is attached as *Appendix 4*. Inflation for the next three years has been based on the historical inflation figures of past three years.

### **6.4 O&M efficiency gains**

The model for tariff allows the O&M costs to increase yearly by inflation less the target set for improvements in efficiency gains. BPC would like to propose O&M efficiency gains of 0% for the tariff period. With ageing infrastructures and rising human resource costs and the last mile Rural Electrification completed, the expenses would increase to maintain the level of services desired by the customers. BPC would like to request that the O&M efficiency gain is not relevant for a growing company like BPC.

---

## **7. Regulatory Fees**

As per the Fees and Charges of the Regulatory Fees Regulation 2006, the license fee for transmission and distribution is 0.2 % of revenues from sale of electricity. The same would be based on the final tariffs approved and the values proposed are indicative.

During the filing on tariff application, it was intimated by BEA vide letter no.BEA/CEO/DGPC/2015-16/677 dated 1 March, 2016 that the revised schedule of Fees and Charges- Regulatory Fees Regulations 2006 has been revised with effect from 1<sup>st</sup> July, 2013. Therefore, the tariff application fees as per the revised changes was worked out as 0.1% of the annual average revenue from electricity tariff claimed by BPC in the first tariff application amounting to Nu.8.834 million. This amount has been added in first year of the tariff year as the regulatory fees.

## **8. Asset Values and Depreciation**

BPC has submitted the gross and net asset value, lifetime, accumulated, and annual depreciation for the year 2015 *Appendix 5*. Bhutan Power System Operator (BPSO)'s asset has also been shown separately as the System operator costs has been calculated separately which is discussed in the next section. Therefore, BPC's asset minus BPSO's asset is given in Schedule A (Assets) of the application form. The asset values and depreciation have been calculated using BPC's depreciation rates which is as same as that specified by the present Tariff Determination Regulation.

BPC would like to propose for the Asset component of the Smart grid to be added separately. It has been assumed that the project will consist of 50% share in hardware and 50% share in software. For hardware component and software component, 15% and 20% depreciation is considered respectively.

The DHI land policy is finalized and with it the land of the DHI owned companies (DoC) will be transferred to DHI and DoC companies will have to pay the lease charge for the land. In the present proposal, the land assets and the future investments for land are included in BPC. The lease charges for land has not been finalized. BPC would like to indicate that this would increase the O&M requirement of BPC and reduce the Return on Land assets.

## **9. System Operator Costs**

Pursuant to the grant of license to BPC operate as the System Operator by BEA on 1<sup>st</sup> July, 2014, National Load Dispatch Center has been upgraded to Department as Bhutan Power System Operator (BPSO). There were discussions on how the O&M costs and the future investments costs of BPSO would be shared as BPSO provides services to parties such as BPC, DHPC and DGPC.

It was discussed and agreed in the System Coordination Committee meeting on 19<sup>th</sup> February, 2016 that the assets of BPSO belong to BPC therefore the O&M cost and future investment of BPSO will be by BPC.

Therefore, the System Operator Asset and Operation and Maintenance Cost is calculated separately and included as the System Operator Costs in the total costs. The Investment Cost of

the BPSO such as NLDC up-gradation is included in the System Operator Costs. The return on assets is calculated by using BPC's overall parameters for WACC calculations for BPSO.

As the System Operator's O&M cost cannot be based on the past actual costs, the expected annual O&M costs of the system operator is submitted and used as the required O&M cost for next tariff period.

The allocation for the system operator to the customer categories is proposed to be allocated based on the Load serviced by BPSO in MW. The System Operation Cost Calculation is attached as *Appendix 6*.

## 10. Investment Plan

The Investment plan include work programs to be implemented by the Bhutan Power Corporation Limited (BPC) in the next five years (2016 to 2020) have been prepared in line with the business activities of the Corporation i.e. Transmission, Distribution, System Operation, Embedded Generation and Corporate Services. The plan outlay in Million Nu is presented in the Table below:

<b>Program</b>	<b>2016</b>	<b>2017</b>	<b>2018</b>	<b>2019</b>	<b>2020</b>	<b>Total</b>
Transmission	1,242	2,369	2,204	512	132	6,458
Distribution	825	712	673	587	466	3,263
System Operation and Smart Grid	109	201	223	290	270	1,093
Embedded Generation	185	179	161	46	1	571
Corporate Services	218	212	155	194	125	905
<b>Total</b>	<b>2,578</b>	<b>3,673</b>	<b>3,415</b>	<b>1,629</b>	<b>993</b>	<b>12,289</b>

*Table 5: Investment Plan for 2016-2020*

The Out of Plan works which are those Associated Transmission System (ATS) which will be funded by the Hydropower Projects is not included in the Investment Plan.

The Investment in Transmission is mainly according to the national plans and programs identified in the National Transmission Grid Master Plan (NTGMP) which is aimed at strengthening the Transmission network, reliability and providing supply to the Special Economic Zones. The Transmission investment also include the transmission rehabilitation which consists of the substation upgradation. The Distribution program consist of the electrification project and the rehabilitation and metering investments. The System Operation is the Bhutan Power System Operator's investment and the investment also covers the investments in Smart Grid and Rehabilitation of the Mini/Micro Hydels. The Corporate Services include the corporate investments and all other investments not falling in the business activities.

The detailed Investment Plan 2016-2020with write up is attached in *Appendix 7*.

BPC's plan outlay investment capitalization schedule in Million Nu. including the Interest During Construction (IDC) for the tariff period is indicated in Table below.

<b>PROGRAM (Nu in Million)</b>	<b>2016</b>	<b>2017</b>	<b>2018</b>	<b>2019</b>	<b>2020</b>
Transmission	133.47	852.45	4,337.40	470.49	1,585.19
Distribution	824.77	712.38	673.07	586.96	465.96
System Operation and Smart Grid	115.70	218.66	245.82	325.07	322.95
Embedded Generation	69.55	189.20	175.50	136.00	1.00
Corporate Services	218.39	211.97	154.68	169.22	150.41
Capital Work in Progress	517.11	251.85			
<b>TOTAL</b>	<b>1,878.99</b>	<b>2,436.51</b>	<b>5,586.47</b>	<b>1,687.74</b>	<b>2,525.49</b>

*Table 6: Investment Capitalization*

There are six contracts in Transmission projects and two in the transmission division for which the contract amounts and the contract end date as per the contract is available. To take into account the Capital Work in progress, the contact amount with the allowance for the price variation as per the contract is used for capitalization. For other Capital Work in progress, the asset is assumed to be capitalized in 2016 and 2017. For those projects that are to be financed through a mix of debt and equity, the IDC has been computed assuming an interest rate 10% and a gearing ratio of 70%. The capital drawdown for each year has been apportioned to debt and equity using the gearing ratio and interest is computed on the debt component of the capital drawdown amount.

The detailed working of investment capitalization schedule including IDC calculation for the tariff period attached in *Appendix 8*.

BPC has taken over 2 x 15 MVA, 132/33 kV Yurmoo Substation from Mangdechu Hydroelectric Project Authority on 11<sup>th</sup> February 2016. BPC has also agreed taken over the Tala Distribution system along with the building from Druk Green Power Corporation on 26<sup>th</sup> February 2016. The details of the Assets are attached in *Appendix 9*. Therefore, the assets value is considered in 2016 capitalization. Recently, Department of Renewable Energy has asked BPC to conduct inventory for Chendebji Micro Hydropower Plant, which is directed by the Government to be transferred to BPC. Therefore, the value of the asset of Chendebji Micro Hydropower Plant would be included to asset based on the formal Handing Taking order and finalized value.

---

---

## **11. Cost of working capital**

### **11.1 Arrears**

For the forthcoming tariff period, BPC proposes arrears of 45 days for HV, MV, and LV category of customers and 50 days for the Wheeling and are presented in the “Input Sheet” of the Application Form. The proposed arrears figures are same as that approved by the Authority for the prevailing tariff period.

### **11.2 Inventory**

For the forthcoming tariff period, BPC proposes an inventory of Nu 425 million, which is the value reported as per the accounts of 31<sup>st</sup> December 2015.

## **12. Power Purchase**

### **12.1 From Generating Companies**

BPC assumes the existing rate a royalty energy price of Nu 0.0/kWh for energy drawn within the royalty limit and an additional energy price of Nu 1.39/kWh for energy drawn above the royalty limit in the “Input Sheet” of the Application Form. These energy(ies) will be purchased from Druk Green Power Corporation’s various generating plants. However, as permitted by the regulation, any revisions of the prevailing generation tariffs will be incorporated in this proposal. The Authority may consider allowing these costs as determined by the Authority to factor in while determining the final tariffs.

### **12.2 Import**

BPC proposes an energy import volume of 4MU for each year of the forthcoming tariff period from WBSEBL and ASEBL, India at the prevailing average import price of Nu 2.46/kWh, in the “Input Sheet” of the Application Form.

As per the Domestic Electricity Tariff Policy, only net monthly import should be allocated to the HV industries. BPC imports net energy only during the winter months especially in the East. Therefore, BPC has assumed a net monthly import of 50 MU.

### **12.3 Embedded Generation**

The historical energy volume and the forecasted energy volume from embedded generation for the forthcoming tariff period are indicated in the “Own Generation Sheet” of the Application Form. BPC has also included the generation by wind as internal generation.

As required, the expected energy volume from the embedded generation is deducted from the total power purchase forecast in “Input Sheet” of the Application Form.

BPC has included the energy generation from the Wind Power Plant at Wangdue Phodrang as internal generation. BPC has not included the cost of wind power plant as decision on the asset

transfer is not finalized. Based on the decision on the asset transfer, the asset value of BPC will change.

### 13. Energy Sales Forecast

BPC has proposed energy sales forecast in MU for each category of customers LV, MV, HV as presented in Table below.

Customer Category		2016	2017	2018	2019	2020
High Voltage (HV)	Industry	1,442.80	1,505.57	1,505.57	1,520.76	1,520.76
	Hydro Power					
	Construction Power	40.54	43.80	43.80	35.04	17.52
	<b>Total</b>	<b>1,483.34</b>	<b>1,549.37</b>	<b>1,549.37</b>	<b>1,555.80</b>	<b>1,538.28</b>
Medium Voltage(MV)	Industry	71.95	71.36	71.36	71.36	71.36
	Hydro Power					
	Construction Power	44.77	48.18	56.94	35.04	30.66
	<b>Total</b>	<b>116.72</b>	<b>119.54</b>	<b>128.30</b>	<b>106.40</b>	<b>102.02</b>
Low Voltage (LV)	LV Rural	88.01	101.15	109.47	116.35	124.56
	LV Others	279.84	270.17	313.49	326.38	334.82
	LV Bulk	76.99	65.15	80.30	89.53	91.61
	<b>Total</b>	<b>444.84</b>	<b>436.47</b>	<b>503.26</b>	<b>532.26</b>	<b>550.98</b>
<b>TOTAL</b>		<b>2,044.90</b>	<b>2,105.38</b>	<b>2,180.93</b>	<b>2,194.46</b>	<b>2,191.29</b>

Table 7: Sales Forecast

The above sales forecast are in calendar year.

The Sales forecast are calculated as per the tariff year as table below:

Category	2016-2017	2017-2018	2018-2019
HV	1,516.35	1,549.37	1,552.58
MV	118.13	123.92	117.35
LV	440.66	469.87	517.76
<b>TOTAL</b>	<b>2,075.14</b>	<b>2,143.16</b>	<b>2,187.70</b>

Table 8: Sales Forecast as per Tariff year

The energy to be wheeled was also forecasted. The energy generation from DGPC and Dagachu is considered. The details of the forecasted generation, wheeling and royalty is presented in table below.

Particulars	2016-2017	2017-2018	2018-2019
Wheeling	5,583.48	5,509.46	5,461.57
Royalty	1147	1147	1147

Table 9: Wheeling and Royalty Forecast

As required is indicated in the “Input Sheet” of the Application Form. The calculations and assumption made and the basis of assumptions of the energy sales forecasts for each category of customer is reported separately in *Appendix 10*.

BPC has forecasted energy sales for LV as per the existing customer category list for the Blockwise consumptions for next three years which is presented in the following table

Blockwise Energy Sales Forecast (MU)		Block I			Block II			Block III		
Sl. #	Customer Category	2016-2017	2017-2018	2018-2019	2016-2017	2017-2018	2018-2019	2016-2017	2017-2018	2018-2019
i)	Rural	64.5	70.0	75.2	21.0	22.4	24.0	9.5	9.7	9.9
	Urban	47.0	51.5	57.3	40.5	44.0	49.3	39.2	41.4	44.5
ii)	Commercial	9.449	9.4	10.4	11.8	9.9	10.6	11.9	27.2	28.6
iii)	Industrial	0.932	0.9	1.0	1.1	0.6	0.7	0.7	7.7	7.9
iv)	Agriculture	0.490	0.5	0.5	0.6	0.3	0.3	0.3	1.8	2.0
v)	Institutions	7.873	7.9	9.0	10.7	9.8	10.5	11.2	42.7	44.9
vi)	Street lighting	0.355	0.4	0.4	0.4	0.6	0.7	0.7	3.6	3.8
vii)	Power house auxiliaries	0.147	0.1	0.2	0.2	0.1	0.1	0.1	1.1	1.1
viii)	Temporary connections	4.078	4.1	4.4	4.7	4.3	4.7	5.0	14.8	16.4
<b>Total</b>		<b>134.777</b>	<b>147.436</b>	<b>134.8</b>	<b>147.4</b>	<b>162.0</b>	<b>87.2</b>	<b>93.9</b>	<b>103.2</b>	<b>147.6</b>

Table 10: Blockwise Energy Sales Forecast for LV customers

---

---

## 14. Losses

BPC's proposed technical losses are as per Schedule E of the of the existing Tariff Determination Regulation.

The computation of wheeling charges presently considers only 50% of the allowable losses (presently 2%) due to export. We were given to understand that this was due to the assumption that the losses were equally shared by BPC and DGPC. As represented in our various submissions to the Authority since 2013 for rectification of the same with the decision regarding the same for the previous periods is under consideration by the Authority, our present tariff proposal considers the full losses due to export to BPC in computation of wheeling charges.

## 15. Non-Tariff Revenue

BPC has reported historical non-tariff revenue for the previous tariff period in the "Input Sheet" of the Application Form and the historical non-tariff revenue for the previous tariff period along with their sources and the proposed non-tariff revenue for the forthcoming tariff period for each customer category is indicated in *Appendix 11*.

The non-tariff revenue for the next three tariff years has been based on the consolidated historical non-tariff revenue as maintained by BPC. However, since the non-tariff revenue is not maintained on a category-wise basis, the total non-tariff revenue has been apportioned based on the no. of customers in the category.

The calculation of the non-tariff revenue for the next is based on the average of past three years.

## 16. Allocation Factor

As per Domestic Electricity Tariff Policy, the allocation factors for assets and associated costs like O&M costs, inventories, fees and levies shall be determined for the customer categories based on the following guidelines:

- i) Where assets and associated costs are exclusively used by a particular customer category, the same shall be allocated fully to this customer category.
- ii) Where assets and associated costs are for export purpose, the entire allocation shall be to the export category.
- iii) Where generation, transmission and distribution assets and their associated costs are meant for joint usage by different customers, the allocation factor shall be based on capacity demand.
- iv) From the above i), ii), and iii), weighted average allocation factors for all the customer categories shall be determined for allocating assets and associated costs that do not fall under the above three items including fees and levies of BEA.

BPC has submitted to BEA the calculations of the allocation factor on 31<sup>st</sup> December 2015. Subsequent to the discussions held with BEA and DHPS on the provisions of the policy, calculations have been reworked. For the joint usage of the assets, the policy states that the

allocation should be based on the capacity demand in MW, BPC worked out the allocation factor based on the Peak Demand in MW for 2014. The Substation allocation is based on the overall peak of 2014 and the MV and LV allocation is based on the contract demand. The 400/220 kV substation of Malbase is allocated to Export since the substation was built with Tala Hydropower Project. The cost of the 400/220 kV substation allocated to export and the corresponding % allocation is redistributed to other customers for the substation assets. The proposed allocation factor is attached in *Appendix 12*.

## 17. Subsidy

As per DETP, progressive block tariff structure with regressive subsidy shall be adopted to all LV household and religious institutions and structures except Dzongs. For other LV customers such as street lightings, temporary connections for non-residential purpose, institutions and all other non-residential LV customers including commercial and industrial customers, the highest LV block tariff shall be charged. Additional subsidy shall also be given to rural domestic household, rural cooperatives, community Lhakhangs and micro trade activities. Subsidy to Medium Voltage shall continue for upcoming tariff period and High voltage customers will not be eligible for subsidy.

## 18. Cost of Supply

The following tariff input parameters are used in the distribution tariff model to calculate to cost of supply.

Customer category	Export	HV	MV & LV
Gearing	40%	40%	65%
CoE	14%	14%	15.5%
CoD	9.41%	9.71%	1.34%
O&M	As per 2015 actual O&M (Mill Nu)		
Losses	As per existing regulation + wheeling loss fully to BPC's account		
Inflation	As per past inflation published by NSB		
Asset Allocation and O&M allocation factor	As proposed		
Royalty Energy Price	Nu.0/kWh		
Additional Energy Price	Nu.1.39/kWh		
Import Energy Price	Nu.2.46/kWh		
Investments	As per the Investment Plan 2016-2020 and capitalization shedule		
System Operator Cost	As Proposed		

*Table 11: Tariff Input Parameters*

---

## 18.1 Unsubsidized Cost of Supply

Customer Category	Unsubsidized Cost of Supply (Nu/kWh)
LV	5.50
MV	5.46
HV	2.21
Export (Wheeling)	0.329

*Table 12: Unsubsidized cost of supply*

## 18.2 Tariff Structure

BPC is proposing the only energy charge for the LV customers and proposing the blockwise tariff to be retained as prevailing structure.

Considering the subsidy provisions in the DETP, block wise sales for Households is only considered for the block wise tariff. For rest of the customer category, the consumptions are added to Block III. The 100 units free electricity to rural households is considered to be continued in upcoming tariff period also.

BPC is submitting the billing assumptions for calculation of the subsidy requirement. The energy consumption forecast rural block I for which the 100 units free electricity is provided is given in the table below:

Consumption Forecast (MU)		2016/17	2017/18	2018/19
<b>LV Rural</b>	0-100	64.50	70.04	75.19

*Table 13: Rural Block I forecast*

In the policy, it is mentioned that the religious structures should be applied a progressive block wise tariff. Presently, private Lhakhangs which has single phase connection and few lighting and heating points are given 100 units free electricity. However, the religious structures in town are categories as institutions and an exercise is required to segregate the customers. LV agriculture includes rice mills, maize mills etc and as per subsidy policy it falls under others which need to be charged the highest block tariff. Based on the available data, for the tariff calculations, BPC has included only household for progressive blockwise and rest of the customers have been added to block three.

The billing data blockwise for LV and the MV and HV forecast is given in the table below:

<b>Billing data (MU)</b>		2016/17	2017/18	2018/19
LV	Cust nos.	179,486	190,312	201,137
	0-100	70	77	87
	100-300	87	94	103
	300+	148	156	168
	Total	305	327	358
	LV bulk	71	73	85
	LV total	376	400	443
MV	GWh	118.132	123.920	117.350
	MVA	62.4	65.9	71.8
HV	GWh	1,516.354	1,549.367	1,552.585
	MVA	315.3	315.3	312.9
Wheeling	GWh	5,537.397	5,463.376	5,358.825

*Table 14: Billing data for the customers*

The upcoming hydropower project of Kholongchu and Nikachu's construction power demand is assumed as MV. The demand for the MV and HV is converted to MVA demand by allowable power factor of 0.85.

For HV and MV, for the tariff structure, BPC propose the current practice of 2 part tariff – Energy Charge and Demand Charge. The present tariff mechanism considers the demand charges on the basis of Nu./ kW /month. Considering that the network requirements and augmentation thereof are based on the kVA that the network has to cater to, BPC has been requesting the Authority, to consider the demand charges to be billed on kVA basis (i.e. Nu / kVA / month) with a recommended power factor of 0.85 at the load side. This will not only incentivize the customers to maintain the power-factor but also improve the overall system's voltage regulation. BPC would propose for the conversion of the demand charge in kW to its equivalent in kVA. The data of the industries based on the Automatic Meter Reading data attached in *Appendix 13*.

The prevailing system provides for the tariff for MV and HV customers to be segregated into Energy and Demand charges. The energy charge is intended to be a pass-through cost of the energy charges (mostly consisting of power purchases from DGPC, covering the expected sales in energy plus the allowable loss component, to determine the cost of energy) and the Demand charge is expected to recover the network costs. However, over the past tariff periods, the principle of cost recovery, considered the overall tariff, computing the same as total cost to be recovered (i.e. Network Cost plus Energy Cost together) divided by the projected energy sales. This overall tariff is then split into energy and demand charges by BEA, considering the aspects of reasonable increase in the demand charges, rather than true reflection of the network cost in fixing the demand charges.

BPC has been and is of the opinion that the demand charges shall reflect the network cost. As presented in the earlier tariff proposals, the main reason for this is to prevent hoarding of demand by the customers, thereby depriving other intending customers of getting load-sanctions and also requiring BPC to augment network to meet the contracted demand when the actual demand is

much less. Recovery of network costs through demand charges would not have any impact on the total outflow (billed amount) for the genuine customers, but would act as a deterrent for any unwanted hoarding of demand by the less diligent customers.

Presently, the applicability of demand charges is based on a minimum charge corresponding to 60% for HV and 27% for MV customers and 50% for MV hydropower. The minimum level of demand, presently being considered by BEA, requires review to consider the full contracted demand to be liable for recovery of the full network cost. This, along with fixing the demand charges to cover the network costs as indicated above, would ensure that the customers would not seek for demand much more than their actual requirement and thus preventing hoarding of power.

For HV and MV, for the tariff structure, BPC proposed the current practice of 2 part tariff – Energy Charge and Demand Charge and demand charge to be based on kVA basis and not on kW basis. The equivalent Nu/kW/month is also shown for comparison purpose. The Domestic Electricity Tariff Policy also prescribes in the tariff structure that the variable charge shall be the generation cost and the fixed charge shall be the network cost. Therefore, the energy charge and the demand charge for HV and MV are proposed as follows.

<b>HV Tariff</b>	<b>2016/17</b>	<b>2017/18</b>	<b>2018/19</b>
Energy Cost( Nu/kWh)	1.45	1.45	1.46
Demand Cost (Nu/kVA/month)	266.46	292.55	379.87
Demand Cost (Nu/kW/month)	313.48	344.18	446.90

*Table 15: Proposed Tariff Structure of HV customers*

<b>MV Tariff</b>	<b>2016/17</b>	<b>2017/18</b>	<b>2018/19</b>
Energy Cost( Nu/kWh)	1.47	1.47	1.47
Demand Cost (Nu/kVA/month)	568.07	602.29	629.25
Demand Cost (Nu/kW/month)	668.32	708.58	740.29

*Table 16: Proposed Tariff Structure of MV Customers without subsidy*

## 19. Tariff Structure with Subsidy

As provided in the DETP, subsidy can be considered only to the MV and LV customers. The subsidy available from the Royalty energy using the DETP of evaluating the same at the export rate after adjusting with transmission loss and wheeling charge works out to be Nu. 2142 million.

The expected royalty energy and the royalty amount for the subsidy is given below:

Plants	Generation (GWh)	Expected Royalty Energy (GWh)			Royalty Amount (Nu in Million)		
		2015	2016	2017	2018	2016	2017
CHP	1858	275	275	275	607	668	668
KHP	375	56	56	56	108	119	119
THP	4840	717	717	717	1392	1531	1531
BHP	317	47	47	47	104	114	114
DHPC	440.375	52	52	52	151	154	157
<b>Total</b>	<b>7830</b>	<b>1147</b>	<b>1147</b>	<b>1147</b>	<b>2362</b>	<b>2586</b>	<b>2589</b>
<b>Wheeling Charges (Nu in Million)</b>					<b>370</b>	<b>370</b>	<b>370</b>
<b>Net Royalty Amount (Nu in Million)</b>					<b>1992</b>	<b>2216</b>	<b>2219</b>
<b>Annual Royalty Amount (Nu. In million)</b>					<b>2142</b>		

Table 17: Expected Royalty Energy and Royalty Amount

The unsubsidized cost of supply worked out in the model is Nu. 5.5 /kWh for LV and Nu 5.46/kWh for MV customers. BPC calculated the subsidy requirement if the tariff for MV and LV are kept at the present tariff.

Subsidy (Nu in million)	2016	2017	2018	Average
LV Total Cost of Supply	2,423.61	2,584.28	2,847.69	
LV subsidized	1,083.33	1,151.52	1,274.61	
LV Subsidy requirement	1,340.29	1,432.76	1,573.08	1,448.71
MV subsidy requirement	244.53	256.52	242.92	247.99
<b>Total subsidy requirement</b>	<b>1,584.82</b>	<b>1,689.27</b>	<b>1,815.99</b>	<b>1,696.69</b>

Table 18: Total Subsidy requirement

BPC proposes to maintain the same tariff as at present for the next tariff cycle and the subsidy requirement can be met through the available royalty energy.

The cost of supply assumes that the cost of supply from DGPC to BPC would be same as Nu 1.39/ kWh i.e. the present level. However, if the total available subsidy from the royalty is available to

subsidize the LV and MV customers, to be as decided by the Government, it is felt that it would be possible to retain the present tariff levels for the MV and LV customers.

However, the average tariff of MV tariff shall be suitably apportioned to ensure that the demand charge (on kVA basis) would take into account the requirement of network cost recovery through demand charge as well as incentivizing the customers to seek realistic demand and maintain the requisite power factor. The structure of MV tariff is proposed below.

MV Tariff	2016/17	2017/18	2018/19
Energy Charge (Nu/kWh)	1.47	1.47	1.47
Demand Charge (Nu/kVA/month)	241.26	277.83	347.17

*Table 19: Proposed subsidized MV Tariff structure*

## 20. Miscellaneous Charges

The current Schedule of Tariffs and Miscellaneous Charges has been last revised in the tariff cycle 2010-2013 and the next revision has now become necessary.

The need to revise the existing schedule of miscellaneous charges is based on the following grounds:

- Introduction of 100 units free electricity.
- Increase in cost of electrical goods and services owing to a general inflation since 2010.
- Change in electricity consumption patterns.
- Bad debts resulting from inadequate charges and their application methodology.
- Reasonability and affordability of the existing charges.

The amount charged for services and deposits are currently low, hence, there is a need to revise the rates in a manner that ensures the cost of services and necessary deposits are adequately covered to prevent bad debts and provide enough deterrence against malpractices.

The proposal for the revision in the miscellaneous charges is presented below:

Particulars	Charges	Proposed Charges
Energy Security deposit		
LV Single phase	Nu. 12/A	Nu. 50/A
LV Three phase	Nu. 36/A	Nu. 150/A
LV Three phase with CT metering	Nu. 36/A	Nu. 150/A
MV	Nu. 72/kVA rating of the transformer	Nu. 150/kVA
HV	Nu. 72/kVA rating of the transformer	Nu.3500/kVA
Reconnection & Disconnection charges	a) Nu. 100 for LV single phase	450
	b) Nu. 150 for LV three phase	675

	c) Nu. 500 for MV & HV customers	2250
Meter testing charges	a) Nu. 50 for LV single phase	450
	b) Nu. 100 for LV three phase	675
	c) Nu. 500 for MV & HV customers	2250
Meter Shifting charges	a) Nu. 100 for LV Single phase	450
	b) Nu. 150 for LV Three phase	675
	c) Nu. 500 for MV & HV customers	2250

*Table 20: Miscellaneous Charge Revision*

The approach adopted with a detailed analysis of the existing charges and penalties that includes their descriptions, applicability and adequacy, and the proposed revisions with the calculations is attached in *Appendix 14*.

## **21. Conclusion**

BPC's tariff proposal is based on the premise that the proposed rates will guarantee generation of required revenues to recover all prudent costs incurred to provide services to customer at the desired customer service level and ensure adequate investments in transmission and distribution network infrastructure to meet the increased reliability and quality of electricity supply in future. Therefore, BPC would like to submit that the Authority consider and approve the proposal for the forthcoming tariff period.

The increases proposed are expected to allow BPC investment for improvement of system as well as providing safe, reliable and good quality power supply to all its customers.

## **22. List of Appendices**

Appendix 1: Loan Agreements

Appendix 2: Gearing and CoD calculation

Appendix 3: Current Replacement Cost

Appendix 4: Inflation

Appendix 5: Asset Value 2015

Appendix 6: System Operator Cost Calculation

Appendix 7: Investment Plan 2016- 2020

Appendix 8: Investment Capitalization and IDC calculations

Appendix 9: Asset Taken Over Details

Appendix 10: Energy Forecast

Appendix 11: Non-Tariff Revenue

---

Appendix 12: Proposed Allocation Factor

Appendix 13: Automatic Meter Reading Data of Industries

Appendix 14: Miscellaneous Charges