

### System audit of Hydro Electric Energy

Chhoden Terformance & System Audit Division



## **OVERVIEW OF PRESENTATION**





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- Study the rationality and impact of power tariff revision;
- Ascertain the efficiency and effectiveness of operations in the power utility companies on the quantity of domestic consumption and the dependence on alternative energy supply mix; and
- Study the environmental aspects of hydropower development.



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Period

### Audit Scope

2005-2010.





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## Issues raised in Audit Report

Inadequacies in Tariff Regulation 2007 Inadequacies in tariff determination of BPCL & DGPCL

Economy, Efficiency & Effectiveness in operations Electricity Affordability & use of other sources of energy



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Environmental Aspects of Hydropower Development

Compliance to Environmental Rules and Regulations at THPA & PHPA



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# THANKS

RAA TUTHORITI

## Methodology of Tariff Determination

- DGPCL determines the tariff using BEA's generation model and BPCL uses BEA's distribution model. Both are based on cost of supply
- DGPC and BPC proposes and BEA approves the tariff



3.1.1 Higher Auxiliary power consumption rates of the generation plant:

Auxiliary Power consumption limit 1.2% for all DGPCL plants

- Tariff revision proposal applied for 1.2 % of annual generations.
- High Auxiliary Power consumption will result in forecast of lower sales and decrease in the revenue of the generation plants.
- This will have an effect on the power tariff determination with lower volumes projected for sales.





1.2 % inclusive of the generation/transformation losses and the auxiliaryconsumption.1.2% is deemed reasonable.

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Require separate allowances for losses and auxiliary consumption, it would be difficult for assessing the performance of the companies and their efforts in curbing and reducing such losses.



3.1.2 Non-bifurcation of assets acquired through grants and others at DGPCL for determination of RoA

 60% DGPCL assets acquired from Gol Grant should not be allowed to earn any return as was the case in BPCL

Led to determination of higher tariff charged to BPCL





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# 3.1.3 Inadequate criteria to determine efficiency gain

The TDR for determination of the operating and maintenance allowance considers:

- Historical costs incurred by the licensee (adjusted for inflation);
- Industry benchmarks applicable to the licensee as set out in Schedule A;
- Opportunities for efficiency improvements; and
- May include comparison with benchmarks from comparable utilities in the region.

Does not specify how the efficiency gain should be determined and what parameters should be used for determining the efficiency gain.

DHPS accepted to look into inclusion of additional criteria.



3.2.1Tariff structure for HV industrial consumers not encouraging efficiency of consumption

Principle for tariff schedule TDR 2007: tariff structures should provide signals to consumers to improve efficiency of consumption energy.

SI.N o	particulars	MV Users	HV users
1	BPC Proposed demand charge	Nu135- 250/Kw	Nu.198- 421/Kw
2	BEA Reviewed average demand charged	Nu.260/Kw	Nu.185/Kw



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Approved tariff Rates and Structure for HV consumers of BPCL for 1<sup>st</sup> Aug 2010 to 30<sup>th</sup> June 2013

HVEnergy Charge(Nu./K Wh)1.511.541.54Demand Charge(Nu./k85105105	Customer Category		1 <sup>st</sup> aug 2010 to 30 <sup>th</sup> June 2011	1 <sup>st</sup> July 2011 to 30 <sup>th</sup> June 2012	1 <sup>st</sup> July 2012 to 30 <sup>th</sup> June 2013
Demand 85 105 105 Charge(Nu./k	Energ Charg Wh) Dem Charg W/M	Energy Charge(Nu./K Wh)	1.51	1.54	1.54
W/Month		Demand Charge(Nu./k W/Month	85	105	105

Source:BPCL power data Book,2011

Demand charge levied to the HV consumers is low which would encourage the consumers to make high or unrealistic contract demands than what is actually required

Capacity Hoarding: Energy demanded by HV industries in 2011 is 1.67billion KWh and the energy withdrawn is 0.98 billion KWh. Only 59.18% contracted amount is used



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Preventing allocation of hoarded energy to meet increased demand.

The Schedule for HV consumers does not encourage efficiency of consumption

- RAA opinion: To encourage the HV industries who are also the maximum domestic consumers for an energy efficient consumption pattern the tariff should have
- Constant energy charge
- Increasing trend of demand charges
- Cost reflective tariff

DHPS accepted to review the tariff structure



## **3.2.2 Inappropriate billing limitation on imports made during lean seasons**

BEA review report of DGPCL tariff

RAA observation

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Import Cost should be billed separately to the BPC based on the actual import cost,

Forecasted import costs will be included in the BPC allowances.

BEA decided to use the historical average of DGPCL's power imports

Historical Average of DGPCL power import for last four years was 49.5 GWh

≻Average annual import cost was Nu.92.07 millon.

➤DGPCL over 3 yrs can bill BPCL at the max of Nu.3 yrs x Nu. 92.07million=276.210 million for recovery of import cost.

>No option for DGPCL if it has to import more than 49.5 GWh.

≻In 2010 the import of 128.31 GWh.



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DHPS Response

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More appropriate solution of establishing the risk sharing module between the DGPCL and BPCL should be considered as the demand for import of power shows huge fluctuations.



### RAA AUTHORIT

# 3.3.1 BPCL's profitability significantly driven by annually increasing tariff

Table 3.3: Approved tariff rates of BPCL from Aug. 2005 to July 2011

Particulars	Aug 2005	July 2006	July 2007	July 2008	July 2009	Aug 2010	July 2011
Block I (0-100kWh)	0.6	0.7	0.75	0.75	0.75	0.85	0.85
Block II (101-300 kWh)	1.1	1.2	1.25	1.35	1.4	1.47	1.54
Block III (301+kWh)	1.30	1.45	1.55	1.70	1.85	1.94	2.04
Low Voltage - Bulk	1.25	1.35	1.55	1.7	1.85	1.94	2.04
Medium Voltage	1.1	1.25	1.3	1.43	1.55	1.63	1.71
Demand charges	54	54	65	75	85	95	105
High Voltage	1.05	1.2	1.29	1.4	1.51	1.51	1.54
Demand Charges	54	54	65	75	85	85	105



#### Table 3.4: Profitability trend of BPCL

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Particulars	2007	2008	2009	2010	2011
(A) PBT with actual tariff	573.15	927.13	986.45	1353.20	1209.01
<ul><li>(B) *PBT with tariff of base year</li><li>2006</li></ul>	557.53	670.92	545.25	833.90	599.04
Effect of increase in tariff	15.63	256.21	441.20	519.30	609.97
(A-B)					
% of profit driven by tariff	2.73	27.63	44.73	38.38	50.45

Assumptions: 1. Demand charges are same as that of actual tariff.

2. Tariff was taken as that of the tariff of base year 2006, since the Corporation has the turnaround for the first time in 2006.

Profit of BPCL has resulted significantly from the annual increase in tariff, representing as high as 50.45% of PBT in 2011



Profit and total revenue had been increasing steadily over the years despite minimal increase in number of units sold, and the constant revenue from wheeling charges and other sources

#### Table 3.5: Performance Based Incentive Scheme (PBIS) of BPCL

Particulars	2007	2008	2009	2010	2011
PBIS	27.64	33.26	33.43	41.86	41.91



Performance indicator such as the increased profit achieved had been significantly driven by annual increase in tariff.

Distribution of PBIS to its employees may not commensurate with their performance.

Increasing profitability mainly through annual tariff revision may be seen as unnecessarily burdensome to the public at large



Existing system of performance evaluation does not adequately analyze and recognize

- → the effect of price revision, increased volume and other factors on the profitability of the
  - Corporation

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- Annual increasing tariff was allowed to avoid
- ✓ steep increase in tariff
- Financial performance target consists only of
- 30% of the overall achievement and balance
   70% includes quantifiable non-financial and
   operational targets.

Annual increasing tariff could also be the main factor in increasing the profitability.



# 3.3.2 Inadequacies in Power reliability determination of the BPCL

No appropriate standards and practices for determination of power reliability.

Reliability indices depends only on two indices namely SAIFI & SAIDI. These two indices only record the power disruption and the duration.

BPCL lacks information on the voltage level and other relevant indices which could be beneficial in ascertaining the reliability of electricity in Bhutan



DHPS Response BPCL's adoption of the SAIFI and SAIDI as adequate measures for power reliability in Bhutan

RAA conclusion

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Indices to measure the voltage level in highly important.

Internationally adopted practices would also enable the BPCL in providing better services to the customers.

# 8.3.3 Power reliability indices below the international levels

BPCL has made significant achievement in power reliability in both transmission and distribution



SAIFI (interruptions/ customer/ year) has been reduced by about 93.63% SAIDI (hours/ customer/year) reduced by 81.52%

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#### Table 3.6: Power reliability Indices of Bhutan and some other countries

Country(2010)	SAIDI (Minutes)	SAIFI(Interruptions per year)
Austria	72	0.9
Denmark	24	0.5
France	62	1.0
Germany	23	0.5
Italy	58	2.2
Netherlands	33	0.3
Spain	104	2.2
UK	90	0.8
Bhutan	277	2.5
Region(2008)	SAIDI (Hours)	SAIFI(Interruptions per year)
Thailand	0.26	6.62
Indonesia	6.8	332
Malaysia	0.287	68.6



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## **RAA Conclusion**

 While the reliability indices of BPCL show progression of the corporation, it will still be unreliable if it does not attain the international levels of reliability in the future.



3.3.4 Variances in expenses made on distribution assets of Rural Electrification Projects

- Reviewed 25 completion reports of the Rural Electrification projects under JICA and ADB funding for the period 2009-2011
- ➤ Variation as high as 61%
- Wide variation in the cost per km/substation and households needs to be studied and rationalized by BPCL to initiate cost control measures by studying the cost effective methods of construction of distribution lines.



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DHPS Response Variation were due to competitive bidding, remoteness, scale of works etc., There is considerable scope for reviewing the reasons for wide variances and initiating appropriate

measures.



3.5 Distribution losses increasing over the years and the loss being consistently high in some ESDs

Table 3.8: Distribution loss% of BPCL						
2008	2009	2010	2011			
2.21	2.80	3.34	2.50			

➢Loss % has been notably high in ESDs like Bumthang, Dagana, Lhuntse, Mongar, Pemagatshel, Thimphu, Trongsa, Trashigang and Trashiyangtse where the losses ranges from 7.95% to 14.10

➢Considerable scope for further reduction of distributions losses in various ESDs.





### 3.4.1 High Tariff charged for low voltage domestic consumers as compared to the industrial users

Table 3.9: Domestic Energy Tariff of 2012

Consumers	Low Volt	age			Medium Voltage		High Voltage	
	Block I	Block II	Block III	LV (Bulk)	Energy	DC	Energy	DC
Tariff (Nu./kWh)	0.85	1.62	2.14	2.14	1.79	115	1.54	105

 Individual consumers are charged as high as Nu.2.14/KWh (Block III) as compared to the Medium Voltage and High Voltage users with Nu.1.79/KWh and Nu.1.54/KWh



## 3.4.3 Consumption of electricity per household has been decreasing for low voltage consumers





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- Tariff structure may not be consistent with the government policy of providing affordable and quality energy services to the nation.
- Tariff regime does not encourage individuals in using environmental friendly energy



# Increasing tariff could be attributed for the decrease in individual household electricity consumption

Study on affordability of electricity





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## **3.5.1** Lack of guidelines on compensatory reforestation .

May not hold the project implementers accountable for not conducting the reforestation activities

Negative precedence to other upcoming hydropower projects.

May undermine the Constitutional wisdom of maintaining 60% land under forest coverage with many hydro power projects coming up in the country.



≫3.6.1 Lack of documents related to environmental mitigation, management and monitoring

≫3.6.2 Lack of Monitoring on environmental aspects

➢ 3.6.3 Lack of Fish Mitigation Measures in Wangchu River Basins

**3.7.1** Inadequate muck disposal sites

≫3.7.1 Improper dumping of muck and excavated materials and inadequate slope stabilization activities

➢3.7.3 Air Pollution around the project vicinity



THPA

**PHPA** 

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