REGULATED INDUSTRIES COMMISSION

T&TEC's Annual Performance Report

For The Period

July 2010 To June 2011

March

2013

Information Document

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Overview of Performance

This is the fourth annual report with respect to the key performance indicators identified in the *Performance Monitoring And Reporting Framework* (PMR) and the *Final Determination: Regulation of Electricity Transmission and Distribution 2006 – 2011* (The Determination). It covers the performance of T&TEC for the period July 2010 to June 2011. The report focuses on those aspects that impact on customers, e.g. levels of service, cost efficiency and commercial efficiency. T&TEC's performance is assessed by comparing the service that was delivered for the previous years.

Overall, T&TEC's performance was mixed for the period under review. In fact, for the last four years that the Regulated Industries Commission (RIC) has been assessing performance, T&TEC's performance has been generally below expectations.

Total system losses for the period averaged 9.19%, exceeding last year's average of 8.9%, and falling well short of the 6.75% target set in the Determination. There is also no evidence that system losses are being actively managed by the utility.

The supply of electricity to customers was less reliable than in the previous year. Although there were fewer transmission trips, there were increases in both the average frequency in system interruptions and the average duration of interruptions. Therefore, reliability, as measured by SAIDI and SAIFI, declined, thus negatively affecting the level of service to customers.

T&TEC's financial performance for the period 2010/11 was fairly consistent when compared to the past three (3) years. T&TEC's ability to meet its financial obligations are well within reasonable means with funds flow interest coverage greater than three (3) times and debt payback period at approximately five (5) years. T&TEC's Liquidity position is also fairly good with operating costs being covered by both billed or collected revenue as seen in working ratio of 1.20 times and working coverage of 1.52 times. Collection rates are also reasonable at 79%. It is observed that T&TEC's return on allowed Regulatory Asset Base (RAB) of 32% is well above the benchmark.

The number of written customer complaints reduced by 15%, down to 212 complaints from the 2009/2010 level. The overall resolution rate was approximately 82%, an improvement of 2%.

Overall, there is little evidence that T&TEC's performance in some of the key areas is improving. The RIC believes that one key issue is the lack of performance related incentives for managers and staff. In order to address this situation, the RIC had proposed the introduction of a productivity scheme, and a "pay for performance" scheme for staff and managers. However, it is up to the Board/Government as shareholder/owner to develop and implement the proposed incentive mechanisms.

Finally, although the data in this report provide a fair reflection of performance, the RIC believes that the quality of data provided can be improved. The RIC, once again, urges T&TEC to improve its data management system to enhance the accuracy and reliability of data.

1.0 INTRODUCTION

The Regulated Industries Commission (RIC) was established by the Regulated Industries Commission Act No. 26, 1998 as the economic regulator of the water and electricity sectors in Trinidad and Tobago. The RIC's role as an economic regulator is to ensure that the service providers do not abuse their monopoly powers by ensuring that they provide a reasonable standard of service at a fair price and that their rights and obligations, and those of their customers, are fairly balanced and enforced. To achieve this role, the RIC undertakes the following principal activities:

- Setting tariffs at levels sufficient for the service providers to finance their activities in accordance with obligatory standards and acceptable level of service expectations, but at the same time promoting efficiency to ensure that tariffs are reasonable and no higher than they need to be;
- Ensuring that service providers meet their level of service obligation; and
- Safeguarding customers' interests by ensuring that services are provided in accordance with established standards of service.

Specifically, Section 56 of the Act empowers the RIC to collect and compile any information which may be of assistance in the exercise of its functions and publish the results thereof. The RIC published a document, "**Performance Monitoring And Reporting Framework**" (PMR) in May 2005, for the purposes of monitoring the services of the electricity sector. The RIC further indicated in the Final Determination: Regulation of Electricity Transmission and Distribution 2006 – 2011 (The Determination) that it will monitor the performance of the Trinidad and Tobago Electricity Commission (T&TEC) for the purpose of determining and reporting on the level of compliance by T&TEC with the Determination. This is the fourth report on T&TEC's performance with regard to the key Performance Indicators that impact on customers, such as, service reliability and cost efficiency. Data used in the assessment were supplied by T&TEC, except where specified otherwise.

Purpose of Document

This document reports on the performance of T&TEC for the period July 2010 to June 2011 with respect to the performance indicators contained in the Determination, the specific directives given by the RIC, and other metrics of performance that are relevant to the electricity transmission and distribution sector. It provides an assessment of the performance indicators against targets set by the Determination as well as against past years and compares these with the performance of other utilities, where data are available.

Structure of Document

The remainder of this report is organized into the following sections:

Section 2.0 Aggregate and Other Economic Data

Section 3.0 Network Reliability

Section 4.0 Financial Performance

Section 5.0 Customer Responsiveness and Service

Section 6.0 Information on Specific Directives

Section 7.0 Conclusions and Recommendations.

A list of key performance indicators and definitions of key terms of the electricity sector (taken from the PMR) is contained in the appendix. Many of these were used in the discussion of T&TEC's performance.

2.0 AGGREGATE & OTHER ECONOMIC DATA

T&TEC is required to collect aggregate data periodically, and to submit these to the RIC quarterly and/or annually. This data set includes electricity coverage, number of customers, kWh purchases and sales, and system losses. Below is a discussion of that information. Performance and data analyses are done primarily against T&TEC's performance and data of the previous year.

2.1 Electricity Service Coverage

One of the indicators of the level of access to electricity is Electricity Service Coverage. In fact, according to the International Energy Agency, "*Individuals' access to electricity is one of the most clear and un-distorted indication of a country's energy poverty status.*"[1] This metric is also often used to gauge the infrastructural capacity for growth in commercial and industrial activities. **Table 1** shows electricity coverage for Trinidad and Tobago as at the mid-year over the period 2008 to 2011.

TABLE 1 - ELECTRICITY COVERAGE

Mid-year	Estimated T&T population (CSO)	Estimated Number of Households (CSO)	Residential Accounts[2]	Service Coverage[3]
2008	1,308,587	348,028	353,862	98%
2009	1,310,106	348,432	364,250	98%
2010	1,317,714	350,456	371,441	-
2011	1,325,402	406,198[4]	379,224	99%

There are very small sections of the country that are not supplied by the national electricity grid. Although Electricity Service Coverage data for 2010 is not available,

[1] International Energy Agency, *World Energy Outlook: Access to Electricity*, retrieved from http://www.iea.org/weo/electricity.asp

[2] The number of residential accounts reported by T&TEC may not correspond with estimated number of households estimated by CSO for 2008-2010. This apparent disparity may be due to several factors, including statistical errors.

[3] Estimated by Central Statistical Office of Trinidad and Tobago (CSO), except 2011 which was obtained from International Energy Agency, *World Energy Outlook 2011*

[4] Actual figure based on 2011 census.

it is expected to be between 98% and 99%. By comparison, Jamaica and Brazil had coverage of 92% and 98.3%, respectively in 2011[5].

2.2 Number of Customers by Class and Area

T&TEC supplies electricity to various customer types – Domestic, Commercial and Industrial – that are categorized by electrical load and supply voltage. All customers are billed for energy consumed, measured in kWh. Industrial customers have an additional charge, demand charge, measured in kVA. A separate classification – Street Lighting – is used to bill government entities for the electricity that is consumed by public lighting. T&TEC's customers are also grouped according to five distribution areas – North, South, East, Central and Tobago. **Table 2** shows the number of active customer accounts by class for both 2009/2010 and 2010/2011. Over 90% of customers are classified as Domestic.

TABLE 2 – NUMBER OF ACTIVE ACCOUNTS BY CLASS (2010/2011 VS. 2009/2010)

YEAR	CLASS				TOTAL
	Domestic	Commercial	Industrial	Street Lighting	
2010/2011*	379,224	38,637	3,216	45	421,122
2009/2010*	371,441	37,986	3,114	49	412,590
% Change	2%	2%	3%	-8%	2%

*As at June 30th

Table 3 shows the number of active customer accounts by area. The South Distribution Area accounts for the largest number of active accounts, with 30% of the customer base. There was an overall increase of 2% in the total number of accounts.

[5] International Energy Agency, *World Energy Outlook 2011*

TABLE 3 – NUMBER OF ACTIVE ACCOUNTS BY AREA (2010/2011 VS. 2009/2010)

YEAR	AREA					TOTALS
	North	South	Tobago	East	Central	
2010/2011*	89,199	127,354	23,547	111,969	69,053	**421,122**
2009/2010*	88,424	125,127	22,622	109,494	66,923	**412,590**
% Change	1%	2%	4%	2%	3%	**2%**

*As at June 30th

2.3 Electricity Purchases and Sales

Table 4 shows the year-on-year comparison of electricity purchased during the period July 2010 to June 2011 against the corresponding period for 2009/2010. There was an overall increase of approximately 4.5% in kWh purchased.

TABLE 4 – KWH PURCHASED YEAR-ON-YEAR COMPARISON

MONTH	FOR YEAR		% Change	Per Quarter Change
	2010/2011	2009/2010		
July	701,770,000	671,253,000	4.55%	2.60%
August	693,330,000	681,713,000	1.70%	
September	692,690,000	681,891,000	1.58%	
October	700,221,000	694,255,000	0.86%	3.49%
November	683,180,000	628,712,000	8.66%	
December	690,087,000	680,593,000	1.39%	
January	711,862,000	660,811,000	7.73%	6.89%
February	659,456,000	614,187,000	7.37%	
March	737,155,000	697,546,000	5.68%	
April	735,174,000	689,649,000	6.60%	4.94%
May	769,726,000	719,255,000	7.02%	
June	740,926,000	731,195,000	1.33%	
TOTAL	**8,515,577,000**	**8,151,060,000**	**4.47%**	

Table 5 shows the total amount of electricity sales in kilowatt hour (kWh) by distribution area for each quarter during the period July 2010 to June 2011. The largest consumption (sales) of electricity occurred in the Central Distribution Area, which represented 38.2% of total consumption, as this area has the highest concentration of large industrial customers. The total consumption of all the areas combined increased very slightly by 0.41% over 2009/2010. It can be inferred that system losses, including own use, accounted for a greater portion of electricity consumed. This is further substantiated by the fact that the value for total system losses was higher for 2010/2011.

TABLE 5 – KWH SALES BY DISTRIBUTION AREA

QUARTER	NORTH	SOUTH	EAST	CENTRAL	TOBAGO	TOTAL
July - September 2010	427,440,105	400,130,532	442,243,431	821,878,429	63,609,918	**2,155,302,415**
October - December 2010	418,441,520	373,495,817	352,138,768	692,911,943	65,691,950	**1,902,679,998**
January – March 2011	384,026,649	396,107,067	412,849,412	785,848,618	54,328,398	**2,033,160,144**
April - June 2011	414,665,163	381,784,696	352,224,630	792,884,073	65,803,508	**2,007,362,070**
Total	**1,644,573,437**	**1,551,518,112**	**1,559,456,242**	**3,093,523,064**	**249,433,774**	**8,098,504,628**
Average	411,143,359	387,879,528	389,864,060	773,380,766	62,358,443	**2,024,626,157**

2.4 Other Economic Data

This section is a compendium of economic and consumption data that are reported on a "per employee" or "per customer" basis.

Table 6 shows a summary of other economic data for 2010/2011 and 2009/2010. Two of the indicators – energy sold per employee and customers per employee – are metrics generally used to measure labour productivity in the electricity distribution sector[6]. In the case of sales per employee and customers per employee, both of these

[6] The World Bank Group (2009). *Benchmarking Data of the Electricity Distribution Sector in the Latin America and Caribbean Region 1995 – 2005*. http://info.worldbank.org/etools/lacelectricity/home.htm

measures showed marginal improvement. Overall, there was a slight increase in productivity.

TABLE 6 – OTHER ECONOMIC DATA

	2010/2011	2009/2010	% Change
kWh Sales per Employee (kWh)	3,021,830	3,009,371	0.41%
Sales per Employee ($)	1,008,952	995,194	1.38%
Customers per Employee	159	154	3.01%
Consumption per capita (kWh)	6,110	6,121	(0.18%)

Another metric of interest in this section is consumption per capita. This is defined as the total amount of electricity sold divided by the population. It gives a measure of the average amount of electricity consumed per person. Per capita consumption for Trinidad and Tobago is significantly higher than that for Latin American and Caribbean countries, and is comparable to several developed countries (**Table 7**). The relatively high level of industrial electricity consumption is one of the reasons for the relatively high per capita consumption in Trinidad and Tobago. The decline in consumption per capita was due to a decline in economic activities, brought about by the global recession in 2008.

TABLE 7 – ELECTRICITY CONSUMPTION PER CAPITA [7]

Country	kWh Consumption per Capita			% Change 2008 - 2009
	2009	2008	2007	
Cuba	1,348	1,327	1,309	1.58%
Jamaica	1,902	2,552	2,542	(25.47%)
Venezuela	3,152	3,074	3,077	2.54%
Italy	5,271	5,661	5,713	(6.89%)
Greece	5,540	5,723	5,628	(3.20%)
Trinidad & Tobago	**5,662**	**5,789**	**5,642**	**(2.19%)**
United Kingdom	5,700	6,061	6,152	(5.96%)
United States	12,914	13,663	13,657	(5.48%)

[7]Electric power consumption (kWh per capita) data was obtained for the respective calendar years from World Bank: World Development Indicators, retrieved from: http://data.worldbank.org/indicator/EG.USE.ELEC.KH.PC/countries/

2.5 Total System Losses

All the electrical energy that enters T&TEC's transmission and distribution network is not sold to customers. Some is lost in the transmission and distribution system due to the electrical resistance of the conductors, and some is consumed for own use by T&TEC. Inaccuracies due to defective meters and illegal consumption may also result in discrepancies between the energy supplied to the end users and what is billed. The combination of all the losses is referred to as the total system losses. Losses resulting from inefficiencies in T&TEC's transmission and distribution networks are referred to as technical losses, and losses due to theft, billing errors, meter inaccuracy, etc, are generally referred to as commercial losses.

The RIC set a system loss target of 6.75% for the regulatory control period June 1, 2006 to May 31, 2011. The method used to calculate the system losses for the purpose of the Determination is based on a formula developed by the RIC[8]. This formula yields a different result from the method that T&TEC uses. **Table 8** shows the system losses reported by T&TEC for the period July 2010 to June 2011, using both T&TEC's and RIC's formulas. A cursory observation of the total annual system losses gives the indication that the T&TEC formula yields a more favorable result (6.20%) than the RIC formula (9.19%). Closer scrutiny of the per quarter values reveals that they both fluctuate significantly about their respective means, with the T&TEC formula being lower except for the October to December quarter (where Collections exceeded Billings). This means that the "Collections/Billings" component

[8]T&TEC determined system losses using the formula:

$$\text{Total System Losses} = 1 - \left\{ \frac{\text{Energy Units Billed}}{\text{Energy Units Purchased}} \right\}$$

The RIC used the following formula, which included an additional factor, to include revenue collected by the service provider and account for commercial efficiencies:

$$\text{Total System Losses} = 1 - \left\{ \frac{\text{Energy Units Billed}}{\text{Energy Units Purchased}} \times \frac{\text{Collections in \$}}{\text{Billings in \$}} \right\}$$

of the RIC's formula has a significant impact on the calculations. Observation of the pattern of both sets of system losses data shows that there is a weak correlation between them, as the rate of change is generally in opposite directions going from quarter to quarter. One explanation of this is that the "collections/billings" component of the RIC's formula captures delays in accounts receivable, which is more a measure of commercial efficiency. The RIC is therefore proposing to use only the formula used by T&TEC for future performance reporting. Also of concern is the extremely low value of the system losses obtained by the T&TEC formula for the July to September 2010 quarter. This "near zero" value seems to be unrealistic for total system losses for the period and brings into question the validity of the data.

TABLE 8 - TOTAL SYSTEM LOSSES 2010/2011

Quarter/Year	Energy Units Billed (kWh)	Energy Units Purchased (kWh)	Collections	Billings	System Loss Applying RIC'S Formula %	System Loss Applying TTEC'S Formula %
			($)	($)		
July - September 2010	2,155,137,196	2,155,534,000	666,821,356	717,782,857	7.12	0.02
October - December 2010	1,902,679,998	2,123,498,000	685,954,378	636,775,187	3.48	10.40
January - March 2011	2,032,732,106	2,108,473,477	623,954,000	675,941,194	11.01	3.59
April - June 2011	2,007,747,429	2,245,825,750	628,365,000	660,519,911	14.95	10.60
TOTAL	**8,098,296,729**	**8,633,331,227**	**2,605,094,734**	**2,691,019,149**	**9.19**	**6.20**

The general pattern of the data suggests that there is no clear effort being made by T&TEC to actively manage system losses, despite the mandate issued by the RIC in the Determination.

3.0 NETWORK RELIABILITY

A critical part of providing quality service to customers is the delivery of a reliable supply of electricity. An unreliable supply, in addition to incurring economic losses and inconveniences, increases the likelihood of damage to customer equipment. It is therefore important for utilities to meet minimum standards of reliability, even as they seek to pursue and maintain economic and operational efficiencies. One of the roles of the RIC, as economic regulator, is to ensure that T&TEC supplies electricity to its customers at an acceptable level of reliability. The reliability of T&TEC's supply was therefore assessed using the under-mentioned indices.

3.1 System Average Interruption Frequency Index (SAIFI)

The System Average Interruption Frequency Index (SAIFI) measures the average number of sustained interruptions per customer. **Table 9** shows the indices for the period July 2010 to June 2011. The annual value of SAIFI for the period, 6.28 interruptions per customer, was a decline in performance, when compared to 5.74 for the same period in 2009/2010. There is also significant scope for improvement when compared with the mean value for North American utilities at 1.10. This means that a T&TEC customer is almost six times more likely to experience an interruption in electricity supply than a North American customer. However, as shown in **Table 10**, T&TEC recorded a marked improvement in SAIFI in 2008 and continued to maintain this performance through to 2011.

TABLE 9 – NETWORK RELIABILITY 2010/2011

INDICATOR	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	2010/2011
SAIFI (No per customer)	0.68	0.56	0.71	0.91	0.52	0.32	0.47	0.37	0.26	0.43	0.51	0.54	**6.28**
SAIDI (minutes)	67.2	55.8	61.8	79.2	45	26.4	31.2	29.4	18.6	36.6	51	45.6	**547.8**
CAIDI (minutes)	98.4	99.6	87	87	85.8	81.6	66.6	79.8	72.6	85.2	99.6	84	**87**

3.2 System Average Interruption Duration Index (SAIDI)

The System Average Interruption Duration Index (SAIDI) measures the average outage duration per customer. The SAIDI was 547.8 minutes for the period July 2010 to June 2011. This is 68 minutes more than that for the same period in the previous year, representing a marked decline in performance. The mean SAIDI for North American utilities is 90 minutes, suggesting that T&TEC's outage duration is over six times longer per customer. There is therefore considerable room for improvement. However, there was significant improvement in SAIDI in 2008 (**Table 10**) and T&TEC maintained this level up to 2011.

3.3 Customer Average Interruption Duration Index (CAIDI)

The Customer Average Interruption Duration Index (CAIDI) is the ratio of SAIDI to SAIFI. It is a measure of the average outage duration that an individual customer would experience. It can also be viewed as the average restoration time. The annual value of CAIDI for 2010/2011 was 87 minutes, with a high of 99.6 minutes in May 2011, and a low of 66.6 in Jan 2011. By comparison, the annual value of CAIDI for 2009/2010 was comparable at 84 minutes, but with a high of 103.2 minutes in July 2009 and a low of 73.8 in June 2010. Therefore annual CAIDI increased slightly year-over-year, but there was less fluctuation month-to-month. Comparing CAIDI over the period 2001 to 2011 (**Table 10**), it can be seen that T&TEC achieved a significant performance improvement in 2008 and maintained this level in the ensuing years to 2011.

TABLE 10 – NETWORK RELIABILITY INDICATORS FOR T&TEC 2001 – 2011

INDICATOR	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	*NAU
SAIFI (No./customer)	9.76	10.56	10.25	9.54	11.43	9.93	10.1	6.94	5.55	6.61	5.68	1.1
SAIDI (minutes)	1128	1093	966	833	1116	996	1020	603	487	563	486	90
CAIDI (minutes)	115	104	94	90	98	100	100	93	87	85	86	82

Reliability measures reported in Table 10 is for calendar years

*NAU = Median values for North American utilities according to IEEE Standard 1366-1998

3.4 Number of Transmission Trips

Table 11 shows the number of transmission trips and interruptions affecting customers during the period July 2010 to June 2011. There were 35 transmission trips during this period. The largest number of these occurred on the 33kV network with 23 trips, followed by the 66kV network with 12 trips. The 132kV network had the best performance with no transmission trips, and therefore no need for restoration. The 66kV network performed better than the 33kV with 100% of the trips being restored within 3 hours (**Table 12**). In the case of the 33kV network, 91.3% of the trips were restored within 3 hours, with the remaining 8.7% taking more than 5 hours.

There were 10% fewer trips in 2010/2011 when compared with the 39 trips which occurred in 2009/2010. The average restoration time was also better for 2010/2011 with 94.3% of the trips being restored within 3 hours compared to 87.2% for 2009/2010. Overall, T&TEC was more effective in maintaining a reliable network both by preventing transmission trips and in restoring the supply on transmission lines during 2010/11.

TABLE 11 – TRANSMISSION TRIPS & INTERRUPTIONS AFFECTING CUSTOMERS JULY 2010 TO JUNE 2011

MONTH/YEAR	Transmission Circuit Trip outs			Number of Interruptions Restored (<3hrs)			Number of Interruptions Restored (<5hrs)		
	33kV	66k V	132kV	33kV	66kV	132kV	33kV	66kV	132kV
Jul-10	3	2	0	2	2	0	0	0	0
Aug-10	2	1	0	2	1	0	0	0	0
Sep-10	3	3	0	3	3	0	0	0	0
Oct-10	5	1	0	5	1	0	0	0	0
Nov-10	1	0	0	1	0	0	0	0	0
Dec-10	0	1	0	0	1	0	0	0	0
Jan-11	1	0	0	1	0	0	0	0	0
Feb-11	0	1	0	0	1	0	0	0	0
Mar-11	1	1	0	1	1	0	0	0	0
Apr-11	0	1	0	0	1	0	0	0	0
May-11	4	0	0	4	0	0	0	0	0
Jun-11	3	1	0	2	1	0	0	0	0
TOTAL	**23**	**12**	**0**	**21**	**12**	**0**	**0**	**0**	**0**

TABLE 12 – SUMMARY OF TRANSMISSION TRIPS & INTERRUPTIONS JULY 2010 - JUNE 2011

	No. of TRIPS			
	33kV	**66kV**	**132kV**	**Overall**
TOTAL	23	12	0	**35**
Restoration < 3hrs	21	12	0	**33**
Restoration < 5hrs	0	0	0	**0**
% < 3hrs	91.3%	100.0%	N/A	**94.3%**
% < 5hrs	0.0%	0.0%	N/A	**0.0%**

4.0 FINANCIAL PERFORMANCE & EFFICIENCY

One of the primary goals of economic regulation is to ensure that the utility operates in a way that ensures financial viability and sustainability, while providing an acceptable quality of service to customers at a reasonable price. **Table 13** shows a select set of financial ratios analyzing the performance of T&TEC based on debt financing capabilities, profitability, liquidity and efficiency.

TABLE 13 – SELECT FINANCIAL RATIOS OF T&TEC'S PERFORMANCE FOR JULY TO JUNE OF YEARS SHOWN

RATIOS	YEAR				TARGET
	2010/11	2009/10	2008/09	2007/08	
Debt Financing					
Funds Flow Interest Cover	3.76	3.91	4.28	3.03	Greater than 3
Debt Pay Back Period (Years)	5.22	5.30	4.99	6.87	Between 5 to 7
Cash Interest Cover	2.06	3.86	1.95	6.83	
Debt as a portion of RAB (%)	169%	306%	242%	274%	Below 65%
Gearing	0.72	0.50	0.43	0.46	
Liquidity					
Internal Financing (%)	54%	1980%	703%	20070%	Greater than 40%
Collection Rate (%)	79%	80%	80%	79%	
Revenue Collected/Operating cost	1.20	1.09	1.13	1.10	
Revenue Billed/Operating Cost	1.52	1.37	1.40	1.38	
Profitability and Efficiency					
Return on RAB (%)	32%	58%	48%	40%	About 9%
Operating Cost per unit ($/KWH)	0.24	0.26	0.23	0.21	

Debt Financing

T&TEC's ability to meet its financial obligations is within an acceptable range. According to the funds flow and cash interest coverage, T&TEC has displayed its ability to meet and maintain its finance cost. The debt payback period is also within the targeted range of approximately five (5) years. However, the debt as a proportion of the Regulatory Asset Base (RAB) is grossly outside of the targeted range. This is mainly due to borrowed funds not being appropriately allocated to RIC approved capital projects under the RAB but being used mainly to fund projects classified as ring fenced, which do not enter the RAB.

T&TEC's Gearing has also increased mainly due to the HSBC long-term loan taken for the Cove Development Project. However, it is still relatively low when compared to gearing of 1.30[9] for U.S. shareholder-owned electric utilities.

Liquidity

Overall, T&TEC has been in a fairly good liquidity position when the past three (3) years are reviewed. The bank overdraft has not been utilized since 2009. This indicates that T&TEC is meeting more of its daily operating expense from tariff revenue. The internal financing ratio signifies whether T&TEC is capable of meeting its approved CAPEX projects from revenue generated. The figures generated for T&TEC implies that there is an issue with the data used in computing the Internal Financing Ratio. T&TEC could not accurately segregate the CAPEX on an annual basis and the majority of CAPEX projects were identified as completed and included in the RAB during 2010/2011. This completion rate of CAPEX in one year, however, is not in line with their past levels of project completion. Other measures using CAPEX will also be affected.

T&TEC's collection rates have been within the ranges of 79% to 80% over the past three (3) years with the remainder being allocated to receivables which stands at approximately $500 million over the past three (3) years. If T&TEC improves its debt collection the overall liquidity position will be enhanced. From observing the working coverage ratios

[9] Calculated from data provided by Edison Electric Institute 2011 Financial Review. Retrieved from: http://www.eei.org/whatwedo/DataAnalysis/IndusFinanAnalysis/finreview/Pages/performance.aspx

T&TEC is quite capable of meeting its operating costs from revenue billed or collected. It must be noted that T&TEC has a current liability of approximately $2.8 billion owed to NGC for the purchase of fuel. A more realistic figure for fuel supplied over an extended period would be $62,321,989[10].

Profitability and Efficiency

Since T&TEC is a state-owned utility, analyzing the general profitability of the service provider may not be as relevant for the purposes of the RIC as it would have been in the case of an investor-owned utility. This is mainly due to the entity's core objective and shareholder interest. Therefore the return on RAB will be used. This is similar to return on capital except the net cash flow return will be compared to the regulatory asset base. Overall with a target of 9% return on RAB, T&TEC seems to be exceeding its target. The major reason is the RAB was determined using incorrect values for CAPEX.

With respect to financial efficiency, operating cost per kWH is one of the measures used. This metric has been fairly stable over the past three (3) years.

[10] This amount was calculated by taking an average monthly cost of fuel for 2010 and assuming a 30 day delay in accounts payable since interest is charged monthly on amounts owed.

5.0 CUSTOMER RESPONSIVENESS AND SERVICE

This sub-section focuses on the customer complaints and their resolution with a focus on those aspects felt by customers.

Table 14 shows the comparison of total complaints received during 2010/2011 and 2009/2010. Overall there was a 15% reduction in the number of complaints and a 2% improvement in the resolution rate. Damaged appliances accounted for the largest percentage reduction in the number of complaints at 72.7% followed by billing query at 33.3%. However, there was a significant increase in the number of high/low voltage complaints, with a percentage increase of 121.2%.

TABLE 14 – COMPARISON OF 2009/2010 WITH 2010/2011

Type of Complaint	No. of Complaints		% Change
	2010/2011	2009/2010	
Damaged appliances	24	88	(72.73%)
Billing query	32	48	(33.33%)
High/Low Voltage	73	33	121.21%
Poles/Other	83	81	2.47%
Total	**212**	**250**	**(15.20%)**
Resolution Rate	**81.60%**	**79.6%**	**2%**

Table 15 shows the total number of complaints by type and the percentage resolution. Of the total complaints received, the largest number was recorded for the "poles/other" category, which accounted for 39%. This was followed by high/low voltage (34%), billing query (15%) and damaged appliances (11%). Of the 212 complaints received, 173 (81.6%) were resolved. This resolution rate was an improvement over the 2009/2010 figure of 79.6%. Damaged appliances, despite having the least number of complaints, recorded the lowest resolution rate at 58.3%.

Damaged appliances' claims continue to be an area of contention between T&TEC and customers.

TABLE 15 – TOTAL COMPLAINTS RESOLVED BY TYPE (2010/2011)

Type of Complaint	No. of Complaints	% of Total Complaints	Total Resolved	% Resolved
Billing query	32	15%	29	90.63%
Damaged appliances	24	11%	14	58.33%
High/Low Voltage	73	34%	65	89.04%
Poles/Other	83	39%	65	78.31%
Total	**212**	**100%**	**173**	**81.60%**

Table 16 gives a breakdown by type of the complaints that were resolved per quarter over the period July 2010 to June 2011. The largest number of complaints was received during the January to March 2011 quarter (44.3%), and the lowest was received in July to September 2010 (15.1%). The percentage resolution per quarter was highest in the October to December 2010 quarter at 89.4%. This was followed by January to March 2011 (81.9%), April to June 2011 (79.5%) and July to September 2010 (71.9%), respectively. The July to September 2010 quarter had the lowest resolution rate despite having the fewest number of complaints.

TABLE 16 - COMPLAINTS RESOLVED BY TYPE PER QTR (2010/2011)

Type of Complaint	Number of complaints received				Number of complaints resolved			
	Jul - Sep 2010	Oct - Dec 2010	Jan - Mar 2011	Apr - Jun 2011	Jul - Sep 2010	Oct - Dec 2010	Jan - Mar 2011	Apr - Jun 2011
Billing query	9	15	5	3	8	13	5	3
Damaged appliances	7	7	3	7	4	5	2	3
High Low Voltage	7	7	55	4	5	7	49	4
Poles/Other	9	18	31	25	6	17	21	21
TOTAL	**32**	**47**	**94**	**39**	**23**	**42**	**77**	**31**
% Resolved by Qtr	**-**	**-**	**-**	**-**	**71.88%**	**89.36%**	**81.91%**	**79.49%**

One of the important indicators of service quality is the promptness of the service provider's response to the queries and complaints of customers. **Table 17** provides a summary of T&TEC's performance with respect to written complaints received during the period July 2010 to June 2011.

TABLE 17 - RESPONSE TO WRITTEN COMPLAINTS

Month/Year	No. of written complaints received	*No. of written complaints not responded to within 2 weeks		Percentage of complaints with Response > 2 weeks
		Received in current month	Received in previous months	
Jul-10	11	1	4	9.09%
Aug-10	7	0	9	0.00%
Sep-10	14	3	4	21.43%
Oct-10	16	0	3	0.00%
Nov-10	14	0	1	0.00%
Dec-10	17	3	2	17.65%
Jan-11	9	0	0	0.00%
Feb-11	64	0	0	0.00%
Mar-11	21	4	0	19.05%
Apr-11	8	1	1	12.50%
May-11	14	0	1	0.00%
Jun-11	17	2	1	11.76%
TOTAL	**212**	**14**	**26**	**6.60%**

T&TEC was actually required to report on the number of written complaints responded to within 5 days. Instead, the service provider supplied information on the number of complaints responded to within 2 weeks. Of the 212 written complaints received, only 6.6% were not responded to within 2 weeks. The highest percentage (21%) of written complaints that were not responded to within 2 weeks was recorded in September 2010. The best performance was achieved in February 2011, when 100% of complaints were responded to within 2 weeks, even though the highest number of written complaints was recorded in that month. The overall performance in 2010/2011 was comparable to 2009/2010 in which there were 257 complaints with 7% not responded to within 2 weeks.

6.0 INFORMATION ON SPECIFIC DIRECTIVES

T&TEC is required to provide information on specific directives related to its operations, in addition to meeting requirements stipulated by the RIC in the Determination. This section reports on two of these specific directives – repair and maintenance of pole-mounted transformers, and repair/replacement of defective street lights.

6.1 Pole-mounted Transformers

In the Final Determination of 2006 – 2011, a directive was given to T&TEC to repair and maintain pole-mounted distribution transformers at a rate of at least 20% per annum.

There were 33,438 pole-mounted transformers in service at the end of the period, as recorded in the 2nd quarter of 2011 (**Table 18**). T&TEC inspected these at a rate of 101.3% per annum. The number recorded may include inspection of additional equipment such as high voltage sections and high voltage equipment (e.g. air break switches). The total percentage inspected/serviced was also well above the 20% minimum requirement. A large percentage of the maintenance was done in the first quarter of 2011, during which approximately 36% of the then existing units were inspected/serviced. **Table 19** shows the comparison between 2010/2011 and 2009/2010. There was a small increase of 2.3% on the number of pole-mounted transformers in service during 2009/2010. Despite this increase, T&TEC was able to raise the number of annual inspections/servicing by 34.7%, resulting in a higher inspection/servicing rate in 2010/2011.

TABLE 18 – REPORT ON REPAIRS AND MAINTENANCE TO POLE – MOUNTED TRANSFORMERS BY QUARTERS (2010/2011)

	3rd Quarter 2010	4th Quarter 2010	1st Quarter 2011	2nd Quarter 2011
Number of Pole Mounted Distribution Transformers	32,878	33,050	33,222	33,438
Number of Pole Mounted Distribution Transformers Inspected	7,688	5,626	10,745	9,828
No of Transformers Serviced	887	841	1,103	835
% Inspected/Serviced	**26.08%**	**19.57%**	**35.66%**	**31.89%**

TABLE 19 – YEAR-ON-YEAR COMPARISON OF REPAIRS & MAINTENANCE OF POLE MOUNTED TRANSFORMERS

	2010/2011	2009/2010	% Change
Total Number of Pole Mounted Distribution Transformers	33,438	32,677	**2.33%**
Total Number of Inspections/Servicing	37,553	27,872	**34.73%**
% Inspections/Servicing	112.31%	85.30%	-

6.2 Street lighting Repair and Replacement

T&TEC is responsible for monitoring the condition and performance of public lighting assets. This includes the development and implementation of plans for the installation, operation, maintenance and replacement of public lighting. The service provider is also required to monitor highway lighting and repair non-working lights within 14 days of discovery. Street lighting failures that are reported to the service provider are to be repaired within 7 days. **Table 20** shows the number of reports received and the number of repairs done during the period July to June for the years 2009/2010 and 2010/2011. For 2010/2011, T&TEC received 16,463 reports, of which

12,738 (or 77.4%) repairs/installations were completed within 7 days. T&TEC also completed 9,037 repairs in response to reported failures for that period. In total, T&TEC completed 25,399 repairs during 2010/2011.

TABLE 20 – MONTHLY REPORT OF STREET LIGHT REPAIRS AND INSTALLATIONS

	1st Quarter		2nd Quarter		3rd Quarter		4th Quarter		TOTAL	
	2009/10	2010/11	2009/10	2010/11	2009/10	2010/11	2009/10	2010/11	2009/10	2010/11
No. of Reports Received	5,556	3,826	4,142	3,528	4,962	4,655	4,587	4,454	19,247	16,463
No. of Repairs & Installation Completed within 7 days	4,335	2,947	3,026	2,543	3,772	3,503	3,598	3,745	14,731	12,738
No. of Repairs & Installation without a report	1,818	2,892	1,649	2,172	1,275	2,281	1,428	1,692	6,170	9,037
Total No. of Repairs & Installation Completed	7,000	6,916	5,469	5,494	6,773	7,067	5,853	5,922	25,095	25,399

Table 21 shows a summary of the year-on-year comparison of repairs of street lights for both years. The number of reports of street lighting failures received in 2010/2011 was approximately 17% less than that received in 2009/2010. There was also a 16% decrease in the number of reported failures that were repaired within 7 days. There was a very slight increase of less than 1% in the 7-day repair rate for reported failures. Therefore, T&TEC showed no real improvement in addressing reported

failures. However, the number of unreported failures that were detected and repaired showed a substantial increase of 46%, raising the overall number of repairs by 1.2%. The increase in self-initiated repairs, along with the slight improvement in the rate of repair of reported failures, puts the overall performance of 2010/2011 above that of 2009/2010.

TABLE 21 – YEAR-ON-YEAR COMPARISON OF REPAIRS OF STREET LIGHTS

	2010/2011	2009/2010	% Change
No. of Reports Received	16,463	19,247	**(16.91%)**
No. of Repairs Completed within 7 days	12,738	14,731	**(15.65%)**
7-day Repair Rate for reported failures	77.37%	76.54%	**0.84%**
No. of Repairs without a report	9,037	6,170	**46.47%**
Total No. of Repairs Completed (Including carryover from previous year)	25,399	25,095	**1.21%**

7.0 CONCLUSIONS & RECOMMENDATIONS

7.1 Conclusions

T&TEC's overall performance was mediocre for the period under review. While there were slight to moderate improvements in some areas, the results in a number of the key areas fell below those of the previous year. Noteworthy performance declines include a fall in network reliability as measured by SAIFI and SAIDI, as T&TEC's customers experienced a lower level of reliability than the previous year. Although there were 10% fewer transmission trips, with a larger percentage of them being restored within 3 hours, there was a deterioration in both the average frequency in system interruptions and the average duration of interruptions, as depicted in an increase in both SAIDI and SAIFI. There is also significant margin for improvement when compared with North American utilities.

The total system losses performance also continued to decline, trending above the 6.75% target, and reaching almost 15% in the final quarter of the period. It is evident that T&TEC has not implemented an effective method of controlling system losses.

T&TEC's financial performance has remained consistent with that of previous years. Even with rising debt levels to fund capital projects such as Cove, T&TEC has maintained desirable interest coverage based on funds from operations. The gearing level is also acceptable when compared to international standards. On the basis of its liquidity position, T&TEC's is quite capable of meeting day to day activities from tariff revenue. Overall, T&TEC is in a financial position to meet its obligations and fund its daily operating activities.

There was a 15% reduction in the number of complaints and a 2% improvement in the resolution rate. Despite the decrease in overall number of complaints, there was an enormous increase of 121% in high/low voltage complaints. Also, T&TEC performed poorly in resolving damaged appliances complaints, with a resolution rate of 58%.

T&TEC showed significant improvement in inspecting/servicing pole-mounted transformers, above what was already an exceptional performance relative to the minimum target set by the Determination. There was also a marked improvement in addressing the number of unreported street lighting failures. However, the rate of addressing reported failures (within 7 days) remained flat despite a significant decrease in the number of reports received from customers.

7.2 RIC's Recommendations

- T&TEC should develop and implement a clear policy to appropriately manage system losses. The RIC intends to introduce measures that will incentivize improvements and penalize substandard performance.
- T&TEC should develop a strategy for improving SAIFI and SAIDI, paying special attention to areas where service interruption is very frequent. This may also help to reduce the number of damaged appliances complaints, as a decrease in interruptions is likely to reduce the number of surges and spikes experienced by customers.
- Analysis of the utility's financials shows that the company has the ability to pay its monthly natural gas bill. Therefore, it is strongly recommended that T&TEC pay these bills as they become due, and make arrangements with NGC to pay off the $2.8 billion in arrears.
- T&TEC should investigate the reason for the enormous increase in high/low voltage complaints, as well as the sharp drop in damaged appliances complaints, and take steps to improve the low rate of resolution of damaged appliances complaints.
- T&TEC should report the inspection of pole-mounted transformers separately from that of air break switches and other high voltage equipment to give more accurate information on the number of pole-mounted transformers inspected.

- T&TEC should maintain its momentum in addressing unreported failures of street lighting and seek to improve on the number of reported failures repaired within 7 days.
- T&TEC should consider the introduction of a productivity/“pay for performance” scheme for staff and managers to enhance performance.

APPENDIX – PERFORMANCE INDICATORS FOR T&TEC FROM THE DETERMINATION

Item	Category	Indicator	Definition	Units	Reporting Period
1.0	**Aggregate Data**				
1.1		Number of electricity customers by class and area	T&TEC's customer data		Yearly
1.2		KWh sales by area	T&TEC's customer data		Semi Annually
1.3		KWh purchased	The basic unit of electric demand, equal to 1,000 watt-hours.	KWh	Monthly
1.4		Total System Losses	Difference between MWh purchased and sold	MWh	Semi Annually
1.5		Number of connections and disconnections			Yearly
1.6		Peak demand	The maximum load during a specified period of time	MW	Yearly
1.7		Electricity coverage (i.e. Access to electricity)	$\frac{[\text{No. of customers (T\&TEC stats)}]}{[\text{No. of households in T\&T}]}$		Quarterly & Yearly
2.0	**Financial**				
2.1		Maintenance cost per kWh Sold	$\frac{\left[\begin{array}{c}\text{Total annual maintenance costs} \\ \text{(excluding capital cost)}\end{array}\right]}{[\text{MWh sold}]}$	$	Yearly
2.2		Cost of fuel per kWh	$\frac{[\text{Total costs of fuel}]}{[\text{Kwh generated}]}$	$	Quarterly & Yearly
2.3		Cost of fuel (sales)	$\frac{[\text{Fuel costs}]}{[\text{Total utility revenues}]} \times 100$	%	Quarterly & Yearly
2.4		Revenue per kWh	$\frac{[\text{Total revenue from sales}]}{[\text{Total no. of Kwh sold}]}$	($)	Yearly

Item	Category	Indicator	Definition	Units	Reporting Period
2.5		Internal manpower costs ratio	Annual internal manpower costs / annual running costs x 100.	%	Yearly
2.6		Energy costs ratio	Annual energy costs / annual running costs x 100.	%	Yearly
2.7		Depreciation costs ratio	Annual depreciation costs / annual capital costs x 100.	%	Yearly
2.8		Net interest costs ratio	(Interest expenses costs – interest income) / annual capital costs x 100.	%	Yearly
2.9		Sales revenues	(Sales revenues / annual revenues) x 100	%	Yearly
2.10		Total cost coverage ratio	Annual revenues / annual costs.	%	Yearly
2.11		Delay in accounts receivable	Year-end account receivable / annual sales revenues x 12.	months equivalent	Yearly
2.12		Investment ratio	Annual investments subject to depreciation / annual depreciation x 100.	%	Yearly
2.13		Debt service coverage ratio	Profit before interest and tax / (Interest + capital repayments).	%	Yearly
2.14		Operating ratio	$\frac{[\text{Operating costs (including depreciation and interest)}]}{[\text{Operating revenue}]}$	%	Yearly
2.15		Working ratio	$\frac{[\text{Operating costs (excluding depreciation and interest)}]}{[\text{Operating revenue}]}$	%	Yearly
2.16		Return on net fixed assets	Net operating income / net fix assets x 100.	%	Yearly
2.17		Return on equity	Profit after interest and tax / shareholders' equity x 100.	%	Yearly
2.18		Operating cost per customer	$\frac{[\text{Total operating costs}]}{[\text{Total no. of customers}]}$	($)	Yearly
2.19		Operating revenue per kWh	$\frac{[\text{Total operating revenue}]}{[\text{Total no. of KWH sold}]}$	($)	Yearly

Item	Category	Indicator	Definition	Units	Reporting Period
2.20		Current ratio	$\frac{[\text{Current assets}]}{[\text{Current liabilities}]}$	%	Yearly
2.21		Quick Ratio	$\frac{[\text{Current assets - stock}]}{[\text{Current liabilities }]}$	%	Yearly
2.22		Return on capital employed	$\frac{[\text{Profit before interest and tax}]}{[\text{Capital employed }]} x100$	%	Yearly
2.23		Gearing	$\frac{[\text{Interest bearing debt}]}{[\text{Interest bearing debt + equity}]}$		Yearly
2.24		Creditors Payments	$\frac{[\text{Creditors}]}{[\text{Credit purchases}]} x12$	Monthly equivalent	Yearly
2.25		Total revenue	Operating revenue and other revenue for the period	($)	Yearly
2.26		Total expenditure	Operating expenses plus other expenses (Operating Expenses includes Generation, Transmission and Distribution, Administration and General, and Depreciation)	($)	Yearly
2.27		Operating profit	Revenue from the organization's regular activities, less costs, and expenses and before income deduction	($)	Yearly
2.28		Asset turnover	$\frac{[\text{Sales}]}{[\text{Capital employed }]}$		Yearly
2.29		Interest Cover	$\frac{[\text{Profit before interest and tax}]}{[\text{Interest }]}$		Yearly
2.30		Long term debt	Debt liabilities due in excess of one year	($)	Yearly

Item	Category	Indicator	Definition	Units	Reporting Period
3.0	**Network Reliability**				
3.1		System average interruption frequency index (SAIFI) (Average number of sustained interruptions per customer)	Total number of reported customer interruptions greater than 1 minute duration / total number of customers served	Interruptions per year	Yearly
3.2		System average interruption duration index (SAIDI) (Average minutes off supply per customer)	Sum of each outage duration in minutes times the number of customers / total number of customers served	Minutes	Yearly
3.3		Customer average interruption duration index (CAIDI) (Average interruption duration)	$\frac{[\mathrm{SAIDI}]}{[\mathrm{SAIFI}]}$	Minutes	Yearly
3.4		Number of faults per 10km of distribution lines			Yearly
3.5		Number of faults per 20km of transmission lines			Yearly
3.6		Number of transmission and distribution circuit trip outs by voltage level			Yearly
3.7		Interruptions restored within 3 hours and 5 hours			Yearly
3.8		Supply interruptions per 100 connected customers			Yearly
3.9		Number of complaints on voltage levels per 100 connected customers			Yearly
3.10		Number of faults assigned to modifications at substations			Yearly

Item	Category	Indicator	Definition	Units	Reporting Period
3.11		Disaggregation of causes for interruptions of supply: 1. Maintenance 2. New construction 3. User connection 4. Faults			Yearly
3.12		Average response time to interruptions		Minutes	Yearly
4.0	**Affordability and other Economic Data**				
4.1		Sales per employee (KWh)	$\frac{[\text{Total KWh sales}]}{[\text{Number of employees}]}$	(KWh)	Yearly
4.2		Sales per employee ($)	$\frac{[\text{Total revenue form sales}]}{[\text{Number of employees}]}$	($)	Yearly
4.3		Customers per employee	$\frac{[\text{Total no of customers}]}{[\text{Total number of employees}]}$	Number	Yearly
4.4		Low/High voltage complaints by area		Number	Quarterly and Yearly
4.5		Consumption per capita (kWh)	$\frac{[\text{Total Kwh sales}]}{[\text{Total population}]}$	KWh	Yearly
4.6		Tariff for electricity services by category			Yearly
4.7		Restrictions for non payment of bills		Number	Yearly
4.8		Average consumption by class		KWh	Yearly
4.9		Average electricity bill by class		KWh	Yearly
4.10		Percentage of Customers with installment plans			Yearly
5.0	**Customer Responsiveness and Service**				
5.1		Calls to emergency phone Line(% answered in 30 sec.)			Quarterly and Yearly

Item	Category	Indicator	Definition	Units	Reporting Period
5.2		Written complaints not responded to within 5 working days			Quarterly and Yearly
5.3		Complaints received (per 100 customers)			Quarterly and Yearly
5.4		Complaints by major type	Reporting on the major areas of complaint	Number	Quarterly and Yearly
6.0	**Operational Indicators**				
6.1		Operator effectiveness - Training requirements (Per generation unit)	$\frac{[\text{MWh lost due to operator caused outage}]}{[\text{MWh generated}]} \times 100$	%	Quarterly and Yearly
6.2		Performance of generation unit when most needed (Per generation unit)	$\frac{[\text{Output (MW) at each monthly peak}]}{[\text{Name plate rating}]}$	Number	Quarterly and Yearly
6.3		Spinning Reserves Availability Indicates how well the system responds to load increases	$\frac{[\text{Spinning reserves at each monthly peak}]}{[\text{System peak load}]} \times 100$	%	Quarterly and Yearly
6.4		Generator Performance under Peak Load	$\frac{\left[\begin{array}{l}\text{The generator unit output (MW)}\\ \text{at each monthly system load peak}\end{array}\right]}{[\text{The unit's name plate rating}]}$		Quarterly and Yearly
6.5		Capacity Factor	$\frac{[\text{Annual electricity produced (MWh)}]}{\left[\begin{array}{l}\text{Installed capacity (MW) x}\\ \text{8760 (period in hours)}\end{array}\right]} \times 100$	%	Yearly
6.6		Load Factor When the capacity factor is approximately the same as the load factor, this is an indication that installed capacity matches demand.	$\frac{[\text{Annual electricity produced (MWh)}]}{\left[\begin{array}{l}\text{Maxium load (MW) x}\\ \text{8760 (period in hours)}\end{array}\right]} \times 100$	%	Yearly
6.7		Monthly System Peak Load Demand Indicates if monthly system peak loads are being met	$\frac{[\text{Available capacity (MW) at each monthly peak}]}{[\text{System peak load}]} \times 100$	%	Quarterly and Yearly

Item	Category	Indicator	Definition	Units	Reporting Period
6.8		Generation Unavailability This indicates the generation capacity short fall due to forced or planned outages	$\frac{\left[\begin{array}{l}\text{Unavailable capacity (MW)}\\ \text{at each monthly peak}\end{array}\right]}{[\text{System peak load}]} \times 100$	%	Quarterly and Yearly
6.9		Forced outage rate at monthly peak (per generator)	$\frac{[\text{unit rating (MW)} \times \text{outage hours (hrs)}]}{[\text{installed capacity (MW)} \times \text{period (hrs)}]}$		Quarterly and Yearly
6.10		Availability Factor Measures the availability of each unit after partial or full outages (both planned and forced) have been allocated Indicates whether sufficient capacity is available in the total system	$\frac{\left[\begin{array}{l}\text{Total hours of operation}\\ \text{of plant during the period}\end{array}\right]}{[\text{Total length of period (hours)}]} \times 100$ Ratio of available to installed capacity	Between 70% to 80% of the range, depending on system output factor %	Quarterly and Yearly
6.11		Output Factor (per unit) Measures the extent to which each unit capability is used	$\frac{[\text{MWh generated in period}]}{\left[\begin{array}{l}\text{Site rating on unit (MW) x}\\ \text{hours in period connected to system}\end{array}\right]} \times 100$	%	Quarterly and Yearly
6.12		Realization of monthly system loads	$\frac{[\text{Available capacity (MW)}]}{[\text{System peak load at each monthly peak}]} \times 100$	%	Quarterly and Yearly
6.13		Inadequate generation capacity due to a forced or planned outages	$\frac{[\text{Unavailable capacity (MW)}]}{[\text{System peak load at each monthly peak}]} \times 100$	%	Quarterly and Yearly
6.14		Average Heat Rate (per unit) Measures the amount of energy needed to produce one KWh of electrical output. Provides information on how efficient the conversion from heat to KWh. The smaller the heat rate the greater the efficiency	$\frac{[\text{Total Energy content of fuel burned}]}{[\text{Net KWh generated by unit}]}$	kJ/KWh	Quarterly & yearly