REGULATED INDUSTRIES COMMISSION

T&TEC's Annual Performance Indicator Report

For The Year

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Information Document

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EXECUTIVE SUMMARY

This is the Ninth Annual Performance Indicator Report for the Trinidad and Tobago Electricity Commission (T&TEC). This report provides an assessment of T&TEC's performance with respect to certain key performance indicators for the electricity transmission and distribution sector for the calendar year 2015. T&TEC's performance is assessed against targets set by the Regulation of Electricity Transmission and Distribution Final Determination: Rates and Miscellaneous Charges (June 01, 2006 to May 31, 2011), hereinafter called the Determination[1]; its performance in previous years; and specific performance metrics of other jurisdictions.

Total system losses worsened as shown by an increase - from 6.93% in 2014 to 7.40% in 2015. As a result T&TEC did not meet the target (of 6.75%) set by the RIC. There were reductions in the system reliability indicators, which indicated an improvement in the reliability of the network. In particular, System Average Interruption Frequency Index (SAIFI) decreased from 4.42 interruptions per customer in 2014, to 4.40 interruptions per customer in 2015. Also, System Average Interruption Duration Index (SAIDI) declined from 326.2 minutes in 2014 to 307.8 minutes in 2015, while Customer Average Interruption Duration Index (CAIDI) fell from 73.8 minutes in 2014 to 70.0 minutes in 2015. However, the number of transmission trips and interruptions on the network increased from 23 in 2014 to 37 in 2015, with a minor increase (0.1%) in the number of trips and interruptions restored within three hours.

In 2015, there were 35,265 pole-mounted transformers in service, representing a 1.5% increase from 2014. The annual percentage of transformers inspected/serviced increased from 101.7% in 2014 to 277.5% in 2015, and exceeded the target of 20% per annum set by the RIC. In terms of street lighting failures, there was an increase in the number of reports received, from 27,564 in 2014 to 28,363 in 2015. However, the 7-day repair rate for these reported failures declined from 41.8% in 2014 to 27.2% in 2015.

[1] The performance indicators were identified in the Performance Monitoring and Reporting Framework 2005 (PMR) and the Regulation of Electricity Transmission and Distribution Final Determination June 01, 2006 to May 31, 2011 (RATES AND MISCELLANEOUS CHARGES).The PMR establishes an effective strategy for monitoring and reporting on the electricity sector in Trinidad and Tobago, to evaluate, guide and strengthen the sector's performance overtime. The Final Determination sets the maximum tariffs and sets a methodology for determining the maximum prices that T&TEC may charge for its services.

Lastly, T&TEC's financial performance continued to deteriorate in 2015. Although the service provider's revenue was able to meet operating expenditure demands and operating costs decreased, there was a 1.25% decrease in the collection rate, constant revenue levels and its debt level increased to finance capital projects. T&TEC's profitability was negatively affected as evidenced by its failure to meet the targeted return on the Regulatory Asset Base (RAB).

SECTION 1.0 INTRODUCTION

1.1 Role of the Regulated Industries Commission (RIC)

The RIC is a statutory body established by the Regulated Industries Act No. 26, 1998. As the economic regulator of the water, wastewater and electricity sectors, the RIC has a responsibility to protect customers from the monopoly power of the service providers. Under Section 6 (1) of the RIC Act the Commission has the power to:

- Establish economic principles and methodology for the setting of rates for services and to perform periodic reviews of the rating regimes;
- Carry out studies of efficiency and economy of operation and of performance of service providers, publish results and take action, where necessary, to protect the interests of customers and other stakeholders;
- Prescribe standards for services, monitor compliance and impose sanctions for non-compliance;
- Investigate consumer complaints in respect of rates, billing and unsatisfactory service and facilitate redress;
- Ensure service providers are able to finance the delivery of services with an appropriate return on investment; and
- Ensure openness and transparency by publishing information which will allow stakeholders the opportunity for input in regulatory decisions.

1.2 Annual Performance Review for T&TEC

The RIC is mandated to carry out studies of efficiency and economy of operation and of performance of service providers under its purview. In the fulfilment of this mandate, it is important to set minimum standards of service delivery, establish rates that will allow the utility to earn sufficient revenue to meet these standards and thereafter, monitor the performance of the utility on a periodic basis. There are broad characteristics that can be assessed to evaluate the performance of utility in reference to its operational and maintenance responsibilities; its management and the responsiveness to customers' matters. Assessing achievement of each characteristic is generally determined by monitoring appropriate indicators/targets over time. Each

broad characteristic may have several options for indicators/targets that can be used to examine different aspects of performance.

T&TEC is required to report on its performance with respect to key metrics set by the RIC on a quarterly and/or annual basis. This dataforms the basis for assessing T&TEC's performance, and the data set comprises of indicators such as, electricity coverage, number of customers, electricity purchases and sales. Additionally, T&TEC's network reliability and system losses are reviewed, as well as other performance criteria, such as, customer responsiveness, equipment maintenance, and financial status. The findings of the assessment are published in an annual performance indicator report for T&TEC.

1.3 Purpose of Document

This document reports on T&TEC's performance for the year 2015 with respect to the performance indicators outlined in the Determination, 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 previously set by the RIC, as well as against performance of the previous year and compares these with the performance of other utilities, where data are available. This is the ninth Annual Performance Indicator Report for T&TEC.[2]

1.4 Structure of Document

This document is divided into three sections. **Section 1.0** highlights the purpose of the report. **Section 2.0** reviews T&TEC's performance with respect to the following broad performance criteria: Aggregate Data, Other Economic Data, Network Reliability, Equipment Maintenance and Financial Performance and Efficiency. Lastly, **Sections 3.0** concludes and proposes recommendations for T&TEC.

Additionally, a list of key performance indicators for the electricity transmission and distribution sector with definitions is contained in the Appendix.[3]

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[2] The data used in this report were supplied by T&TEC, except where specified otherwise.

[3] The general list of performance indicators for the electricity sector is contained in the Performance Monitoring and Reporting Framework 2005 (PMR)

SECTION 2.0 PERFORMANCE REVIEW

2.1 Aggregate Data

2.1.1 Electricity Service Coverage

Electricity Service Coverage is an indicator of the level of access to electricity. It is often used to gauge the infrastructural capacity for growth in commercial and industrial activities. The electricity service coverage for the year 2015 was estimated to be at least 98.3%, with only a small percentage of the population not being supplied by the national electricity grid.[4]

2.1.2 Number of Customers by Class and Area

T&TEC supplies electricity to customers according to specific classes that are, based on the customer's electrical load and supply voltage. There are three broad customer classes: Domestic, Commercial and Industrial classes.[5] All customers are billed for energy consumed, measured in kilowatt per hour (kWh). Industrial customers pay an additional charge (demand charge) based on their kilovolts-ampere (kVA) demand. A separate classification, Street Lighting, is used to bill the electricity that is consumed by private and public outdoor lighting. The number of customer accounts by class for the years 2014 and 2015 is presented in table 1. In 2015, T&TEC had 461,700 customers, which represented a 2.4% growth from 2014. The Domestic class accounted for 88.4% of T&TEC's customer base, while the Commercial, Industrial and Street Lighting classes collectively accounted for 11.6%. Although the number of domestic accounts increased by 1.9% (i.e. 7,538 accounts), the commercial class had the largest percentage growth over the period, increasing by 7.1% (or 3,286 accounts) in 2015.

[4] Due to data unavailability, electricity service coverage was calculated using the 2011 Population and Housing Census data on Households, obtained from the Central Statistical Office of Trinidad and Tobago. The metric was calculated as follows: [No. of households with electricity access/No. of households] x100.

[5] **Domestic (Rate A)** supplied at 115/230V at loads less than 50kVA. **Commercial (Rate B)** supplied at 115/230V or 230/400V at loads less than 50kVA. **Commercial (Rate B1)** supplied at 115/230V, 230/400V, 6.6kV, 12kV or 33kV at loads greater than 50kVA but less than 350kVA. **Industrial (Rate D1-5, E1-5)** supplied at 115/230V, 230/400V, 6.6kV, 12kV, 33kV, 66kV, 132kV and higher voltages at various loads greater than 50kVA.

Table 1: Number of Active Accounts by Class (2014-2015)

Year	Customer Class				TOTAL
	Domestic	Commercial	Industrial	Street Lighting	
2014	400,818	46,284	3586	45	**450,733**
2015	408,356	49,570	3729	45	**461,700**
% Change	1.9	7.1	4.0	0	**2.4**

T&TEC's operations are grouped into five distribution areas, namely North, South, East, Central and Tobago. The number of customer accounts by area, for the years 2014 and 2015 is presented in table 2. In 2015, the South area had the largest number of active accounts (139,973), and accounted for 30.3% of T&TEC's customer base. Although the Tobago area had the smallest number of active accounts in 2015 (26,609 accounts), it had the largest growth, expanding by 4.2% over the period.

Table 2: Number of Active Accounts by Area (2014-2015)

Year	Area					Total
	North	South	East	Central	Tobago	
2014	91,219	136,116	120,932	76,928	25,538	**450,733**
2015	91,918	139,973	123,631	79,569	26,609	**461,700**
% Change	0.8	2.8	2.2	3.4	4.2	**2.4**

2.1.3 Electricity Purchased (kWh)

T&TEC is an electricity transmission and distribution company and purchases electrical energy from three (3) independent power producers (IPPs).[6] Energy purchased is measured in kilowatt-hours (kWh). The total amount of electricity purchased from the generators for the years 2014 and 2015 is presented in table 3. In 2015, the amount of electricity purchased was 9,564,005,134kWh, which represented a 1.5% increase from 2014. T&TEC purchased the highest amount of electricity

[6] T&TEC also has its own generation capacity of 85MW located in Tobago, which is the primary source of electricity to the island.

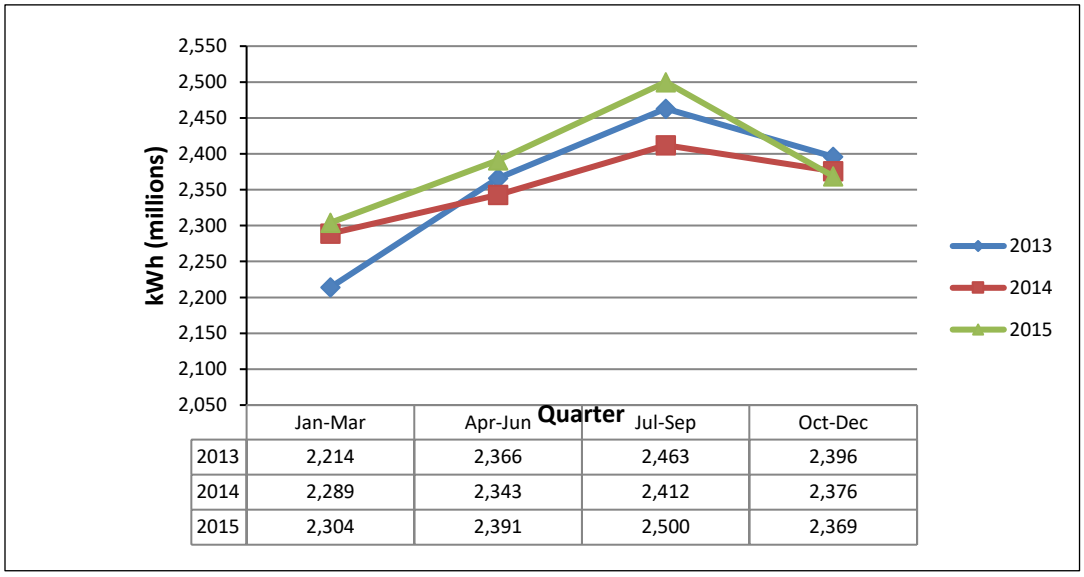
during the third quarter (2,499,605,240 kWh), and the least amount during first quarter (2,303,760,387kWh).

Table 3: Electricity Purchased by Quarter (2014 -2015)

Quarter	Electricity Purchased (kWh)	
	2014	2015
Jan-Mar (Q1)	2,288,589,420	2,303,760,387
Apr-Jun (Q2)	2,342,624,442	2,391,206,666
Jul-Sep (Q3)	2,412,195,358	2,499,605,240
Oct-Dec (Q4)	2,375,661,665	2,369,432,840
TOTAL	**9,419,070,885**	**9,564,005,134**

A graphical representation of the trends in the total amount of electricity purchased over the three-year period 2013-2015 is presented in figure 1. The amount of electricity that T&TEC purchased from the generators followed a similar trend over the three years. In fact, peak purchases typically occurred during the third quarter, while the lowest purchases occurred during the first quarter. Peak purchases were partly due to manufacturing and industrial sector ramp up of production over the period.

Figure 1: Electricity Purchased by Quarter: 3-Year Trends (2013-2015)



2.1.4 Electricity Sales (kWh) by Distribution Area

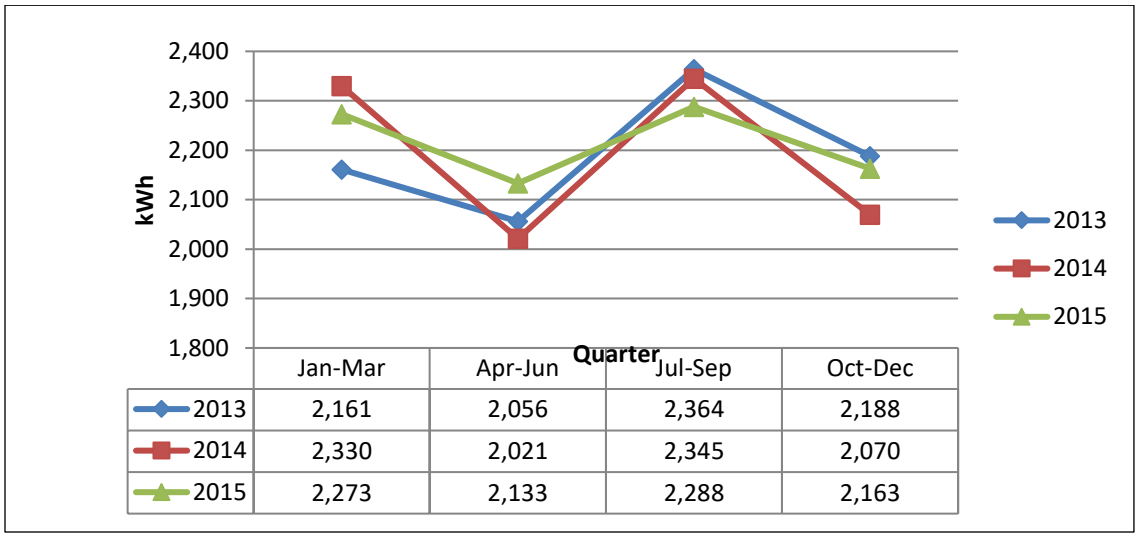
T&TEC measures energy sold in kilowatt-hours (kWh). The total amount of electricity sold by T&TEC for the years 2014 and 2015 is presented in table 4. In 2015, electricity sales (consumption) were 8,856,654,588 kWh, which represented a 1% increase from 2014. The Central area had the highest percentage of total consumption (34.1%) in Trinidad and Tobago. This corresponds to the fact that the area has the highest concentration of large industrial customers through the country. Conversely, the Tobago area had the lowest percentage of total consumption, accounting for 3.6% of total electricity sales.

Table 4: Electricity Sales by Quarter per Area, kWh (2014-2015)

Period	Electricity Sales per Distribution Area (kWh)					Total per Quarter
	North	South	East	Central	Tobago	
Jan –Mar (Q1)	417,026,269	472,849,887	469,637,569	840,994,249	72,152,251	2,272,660,225
Apr – Jun (Q2)	434,730,936	478,017,140	424,115,887	711,479,326	84,544,255	2,132,887,544
Jul – Sep (Q3)	412,352,903	503,389,076	480,551,030	814,166,481	77,636,356	2,288,095,846
Oct – Dec (Q4)	454,194,089	506,628,831	460,964,341	654,177,482	87,046,229	2,163,010,973
Total (2015)	**1,718,201,685**	**1,961,009,333**	**1,835,365,811**	**3,020,731,466**	**321,346,293**	**8,856,654,588**
Total (2014)	**1,684,584,191**	**1,769,400,876**	**1,756,774,889**	**3,253,520,732**	**302,502,074**	**8,766,782,762**

A graphical representation of the trends in electricity sales (consumption) for the three-year period 2013-2015 is presented in figure 2. The annual amount of electricity sold (consumption) fluctuated throughout the years. Peak consumption typically occurred during the third quarter, while the lowest consumption occurred during the second quarter. The staggered decrease in the consumption of ArcelorMittal (T&TEC's largest customer at the time) over the years did not allow definitive trends to be established.

Figure 2: Annual Electricity Sales by Quarter: 3-Year Trends (2013-2015)

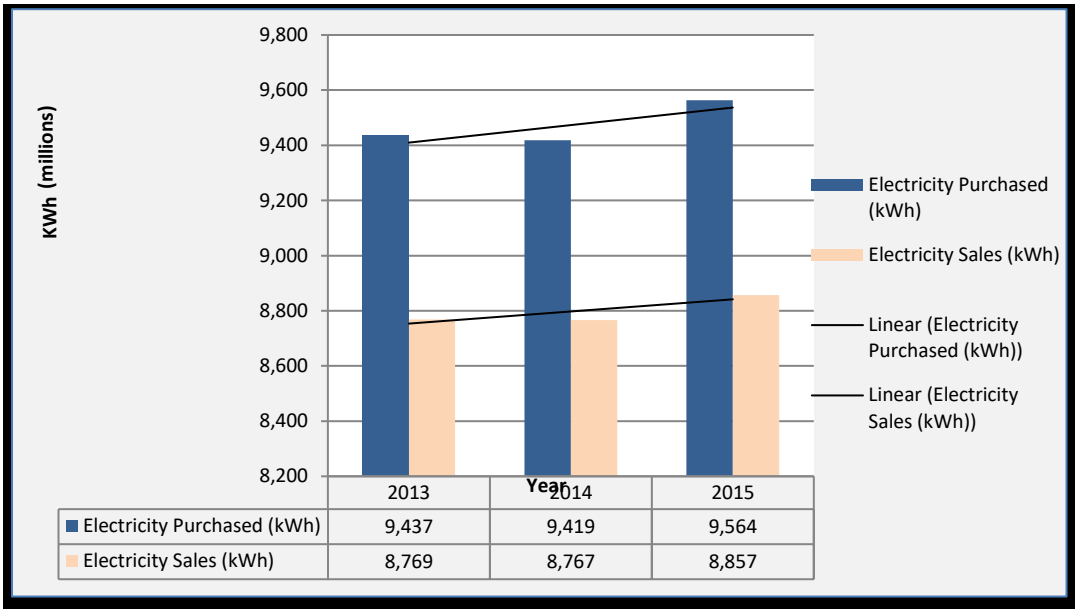


	Jan-Mar	Apr-Jun	Jul-Sep	Oct-Dec
2013	2,161	2,056	2,364	2,188
2014	2,330	2,021	2,345	2,070
2015	2,273	2,133	2,288	2,163

2.1.5 Comparison of Annual Electricity Purchased to Annual Electricity Sales

The data collected for the electricity purchased by T&TEC from the generators is measured on a real-time basis while electricity sales are tabulated on customers' consumption billed over various cycles. Consequently, the trends of peaks and troughs for these two indicators do not occur simultaneously on a quarterly basis. This is a cause for concern as the discrepancy may be misleading, as the gap between the indicators could actually be smaller or larger. Figure 3 shows a comparison of the annual amount of electricity purchased to the annual amount of electricity sold over the three-year period 2013-2015. The rate of increase of electricity purchased has been aligning with the rate of increase in electricity sales over the period. This is an indication that the disparity between electricity purchased and electricity sales has been lessening over the period.

Figure 3: Electricity Purchases vs. Annual Electricity Sales (2013-2015)



	2013	2014	2015
Electricity Purchased (kWh)	9,437	9,419	9,564
Electricity Sales (kWh)	8,769	8,767	8,857

2.1.6 Total System Losses

Not all the electrical energy purchased by T&TEC from the generation companies is available for sale to customers. The difference between the electricity entering T&TEC's system and that supplied to its customers is referred to as the total system losses. Total system losses are due to a combination of technical and non-technical losses. Technical losses arise due to physical reasons, such as, the materials used to construct transmission and distribution networks, the configuration and operation of the networks and the inherent inefficiencies in various pieces of equipment. Non-technical losses, at times called commercial losses, arise when energy is delivered to customers but no revenue is collected by the utility for the delivered energy. These losses are usually the result of measurement errors, recording errors, theft and any other instance where the energy has not been billed by the utility.

The RIC set a total system losses target of 6.75% to be achieved by T&TEC. Table 5 shows T&TEC's total system losses for the years 2014 and 2015. Total system losses increased from 6.93% in 2014 to 7.40% in 2015, and hence did not meet the target set by the RIC. The highest system losses occurred during April to June (10.80%) while the lowest system losses occurred during January to March (1.35%). This wide variation in the quarterly values of the system losses can be attributed to the discrepancy between the real-time purchases data from the generators and the delayed billing information for energy sold to customers, as mentioned in section 2.1.5.

Table 5: Total System Losses by Quarter (2014-2015)

Quarter	Indicator		System Loss[7] (%)
	Energy Units Billed (kWh)	Energy Units Purchased (kWh)	
Jan – Mar (Q1)	2,272,660,225	2,303,760,387	1.35
Apr – Jun (Q2)	2,132,887,544	2,391,206,666	10.80
Jul – Sept (Q3)	2,288,095,846	2,499,605,240	8.46
Oct – Dec (Q4)	2,163,010,973	2,369,432,840	8.71
TOTAL 2015	**8,856,654,588**	**9,564,005,134**	**7.40**
TOTAL 2014	**8,766,782,762**	**9,419,582,885**	**6.93**

2.2 Other Economic Data

This section examines T&TEC's performance based on specific economic and consumption indicators which are reported on a 'per employee' or 'per customer' basis. The main indicators include electricity sales per employee (kWh), sales per employee ($), customers per employee and consumption per capita (kWh). T&TEC's performance with respect to these indicators for the years 2014 and 2015 is presented in table 6.

The electricity sales per employee and customers per employee indicators are generally used to measure labour productivity and the effective use of resources in the electricity distribution sector.[8] In 2015, electricity sales (kWh) increased by 1.0%, and electricity sales per employee (kWh) increased by 2.8%. Although the number of customers increased by 2.4% in 2015, the number of employees decreased by 1.7%, resulting in a 4.2% increase in customers per employee. T&TEC's performance with respect to these indicators suggested that its labour force and use of resources were more efficient in 2015.

[7] Total system losses is calculated by the following T&TEC formula:

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

[8] 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

Table 6: Other Economic Data (2014-2015)

Data	2014	2015	% Change
Number of Employees	3,183	3,129	(1.7)
Electricity Sales (kWh)	8,766,782,761	8,856,654,587	1.0
Number of Customers	450,733	461,700	2.4
Electricity Sales per Employee (kWh)	2,754,252	2,830,506	2.8
Electricity Sales per Employee ($)	977,790	1,003,437	2.6
Customers per Employee	142	148	4.2

Table 7 shows a comparison of the electricity sales per employee (GWh) and the customers per employee ratios for Trinidad and Tobago with that of other Caribbean countries for the year 2015, based on the Annual Reports of the respective electricity utilities. In 2015, Trinidad and Tobago's electricity sales per employee (GWh) ratio was the highest out of the group of countries and comparable with that of Barbados. However, Trinidad and Tobago's customers per employee ratio was the lowest signifying that the other countries statistically required less employees to serve their entire customer base. Barbados had the highest ratio in this regard.

Table 7: Other Economic Data for selected countries (2015)

Indicator	Dominica	St. Lucia	Jamaica	Barbados	Trinidad and Tobago
Electricity Sales (GWh) per Employee	494,792	1,339,286	1,854,650	2,773,333	2,830,521
Customers per Employee	186	266	362	382	148

Consumption per capita is defined as the total amount of electricity sold, divided by the population. It gives an indication of a country's electricity consumption averaged per individual, not accounting for the specific purpose of use whether domestic, commercial or industrial. Table 8 shows the electricity consumption per capita of Trinidad and Tobago for the years 2013 to 2015, which was calculated using electricity sales (consumption) and population size for the respective years. Trinidad and Tobago's electricity consumption per capita fluctuated over the three-year period, decreasing from 6,542 kWh in 2013 to 6,516 kWh in 2014, and then increasing to 6,562

kWh in 2015. This suggested that there was a 0.70% growth in the average electricity consumption per person within the country in 2015. Table 9 shows a comparison of Trinidad and Tobago's electricity consumption per capita with that of other countries for the year 2014, based on World Bank data.[9] In 2014, Trinidad and Tobago's electricity consumption per capita was significantly higher than that of five (5) selected countries in the Caribbean and Latin America (Jamaica, Cuba, Suriname, Panama and Venezuela) and the world average consumption per capita. However, Trinidad and Tobago's electricity consumption per capita was more comparable to countries such as Estonia, Slovak Republic, Oman and Czech Republic, which all had a comparable GDP per Capita.[10] The relatively high level of industrial electricity consumption in Trinidad and Tobago is a major contributor to the country's high electricity consumption per capita.

Table 8: Electricity Consumption Per Capita for Trinidad and Tobago (2014-2016)

Year	Electricity Consumption Per Capita (kWh)[11]	Change (%)
2013	6,542	(0.40)
2014	6,516	(0.39)
2015	6,562	0.70

[9] Due to the unavailability of 2015 data, 2014 data is presented to give the reader a picture of T&T"s performance against other countries during that year. The countries were selected based on data availability, at the time when this report was being drafted.

[10] Given the unavailability data for other Caribbean countries, T&T"s electricity consumption was also compared to countries outside of the region that had a comparable GDP per capita at the time.

[11] Electricity consumption per capita values were calculated using electricity sales (kWh) and population size data of Trinidad and Tobago for the respective years. Data was obtained from T&TEC and the Central Statistical Office (CSO) of Trinidad and Tobago.

Table 9: Electricity Consumption per Capita for selected countries (2014)

Country	GDP Per Capita (US$)[12]	Electricity Consumption per Capita (KWh)[13]
Jamaica	4,855.7	1,056
Cuba	7,050.5	1,434
Suriname	9,564.41	3,631.86
Panama	12,593.74	2,062.76
Venezuela	16,615.0	3,658
Slovak Republic	18,595.2	5,137
Estonia	19,941.5	6,732
Czech Republic	19,744.6	6,259
Oman	20458.5	6,554
Trinidad & Tobago	**19,325.2**	**6,516***
World	**10,850.22**	**3,126.33**

*The RIC notes the that its calculated value (6,516 kWh) for Trinidad and Tobago's electricity consumption per capita for 2014 varies with the World Bank's (7,134 kWh) which may be attributable to a difference in the data reported to the entities.

2.3 Network Reliability

A critical part of providing quality service to customers is the delivery of a reliable supply of electricity. An unreliable supply results in economic losses and inconveniences, and increases the likelihood of damage to a customer's equipment. Therefore, it is important for a utility to meet some minimum standards of reliability, even as it seeks to pursue and maintain economic and operational efficiencies. One of the roles of the RIC, as the economic regulator, is to ensure that T&TEC supplies electricity to customers at an acceptable level of reliability.

Reliability metrics are an indication of the condition of the network system. These indicators let a utility know if the system is getting better or worse over time. Since all systems are different and stressed by different factors, it can be very hard to make a legitimate comparison between two systems. This means reliability indices are situational in nature and will present different baselines

[12] GDP per Capita (US$) data was obtained on 22.08.2017 from the World Bank: World Development Indicators at http://data.worldbank.org/indicator/NY.GDP.PCAP.CD?end=2014&start=1960

[13] Electricity consumption per Capita (kWh) data was obtained on 22.08.2017 from World Bank: World Development Indicators, at http://data.worldbank.org/indicator/EG.USE.ELEC.KH.PC

depending on the many intrinsic factors affecting the system[14]. The IEEE Guide for Electric Power Distribution Reliability Indices (IEEE 1366-2012) is the standard that has been applied across many jurisdictions with respect to monitoring and reporting on reliability, and will be used to assess T&TEC's reliability of supply using the under-mentioned indices. Table 10 shows the network reliability indicators: System Average Interruption Frequency Index (SAIFI), System Average Interruption Duration Index (SAIDI) and Customer Average Interruption Duration Index (CAIDI) for the year 2015.

2.3.1 System Average Interruption Frequency Index (SAIFI)

The System Average Interruption Frequency Index (SAIFI) measures the average number of sustained interruptions per customer. The annual value of SAIFI for 2015 was 4.40 interruptions per customer, which represented a minor improvement (0.5%) from 2014. The index suggested that a T&TEC customer will most likely experience approximately four interruptions in electricity supply per year, as compared to the one interruption per customer of selected North American utilities based on the mean values indicated in the IEEE 1366-1998. In 2015, SAIFI was highest in March, with 0.50 interruptions per customer on average for the month.

2.3.2 System Average Interruption Duration Index (SAIDI)

The System Average Interruption Duration Index (SAIDI) measures the average outage duration per customer. The annual value of SAIDI for 2015 was 307.8 minutes, which represented a 5.6% improvement from 2014. The mean value for SAIDI for the selected North American Utilities according to the IEEE 1366-1998 is 58.49 minutes, suggesting that the yearly outage duration can be about five times longer per T&TEC customer. In 2015, SAIDI was highest in March, with outages lasting 33.64 minutes on average for the month.

2.3.3 Customer Average Interruption Duration Index (CAIDI))

The Customer Average Interruption Duration Index (CAIDI) is a ratio of SAIDI to SAIFI. It is a measure of the average outage duration that an individual customer would experience, and can be viewed as the average restoration time. The annual value of CAIDI for 2015 was 70.0 minutes, which represented a 5.1% improvement from 2014. The index suggested that a customer who

[14] Evaluation of Data Submitted in APPA's 2013 Distribution System Reliability & Operations Survey http://www.publicpower.org/files/PDFs/2013DSReliabilityAndOperationsReport_FINAL.pdf

experienced an outage on the distribution system was without electricity for an average of 70.0 minutes, compared to the 96.47 minutes for the selected North American Utilities according to the IEEE 1366-1998. In 2015, CAIDI was highest in February (83.59 minutes) and lowest in January (47.99 minutes).

Table 10: Network Reliability (2015)

Indicator	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	2015	NAU*
SAIFI (No./customer)	0.48	0.29	0.50	0.33	0.29	0.39	0.32	0.30	0.29	0.39	0.45	0.36	4.40	1.11
SAIDI (minutes)	22.80	24.60	33.64	21.57	21.97	29.61	26.40	23.40	23.40	30.60	27.00	22.80	307.8	58.49
CAIDI (minutes)	47.99	83.59	67.65	64.45	75.98	75.10	83.40	76.80	79.20	79.80	58.80	63.00	70.0	96.47

Note: NAU* are values for selected North American Utilities supplied by the American Public Power Association, APPA, according to IEEE Standard 1366-2012.[15]

2.3.4 Network Reliability Trends

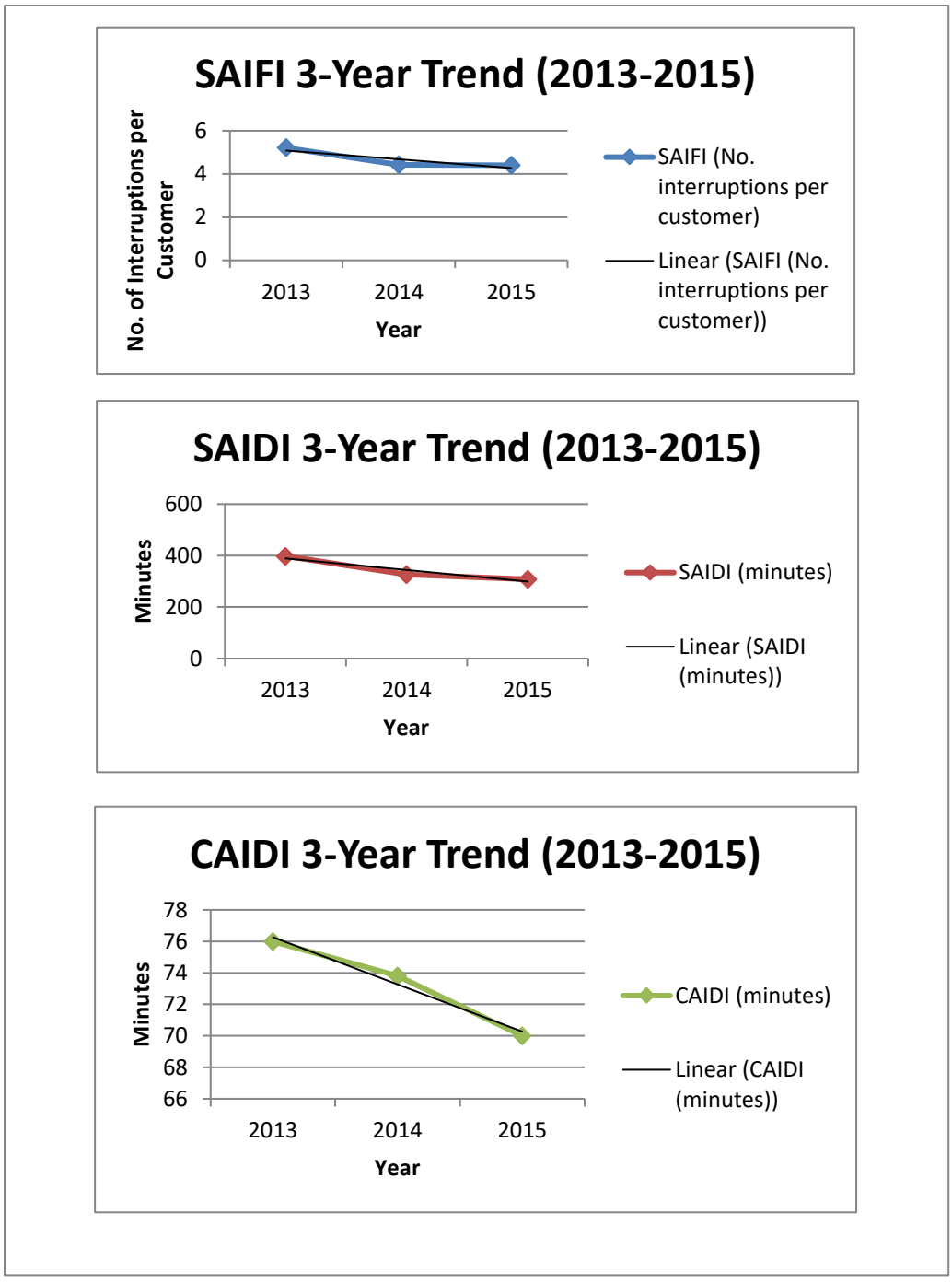
Table 11 shows the network reliability indicators over the three-year period 2013-2015, and figure 4 gives a graphical representation of the trends in these indicators over the same period. The SAIFI, SAIDI and CAIDI indicators all declined over the three years, suggesting that there has been some improvement in the reliability of the network from 2013 to 2015.

Table 11: Network Reliability: 3-Year Trends (2013–2015)

INDICATOR	2013	2014	2015
SAIFI (No. interruptions per customer)	5.21	4.42	4.40
SAIDI (minutes)	398	326.2	307.8
CAIDI (minutes)	76	73.8	70.0

[15] Evaluation of Data Submitted in APPA's 2013 Distribution System Reliability & Operations Survey http://www.publicpower.org/files/PDFs/2013DSReliabilityAndOperationsReport_FINAL.pdf

Figure 4: Network Reliability 3-Year Trend (2013 – 2015)



2.3.5 Number of Transmission Trips & Interruptions Affecting Customers

In 2015, there were 37 transmission trips and interruptions on the network, as shown in table 12. Most of these trips and interruptions occurred on the 33kV network, which had 22 trips, followed

by the 66kV network with 13 trips and interruptions, and the 132kV network with two trips and interruptions. T&TEC performed the best at restoring trips and interruptions on the 132kV network, as 100% of the trips and interruptions were restored within three hours. In the case of the 33kV network, T&TEC restored 77.3% of the trips and interruptions within three hours, 13.6% between three to five hours, and the remaining 9.1% took more than five hours. On the 66kV network, T&TEC restored 76.9% of the trips and interruptions within three hours, and 23.1% within five hours.

Table 12: Transmission Trips & Interruptions Affecting Customers (2015)

Month	Transmission Circuit Trip outs			Number of Interruptions Restored (<3hrs)			Number of Interruptions Restored (<5hrs)		
	33kV	66k V	132kV	33kV	66k V	132kV	33kV	66k V	132kV
Jan	3	0	0	3	0	0	0	0	0
Feb	1	0	0	1	0	0	0	0	0
Mar	1	0	0	1	0	0	0	0	0
Apr	2	2	0	0	2	0	2	0	0
May	1	1	0	1	1	0	0	0	0
Jun	0	0	1	0	0	1	0	0	0
Jul	0	4	0	0	3	0	0	1	0
Aug	0	2	0	0	2	0	0	0	0
Sep	1	1	0	1	0	0	0	1	0
Oct	5	1	0	3	1	0	0	1	0
Nov	6	0	0	5	0	0	1	0	0
Dec	2	2	1	2	1	1	0	0	0
Total	**22**	**13**	**2**	**17**	**10**	**2**	**3**	**3**	**0**

In 2015, there was a 60.9% increase in the number of transmission trips and interruptions on the network from 2015 (which had 23 trips and interruptions). There was a negligible increase in the average number of trips and interruptions that were restored within three hours, from 78.3% in 2014 to 78.4% in 2015 (see table 13). Additionally, the average number of trips restored within five hours, increased from 13% in 2014 to 16.2% in 2015.

Table 13: Summary of Transmission Trips & Interruptions (2014 - 2015)

Indicator	No. of Transmission Trips & Interruptions (2014)				No. of Transmission Trips & Interruptions (2015)			
	33kV	66kV	132kV	Overall	33kV	66kV	132kV	Overall
TOTAL	17	6	0	**23**	22	13	2	**37**
Restoration < 3hrs	13	5	0	**18**	17	10	2	**29**
Restoration < 5hrs	2	1	0	**3**	3	3	0	**6**
% < 3hrs	76.5%	83.3%	0%	**78.3%**	77.3 %	76.9 %	100%	**78.4%**
% < 5hrs	11.8%	16.7%	-	**13.0%**	13.6 %	23.1 %	-	**16.2%**

2.4 Equipment Maintenance

T&TEC is required to provide information on specific directives related to its operations as stipulated by the RIC. This section reports on two of these specific directives, namely repair and maintenance of pole-mounted transformers, and repair/replacement of defective streetlights.

2.4.1 Pole-mounted Transformers

According to the Determination, T&TEC has a directive to repair and maintain pole-mounted distribution transformers at a rate of at least 20% per annum. Table 14 shows the number of repairs and maintenance to pole-mounted transformers by quarters for the year 2015. Additionally, table 15 shows a year-on-year comparison of repairs and maintenance to pole-mounted transformers for the years 2014 and 2015. There were 35,265 pole-mounted transformers in service at the end of 2015, which represented a 1.5% increase from 2014. The annual percentage of transformers inspected/serviced by T&TEC increased from 101.7% in 2014 to 277.5% in 2015, and remained well above the 20% minimum requirement.[16] In 2015, most of the maintenance was undertaken in the fourth quarter, during which approximately 104.8% of the existing units were inspected/serviced.

[16] These percentage values may have included inspection of additional equipment such as high voltage sections and high voltage equipment (e.g. air break switches).

Table 14: Repairs and Maintenance to Pole-Mounted Transformers by Quarter (2015)

Indicator	Quarter			
	Jan-Mar (Q1)	Apr-Jun (Q2)	July-Sep (Q3)	Oct-Dec (Q4)
Number of Pole Mounted Distribution Transformers	34,958	35,141	35,059	35,265
Number of Pole Mounted Distribution Transformers Inspected	9,898	17,985	27,567	33,551
No of Transformers Serviced	967	1,723	2,766	3,410
% Inspected/ Serviced	**31.1%**	**56.1%**	**86.5%**	**104.8%**

Table 15: Repairs/Maintenance to Pole-Mounted Transformers (2014-2015)

Indicator	Year		% Change
	2014	**2015**	
Total No. of Pole Mounted Distribution Transformers	34,743	35,265	**1.5%**
Total No. of Inspections/Servicing	35,345	97,867	**176.9%**
% Inspections/Servicing	**101.7%***	**277.5%***	**-**

*This value may have included inspection of additional equipment such as high voltage sections and high voltage equipment (e.g. air break switches).

2.4.2 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. T&TEC is required to repair street lighting failures reported to them within 7 days. T&TEC is also required to monitor highway lighting and repair non-working lights within 14 days of discovery. In 2015, T&TEC received 28,363 reports on street lighting failures (see table 16). The largest number of reports was received during the first quarter (10,040 reports). Of the total number of reports received, T&TEC completed repairs and installations to 7,702 streetlights (or 27.2%), within seven days. Additionally, T&TEC completed 4,996 repairs

in response to failures that were not reported by the public. In total, T&TEC completed 29,197 street light repairs and installations in 2015.

Table 16: Street Light Repairs and Installations by Quarter (2015)

Indicator	Quarter				Total
	Jan-Mar	Apr-Jun	July - Sept	Oct - Dec	
(1) No. of Reports Received	10,040	6,903	6,461	4,959	**28,363**
(2) No. of Repairs & Installation Completed within 7 days	2,368	2,067	1,743	1,524	**7,702**
(3) No. of Repairs & Installation without a report	817	1,500	1,469	1,210	**4,996**
(4) Total No. of Repairs & Installation Completed	6,896	8,243	7,184	6,874	**29,197**

Note:

(1) Reports received from customers and/or members of the public for repairs to existing streetlights and for new streetlights

(2) Work arising from reports received as in Note 1 and completed in 7 days or less of the date received.

(3) Work arising from sources other than customer reports, e.g. inspections by staff and observation by crews.

(4) Total work completed within the quarter i.e. repairs and installations arising from customer reports as well as inspections and observation by crews.

Table 17 shows a comparison of the number of street lighting repairs for the years 2014 and 2015. In 2015, the number of reports of street lighting failures received by T&TEC was approximately 2.9% higher than that received in 2014 (27,564). T&TEC's performance, with respect to addressing reported street lighting failures, worsened over the period as shown by a 14.6% decline in the 7-day repair rate for such failures. However, the number of unreported street lighting failures that were detected and repaired by T&TEC over the period, increased by 13.9%. Overall, there was 11.6% increase in the total number of repairs and installations completed by T&TEC over the period.

Table 17: Summary of Street Light Repairs (2014-2015)

Indicator	2014	2015	% Change
No. of Reports Received	27,564	28,363	2.9%
No. of Repairs Completed within 7 days	11,519	7,702	-33.1%
7-day Repair Rate for reported failures	41.8%	27.2%	-34.9%
No. of Repairs without a report	4,385	4,996	13.9%
Total No. of Repairs Completed (Including carryover from previous year)	26,172	29,197	11.6%

2.5 Financial Performance and 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. The RIC has a duty to ensure that T&TEC is able to finance its functions and thus, should enable T&TEC to earn a return on its regulatory asset base that is at least equal to its cost of capital in addition to raising finance on reasonable terms. Table 18 below shows a select set of financial ratios which assess the performance of T&TEC from the perspective of debt financing, liquidity, profitability and efficiency. The formulas/definition are presented in the Appendix.[17]

Table 18: Select Financial Ratios of T&TEC's Performance for 2014 and 2015

RATIOS	YEAR		TARGET
	2014	2015	
Debt Financing			
Gearing - Full Ratio	(7.07)	(5.61)	**70 (Notional)**
Gearing - Equity & Reserves Only	10.41	11.09	**70 (Notional)**
Funds Flow Interest Cover	(0.30)	1.09	Greater than 3
Cash Interest Cover	(5.22)	(0.66)	Greater than 1
Debt Pay Back Period (Years)**	(30.74)	302.27	Between 5 to 7
Debt as a proportion of RAB (%)	945 %	1147 %	Below 65%
Liquidity			
Funds From operations ($)	(421,992,000)	43,386,213	
Collection Rate (%)	80%	79%	
Revenue Billed/Operating Cost	0.87	1.01	Greater than 2
Revenue Collected/Operating cost	0.93	1.04	Greater than 1
Internal Financing (%)	(252)%	7 %	Greater than 40%
Profitability and Efficiency			
Return on RAB (%)	(3.1%)	4%	≈ 9%
Operating Cost per unit ($/kWh)	0.35	0.33	

** The debt payback period is reflected as a negative figure because the Funds from Operations (FFO) was in deficit due to the operating expenditure exceeding income in that year.

[17] The general list of performance indicators for the electricity sector is contained in the Performance Monitoring and Reporting Framework 2005 (PMR)

2.5.1 Debt Financing

Utilities are very capital intensive operations. Consequently, there is a tendency to rely heavily on debt as a means of financing capital investments. It is not unusual for the capital structure of a regulated utility to be composed of more debt than equity, which is reflected in a relatively high gearing ratio. While this is usually considered as a greater risk of default for a business, it is mitigated by the fact that utilities generally have a more stable revenue stream that is less sensitive to changes in the economy. In fact, it is common to utilise a notional gearing for regulated utilities companies as compared to using the actual gearing. T&TEC's actual gearing ratio is lower than the notional due to factors associated with its current tariff structure. T&TEC's profitability ratios highlight the increasing deficits and hence the abnormal trends in the gearing. However, this financing structure demonstrated some improvement in 2015 in comparison to 2014. Both ***funds flow*** and ***cash interest coverage*** were significantly below their ideal target ranges in both 2014 and 2015 which implies that T&TEC may have experienced difficulty in meeting its finance costs. The debt payback period in 2014 was negative as the ***Funds from Operations*** (FFO) was insufficient to cover the increase in operating expenditure for that period. This resulted in the negative figure reflected as the payback period for 2014. In 2015 revenue was able to meet operating expenditure. However, the debt repayment period is by no means acceptable and suggests that T&TEC has to increase revenues and/or significantly reduce its operating expenditures in order to devote more funds to debt repayment.

Debt as a portion of Regulatory Asset Base (RAB) remained well above the target of 65%, which suggests which suggests that borrowed funds are not necessarily being used to fund capital projects only. T&TEC's gearing ratio increased partly due to an increase in the advance from the GORTT which was meant to assist with loan repayments.

2.5.2 Liquidity

According to the indicators presented, T&TEC liquidity was below the targeted levels as the collection rate decreased from 80% in 2014 to 79% in 2015. Even though revenue levels remained constant in 2015, the revenue to operating expenditure showed some improvement, as there was a 36% ($337 million) decrease in transmission and distribution costs compared to 2014. This suggests that T&TEC may have faced challenges in meeting its full operating costs. This is evident

in the 35% ($1.2 billion) increase in payables between 2014 and 2015. This inference was further substantiated by observing that in 2014 revenue was only able to cover 87% of operating costs, while in 2015 revenue just covered operating costs 1.01 times. The revenue collected during the period yielded no significant variance in performance to billed revenue. However, the revenue collected index hovered around the acceptable target of one.

The constant revenue figures and increasing operating costs continue to affect the internal financing ratio negatively. The utility was unable to provide any internal financing in 2014 as the FFO was in a deficit, and although there was an excess in FFO in 2015, only 7% was available, which is significantly below the recommended level of 40%. This ratio also does not take into account the funds required to finance T&TEC's existing debt, which continued to increase. This situation confines the funds available to finance capital projects.

2.5.3 Profitability and Efficiency

T&TEC is a state-owned utility and generating the required profit is important to maintaining financial viability. However, analysing profitability may not be as relevant as in the case of an investor-owned utility. Therefore, instead of assessing the traditional return on capital, it is better suited to measure the return on the RAB for entities with this type of governance structure. For the years 2014 and 2015, the net cash flow return on the RAB was negative 31% and positive 4% respectively, which was below the benchmark of 9%. This implies that T&TEC is not making an acceptable return on its RAB and is not generating returns to invest into future activities.

The above approach is often supplemented by financial metrics on costs such as the operating cost per kWh, which may be more suitable in determining the efficiency of operations in a state owned utility. The operating cost per kWh decreased from $0.35 in 2014 to $0.33 in 2015. Efficiency incentives were included in the last rate review, to encourage the utility to keep operating costs at sustainable levels. The RIC will continue with such financial efficiency measures in the next rate review period to incentivize the service provider to reduce its costs.

SECTION 3.0 CONCLUSION AND RECOMMENDATIONS

3.1 Conclusion

The findings of the assessment show that T&TEC has been making some effort to enhance its efficiency and service levels to customers, as evidenced by improved performances in certain key performance indicators of the electricity transmission and distribution sector. However, there is still a need for significant improvement in other areas.

Total system losses increased from 6.93% in 2014 to 7.40% in 2015; therefore indicating a weakening in performance. There was an improvement in the reliability of the network, as demonstrated by reductions in the system reliability indicators SAIFI (4.40 interruptions per customer), SAIDI (307.8 minutes) and CAIDI (70.0 minutes). However, a 60.9% increase in the number of transmission trips and interruptions may have compromised the reliability of the network over the period.

T&TEC made some improvement to equipment maintenance, despite an increase of 1.5% in the number of pole-mounted distribution transformers in service in 2015. The annual percentage inspected/serviced increased from 101.7% in 2014 to 277.5% in 2015, and remained well above the target of 20% set by the RIC. In terms of street lighting repair and replacement, there was 2.9% increase in the number of reports received by T&TEC. However, the 7-day repair rate for these reported street lighting failures declined by 14.6%.

Lastly, T&TEC's revenue was able to meet its operating expenditure demands together with achieving positive Funds from Operations (FFO) outlook in 2015. However, the debt repayment period was by no means acceptable, suggesting that T&TEC must increase revenues and/or reduce operating expenditure in order to devote more funds to debt repayment. Debt as a portion of the Regulatory Asset Base (RAB) did not meet the target of 65% set by the RIC, which adversely affected the service provider's ability to finance capital projects. Also, T&TEC did not make an acceptable return on its RAB, nor did it generate returns to invest in planned future activities, despite a 4% increase in the net cash flow return on the RAB. Additionally, there was a slight decline in T&TEC's collection rate from 80% in 2014 to 79% in 2015.

3.2 RIC's Recommendations

Based on the RIC's assessment of T&TEC's performance with respect to key performance indicators of the electricity transmission and distribution sector for the year 2015, the RIC proposes the following recommendations:

- T&TEC should investigate the reason for the significant increase in the number of transmission trips on the network, and develop clear strategies to reduce these trips;
- T&TEC should investigate the reason for the significant increase in consumer complaints, and develop a strategy to reduce the number complaints it receives;
- T&TEC should continue to develop strategies for reducing the frequency and duration of power outages. This would improve the SAIFI and SAIDI indicators, and may reduce the number of complaints related to damage appliances;
- T&TEC should continue to develop strategies to improve its repair rate for reported street lighting failures;
- T&TEC should closely monitor its operating cost per unit ($/kWh) as a gauge to enhancing its financial performance. The Commission should also develop a strategy to increase revenues and significantly reduce its operating expenditure in order to improve financial viability; and
- T&TEC should continue its efforts to collect outstanding funds from customers.

APPENDIX: PERFORMANCE INDICATORS FOR T&TEC

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		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		Gearing	$\frac{[\text{Interest bearing debt}]}{[\text{Interest bearing debt + equity}]}$		Yearly
2.2		Funds Flow Interest Cover (Times)	$\frac{\text{(FFO + Interest)}}{\text{Interest}}$		Yearly
2.3		Cash Interest Cover (Times)	$\frac{\text{Opening Cash Flow}}{\text{Interest Expense}}$		Yearly
2.4		Debt Pay Back Period (Years)	$\frac{\text{Net Debt}}{\text{FFO}}$	Years	Yearly
2.5		Debt as a proportion of RAB (%)			
2.6		Collection Rate	$\frac{\text{Revenue – Receivables}}{\text{Revenue}}$	%	Yearly
2.7		Revenue Billed/Operating Cost	$\frac{\text{Revenue Billed}}{\text{Operating Cost}}$	$	Yearly
2.8		Revenue Collected/Operating cost	$\frac{\text{Revenue Collected}}{\text{Operating Cost}}$	$	Yearly
2.9		Internal Financing (%)	$\frac{\text{(FFO – Dividends)}}{\text{Net CAPEX}}$	$	Yearly

Item	Category	Indicator	Definition	Units	Reporting Period
2.10		Return on RAB (%)	Net operating income / RAB x 100.	%	Yearly
2.11		Operating cost per unit	$\frac{\text{Total Operating costs}}{\text{Total no. of kWh sold}}$	$	Yearly
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)	$\frac{[\text{SAIDI}]}{[\text{SAIFI}]}$	Minutes	Yearly
3.4		Number of transmission and distribution circuit trip outs by voltage level			Yearly
3.5		Interruptions restored within 3 hours and 5 hours			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

Item	Category	Indicator	Definition	Units	Reporting Period
4.4		Consumption per capita (kWh)	$\frac{[\text{Total Kwh sales}]}{[\text{Total population}]}$	KWh	Yearly
5.0	**Customer Responsiveness and Service**				
5.1		Complaints by major type	Reporting on the major areas of complaint	Number	Quarterly and Yearly
5.2		Written complaints not responded to within 5 working days			Quarterly and Yearly