

T&TEC's Annual
Performance Indicator
Report
For The Year
2018

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Information
Document

TABLE OF CONTENTS	PAGE
EXECUTIVE SUMMARY	3
SECTION 1.0 INTRODUCTION	5
1.1 Background.....	5
1.2 Purpose of this Document.....	6
1.3 Structure of Document.....	6
SECTION 2.0 PERFORMANCE REVIEW	7
2.1 Aggregate Performance	7
2.1.1 Electricity Service Coverage.....	7
2.1.2 Number of Customers by Class and Area	7
2.1.3 Electricity Purchases and Electricity Sales	8
2.1.4 Total System Losses	12
2.2 Other Economic Data	13
2.2.1 Electricity sales per employee (kWh) and Customers per employee	13
2.2.2 Consumption per capita	15
2.3 Network Reliability	17
2.3.1 System Average Interruption Frequency Index (SAIFI)	18
2.3.2 System Average Interruption Duration Index (SAIDI)	18
2.3.3 Customer Average Interruption Duration Index (CAIDI).....	18
2.3.4 Number of Transmission Trips & Interruptions Affecting Customers	20
2.4 Customer Responsiveness and Service	22
2.4.1 Complaints Received and Resolved.....	22
2.4.2 Complaints Resolution Rate	23
2.4.3 Response to Written Complaints.....	24
2.5 Equipment Maintenance	24
2.5.1 Repair and Maintenance of Pole-mounted Distribution Transformers	25
2.5.2 Street Lighting Repair	25
2.6 Financial Performance and Efficiency	27
2.6.1 Debt Financing	27
2.6.2 Liquidity	28
2.6.3 Profitability and Efficiency	28
SECTION 3.0 CONCLUSION AND RECOMMENDATIONS.....	29
3.1 Conclusion.....	29
3.2 Recommendations	29

APPENDIX: PERFORMANCE INDICATORS FOR T&TEC 31

LIST OF TABLES	PAGE
Table 1: Number of Active Accounts by Class (2017 - 2018).....	8
Table 2: Number of Active Accounts by Area (2017 - 2018)	8
Table 3: Electricity Purchased, kWh (2017 - 2018)	9
Table 4: Electricity Sales per Distribution Area, kWh (2017 - 2018)	10
Table 5: Total System Losses (2017 - 2018)	13
Table 6: Other Economic Data (2017-2018)	14
Table 7: Other Economic Data: Trinidad and Tobago vs Regional Countries (2017).....	15
Table 8: Electricity Consumption Per Capita for Trinidad and Tobago (2016-2018)	15
Table 9: Electricity Consumption per Capita: Trinidad and Tobago vs Selected Countries (2017)	17
Table 10: SAIFI, SAIDI & CAIDI (2018).....	19
Table 11: Transmission Trips & Interruptions Affecting Customers (2018).....	21
Table 12: Summary of Transmission Trips & Interruptions Affecting Customers (2018)	21
Table 13: Complaints Received by Type (2017 - 2018).....	22
Table 14: Complaints Resolved by Type (2017-2018).....	23
Table 15: Complaints Resolution Rate (2017 - 2018)	23
Table 16: Response to Written complaints (2017-2018)	24
Table 17: Repairs & Maintenance to Pole-Mounted Transformers (2017-2018)	25
Table 18: Street Light Repairs(2018)	26
Table 19: Summary of Street Light Repairs (2017 - 2018)	26
Table 20: Select Financial Ratios of T&TEC's Performance (2017 - 2018)	27

LIST OF FIGURES	PAGE
Figure 1: Electricity Purchased (kWh): Three-Year Trend (2016 - 2018).....	9
Figure 2: Electricity Sales - Three Year Trend (2017 - 2018)	11
Figure 3: Electricity Purchased vs. Electricity Sales: Three -Year Trend (2016 - 2018).....	12
Figure 4: SAIFI, SAIDI, & CAIDI: Three-Year Trends (2016-2018).....	20

EXECUTIVE SUMMARY

This is the twelfth Annual Performance Indicator Report for the Trinidad and Tobago Electricity Commission (T&TEC)¹. This report provides an assessment of T&TEC's performance for the year 2018. It focuses on the key performance indicators identified in the "Performance Monitoring and Reporting (PMR) Framework for the Electricity Transmission and Distribution Sector (2005)" and the "Regulation of Electricity Transmission and Distribution Sector (June 01, 2006 to May 31, 2011) - Final Determination: Rates and Miscellaneous Charges (2006)", hereinafter called "the Determination". T&TEC's performance is assessed on those aspects that impact on customers, using targets set out in the Determination (2006), historical performance, and performance metrics of other jurisdiction in some instances.

For the period under review, T&TEC reported a 0.8% growth in its customer base from 479,632 in 2017 to 483,559 in 2018. However, total electricity purchased by T&TEC from the power generators, declined by 1%, from 9,318,243,847 kWh in 2017 to 9,225,091,000 kWh in 2018. Similarly, total electricity sales declined by 1.2%, from 8,564,536,977 kWh to 8,463,412,741 kWh over the same period. T&TEC's electricity sales per employee increased by 1.3% (from 2,717,764 kWh in 2017 to 2,752,329 kWh in 2018), while its customers per employee increased by 3.3% (from 152 in 2017 to 157 in 2018).

On the network, T&TEC experienced a marginal increase in total system losses, from 8.08% in 2017 to 8.28% in 2018. Thus, it did not meet the total system losses target (of 6.75%) set by the RIC. System Average Interruption Frequency Index (SAIFI) decreased by 13.3%, from 4.50 interruptions per customer in 2017 to 3.90 interruptions per customer in 2018. Also, System Average Interruption Duration Index (SAIDI) decreased by 6.7%, from 417 minutes in 2017 to 389 minutes in 2018. Customer Average Interruption Duration (CAIDI), however, increased by 6.5%, from 93 minutes in 2017 to 99 minutes in 2018. The number of transmission trips and interruptions on the network (33) increased by 3.1% in 2018, while the restoration rate² for these trips and interruptions increased marginally, from 81.3% in 2017 to 81.8% in 2018.

¹ T&TEC is responsible for the transmission and distribution of electrical power to customers within Trinidad and Tobago.

² This refers to the percentage of transmission trips and interruptions restored within three (3) hours.

T&TEC received 49,247 customer complaints in 2018, which was more than double (125.9%) that of the number of complaints it received in 2017. Poles/other complaints accounted for the majority of these complaints (29,576 or 60%), followed by billing queries (15,208), high/low voltage complaints (3,521), and damaged appliances complaints (942) respectively. T&TEC was able to resolve 48,011 of the total number of complaints received in 2018, thus attaining a complaints resolution rate of 97.5%, compared to 99.6% in 2017.

T&TEC had 39,467 pole-mounted transformers in service at the end of 2018, compared to 38,538 in 2017. The percentage of pole-mounted distribution transformers inspected/serviced by T&TEC in 2018 was 38.8%, which was well above the 20% minimum requirement set by the RIC. In terms of street lighting repairs and installations, T&TEC received 27,945 reports for repairs to existing streetlights from customers and/or members of the public in 2018. Of these reports, T&TEC completed 5,266 repairs (18.8%) within a 7-day period. Apart from this, T&TEC completed 15,715 street lighting repairs in response to failures detected by its crews and other staff.

T&TEC's financial performance continued to be below par, as operating revenue for the period was below operating expenditure in 2018. However, there was some improvement in T&TEC's revenue levels, which needs to be maintained in order to have a sustained effect going forward on its liquidity position. There was also an improvement in the funds from operations (FFO) compared to 2017; however, there needs to be vast improvement to achieve profitability. The RIC acknowledges that a strengthening of revenue streams, both new and existing, is necessary for T&TEC to achieve financial sustainability.

SECTION 1.0 INTRODUCTION

1.1 Background

As the economic regulator of the electricity, and the water and wastewater sectors in Trinidad and Tobago, the RIC has a mandate to regulate the service providers under its purview, in a manner which promotes efficiency and economy in their operations. In carrying out its regulatory role, the RIC is guided by the legislative and regulatory framework set out in the RIC Act No. 26 of 1998. Section 6(1) of the RIC Act empowers the RIC to, amongst other things, prescribe and publish standards for service; monitor service providers and conduct checks to determine compliance with standards; impose such sanctions for non-compliance with standards; and carry out studies of efficiency and economy of operation and of performance by service providers and publish the results thereof.

In keeping with the above mandate, the RIC developed a Performance Monitoring and Reporting (PMR) Framework for the Electricity Transmission and Distribution Sector in 2005, for the purposes of monitoring the services of the sector.³ The PMR Framework requires T&TEC to provide data on a core set of financial, operational and service quality measures on a quarterly and annual basis. This dataset includes aggregate data on electricity coverage, number of customers, electricity purchased and electricity sales. T&TEC's network reliability and system losses are also included, as well as other performance criteria, such as customer responsiveness, equipment maintenance, and financial status.

Further to the PMR Framework (2005), the RIC published key performance indicators in the Determination (2006) to monitor the performance of T&TEC. The Determination (2006) also outlined specific directives that were to be followed by T&TEC during the regulatory period (2006-2011). Accordingly, the RIC has been carrying out on-going assessments of T&TEC's performance since 2006. These assessments have been released publicly in annual Performance Indicator Reports. This is the twelfth Annual Performance Indicator Report for T&TEC.⁴

³ Service performance in this context refers to the delivery of an electricity supply to meet customer's load requirements within targeted quality limits and within targeted levels of reliability.

⁴ All the data in this document was supplied by T&TEC, except where specified otherwise.

1.2 Purpose of this Document

This document reports on the performance of T&TEC for the year 2018, with respect to the key performance indicators outlined in the PMR Framework (2005), specific directives included in the Determination (2006), and any other metrics of performance that are relevant to the electricity transmission and distribution sector, as decided by the RIC. It provides a comparison of T&TEC's performance against indicators outlined in the PMR Framework (2005), the targets set by the Determination (2006), its historical performance, and the performance metrics of other utilities, where relevant and subject to availability of data.

1.3 Structure of Document

This document is divided into three sections. **Section 1.0** highlights the purpose and structure of the report. **Section 2.0** gives a review of T&TEC's performance with respect to some broad performance criteria including: Aggregate Performance, Other Economic Data, Network Reliability, Customer Responsiveness and Service, Equipment Maintenance, and Financial Performance and Efficiency. **Section 3.0** gives a conclusion and recommendations for T&TEC.

An abridged list of key performance indicators for the electricity transmission and distribution sector is contained in the appendix.⁵

⁵ 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 Performance

2.1.1 Electricity Service Coverage

Electricity Service Coverage is an indicator of the level of access to electricity. It may be used to gauge the potential for growth in the country's commercial and industrial sectors. As at 2017, T&TEC's service coverage was estimated at 99.3%, with only a small percentage of the population not supplied by the national electricity grid.⁶

2.1.2 Number of Customers by Class and Area

T&TEC categorizes its customers according to specific classes, based on the customer's electrical load and supply voltage. These classes include the residential, commercial and industrial customers.⁷ All customers are billed for energy consumed, measured in kilowatt per hour (kWh). Industrial customers have an additional demand charge, measured in kilovolts-ampere (kVA). A separate classification, street lighting, is used to bill private customers and governmental agencies for electricity that is consumed by private and public outdoor lighting respectively.

The number of active accounts per customer class for the years 2017 and 2018 is outlined in table 1. T&TEC had 483,559 customer accounts in 2018, which represented a 0.8% increase from 2017 (479,632). The domestic class (425,643) accounted for the largest share (88.0%) of T&TEC's customer base. This was followed by the commercial class (11.1%), and the industrial and street lighting classes respectively which collectively accounted for less than 1% of T&TEC customer base. The commercial class, in particular, had the highest growth in 2018, expanding by 660 accounts or 1.2%.

⁶ Electricity Service Coverage is calculated as (No. of households with electricity access/No. of households) x100. Note: data for the year 2018 was unavailable at the time this report was being prepared.

⁷ **Residential (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 or 132kV at loads greater than 50kVA but less than 25,000kVA.

Table 1: Number of Active Accounts by Class (2017 - 2018)

Year	Customer Class				Total
	Domestic	Commercial	Industrial	Street Lighting	
2018	425,643	53,910	3,961	45	483,559
2017	422,405	53,250	3,932	45	479,632
Percentage Change (%)	0.8%	1.2%	0.7%	0%	0.8%

T&TEC generally serves its customers according to five (5) distribution areas across Trinidad and Tobago, namely North, South, East, Central and Tobago. The number of active customer accounts per distribution area for the years 2017 and 2018 is shown in table 2. The South distribution area had the largest number of active accounts (145,940) in 2018, and accounted for 30% of T&TEC's customer base. This was followed by the East (130,482) and North (94,275) distribution areas respectively. The Central distribution area (84,469) had the largest growth, expanding by 974 accounts or 1.2% in 2018.

Table 2: Number of Active Accounts by Area (2017 - 2018)

Year	Distribution Area					Total
	North	South	East	Central	Tobago	
2018	94,275	145,940	130,482	84,469	28,393	483,559
2017	94,030	144,835	129,213	83,490	28,119	479,687
Percentage Change (%)	0.3%	0.8%	0.9%	1.2%	1.0%	0.8%

2.1.3 Electricity Purchases and Electricity Sales

T&TEC generally purchases bulk electrical energy from three (3) independent power producers (IPPs) in Trinidad and Tobago.⁸ In 2018, the total amount of electricity purchased was 9,225,091,000 kWh, which represented a 1% decline from 2017 (9,318,243,847 kWh), as shown in table 3. The highest amount of electricity purchased by T&TEC occurred during the 3rd quarter (Jul-Sep), and the lowest during the 1st quarter (Jan-Mar).

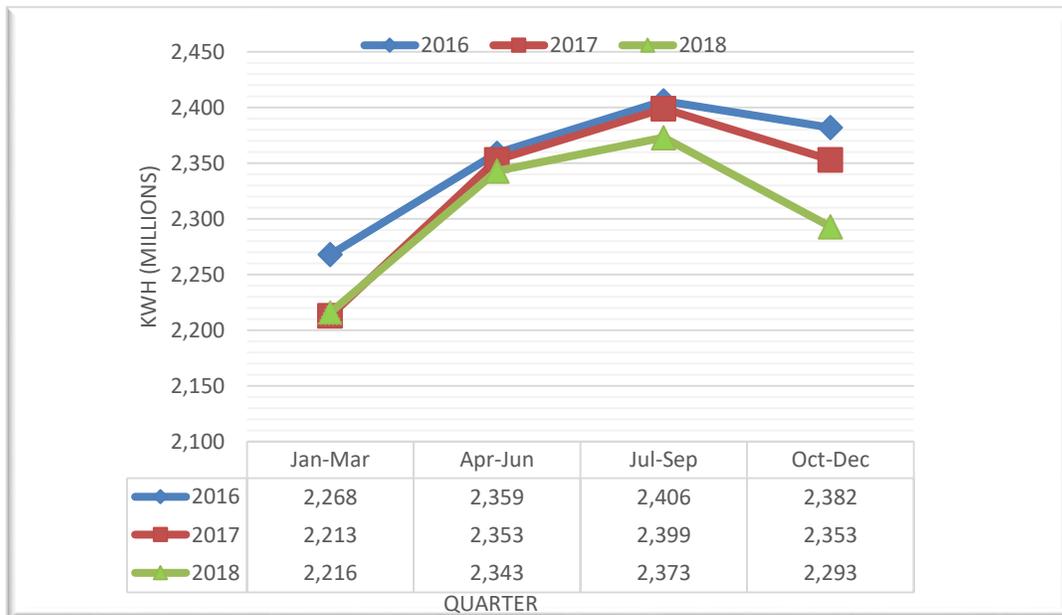
⁸ These power generators include the Power Generation Company of Trinidad & Tobago Ltd, Trinity Power Ltd, and Trinidad Generation Unlimited. T&TEC also has its own generation capacity of 75MW in Tobago.

Table 3: Electricity Purchased, kWh (2017 - 2018)

Quarter	kWh	
	2018	2017
Jan-Mar (Q1)	2,216,074,000	2,213,403,347
Apr-Jun (Q2)	2,343,013,000	2,352,662,500
Jul-Sep (Q3)	2,373,236,000	2,398,736,000
Oct-Dec (Q4)	2,292,768,000	2,353,442,000
Total	9,225,091,000	9,318,243,847

As illustrated in figure 1, the pattern of electricity purchased by T&TEC was very similar over the last three years, typically increasing through quarters 1 and 2, and declining in quarter 4. The peaks in electricity purchased by T&TEC were partly due to manufacturing and industrial sector ramp up production during the period.

Figure 1: Electricity Purchased (kWh): Three-Year Trend (2016 - 2018)



Electricity sales (consumption) per distribution area for the years 2017 and 2018 are shown in table 4. In 2018, T&TEC's reported electricity sales of 8,463,412,741 kWh, which represented a 1.2% decrease from 2017 (8,564,536,977 kWh). The highest electricity sales occurred in the Central distribution area, which accounted for more than 30% of annual electricity sales. This relatively

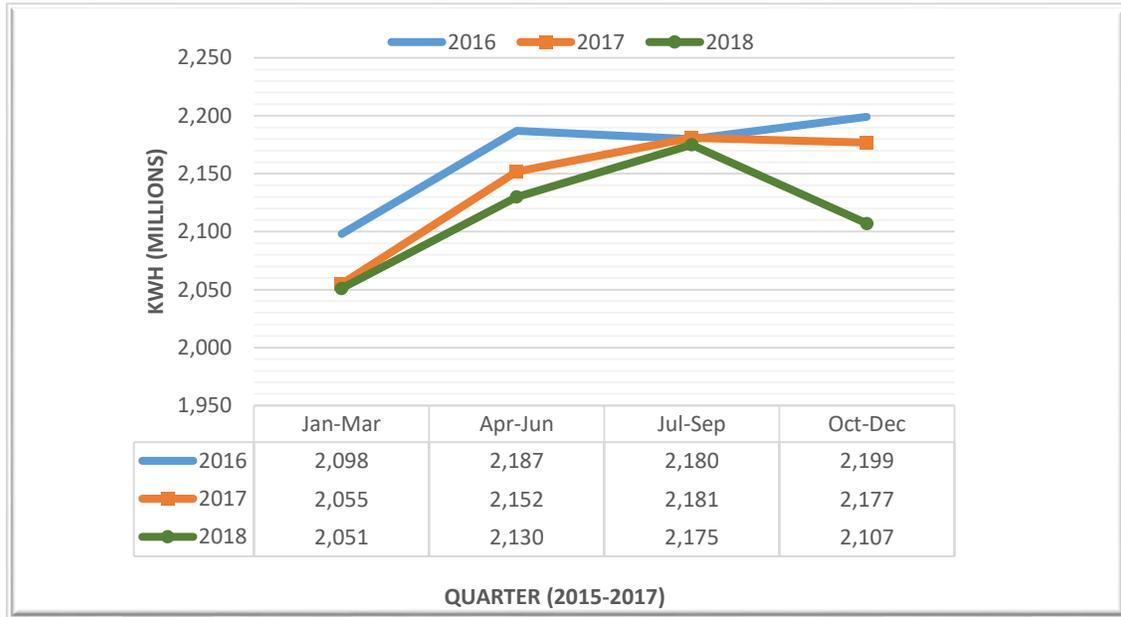
high electricity consumption in the Central distribution area is consistent with the fact that the area has the highest concentration of large industrial customers in Trinidad and Tobago.

Table 4: Electricity Sales per Distribution Area, kWh (2017 - 2018)

Month	Electricity Sales per Distribution Area (kWh)					Total
	North	South	East	Central	Tobago	
Jan – Mar Q1	382,775,825	486,128,171	458,337,488	651,030,088	72,880,773	2,051,152,345
Apr – Jun Q2	444,597,510	502,278,294	459,599,492	638,784,229	85,228,441	2,130,487,966
Jul – Sep Q3	399,671,251	517,003,908	488,663,362	690,774,097	78,853,481	2,174,966,099
Oct – Dec Q4	468,062,128	477,795,978	467,902,685	605,160,880	87,884,660	2,106,806,331
Total (2018)	1,695,106,714	1,983,206,351	1,874,503,027	2,585,749,294	87,884,660	8,463,412,741
Total (2017)	1,730,389,162	2,020,713,101	1,884,292,540	2,601,537,087	327,605,087	8,564,536,977

The trends in T&TEC’s electricity sales for the three-year period 2016-2018 are shown in figure 2. Electricity sales fluctuated throughout 2016, with peak sales occurring in the 2nd quarter (Apr-Jun). In 2017 and 2018, there was a change from this trend, with electricity sales instead increasing up to, and peaking in the 3rd quarter (Jul-Sep). Electricity sales then declined in the 4th quarter (Oct-Dec).

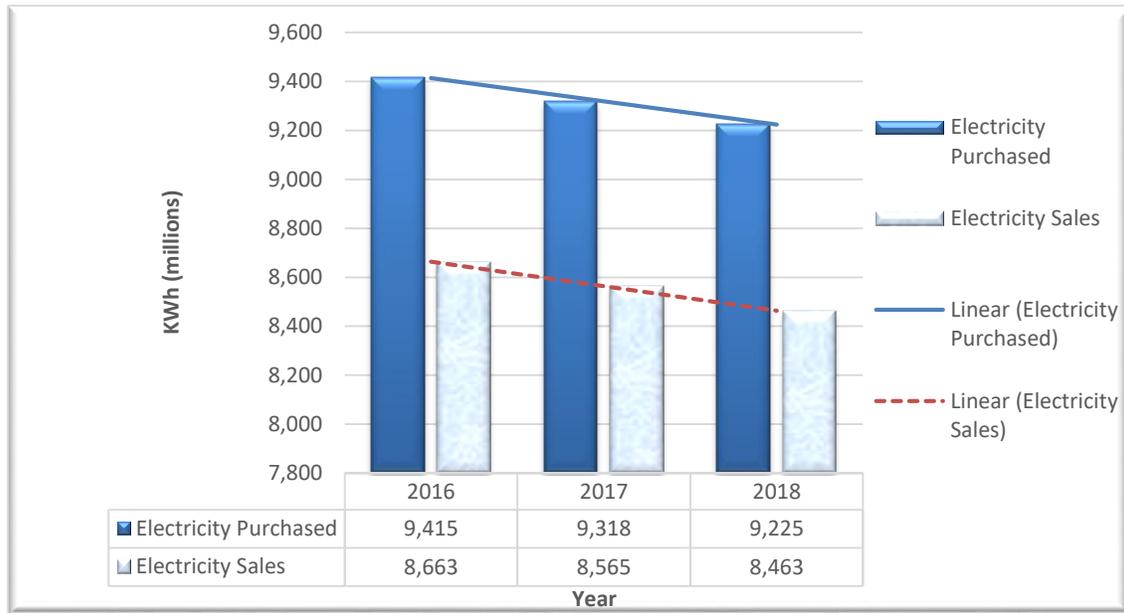
Figure 2: Electricity Sales - Three Year Trend (2017 - 2018)



The electrical energy that T&TEC purchases from the power generators is measured in real-time, whereas electricity sales is computed from customers’ consumption that is billed over various billing cycles. As a result, the trends in peaks and troughs for electricity purchased and electricity sales may not simultaneously occur on a quarterly basis.

A comparison of the annual amount of electricity purchased against the annual amount of electricity sales over the three-year period 2016-2018 is shown in figure 3. It shows that there has been a downward trend in both measures over the period. Further, the rate of decrease in electricity purchased appeared to be aligned with the rate of decrease in electricity sales, which indicates that the disparity between the two has been decreasing.

Figure 3: Electricity Purchased vs. Electricity Sales: Three -Year Trend (2016 - 2018)



2.1.4 Total System Losses

Not all of the electrical energy that T&TEC purchases from the power generators is available for sale to customers. The difference between the electricity entering T&TEC’s network and that supplied to customers is referred to as ‘total system losses’. Total system losses are usually 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 lines, the configuration and operation of the networks and the inherent inefficiencies in various pieces of equipment. Whereas, non-technical losses or commercial losses, arise when electrical energy is delivered to customers but no revenue is collected by the utility. Non-technical losses are generally due to metering errors, recording errors, theft and any other instance where the energy is not billed by the utility.

The RIC set a total system losses target of 6.75% to be achieved by T&TEC by the end of the regulatory control period June 1, 2006 to May 31, 2011.⁹ In 2018, T&TEC’s total system losses

⁹ This may be subject to change upon the completion of the current price review that is being conducted by the RIC. Total system losses is calculated by the following T&TEC formula:

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

was 8.26%, compared to 8.08% in 2017 (see table 5). In 2018, system losses were highest during the 3rd quarter (Jul-Sep) and lowest during the 1st quarter (Jan-Mar). The variation in the quarterly values of system losses in 2018 was likely due to the lag between the real-time energy purchased from the generators and delayed billing for energy sold to customers, as mentioned in section 2.1.3.

Table 5: Total System Losses (2017 - 2018)

Quarter	Energy Units Consumed (kWh)	Energy Units Purchased/Generated (kWh)	System Loss ¹⁰ (%)
Jan – Mar (Q1)	2,054,453,979	2,216,074,000	7.29%
Apr – Jun (Q2)	2,127,126,164	2,343,013,000	9.21%
Jul – Sept (Q3)	2,174,966,099	2,373,236,000	8.35%
Oct – Dec (Q4)	2,106,866,499	2,292,768,000	8.11%
Total 2018	8,463,412,741	9,225,091,000	8.26%
Total 2017	8,564,536,977	9,318,243,847	8.08%

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, customers per employee and consumption per capita

2.2.1 Electricity sales per employee (kWh) and Customers per employee

Electricity sales per employee and customers per employee are two indicators that are generally used to measure labour productivity and the effective use of resources in the electricity distribution sector.¹¹ In 2018, T&TEC had 3,065 employees, which represented a 2.3% decline from 2017, as shown in table 6. There was a small increase (1.3%) in kwh sales per employee from 2,717,764 kWh in 2017 to 2,752,329 kWh in 2018. Whereas, revenue per employee (\$) decreased marginally

¹⁰ Total system loss is calculated by the following T&TEC formula:

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

¹¹ 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>

(0.4%), from \$TT 951,889 in 2017 to \$TT 947,843 in 2018, there was a small increase in the customers per employee (3.3%), going from 152 in 2017 to 157 in 2018.

Table 6: Other Economic Data (2017-2018)

Indicator	Year		% Change
	2018	2017	
Number of Employees	3,075	3,149	(2.3)
Electricity Sales (kWh)	8,463,412,741	8,564,536,977	(1.2)
Electricity Sales per Employee (kWh)	2,752,329	2,717,764	1.3
Electricity Sales/Revenue per Employee (\$)	947,843	951,889	(0.4)
Number of Customers	483,559	479,632	0.8
Customers per Employee	157	152	3.3

T&TEC's performance with respect to electricity sales per employee (kWh) and customers per employee was compared to the performance of some electric utilities within the Caribbean region for the year 2017.¹² T&TEC's electricity sales per employee (8,463,412,741 kWh) was significantly higher than that of other electric utilities within the Caribbean, including the Cayman Islands (2,878,704 kWh), Jamaica (1,925,053 kWh), and Belize (1,748,348 kWh), as shown in table 7. T&TEC's customer per employee ratio (157) was lower than that of the electric utilities in Jamaica (386) and Belize (299), but higher than that of the Cayman Island (135).

¹² The comparisons were based on data for the year 2017, as 2018 data was not available at the time this report was being published. Relevant data was retrieved from the following reports: Dominica Electricity Services 2017 Annual Report, Jamaica Public Service Co. Ltd. 2017 Annual Report, Caribbean Utilities Co. Ltd. 2017 Annual Report, and Belize Electricity Ltd. Annual Report 2017.

Table 7: Other Economic Data: Trinidad and Tobago vs Regional Countries (2017)

Indicator	Caribbean Country			
	Jamaica	Cayman Islands	Belize	Trinidad and Tobago
No. of Customers	642,944	29,160	94,465	483,559
No. of Employees	1,666	216	316	3,075
Electricity Sales (kWh)	3,207,139,000	621,800,000	552,478,000	8,463,412,741
Electricity Sales per Employee (kWh)	1,925,053	2,878,704	1,748,348	2,752,329
Customers per Employee	386	135	299	157

2.2.2 Consumption per capita

Consumption per capita refers to total electricity sales (kWh) of a country, divided by the population. This metric provides an indication of a country's electricity consumption averaged per capita, not accounting for the specific purpose of use whether residential, commercial or industrial.

A comparison of Trinidad and Tobago's electricity consumption per capita over the three-year period 2016-2018 is shown in table 8. There has been a steady decrease in Trinidad and Tobago's electricity consumption per capita over the last three years, from 6,399 kWh in 2016, to 6,320 kWh and 6,227 kWh in 2017 and 2018 respectively. This decline in electricity consumption per capita (kWh) correlates with the decline in electricity sales over the same period as mentioned in section 2.1.3.

Table 8: Electricity Consumption Per Capita for Trinidad and Tobago (2016-2018)

Year	Electricity Consumption Per Capita (kWh) ¹³	Change (%)
2018	6227	(1.5)
2017	6320	(1.2)
2016	6399	(2.5)

¹³ Consumption per capita was calculated using electricity sales data from T&TEC and population data from the Central Statistical Office of Trinidad and Tobago. Note: the 2018 population mid-year estimate was available at the time this report was being published.

Trinidad and Tobago's electricity consumption per capita was also compared with data for five (5) Latin American and Caribbean (LAC) countries, as well as against four (4) other countries with comparable GDP per capita to Trinidad and Tobago for the year 2017.¹⁴ According to the IEA Atlas of Energy, Trinidad and Tobago's electricity consumption per capita was 7,700 kWh, which was significantly higher than that of several countries within the LAC region including Jamaica (1,100 kWh), Cuba (1,500 kWh), Dominican Republic (1,500 kWh), Panama (2,300 kWh), and Venezuela (2,400 kWh), as shown in table 9.

Similarly, Trinidad and Tobago's electricity consumption per capita was also higher than other countries worldwide with comparable GDP per capita. These include Uruguay (3,000 kWh), Lithuania (4,200 kWh), Slovak Republic (5,400 kWh), and Oman (7,100 kWh), as shown in table 9. Trinidad and Tobago's relatively high level of industrial electricity consumption has been a major contributor to its high electricity consumption per capita.

¹⁴ Data for the year 2018 was unavailable at the time this report was being prepared. Thus, the data outlined in table 9 is based on relevance and availability. The data is presented to give a snapshot of how Trinidad and Tobago's performance compares to similarly placed jurisdictions.

**Table 9: Electricity Consumption per Capita: Trinidad and Tobago vs Selected Countries
(2017)**

Country		Electricity Consumption per Capita (kWh/capita) ¹⁵	GDP Per Capita (Current US\$) ¹⁶
Latin American and Caribbean (LAC) countries	Jamaica	1,100	4,883.9
	Cuba	1,500	7,961.8
	Dominican Republic	1,500	6,793.5
	Panama	2,300	14,366.9
	Venezuela, RB	2,400	15,692.4
Non-regional Countries with Comparable GDP per capita	Uruguay	3,000	16,437.2
	Lithuania	4,200	16,840.9
	Slovak Republic	5,400	16,544.2
	Oman	7,100	15,130.5
Trinidad & Tobago		7,900*	16,334.2

*The RIC notes that this value of electricity consumption per capita outlined by the IEA Energy Atlas (2017) is higher than the value calculated by the RIC in table 8. This variation may be attributable to delays/time lags in the reporting of data across the relevant reporting 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 customers' 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 and allow the utility and regulator to assess the system's performance. The comparative analysis of the reliability of the networks of different utilities has to take into account that the electrical/structural configuration of a network, and the prevailing climatic conditions can significantly impact its reliability. Reliability indices are, therefore, situational in nature and will present different baselines depending on the many intrinsic

¹⁵ Electricity consumption per capita for the year 2017 was retrieved on 22.01.2020 from IEA Atlas of Energy <http://energyatlas.iea.org/#!/tellmap/-1118783123/1>

¹⁶ GDP per Capita (Current US\$) for the year 2017 was retrieved on 22.01.2020 from the World Bank <https://data.worldbank.org/indicator/NY.GDP.PCAP.CD?end=2017&start=1960>

factors affecting the system.¹⁷ Notwithstanding this, the IEEE Guide for Electric Power Distribution Reliability Indices (IEEE 1366-1998) is a standard that has been applied across many jurisdictions with respect to monitoring and reporting on reliability. Accordingly, the reliability of T&TEC's supply is assessed using the under-mentioned indices, as defined in IEEE 1366-2012.

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. In 2018, the annual value of SAIFI was 3.90 interruptions per customer, which represented a 13.3% decline from 2017 (4.50 interruptions per customer). This improved value of SAIFI suggested that, statistically a T&TEC customer likely experienced three to four interruptions in electricity supply per year, in comparison to one interruption per customer in selected North American utilities according to the IEEE Standard 1366-1998 (see table 10). In 2018, SAIFI was lowest in January (0.22 interruptions per customer on average per month) and highest during August and September (0.45 interruptions per customer on average per month).

2.3.2 System Average Interruption Duration Index (SAIDI)

The System Average Interruption Duration Index (SAIDI) measures the average outage duration per customer. In 2018, the annual value of SAIDI was 389 minutes, which represented a 6.7% decline from 2017 (417 minutes). This improved value of SAIDI suggested that the yearly outage duration for a T&TEC customer was about four times longer than the median value of SAIDI for selected North American utilities according to IEEE Standard 1366-1998 (i.e. 90 minutes). In 2018, SAIDI was lowest in February with outages lasting 21 minutes and highest in August (49.2 minutes).

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. It can also be viewed as the average restoration time. The annual value of CAIDI was 99 minutes in 2018, with a high of 109.80 minutes in June, and a low of 81 minutes in May (see table 10).

¹⁷ Evaluation of Data Submitted in APPA's 2013 Distribution System Reliability & Operations Survey
http://www.publicpower.org/files/PDFs/2013DSReliabilityAndOperationsReport_FINAL.pdf

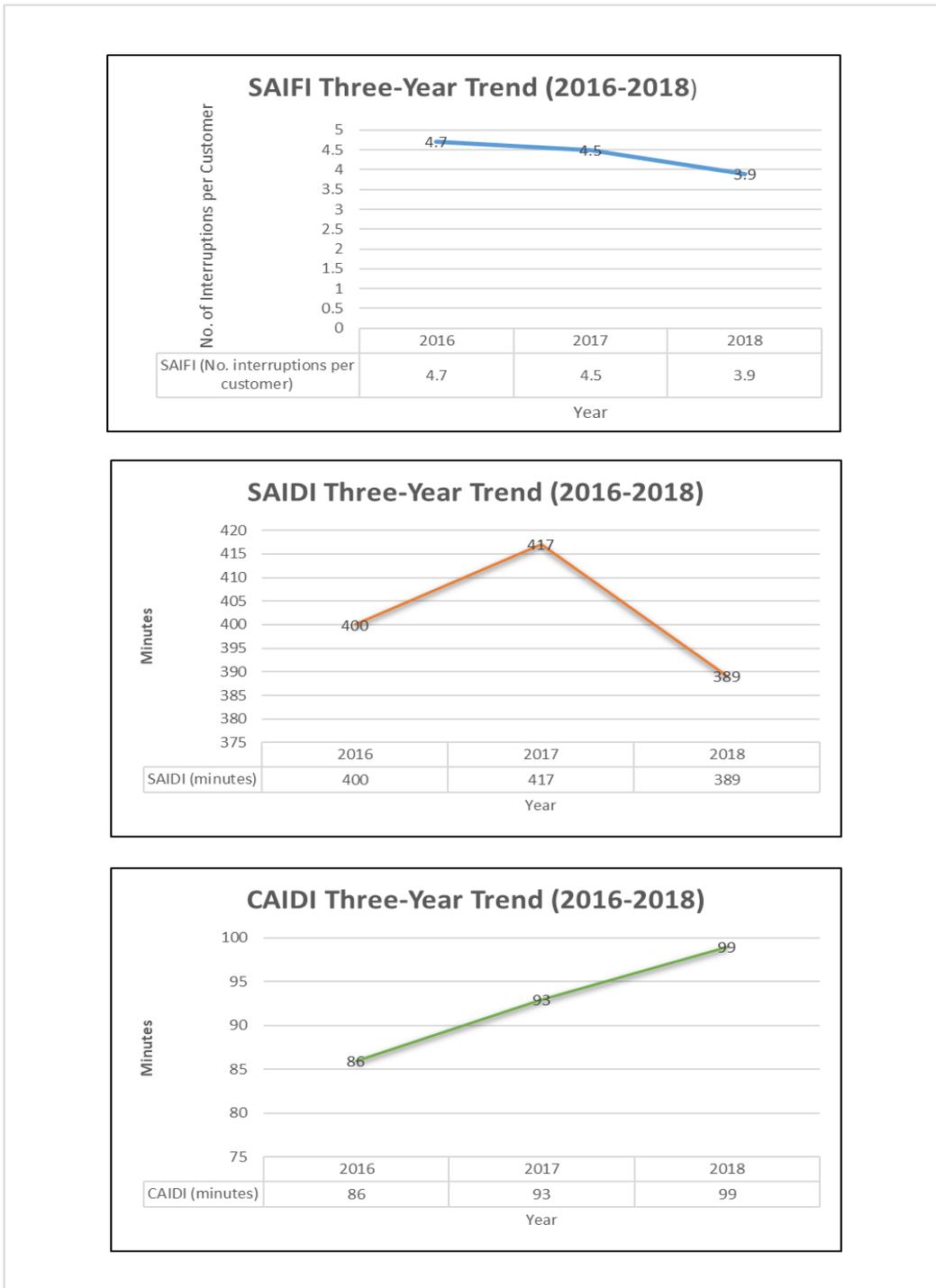
Table 10: SAIFI, SAIDI & CAIDI (2018)

Indicator	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total	NAU*
SAIFI (No./customer)	0.22	0.25	0.30	0.25	0.34	0.34	0.40	0.45	0.45	0.35	0.32	0.24	3.9	1.1
SAIDI (minutes)	23.40	21.00	30.00	22.20	28.20	37.20	35.4	49.2	44.4	41.4	33.0	23.4	389	90
CAIDI (minutes)	108.00	84.00	98.40	87.60	81.00	109.80	87.0	108.6	97.2	118.2	102.6	97.8	99	82

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

An examination of the trends in SAIFI, SAIDI and CAIDI over the three-year period 2016-2018 is shown in figure 4. Overall, the annual values of SAIFI and SAIDI decreased over the period, while there was a steady increase in the annual values of CAIDI.

Figure 4: SAIFI, SAIDI, & CAIDI: Three-Year Trends (2016-2018)



2.3.4 Number of Transmission Trips & Interruptions Affecting Customers

In 2018, there were 33 transmission trips and interruptions affecting customers, as shown in table 11. This represented a 3.1% increase from 2017 which had 32 trips and interruptions. The majority

of the trips and interruptions occurred on the 33kV network (27); followed by the 66kV network and the 132kV network respectively.

Table 11: Transmission Trips & Interruptions Affecting Customers (2018)

Month	Transmission Circuit Trip			Number of Interruptions Restored (<3hrs)			Number of Interruptions Restored (<5hrs)		
	33kV	66k V	132kV	33kV	66kV	132kV	33kV	66k V	132kV
Jan	1	0	0	0	0	0	1	0	0
Feb	2	0	0	2	0	0	0	0	0
Mar	0	0	0	0	0	0	0	0	0
Apr	1	3	0	1	3	0	0	0	0
May	0	0	0	0	0	0	0	0	0
Jun	2	0	0	2	0	0	0	0	0
Jul	4	0	0	4	0	0	0	0	0
Aug	7	2	0	4	2	0	3	0	0
Sep	4	0	1	3	0	0	1	0	1
Oct	1	0	0	1	0	0	0	0	0
Nov	3	0	0	3	0	0	0	0	0
Dec	2	0	0	2	0	0	0	0	0
Total	27	5	1	22	5	0	5	0	1

With respect to restoring transmission trips and interruptions, T&TEC performed the best on the 66kV network, as all the trips and interruptions were restored within a three (3) hour period (see table 12). In the case of the 33kV network, T&TEC restored 81.5% of trips and interruptions within three (3) hours, and the remaining 18.5% within the five (5) hour period. On the 132kV network, 100% of the trips were restored within 5 hours.

Table 12: Summary of Transmission Trips & Interruptions Affecting Customers (2018)

Trips and Interruptions	No. of Trips and Interruptions on Network			
	33kV	66kV	132kV	Total
Total	27	5	1	33
Restoration < 3 hrs	22	5	0	27
Restoration < 5 hrs	5	0	1	6
% < 3 hrs	81.5%	100%	0%	81.8%
% < 5hrs¹⁸	100%	100%	100%	100%

¹⁸ This percentage includes the percentage of transmission trips and interruptions restored in less than 3 hours, i.e. % < 3 hrs.

2.4 Customer Responsiveness and Service

This section highlights T&TEC’s response to customer complaints, with a focus on those aspects that are most important to customers. One of the best signals that a utility is improving its service to customers is a reduction in the number of complaints it receives. T&TEC’s customer responsiveness and service are assessed using the following indicators: number of complaints received, number of complaints resolved and complaints resolution rate.

2.4.1 Complaints Received and Resolved

In 2018, T&TEC received 49,247 customer complaints. This represented a significant increase (125.9%) from 2017 which had 21,804 customer complaints, as shown in table 13. Poles/other complaints accounted for the majority of these complaints (29,576 or 60%), followed by billing queries (15,208), high/low voltage complaints (3,521), and damaged appliances complaints (942) respectively. In 2018, T&TEC received the most number of complaints during the 3rd quarter (13,984) and the least during the 2nd quarter (9,702).

Table 13: Complaints Received by Type (2017 - 2018)

Type of Complaint	No. of Complaints Received									
	2018					2017				
	Jan-Mar	Apr-Jun	Jul-Sep	Oct-Dec	Total	Jan-Mar	Apr-Jun	Jul-Sep	Oct-Dec	Total
Billing Query	3,225	2,992	4,093	4,898	15,208	2,478	3,906	4,391	2,865	13,640
Damaged Appliances	219	202	275	246	942	131	142	286	203	762
High/Low Voltage	692	854	1,057	918	3,521	120	179	225	166	690
Poles/Other¹⁹	8,590	5,654	8,559	6,773	29,576	1,302	1,755	2,138	1,517	6,712
Total	12,726	9,702	13,984	12,835	49,247	4,031	5,982	7,040	4,751	21,804

T&TEC resolved 48,011 in 2018, compared to 21,716 complaints in 2017 (see table 14). T&TEC resolved the largest number of complaints during the 3rd quarter (13,828) and the least during the

¹⁹ “Other” complaints include but are not limited to defective streetlights, power outages, delays in the delivery of service and line relocation and removals.

2nd quarter (9,564).

Table 14: Complaints Resolved by Type (2017-2018)

Type of Complaint	No. of Complaints Resolved									
	2018					2017				
	Jan-Mar	Apr-Jun	Jul-Sep	Oct-Dec	Total	Jan-Mar	Apr-Jun	Jul-Sep	Oct-Dec	Total
Billing Query	3,225	2,992	4,093	4,898	15,208	2,475	3,905	4,391	2,865	13,636
Damaged Appliances	199	183	201	243	826	131	118	279	203	731
High/Low Voltage	681	849	1,029	898	3,457	119	177	222	161	679
Poles/Other	7,756	5,540	8,505	6,719	28,520	1,302	1,755	2,096	1,517	6,670
Total	11,861	9,564	13,828	12,758	48,011	4,027	5,955	6,988	4,746	21,716

2.4.2 Complaints Resolution Rate

In 2018, T&TEC improved its resolution rate for high/low voltage complaints. However, the resolution rate for damaged appliances and poles/other complaints worsened over the period (see table 15). As a result, T&TEC's overall complaints resolution rate declined from 99.6% in 2017 to 97.5% in 2018.

Table 15: Complaints Resolution Rate (2017 - 2018)

Complaints by Type	Resolution Rate (%) ²⁰	
	2018	2017
Billing Query	100%	100%
Damaged Appliances	87.7%	95.9%
High/Low Voltage	98.2%	98.0%
Poles/Other	96.4%	99.4%
Total	97.5%	99.6%

²⁰ Calculated as (Complaints Resolved/Complaints Received) *100

2.4.3 Response to Written Complaints

The timeliness of T&TEC’s response to a customer complaint is an important indicator of its service quality. Customers can lodge complaints to T&TEC in several ways, including via telephone or in writing. T&TEC’s response to written customer complaints over the period 2017-2018 is shown in table 16. In 2018, T&TEC received 251 written complaints, which represented a 28.1% increase from 2017. Of the 251 written complaints, 70 (or 27.9%) were not responded to within a two-week period. In August and September, T&TEC was able to respond within 2 weeks to 100% of the written complaints received.

Table 16: Response to Written complaints (2017-2018)

Month/Year	No. of written complaints received	No. of written complaints not responded to within 2 weeks	No. of written complaints not responded to within 2 weeks	% complaints with Response > 2 weeks
		Received in the month	Received in previous months	
Jan	13	5	0	38.5%
Feb	13	1	0	7.7%
Mar	26	10	0	38.5%
Apr	13	4	0	30.7%
May	13	2	0	15.4%
Jun	26	8	0	30.8%
Jul	27	11	0	40.7%
Aug	31	0	0	0%
Sep	25	0	0	0%
Oct	17	5	0	29.4%
Nov	23	12	0	52.2%
Dec	24	12	0	50.0%
Total 2018	251	70	0	27.9%
Total 2017	196	14	13	13.8%

2.5 Equipment Maintenance

The Determination (2006) states that T&TEC is required to provide information on specific directives related to its operations, including repair and maintenance of pole-mounted distribution transformers, and repair/replacement of defective streetlights.

2.5.1 Repair and Maintenance of Pole-mounted Distribution Transformers

T&TEC is required to repair and maintain pole-mounted distribution transformers at a rate of at least 20% per annum. At the end of 2018, T&TEC had 39,467 pole-mounted transformers in service, compared to 38,538 in 2017 (see table 17). This represented a 2.4% increase over the period. The annual percentage of pole-mounted distribution transformers inspected/serviced in 2018 was 38.8%, which was well above the 20% minimum requirement.

Table 17: Repairs & Maintenance to Pole-Mounted Transformers (2017-2018)

Indicator	No. of Pole-Mounted Transformers							
	2018				2017			
	Jan-Mar (Q1)	Apr-Jun (Q2)	July-Sep (Q3)	Oct-Dec (Q4)	Jan-Mar (Q1)	Apr-Jun (Q2)	July-Sep (Q3)	Oct-Dec (Q4)
No. of Pole Mounted Distribution Transformers	38,815	39,072	39,287	39,467	37,636	37,986	38,304	38,538
No. of Pole Mounted Distribution Transformers Inspected	6,326	9,737	11,662	13,832	3,719	8,599	11,581	11,959
No. of Transformers Serviced	297	707	1,016	1,480	751	1,511	770	2,867
% Inspected/ Serviced	17.1%	26.7%	32.3%	38.8%	11.9%	26.6%	32.2%	38.5%

2.5.2 Street Lighting Repair

T&TEC is responsible for monitoring the condition and performance of public lighting assets. This includes the development and implementation of plans for the operation, maintenance and replacement of public lighting. T&TEC is required to repair street lighting failures that are 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.

The number of street lighting repairs undertaken by T&TEC in 2018 is shown in table 18. T&TEC received 27,945 reports from customers and/or members of the public for repairs to existing streetlights. Of these, T&TEC only completed 5,266 or 18.8% repairs within 7 days. Apart from this, T&TEC completed 15,715 street lighting repairs in response to failures detected by its crews and other staff during the period. In total, T&TEC completed 46,353 street light repairs in 2018.

Table 18: Street Light Repairs (2018)

Indicator	2018				
	Jan-Mar (Q1)	Apr-Jun (Q2)	Jul-Sep (Q3)	Oct-Dec (Q4)	Total
1. No. of Reports Received	8,116	5,350	8,131	6,348	27,945
2. No. of Repairs Completed within 7 days	1,296	729	1,531	1,710	5,266
3. No. of Repairs without a report	7,968	1,620	2,698	3,429	15,715
4. Total No. of Repairs Completed	14,799	6,633	14,727	10,194	46,353

Note:

- 1) Reports received from customers and/or members of the public for repairs to existing streetlights and for new street lights.
- 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 month, i.e. repairs arising from both customer reports as well as inspections and observation by crews.

A comparison of T&TEC's performance with respect to street lighting repairs for years 2017 and 2018 is shown in table 19. There was a 37.4% decrease in the number of reports of street lighting failures received in 2018 (27,945), compared to 2017 (44,520). Also, there was a 61.8% percentage increase in the 7-day repair rate for these reported failures, indicating some improvement in T&TEC's performance. The number of unreported failures that were detected and repaired by T&TEC increased by approximately 140% over the period.

Table 19: Summary of Street Light Repairs (2017 - 2018)

Indicator	Year		Percentage Change (%)
	2018	2017	
No. of Reports Received	27,945	44,520	(37.4%)
No. of Repairs Completed within 7 days	5,266	5,454	(3.4%)
7-day Repair Rate for reported failures	19.9%	12.3%	61.8%
No. of Repairs without a report	15,715	6,498	141.8%
Total No. of Repairs Completed (includes carryover from previous year)	46,353	47,111	(1.6%)

2.6 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 efficient expenditure.

Table 20 below shows a selected set of financial ratios which assess the performance of T&TEC from the perspective of debt financing, liquidity, profitability and efficiency.

Table 20: Select Financial Ratios of T&TEC's Performance (2017 - 2018)

RATIOS	YEAR		TARGET
	2017	2018	
Debt Financing			
Gearing (%)	84	56	
Funds Flow Interest Cover	0.33	0.66	Greater than 3
Cash Interest Cover	(3.61)	1.30	Greater than 1
Debt Pay Back Period (Years)	(43.13)	(76.22)	Between 5 to 7
Debt as a proportion of RAB (%)	1062%	118%	Below 65%
Liquidity			
Collection Rate (%)	62%	62%	
Revenue Billed/Operating Cost	0.92	0.95	Greater than 2
Revenue Collected/Operating cost	0.89	1.05	Greater than 1
Internal Financing (%)	(83)%	(3)%	Greater than 40%
Profitability and Efficiency			
Return on RAB (%)	-25%	-2%	≈ 9%
Operating Cost per unit (\$/kWh)	0.38	0.38	

2.6.1 Debt Financing

T&TEC showed an improvement in its gearing. For the years, 2017 and 2018 both funds flow interest cover and cash interest coverage continue to fall outside the respective target ranges, suggesting that T&TEC may have experienced difficulty in meeting its finance costs.

Funds from operations, while improving, remains well below the ideal target range, and continues to adversely impact the debt payback period metric.

Debt as a portion of Regulatory Asset Base (RAB) remained well above the target of 65%, but has improved considerably when compared to the previous year. The continued high level of this ratio suggests that substantial portions of borrowed funds are not necessarily being used to fund capital projects.

2.6.2 Liquidity

T&TEC's liquidity position improved slightly over the review period, with revenue collected to operating cost ratio moving to the target range. The collection rate remained stable at 62%, and both T&TEC's revenue and receivables increased slightly over the period. Revenue improved by \$16.5 million from 2017 to 2018, and receivables increased by \$30.1 million. The working coverage ratios, which compare both revenue collected and billed income to operating costs, both improved over the period, but remained below target levels.

An increase in funds from operations for the period 2017-2018 impacted positively on the internal financing ratio, however greater improvement is required as it is still a challenge for T&TEC to fund capital expenditure from internal cash flows.

2.6.3 Profitability and Efficiency

T&TEC is a state-owned and operated utility and analysing profitability in the same manner as is done in the case of an investor-owned utility may not be as useful. Instead of assessing the traditional return on capital, measuring the return on RAB is better suited to this type of governance structure. This approach is similar to the return on capital except the net cash flow is compared to the regulatory asset base. Over the two-year period 2017 – 2018, there was an improvement in the net cash flow return on the RAB moving from negative 25% to negative 2%.

The above approach is often supplemented by financial metrics on costs such as the operating cost per kWh, which is better suited to determining the efficiency of operations in a state owned public utility. The operating cost per kWh remained stable at 0.38. The Funds from Operations (FFO), though well below par, improved over the previous year, going from (\$259,561,235) in 2017 to (\$147,478,184) in 2018.

SECTION 3.0 CONCLUSION AND RECOMMENDATIONS

3.1 Conclusion

For the period under review, T&TEC showed improvement in a number of key performance indicators. These include the system reliability indicators SAIFI (3.90 interruptions per customer) and SAIDI (389 minutes), and the restoration rate for transmission trips and interruptions affecting customers (81.8%). However, while there was some improvement in the labour productivity indicators, i.e. kWh electricity sales per employee (2,752,329 kWh) and customers per employee (157) in 2018, T&TEC's performance remained below that of other utilities within the Caribbean region with respect to both indicators. T&TEC also marginally improved the annual percentage of pole-mounted distribution transformers inspected/serviced (38.8%), as well as the repair rate for reported street lighting failures (19.9%) in 2018.

Notwithstanding the above, certain operational performance areas require closer attention, including total system losses (8.26%) and total transmission trips and interruptions on the network (33), which both increased over the period. Additionally, T&TEC should pay greater attention to the number of customer complaints (49,247) which doubled in 2018, and to its overall financial performance which continues to face various challenges.

3.2 Recommendations

In an effort to improve T&TEC's performance moving forward, the RIC suggests that T&TEC undertake the following actions:

- Investigate the reason for the recurrent increases in system losses, and identify strategies to manage these losses;
- Investigate the reason for the significant increase in customer complaints, and adopt a suitable strategy to reduce the quantum;
- Reconcile the real-time data captured for electricity purchased from the generators to the delayed billing information for electricity sold to customers. This would allow for a more reliable estimate of total system losses (both technical and commercial);
- Continue efforts to reduce the frequency and duration of service interruptions;
- Develop strategies to improve labour productivity and the effective use of resources;

- Continue efforts to improve the 7-day repair rate for reports of street lighting failures from customers and/or members of the public;
- Continue efforts to collect outstanding funds, including accounts receivables from government Ministries and local government authorities.
- Continue efforts to improve its overall revenue position, inclusive of new revenue streams where applicable.

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	$\frac{[\text{Interest bearing debt}]}{[\text{Interest bearing debt} + \text{equity}]}$		Yearly
2.2		Funds From Operations (\$)	$\frac{\text{Operating Revenue} - \text{Operating Expenses}}{\text{Operating Revenue} - \text{Operating Expenses}}$	\$	Yearly
2.3		Funds Flow Interest Cover (Times)	$\frac{(\text{FFO} + \text{Interest})}{\text{Interest}}$		Yearly
2.4		Cash Interest Cover (Times)	$\frac{\text{Opening Cash Flow}}{\text{Interest Expense}}$		Yearly
2.5		Debt Pay Back Period (Years)	$\frac{\text{Net Debt}}{\text{FFO}}$	Years	Yearly
2.6		Debt as a proportion of RAB (%)	$\frac{\text{Net Debt}}{\text{RAB}}$		
2.7		Collection Rate	$\frac{\text{Operating Revenue} - \text{Receivables}}{\text{Operating Revenue}} \times 100 \%$	%	Yearly
2.8		Revenue Billed/Operating Cost	$\frac{\text{Operating Revenue Billed}}{\text{Operating Cost}}$		Yearly
2.9		Revenue Collected/Operating cost	$\frac{\text{Revenue Collected}}{\text{Operating Cost}}$		Yearly

Item	Category	Indicator	Definition	Units	Reporting Period
2.10		Internal Financing (%)	$\frac{(\text{FFO} - \text{Dividends})}{\text{Net CAPEX}} \times 100\%$	%	Yearly
2.11		Return on RAB (%)	$\frac{\text{Net operating income}}{\text{RAB}} \times 100\%$	%	Yearly
2.12		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

Item	Category	Indicator	Definition	Units	Reporting Period
4.3		Customers per employee	$\frac{[\text{Total no of customers}]}{[\text{Total number of employees}]}$	Number	Yearly
4.4		Consumption per capita (kWh)	$\frac{[\text{Total Kwh sales}]}{[\text{Total population}]}$	KWh	Yearly