POWER PERSPECTIVES

State overview: Tamil Nadu

Part of Power Perspectives

An initiative by Prayas (Energy Group), Pune

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Prayas (Energy Group)

About Prayas

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About Power Perspectives

Power Perspectives is an initiative by Prayas (Energy Group) to provide brief commentaries and analyses on important developments in the Indian power sector in various states and at the national level. The portal hosts articles on a wide-ranging set of issues to inform policy makers, regulators, researchers, journalists and civil society organisations about sector developments from a public interest perspective. The initiative focuses on critical developments that are not adequately reported.

As part of the initiative, developments in focus states are tracked. In addition to articles, each focus state has a "State Overview" document which provides a brief background of the state and infographics with key statistics. The portal can be accessed here: https://prayaspune.org/peg/resources/power-perspective-portal.html

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1. Overview

Tamil Nadu has the one of the highest Gross State Domestic Products (GSDP) in the country, is industrialised, and has good socio-economic indicators. The state's power sector also claims the third highest total installed capacity, and the highest generation from renewable sources in the country[1]. It was also one of the first states to meet the goal of 100% household and village on-grid electrification. In spite of this, Tamil Nadu's power sector has been plagued with supply and finance constraints through the years.

Till the early 2010's, severe energy and peak demand shortages were commonplace in Tamil Nadu. For instance, in FY13, there was a deficit of 17.5% in the energy required to meet the demand of the utility. Load shedding happened regularly across the state and power cuts lasted for hours at a time. The power sector is also a political priority, with elections being won and lost on its basis[2]. Given its political significance and impact on utility expenses, bridging the demand-supply gap was recognised as one of the overriding concerns of the utility, and measures were taken towards this end[3]. In the times of supply deficit, the utility's energy demand was met with high cost addition from state and private sector sources. Due to its contribution to the utility's expenditure, such high power purchase costs have significant impact on the financial viability of the DISCOM, and is further discussed in section 3. The supply situation in Tamil Nadu has since improved, with the shortfall in energy availability down to 0.2% in FY18 and the withdrawal of various load management practices in the state.

Like the demand-supply gap, the financial viability of the state's only distribution company (DISCOM), the Tamil Nadu Generation and Distribution Company (TANGEDCO), was also recognised as a core concern. But unlike the former, financial issues have continued to be a matter of concern in the state. The state had stagnant electricity tariffs for seven years, from FY03 till FY10, which resulted in huge accumulated losses, and required the DISCOM to borrow funds even to carry out operational functions. This financial situation could be attributed to the high cost of supply, infrequent tariff revisions, and operational inefficiencies. Several central sector bailout schemes, such as the Financial Restructuring Plan (FRP) and the Ujwal DISCOM Assurance Yojana (UDAY), were adopted to improve the situation and restructure the DISCOM's debt. These schemes and the financial situation of the state's power sector are further discussed in section 2, and the status of the distribution business is detailed in section 4.

As a result of the high power purchase costs and the stagnant consumer tariffs, the state utility depends heavily on subsidy. In fact, the electricity revenue subsidy has accounted for 14% of the Tamil Nadu's Aggregate Revenue Requirement (ARR), on an average, from FY13 to FY19[4]. This subsidy is predominantly distributed to agricultural and domestic consumers, and the subsidised categories in the state account for over 50% of the utility's sales mix. However, Tamil Nadu's high dependence on subsidy is offset by the limited potential of state budget growth. Due to this, the utility also depends on cross subsidy from industrial and commercial consumers to compensate for the tariff reductions to domestic and agricultural

[1] http://www.cea.nic.in/reports/monthly/installedcapacity/2019/installed_capacity-10.pdf
https://www.hindustantimes.com/india-news/15-states-have-100-household-electrification-now-says-govt/story-jQ5pUzcLE8xCRGoQPmokUM.html

[2] https://www.livemint.com/Politics/f0jg75XXKKNSBm31bw9uPI/In-Tamil-Nadu-electricity-supply-beats-corruption-developm.html

[3] https://cms.tn.gov.in/sites/default/files/documents/energy_6_0.pdf

[4] Considering approved subsidy as per the state's annual subsidy order and approved ARR as reported in the FY18 tariff order for Tamil Nadu.

categories. But the high cost of power and the growth of generation from renewable sources has created fertile ground for the migration of industrial consumers away from the utility to cheaper open access and captive sources of power. This dependence on subsidy and potential for sales migration is explained in section 5.

The Electricity Act 2003 required State Electricity Boards to be unbundled into separate institutions to oversee generation, transmission, and distribution. But the state's power continued to be supplied by a vertically integrated utility, the Tamil Nadu Electricity Board (TNEB), till 2010. Even when this utility was unbundled in 2010, generation and distribution were still clubbed under one entity. The erstwhile TNEB was unbundled into a holding company (TNEB Limited), and two subsidiaries. The transmission function was to be overseen by the Tamil Nadu Transmission Company (TANTRANSCO) and the generation and distribution functions were to be carried out by the Tamil Nadu Generation and Distribution Company (TANGEDCO). The unbundled utilities are regulated by the Tamil Nadu Electricity Regulatory Commission (TNERC). The TNERC has regulated the utilities, and its integrated predecessor, since 1999. The regulatory function of the TNERC, and its role in the operation of the DISCOM is discussed in section 6.

2. Financial challenges

2.1. Financial position of the DISCOM

Even before its unbundling in 2010, TNEB had accumulated a loss of Rs. 17,207 Crore. A transfer scheme was mandated to aid the unbundling, which required the transfer of assets, liabilities and personnel from the formerly integrated TNEB. This was intended to ease some of the financial pressure from the newly formed utilities. But the transfer of assets and liabilities, as required under the scheme, was delayed multiple times, and has still not been completed[5].

Post unbundling, the regulatory asset of TANGEDCO was estimated to be Rs. 24,762 Crore by FY12[6]. Further, in order to finance the DISCOM's operational needs, short term borrowings were made, which resulted in a cumulative outstanding debt of Rs. 24,422 Crore in FY12[7]. To address these growing losses and debts, the state government adopted the FRP in December 2012. However, in FY16, four years after the adoption of the FRP, TANGEDCO was among the bottom five states in the country, with regard to losses registered in FY16[8]. Given TANGEDCO's financial situation, a tripartite Memorandum of Understanding (MoU) was signed in January 2017, between the central government, the state government, and TANGEDCO, to adopt UDAY. Under UDAY, the state government undertook 75% of the utility's outstanding debt as on 30th September 2015, which amounted to Rs. 22,815 Crore, and converted it into bonds which were to be transferred to TANGEDCO in the form of grants for the next five years. Despite

[5] The transfer scheme addressing the assets and liabilities were deferred at least five times, before it was finalised in 2015 and its impact was included in the accounts of FY16.
https://cms.tn.gov.in/sites/default/files/go/energy_e_47_2015.pdf

[6] http://www.tnerc.gov.in/orders/Tariff%20Order%202009/2012/T.O%20No.%201%20of%202012%20dated%2030-03-2012.pdf

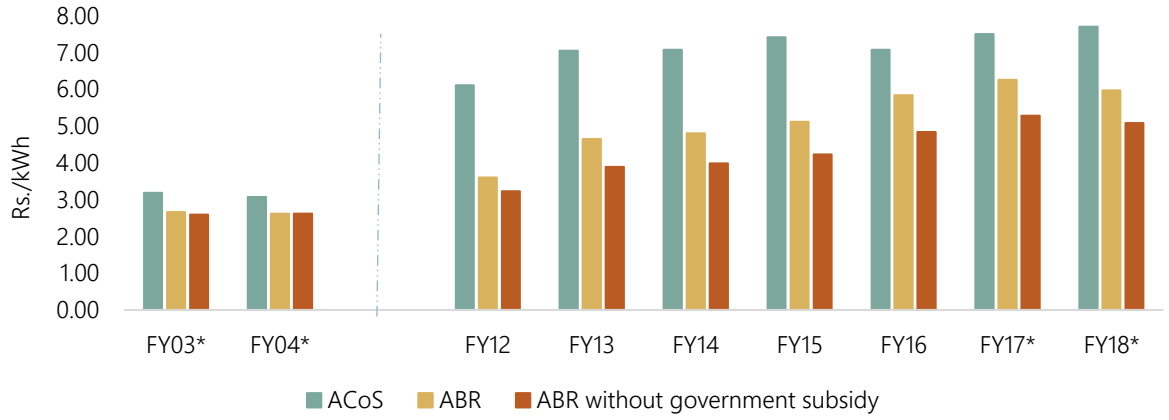
[7] https://cms.tn.gov.in/sites/default/files/gos/energy_e_142_2012.pdf

[8] https://www.pfcindia.com/DocumentRepository/ckfinder/files/Operations/Performance_Reports_of_State_Power_Utilities/1_Report%20on%20the%20Performance%20of%20State%20Power%20Utilities%202013-14%20to%202015-16.pdf

these attempts, TANGEDCO's annual financial losses have been increasing in recent years, in fact the losses increased by 78% between FY17 and FY18[9].

The primary reason for increasing losses is that consumer tariffs are not scaled up in proportion to the rising cost of power, which results in revenue gaps. As is seen in figure 2.1, the difference between TANGEDCO's Average Cost of Supply (ACoS) and Average Billing Rate (ABR, the tariff effectively paid by the consumer) goes from Rs. 0.53/kWh in FY03 to Rs. 2.5/kWh in FY12, with government subsidy. Even after the adoption of FRP and UDAY, revenue gaps have continued to persist and account for 26% of the ACoS, on average, between FY13 and FY18. The figure also highlights the influence of government subsidy on the finances of the DISCOM. The proportion of per unit subsidy increased from 2% of the ACoS in FY03 to 6% in FY12, and has since accounted for an average of 12% of the ACoS.

Figure 2.1: ACoS-ABR gap



Source: Prayas (Energy Group) compilation based on TANGEDCO's tariff orders
*Note: The *starred years use data approved by the TNERC, whereas audited actuals are used for the other years*

In addition, it is crucial to note that Tamil Nadu does not levy fuel surcharges for timely recovery of fait accompli, prudent costs related to variations in fuel price and purchase rate during the year. The lack of such mechanisms also strains the finances of the DISCOM, especially the working capital requirement, which is needed to ensure timely payments to generators. Non implementation of the fuel surcharge mechanism, though intended to protect consumers from tariff changes, results in levy of avoidable carrying cost on consumers which could increase future tariffs.

Another indicator of the DISCOM's financial health is the extent of working capital borrowings undertaken by the utility to carry out its daily operation. TANGEDCO met 52% of its cumulative working capital requirement from FY16 to FY18 through short-term loans[10]. This includes Rs. 11, 824 Crore which the DISCOM borrowed since the launch of UDAY, a scheme which sought to reduce dependence on short term loans.

2.2. Regulatory treatment of finances

The UDAY take over is estimated to reduce TANGEDCO's interest payments by about Rs. 3,125 Crore per year. As this saving is to take place due to significant burden being taken over by the state government, it

[9] As per TANGEDCO's profit and loss statement, https://www.tangedco.gov.in/linkpdf/profitloss2017-18.pdf, the losses went from Rs. 4,349 Crore in FY17 to Rs. 7,761 Crore in FY18.
[10] https://www.tangedco.gov.in/linkpdf/profitloss2017-18.pdf

will result in fiscal pressure on the state government. TANGEDCO reported that the state government will have to reduce subsidy commitments by Rs. 2,500 Crore to maintain a fiscal deficit amounting to 3% of GSDP, as prescribed in the Fiscal Responsibility and Budget Management Act, 2003. Accordingly, TANGEDCO proposed to offset the state government subsidy commitment to domestic consumers by the potential savings in interest payments made due to the debt take over. This was done by allocating Rs. 2,503 Crore from TANGEDCO's estimated savings for this purpose. TNERC approved this as a one-time measure and, as the adjustment was with subsidy, there was no impact on domestic consumer tariffs. TNERC has also stated that it will not regulate the interest savings due to UDAY. Therefore, the mechanism and mode of evaluating whether the expected savings are actually made is unclear especially as true-ups for this year have not been completed. It is also not clear if the adjustment in subsidy will be revised based on actual savings when performance is evaluated.

Further, TNERC has adjusted the UDAY debt take-over via state government bonds with the cumulative revenue gaps approved by the Commission at Rs. 32,532 Crore. Such an adjustment reduced the cumulative revenue gap for FY17 to Rs. 10,433 Crore. As the debt take-over is to be transferred to the DISCOM in the form of grants, amounting to Rs. 4,563 per year over five years, the state government has committed to taking over the liabilities as well as the pending revenue gaps to be recovered from consumers. Thus, the regulatory treatment is consistent with the state government's approach to the UDAY take-over. However, the reduction should have been made as and when the grant of Rs. 4,563 Crore is provided by the state government, as delays in its provision would also affect the finances and the carrying cost burden of TANGEDCO.

In any case, the treatment of UDAY liabilities and the regulatory treatment of debt take over highlights the increasing dependence of TANGEDCO on state governments grants and subsidies. Without improvements in the financial predicament and performance, significant investments in other sectors are at the risk of being crowded out due to power sector requirements.

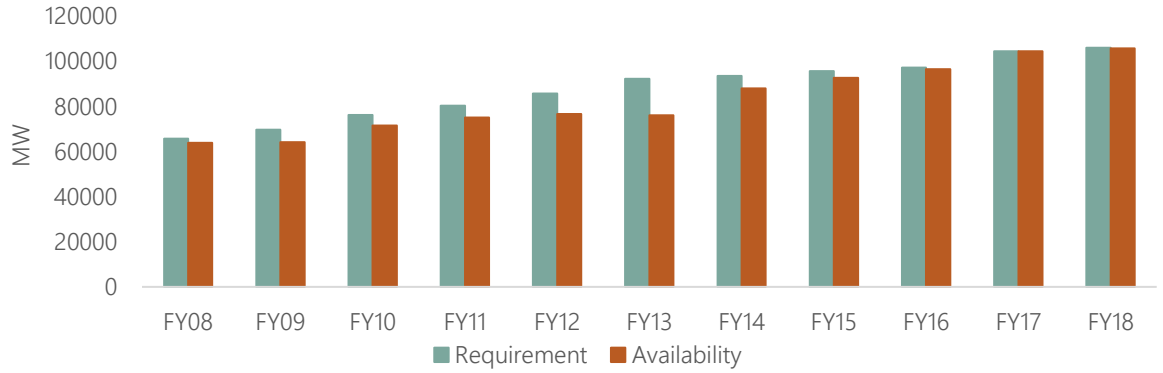
Thus, despite successive bailouts, the DISCOM's financial viability is on shaky ground. The rising revenue gaps and increasing working capital borrowings can be attributed to the high cost of power procurement, the irregular revision of tariffs, uncertainty in demand estimation due to potential sales migration, and the regulatory effectiveness in ensuring accountability of the DISCOM. This is discussed in more detail in the following sections.

3. Power purchase

3.1. Power purchase in the times of shortage

Power shortages have plagued Tamil Nadu's power sector since the 1970s, resulting in power cuts that lasted for hours, and affected consumers and the economy. Over the decades the state saw insufficient addition of long-term conventional capacity while demand kept growing. Without such timely, systematic addition of base-load capacity, shortages continued to increase through the 2000s and 2010s. Subsequently, to manage shortages, the state undertook measures to restrict and control supply through planned, transparent load shedding and investment in capacity addition within and outside the state. Figure 3.1 shows the energy availability for TANGEDCO as compared to the state's energy requirement since FY08.

Figure 3.1: Actual energy availability and requirement between FY08 and FY18



Source: Prayas (Energy Group) compilation based on Load Generation Balance Reports by CEA

As a state with limited lignite and coal resources, generating plants built by TANGEDCO within the state would inherently be high cost due to coal transportation. Further, procurement from central and state generating stations before 2015 was limited by transmission constraints in the southern grid[11]. However, there were also issues with delays in construction of plants and inefficiencies in planning, which contributed to the slow capacity addition. It is curious to note that despite having significant shortages, TANGEDCO did not participate in competitive bidding processes for procurement of power till FY12, given that many states in similar predicaments were able to discover relatively lower tariffs through competitive bidding.

Much of the contracted capacity planned in the 2000s was commissioned only by FY14, and the demand-supply gap was brought down. However, due to the reasons discussed above, most of the capacity added in the past two decades were high cost adding to TANGEDCOs financial woes. The power purchase costs went from accounting for 47% of the state's revenue requirement in FY03, to 78% in FY12, and has since made up around 70% of the ARR, on average.

3.2. Power procurement mix

Figure 3.2 and figure 3.3 depict the power procurement in the state for FY13, FY15, and FY18, ownership wise and fuel wise, respectively. As seen in figure 3.2, most of the procurement across the years can be attributed to state and central generation, with them accounting for an average of 35% and 32% of the total power procured. While the cost of procurement from central sources averages at Rs. 3/kWh, state generation is more expensive at an average of Rs. 4.5/kWh. TANGEDCO also procures some of the power required from market and renewable generation sources, at average rates of Rs. 4.9/kWh and Rs. 3.5/kWh.

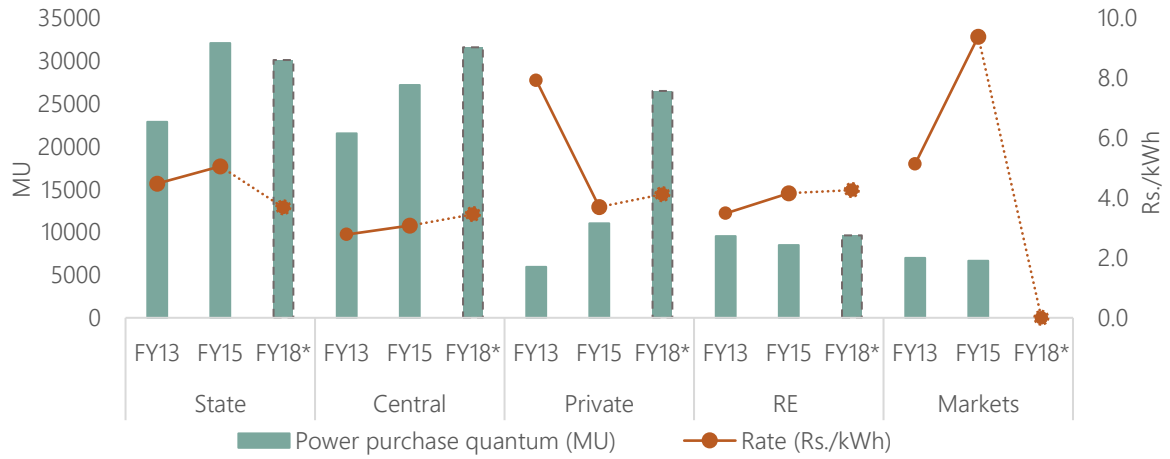
Currently, power procurement from private sources is also substantial, particularly with regard to costs. In addition to a few Independent Power Plants (IPPs), the state had also entered into competitively bid (Case 1) agreements with private generators[12]. The generation from these competitively bid sources account for 24% of the total power procured and cost 8% more than the approved average power purchase of TANGEDCO. The cost-plus IPPs were contracted about two decades ago, and much of this capacity is gas

[11] Of the eleven private generators who signed power purchase agreements under case 1 bidding with TANGEDCO in 2014, only one has been granted long term access by the Power Grid Corporation of India Limited. Even in that case, access has been granted for only 30% of the total power procured from the generator.

[12] This private generation was supposed to serve the state from FY14 to FY29, but was not considered in the state's audited accounts till FY16, probably as transmission constraints restricted drawal of this contracted energy. The projections for procurement in FY18 include these sources.

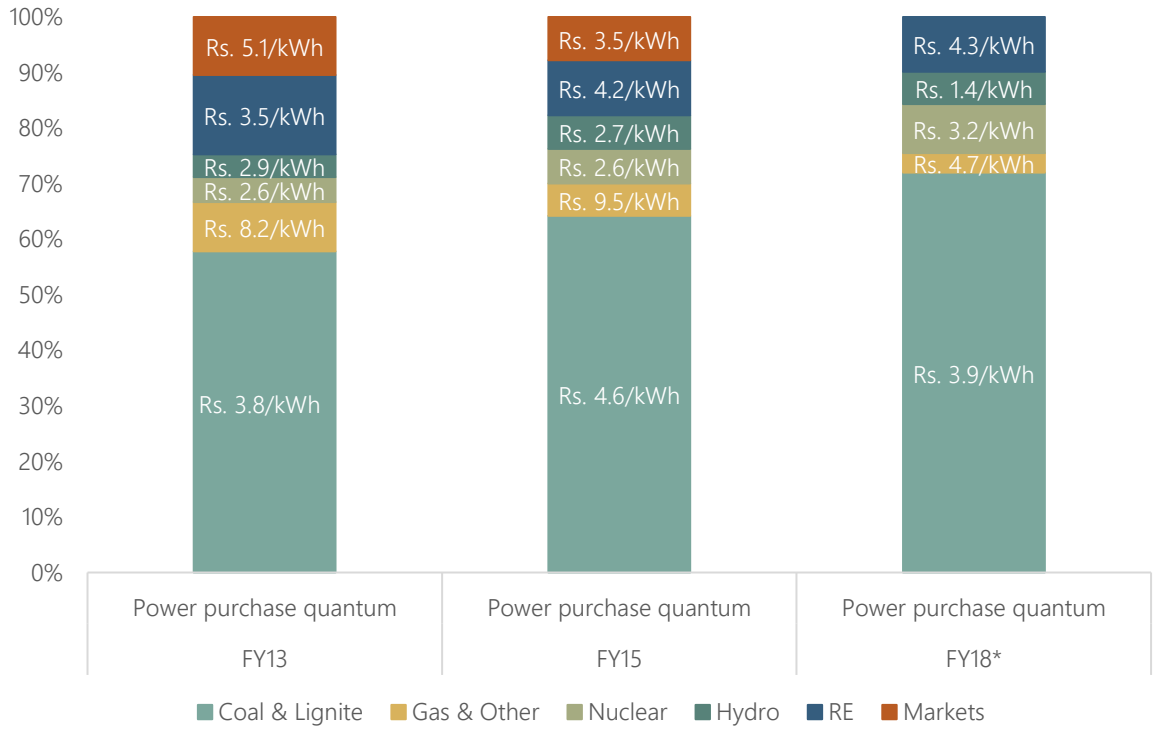
based, underutilised, and high cost due to constraints in fuel availability. This is also true for gas based capacity owned by TANGEDCO, which is the most expensive source of power and accounts for 7% of the total generation by the utility.

Figure 3.2: Quantum and rate of power purchase by ownership[13]



Source: Prayas (Energy Group) compilation based on TANGEDCO's tariff order for FY18
*Note: The *starred years use data approved by the TNERC, whereas audited actuals are used for the other years*

Figure 3.3: Share and rate of power purchase by fuel



Source: Prayas (Energy Group) compilation based on TANGEDCO's tariff order for FY18
*Note: The *starred years use data approved by the TNERC, whereas audited actuals are used for the other years*

[13] The numbers considered for FY18 in figure 3.2 and 3.3 are approved, not actuals, and does not anticipate short term power purchase. Power purchased under the 'markets' category, from bilateral and exchange trade, and unscheduled interchange has not been accounted for in FY18. But 1000 MW has already been procured in FY18 through short term bidding, at an average rate of Rs. 4.2/kWh.

As seen in figure 3.3, coal and lignite generation accounts for most of the power procured, with renewable and market sources following suit. TANGEDCO also meets around 6% of its power procurement from nuclear sources, which has been increasing in proportion of the total procurement. In addition to this, TANGEDCO also has been purchasing power in the short term via the DEEP portal from FY16, at rates that vary from Rs. 3/kWh to Rs. 9/kWh. Given the above, the power procurement costs of TANGEDCO are high, with most sources amounting to Rs. 3/kWh or more.

3.3. High cost power purchase

Table 3.1 lists the plants from which TANGEDCO procured power at a rate of Rs. 4.5/kWh or more in FY16[14]. These projects account for a third of the total quantum of power procured, and make up 44% of the total cost of procurement. As is seen, state owned plants account for 94% of the listed high cost capacity.

Table 3.3.1: High cost procurements that constitute TANGEDCO's power purchase mix in FY16

Power plant	Ownership	Fuel	Contracted capacity (in MW)	Quantum procured (in MU)	Rate (Rs./kWh)	Age of units (years)
Ennore TPS	State	Coal	450	392	21.83	41-46
Tuticorin TPS	State	Coal	840	6501	5.38	24-37
Mettur TPS	State	Coal	1050	5406	5.06	26-29
North Chennai TPS	State	Coal	630	4071	6.06	20-22
Mettur TPS Stage III	State	Coal	600	2664	5.96	3
North Chennai TPS Stage II	State	Coal	1200	4468	4.76	2
Tirumakottai GTPS	State	Gas	107.88	363	10.09	15
Kuttalam GTPS	State	Gas	101	552	6.73	13
Basin Bridge GTPS	State	Gas/Naphtha	120	11	263	20
Valuthur	State	Gas	187.2	680	8.38	8-13
Erode HEP[15]	State	Hydro	423.5	756	6.45	5-79
Samalpatti DEPP	Private	Diesel	105.66	35.81	23.76	15
Madurai Power Co	Private	Diesel	106	39.95	26.17	15
Pillaiperumalnallur GTPP	Private	Gas	330.5	159.18	21.8	15
TAQA Neyveli Power Co	Private	Lignite	250	1384.93	4.57	14

Source: Prayas (Energy Group) compilation based on various state regulatory orders

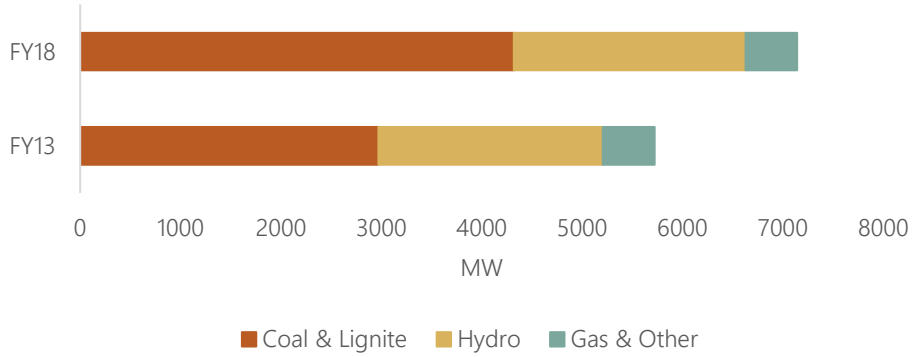
[14] It is important to note that the per unit cost estimation will vary depending on the generation despatched in the year.

[15] In FY16, Erode HEP accounts for 3% of the quantum and cost of high cost power purchase. The higher cost from this HEP can be attributed to the breakup of interest charges accrued on account of renovations.

3.4. State generation capacity

State generation plays an important role in the power purchase of TANGEDCO, both in quantum and cost. The fuel-wise split of the state's installed capacity is seen in figure 3.4. The total quantum of the state's installed capacity has increased by 25% between FY13 and FY18, driven predominantly by the increase in coal based capacity.

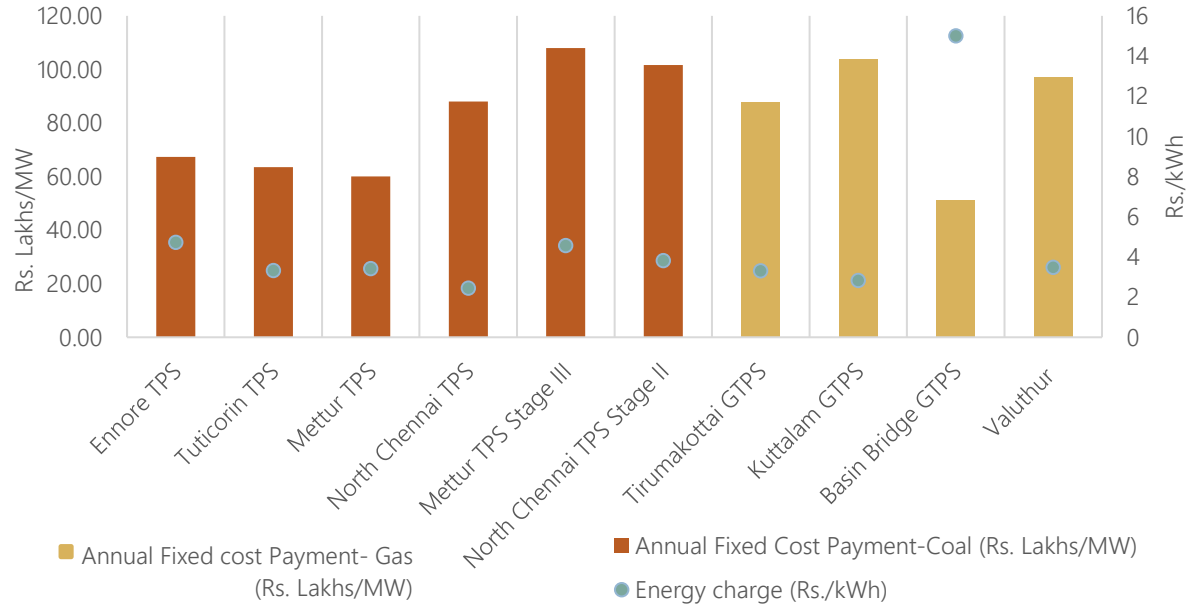
Figure 3.4: Fuel-wise split of state generation capacity in MW



Source: Prayas (Energy Group) compilation based on TANGEDCO's data cards for FY13 and FY18

Coal based capacity also accounts for 80% of the cost of procurement from the state's own generation, with hydro and gas based generation making up around 10% each. This is despite hydro capacity contributing to around 36% of the total installed capacity, while gas accounts for 8%. Given this, figure 3.5 illustrates the cost implication of coal and gas based state owned generation in FY16, through the annual fixed cost payments (in Rs. Crore/MW) and variable cost (in Rs./kWh).

Figure 3.5: Cost of state owned coal and gas generation as on FY16



Source: Prayas (Energy Group) compilation based on TANGEDCO tariff order for FY18

The state's generating capacity includes some cost intensive additions, both in terms of fixed and variable costs. Plants such as North Chennai TPS Stage II and Mettur TPS Stage III are newly commissioned plants

with high fixed costs. This can be ascribed to delays of more than two years from schedule during construction[16]. On the other hand, in case of depreciated plants like the Basin Bridge GTPS, the fixed cost is low, but the energy charge is very high. This plant in particular is plagued by the unavailability of fuel (natural gas), and uses naphtha instead, which drives up its energy charge. Another such example is the Ennore TPS, whose high energy charge can be attributed to deteriorating operational parameters owing to its vintage[17]. In parallel with fuel costs and delays in construction, the efficiency of plant operations also influences costs. Table 3.2 lists some operational parameters of state owned coal and gas based generators in FY16.

Table 3.4.1: Operational parameters of state owned coal and gas generation as on FY16

Power plant	Actual PLF (%)	Approved PLF (%)	Actual SHR (kCal/kWh)	Approved SHR (kCal/kWh)
Valuthur GTPS	86.63%	80%	1796	1850
North Chennai TPS	85%	89%	2466	2393
Mettur TPS Stage III	85%	85%	2444	2450
North Chennai TPS Stage II	85%	85%	1984	2450
Mettur TPS	80.25%	89%	2495	2500
Tuticorin TPS	77%	85%	2559	2453
Kuttalam GTPS	64.35%	80%	1990	1850
Tirumakottai GTPS	42.23%	80%	2313	1850
Ennore TPS	31.08%	25%	4156	3200
Basin Bridge GTPS	1%	5.71%	3432	3219

Source: Prayas (Energy Group) compilation based on true-up in TANGEDCO's tariff order and petition for FY18

The norm set by the Commission, the approved parameter, is compared to the actual value attained during operation. While most of the plants are in line with PLF norms, they default with higher operational heat rates than that approved. This is due to a host of reasons, that include units that have outlived their useful life, receipt of low quality fuel, running units at partial loads, and issues in operation and maintenance. Owing to these factors, the cost of conventional generation is driven upwards, whereas renewable generation, which is already available at rates which are around 12% lower than the average power purchase costs, is likely to become more competitive given technological advancements and state and central backing.

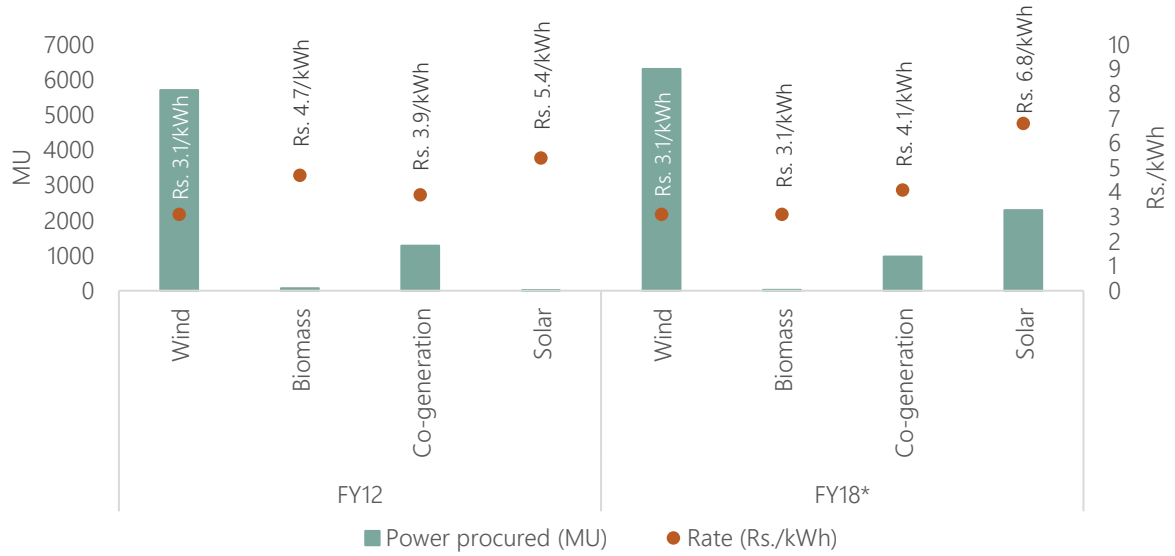
16 https://cag.gov.in/sites/default/files/audit_report_files/Tamil_Nadu_Public_Sector_Undertakings_1_2014_annexures.pdf

17 The plant was decommissioned, with Unit V being shut down in FY13 and Unit I to IV being shut down in FY17. Generation from all its units was stopped in FY16.

3.5. Renewable generation capacity

While wind based power accounts for the majority of procurement from renewable sources, power from solar, biomass, and co-generation sources also contribute to this mix[18]. Figure 3.6 depicts the quantum and costs of procurement from renewable sources in FY12 and FY18.

Figure 3.6: Procurement quantum and costs owing to renewable sources



Source: Prayas (Energy Group) compilation based on TANGEDCO's tariff order for FY18
*Note: The *starred years use data approved by the TNERC, whereas audited actuals are used for the other years*

Between FY12 and FY18, power procurement from biomass and cogeneration sources fell by 73% and 24%, respectively, even though capacity addition from these sources grew by 41% and 8%, in the same time period. On the other hand, power procured from solar sources in FY18 increased staggeringly, amounting to around 200 times the quantum in FY12, which is reflection of the increase in solar capacity additions. The role of solar power generation is projected to further increase, with the state setting a target of 9000 MW by 2023, aimed at servicing the utility, open access consumers, and prosumers. The growing renewable energy capacity addition needs to be seen in the context of the state's base-load capacity, anticipated changes in demand due to migration of sales, and techno-economic change, which would help manage the variable nature of renewable generation.

3.6. Capacity in the pipeline

Notwithstanding the growth of renewable energy based generation, predominantly in the private sector, the state has 15,500MW of capacity addition in the pipeline, as detailed in Table 3.3. In addition to this state owned conventional capacity, there is also a 'new' central 4,000 MW Ultra Mega Power Project planned at Cheyyur, of which 1,600 MW is Tamil Nadu's share. However, calling projects like Cheyyur UMPP, Ennore replacement TPP, etc. 'new' is a bit of a misnomer, as these plants have remained in the pipeline at least since FY12, with little to no updates on the progress of these projects. While 'new' projects

[18] Nuclear, hydro wind, solar, and co-generation plants have must run status, which means that power generated by them will be dispatched first. Other plants are dispatched as per their energy charges (lowest to highest), according to the Merit Order.

account for 61% of the state's anticipated capacity additions, 39% of such capacity is already under construction. Capacity addition at such a scale, with the context of growing renewable generation[19] and potential sales migration, could pose serious complications to the viability of the state DISCOM.

Table 3.6.1: State owned future capacity additions from conventional sources[20]

Project	Status	Fuel	No. of units	Capacity (MW)	Cost (Rs. Crore)	Expected year of commissioning
ETPS Expansion Thermal Power Project	Under construction	Coal	1	660	6,380	FY23
Ennore SEZ Thermal Power Project	Under construction	Coal	2	1,320	9,800	FY21
North Chennai Thermal Power Station Stage-III	Under construction	Coal	1	800	6,376	FY20
Uppur Thermal Power Project	Under construction	Coal	2	1,600	12,778	FY23
Udangudi Thermal Power Project Stage–I	Under construction	Coal	2	1,320	13,076	FY22
Kundha Pumped Storage Hydro Electric Project	Under construction	Hydro	4	500	1,831	FY23
Total capacity under construction				6,200	50,241	
Ennore Replacement Thermal Power Project	New	Coal	1	660	5,400	FY25
Udangudi Expansion Project Stage-II	New	Coal	2	1320	8,745	FY27
Udangudi Expansion Project Stage-III	New	Coal	2	1320	8,745	FY27
Sillahallah Pumped Storage Hydro Electric Project	New	Hydro	4	2000	7,000	FY26
Kadaladi Thermal Power Project	New	Coal	5	4000	24,000	Not mentioned
Kadaladi Ultra Mega Solar PV park Power Project	New	RE		500	2,350	FY21
Total capacity in the pipeline				9,800	56,240	
Total capacity additions				16,000		

Source: Prayas (Energy Group) compilation based on TANGEDCO's Capital Investment Plan petition for control period FY20 to FY22

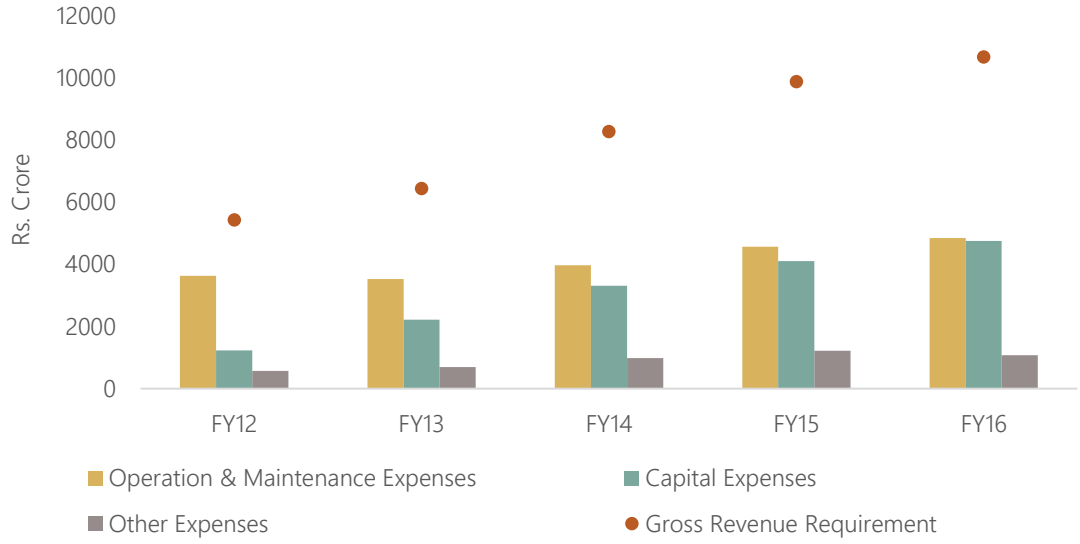
[19] As per TANGEDCO's Capital Investment Plan for FY20 to FY22, the 12 GW of renewable energy based capacity addition is anticipated by FY27. https://www.tangedco.gov.in/cfc(301219).html

[20] The cost (in Rs. Crore) of ongoing projects includes interest during construction (IDC) accrued due to delays.

4. Distribution business and quality of supply and service

After power purchase costs, distribution costs account for a sizeable proportion of the utility's expenses and impact the quality of supply and service to the consumer. While the state has faced transmission and distribution issues in the past, there have been considerable investments toward addressing these issues, and improving supply quality and the efficiency of the network. Such capital investments, aimed at reducing the aggregate technical and commercial losses, in the distribution business increased at a growth rate of 86% annually from FY12 to FY16[21]. These investments included both state and central initiatives, such as sanctioned investments of Rs. 3,440 Crore under Restructured Accelerated Power Development & Reforms Programme (R-APDRP), Rs. 1,561 Crore under Integrated Power Development Scheme (IPDS), and Rs. 924 Crore under Deendayal Upadhyaya Gram Jyoti Yojana (DDUGJY), for FY17. Such capital investments contribute to the costs of the state distribution business. Figure 4.1 illustrates the contribution of capital expense and operation and maintenance (O&M) expense to the distribution cost.

Figure 4.1: Capital and O&M expenses of the distribution business



Source: Prayas (Energy Group) compilation based on TANGEDCO tariff order for FY18

Capital expenses[22] account for around 40% of the costs, and have been growing by 40% annually in the period considered. O&M expenses have also been growing at a rate of 8% per year between FY12 and FY16, but have dropped from accounting for 67% of the distribution costs in FY12 to 45% in FY16. The growth rate of 8% per year in O&M expenses is, however, reflective of the 5.72% inflation linked escalation of component costs[23]. This includes employee costs, administration and general expenses, and repair and maintenance costs[24]. Such expenditure is pertinent to improving and maintaining the quality of supply and

[21] http://www.tnerc.gov.in/orders/Tariff%20Order%202009/2017/TariffOrder/TANGEDCO-11-08-2017.pdf
[22] The capital expense includes depreciation, interest on long term loans, and return on equity.
[23] Tamil Nadu's tariff regulations mandate that the increase in costs due to inflation is passed through to consumers. In lieu of this, an escalation of 5.72% has been considered on the components of O&M expenses (i.e. employee costs, administration and general expenses, and repair and maintenance costs)
[24] The component costs of O&M expenses are, however, not reported in a disaggregated manner by TANGEDCO.

service to the consumer, which means access to uninterrupted and reliable power supply, as per the state's distribution standards of performance.

Operational parameters and the related O&M costs of the distribution business warrant observation. A decreasing trend in O&M costs can serve as an indicator of the efficient function of the distribution business. Conversely, a fall in these expenses may also be symptomatic of financial constraints as they often are the first to be forgone by utilities, in order to reduce the working capital. Such cost cutting can have adverse impacts on the quality of supply and service provided to the consumer base of the DISCOM.

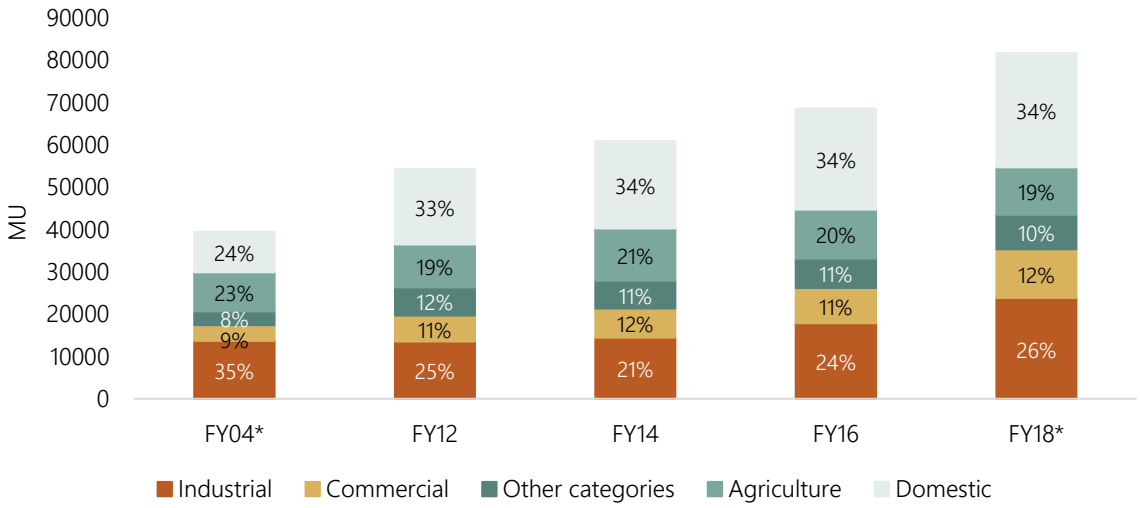
Parameters like restoration of supply during interruptions, replacement of failed distribution transformers, instances and replacement of faulty meters, etc. are indicators of the supply and service condition in the state. TANGEDCO reports that the targets set on such parameters have been met and surpassed, since FY17. However, no data is publicly available to corroborate this and audits to verify the same are not carried out. Further, as per the National Crime Records Bureau, Tamil Nadu accounted for 5% of all deaths due to electrocution in the country in FY17[25], but the utility does not report such details. Safety, like quality of supply, is another aspect of the power sector that should be tracked and monitored.

5. Demand estimation and revenue

5.1. Sales mix and tariffs

As of FY18, TANGEDCO has a consumer base comprising of 28 million consumers. This includes connections across the domestic, agriculture, industrial, and commercial categories, as is seen in figure 5.1. As one of the most industrialised states in the country, industrial and commercial consumers account for an average of 38% of the DISCOM's sales, in the period considered. The domestic category's contributions to total sales in the same time period are also dominant, amounting to 32%, on average.

Figure 5.1: Sales mix of TANGEDCO



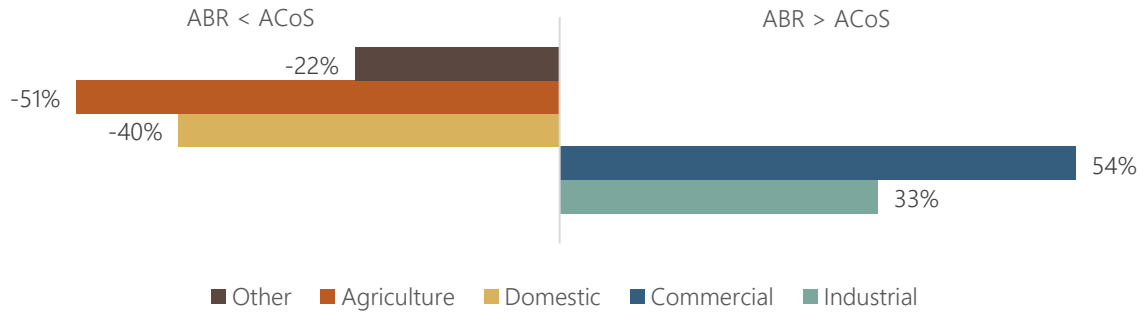
Source: Prayas (Energy Group) compilation based on TANGEDCO's tariff and subsidy orders
*Note: The *starred years use data approved by the TNERC, whereas audited actuals are used for the other years*

[25] https://ncrb.gov.in/sites/default/files/adsi_reports_previous_year/table-1.9_1.pdf

The agriculture category, which makes up around 8% of the DISCOMs sales, receives unmetered supply[26] as of FY20, despite government orders mandating metering since 2009[27]. In addition to this, below poverty line (BPL) domestic households also remain unmetered. Due to the lack of metering of these categories, the veracity of their estimated demand is questionable. The estimated consumption is also strongly linked to the estimated distribution losses in the state. Overestimation of unmetered consumption can hide high line losses and theft, and project an incorrect representation of the efficiency of DISCOM operations[28].

In addition to being unmetered, agricultural and BPL categories also receive fully subsidised, i.e. free, power. Domestic consumption, other than that by BPL households, is also partially subsidised. Since FY17, all domestic consumers were allowed fifty units of free supply per month. To compensate for these non-cost reflective tariffs from subsidised categories, the utility depends on government subsidy and resorts to charging its cross subsidising consumers higher tariffs. Figure 5.2 illustrates the percentage difference between the cost of supply and the revenue obtained from sales to TANGEDCO's consumer categories, based on approved values for FY18. The 'other' category seen in the figure includes railway traction, government and private educational institutions, places of public worship, lift irrigation and co-operative societies, public lighting and water works, power loom, and temporary supply. Both the industrial and commercial categories include high tension (HT) and low tension (LT) consumers. The industrial category is dominated by HT consumers who account for 64% of sales to the category. On the other hand, sale to LT consumers make up the majority of commercial category sales, at 77%.

Figure 5.2: Extent of cross subsidy in FY18[29]



Source: Prayas (Energy Group) compilation based on TANGEDCO's tariff orders

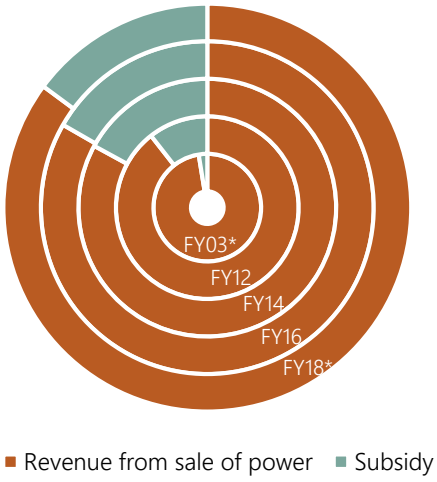
As is seen in the figure, to make up for some of the subsidised tariffs paid by agricultural, domestic, and other consumers, industrial and commercial consumers are billed at rates higher than the cost of supply. Thus, TANGEDCO's current mode of operation relies heavily on subsidy and cross subsidy to cater to its consumer base.

[26] In the early 1980s, free power was provided to small farmers, and later in the decade, metering for agricultural consumption was discontinued. This practise has since continued.
[27] http://www.tnerc.gov.in/orders/Tariff%20Order%202009/2009/TO-1-119.pdf
[28] https://www.prayaspune.org/peg/publications/item/395-understanding-the-electricity-water-and-agriculture-linkages.html
[29] Cross subsidising categories are charged an ABR which is more than the ACoS, whereas cross subsidised categories pay less than the ACoS. The ACoS approved by TNERC for FY18 is Rs. 5.85/kWh

5.2. Role of subsidy

Subsidy in Tamil Nadu is central to the finances of the state's power sector, accounting for an average of 11% of the ARR from FY12 to FY18. Figure 5.2 shows the share of subsidy in the DISCOM's revenue from sale of power for FY03, FY12, FY14, FY16, and FY18.

Figure 5.3: Revenue from sale of power with subsidy



Source: Prayas (Energy Group) compilation based on TANGEDCO's tariff and subsidy orders
*Note: The *starred years use data approved by the TNERC, whereas audited actuals are used for the other years*

Between FY03 and FY12, subsidy went from accounting for 3% of the revenue from sales, to 11%. In FY14, its share had increased to 17% of revenue from sales. Moreover, subsidy grew at a rate of 26% per year between FY03 and FY12, but this growth rate spiked to 55% per year between FY12 and FY14. This increase in subsidy is attributed to the increase in tariffs across categories that took place in FY12, which was directly compensated with subsidy to protect consumers from tariff shock. After this spike, subsidy has continued to increase steadily, both in quantum and as a percentage of ARR[30]. Owing to the implementation of the increase in tariffs, which was subsumed by subsidy, there was a shift in the subsidy structure, as illustrated in Figure 5.4.

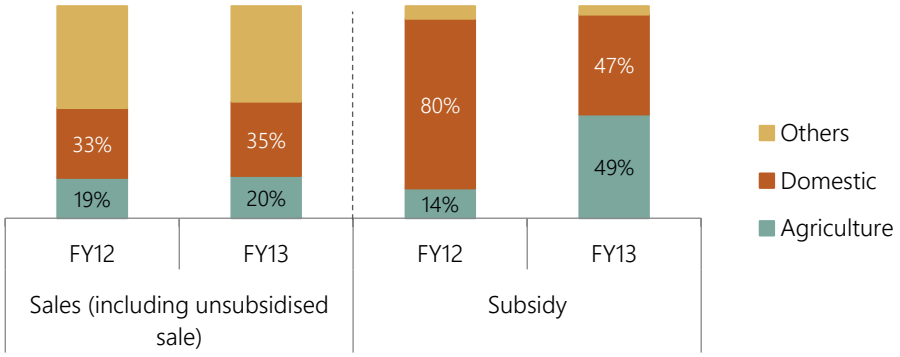
Before FY12, domestic consumers were the dominant recipients, taking up around 77% of the total subsidy provision from the government. In FY12, domestic and agriculture tariff[31] underwent a 52% and 600% increase, respectively, which was completely compensated by government subsidy. This resulted in agriculture subsidy amounting for half of the total government subsidy in FY13.

Since then, subsidy to the agriculture category has had an increasing share in the total subsidy, despite the category's declining contribution to the state's sales mix. Additionally, while domestic subsidy has fallen as a proportion of total government support, it has still been increasing in quantum since FY12. In FY18, Rs.

[30] Till FY17, when subsidy quantum accounted for 18.87% of the ARR. In FY18, subsidy accounted for 16.15% of ARR. This drop in subsidy quantum without any corresponding change in sales and per unit subsidy, can be attributed to the erratic pattern of subsidy provision in Tamil Nadu.
[31] The tariff for agricultural consumption increased from Rs. 250/HP/annum to Rs. 1750/HP/annum, which stayed in effect from April 2013 to June 2013. From June 2013 the tariff further increased to Rs. 2500/HP/annum. In December 2014 the tariff underwent further increase and amounted to Rs. 2875/HP/annum. These subsequent hikes in tariff were also directly subsidised by the government.

3,700 Crore has been provisionally allocated to the category and all domestic consumers are partially or fully subsidised, without any cap on consumption. Since subsidy is typically provided as an avenue of assistance, targeting intended recipients is central to the efficiency of the mechanism. But, in Tamil Nadu, domestic subsidy is provided even to consumers using more than 100 units per month.

Figure 5.4: Shift of subsidy shares from domestic to agriculture post FY12



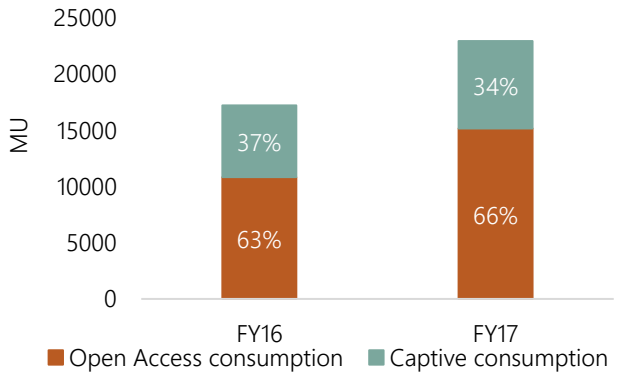
Source: Prayas (Energy Group) compilation based on TANGEDCO's tariff and subsidy orders

However, the utility's high dependence on subsidy has proved to be favourable till now with regard to financial viability. Over 50% of the state's sales mix is subsidised by the government, and this subsidy is paid on time. This enables the DISCOM to effectively meet part of its expenses. However, this is only a solution for the short term, given the limited potential for state budget growth. Going forward, it is unclear if the state government will be in a position to provide such significant support.

5.3. Sales migration

Tamil Nadu has seen erosion of cross-subsiding sales to captive options even before 2003, due to shortages and non-competitive rates. As of FY17, sales migration owing to open access and captive amounted to 23,000 MU, which is comparable to 28% of the DISCOM's sales that year. This is brought out in figure 5.5, which shows the extent of sales migration in Tamil Nadu in FY16 and FY17. Of the total sales migration in these years, open access accounts for an average of 65% and captive makes up 35%. However, this is a conservative estimate that does not account for captive generation projects below 1 MW, which is the case for many renewable projects.

Figure 5.5: Sales migration in FY16 and FY17



Source: Prayas (Energy Group) compilation based on CEA documents and regulatory submissions by TANGEDCO

Costs are the predominant reason for the migration of industrial consumers from the utility. As a cross subsidising category, industrial tariffs are high, making sales migration through open access and captive generation attractive options. In an attempt to keep costs competitive, tariffs to industrial consumers have not been increased since FY16. Additionally, captive consumers have to pay parallel operation charges and open access consumers have to pay various migration charges.

One such charge is the cross subsidy surcharge (CSS), which was set high at Rs. 3.8/kWh, as per the tariff order of FY14. Despite this, FY17 saw a 40% increase in open access consumption and a 22% increase in captive consumption, as compared to FY16. Further, sales migration is likely to increase going forward since CSS was brought down by half, to Rs. 1.67/kWh, owing to the adoption of National Tariff Policy principles and as per the FY18 tariff order. Given that Tamil Nadu has high potential for sales migration and that industrial consumers constitute a major portion of the DISCOM's sales, the utility must account for the likely growth of sales migration in its future planning.

6. Regulatory accountability

Maintaining the state utility as a viable and stable business is the shared responsibility of the utility itself, the state government, and the electricity commission. The unbundling of the erstwhile TNEB was expected to aid this through the introduction of commercial operating principles to the newly formed subsidiaries, under the regulation of the TNERC. This was intended to reduce political interference in tariff setting and establish transparency and efficiency in the running of the utilities. However, these intentions have not completely translated to practical operation, contributing to the financial dysfunction in the operation of the utility.

The TNERC was established in FY99[32], and has a staff strength of 31 employees[33]. This includes the Commission itself, which is a three member panel, comprising of a chairman and two members. However, the Commission has not always operated at full strength, owing to delays in the appointment of its members. Since its conception, the chairperson's post has suffered delays averaging 1 year and 7 months. In comparison, delays in the appointment of members only span an average of 4-5 months. It is interesting to note that two of the four chairpersons, and six of the ten members appointed to date have been ex-officio members of the state utility or TRANSCO. The chairman of the currently effective Commission was also formerly in the employ of TANGEDCO. While these appointments come with experience of the sector, they are counterproductive to the intent of the TNERC functioning as an independent institution without political interference.

The TNERC has attempted several initiatives toward ensuring transparency and accountability. For instance, it has issued an annual subsidy order, that is both regular and comprehensive, since the early 2000s. This exercise is particularly beneficial in Tamil Nadu, since subsidy plays a crucial role in power sector finances and affects over 50% of the state's sales mix. The Commission has also taken up suo moto initiative in tariff setting, when the utility lapsed in submission of a petition in FY15. Despite the TNERC taking up this initiative, this order was met with dissent, even within the Commission on matters of legal validity,

[32] http://www.tnerc.gov.in/goorders/go58.pdf
[33] http://www.tnerc.gov.in/download/RTI/RTI-Act-%20Updated%20as%20on%2026.08.2014.pdf

procedure conformity, and issue based merits[34]. Additionally, during the assessment of tariff petitions, the regulator has held public hearings at multiple locations, to aid stakeholder participation. This practise is carried out not only for tariff, but also for other regulatory proceedings, such as capital investment. The Commission also has attempted to implement performance based incentives by linking the return of equity to the supply availability of the generator. But this remains an attempt on paper, as there has been no tracking or third-party audits to ensure this.

Conversely, the TNERC can also widen the scope of its operations and take steps to hold the utility responsible. The following are some steps in that direction:

- Revision of tariffs and implementation of MYT

Regular tariff revisions that are crucial to the effective functioning of the utility are not carried out in Tamil Nadu. TNEB recorded a revenue gap of Rs. 1,715 Crore in FY03, solely due to delayed implementation of tariff revision[35]. From FY03 to FY19, there have been a total of six tariff orders, at irregular intervals[36]. Even in these tariff orders timely true ups, based on audited accounts of the TANGEDCO are not carried out.

It is understood that an annual tariff process is a time intensive exercise for the utility and the TNERC. In order to address this, and meet other objectives such as introducing regulatory certainty for costs and tariffs, tracking and holding the DISCOM accountable for its performance in the medium term, and to help with medium term planning; tariff revisions can be carried out on a multi-year basis, as recommended by the Electricity Act 2003. As per the state's Tariff regulations, as amended in FY13, the control period under the multiyear tariff (MYT) framework is three years[37]. TNERC should extend this to a five year period to ensure medium term planning and performance accountability. The utility could further use the MYT process to define normative parameters, and introduce incentives for improvements in efficiency, while ensuring tariff certainty and reducing risks.

-Ensuring compliance to directives

The TNERC has required the utility to implement several directives, such as the metering of huts and agriculture services, filing of annual tariff petitions, adherence to timelines for schemes and projects, amongst others. TANGEDCO, however, is yet to fulfil these conditions, despite several iterations of deferment. It falls within the ambit of the Commission to ensure that its directives are adhered to, and penalise any lapses.

- Scrutiny of power procurement costs

The average cost to procure power from the state's generation resource is high to begin with, owing to technology, transmission constraints, vintage, delays in construction etc. Power procured from private sources also tend to be higher cost. Given its impact on consumer tariffs and DISCOM finances, more rigorous and prudent cost assessment with regard to power procurement will prove to be beneficial for both the utility and the consumers.

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34 http://www.tnerc.gov.in/orders/Tariff%20Order%202009/2014/Tariff%20Order/TANGEDCO/Tariff%20Order%209%20of%202014-TANGEDCO.pdf

35 http://www.tnerc.gov.in/tarorder/chapter7.pdf

36 An annual tariff order was published in FY03, FY11, FY12, FY14, FY15 (suo moto), FY18.

37 http://www.tnerc.gov.in/regulation/Tariff/2012/MYT-18-3-English.pdf

- Medium term planning

TANGEDCO faces uncertainty in demand due to the potential for sales migration, which makes power procurement planning tricky albeit essential. A medium term approach to planning and capacity addition would help account for the impact of sales migration and other operational trends. It would also help track the status of regulatory assets under UDAY, which the utility is required to report but is yet to carry out. This can be done as part of the Multi-Year Tariff process.

With regard to developing an efficient power sector, it is crucial that all stakeholders, especially the DISCOM and the Commission, take timely action to address these challenges in the near future.