

1. Introduction

This report presents the estimated cost of service for various consumer categories of the SouthernPower Distribution Company Limited (APSPDCL), for the year starting on April 1, 2015 and ending on March 31, 2016. The objective of this report is to classify the costs into demand; energy and customer related components and then apportion the same to various customer categories.

The steps involved in the analysis are:

- Forecasting the energy and peak demand requirements for the power system in the year under consideration;
- Forecasting the energy and peak demand requirements at the transmission-distribution interface in that year;
- Estimating the energy and peak demand requirements for each customer category for that year;
- Estimating the costs of providing the energy and peak demand required for each customer category; and
- Classifying and allocating the above costs to various consumer categories of APSPDCL at the retail level.

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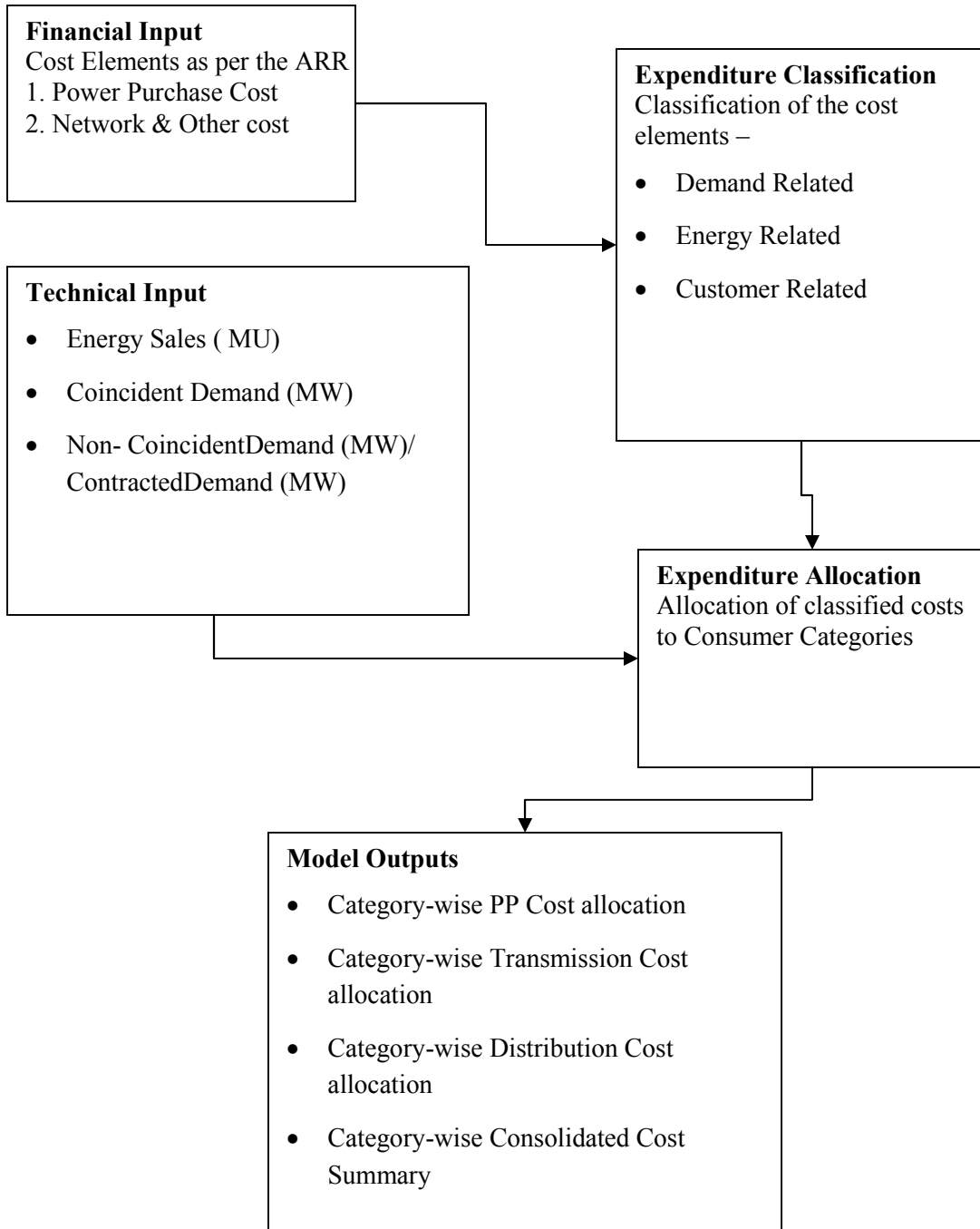
COST OF SERVICE MODEL FOR APSPDCL

The cost of service calculations are based on the cost of service model developed for SPDCL. The model, as currently used, calculates the cost of serving all consumer categories of APSPDCL.

All financial input into the model is as per the ARR for the year 2015-16, including revenue, and expenditure data.

The following section gives a brief overview of the Cost of Service model developed for APSPDCL

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Financial Input Sheet

This forms the base for the income and expenses data for the APSPDCL. The values are as per the ARR for the year 2015-16.

Technical Input Sheet

This part includes the system data required for the cost of service calculation. The energy and losses in the system are included along with the data regarding the customers responsible for the corresponding sales and losses. The percentage loss quoted is the loss in the distribution system and hence accounts for the energy that is unavailable for sale to the retail customers.

APSPDCL customers are segregated into LT and HT customers which includes EHT (220 kV and 132 kV), Sub-transmission (33kV) and distribution (11kV and LV). The EHT customers are included as APSPDCL customers, even though they may be connected at 220 kV or 132 kV. In this study, technical losses experienced in EHT system are covered by EHT, 33kV, 11kV and L.T loads. Hence they need to be apportioned to all loads in the system.

The HT customer categories in the APSPDCL system are;

HT Customers

- Industrial – Cat- I (11KV, 33KV and 220/132 KV)
- HT Others – Cat- II (11KV, 33KV and 220/132 KV)
- Irrigation and Agriculture – Cat-IV (11KV, 33KV and 220/132KV)
- Railway Traction – Cat V (132KV)
- RESCOs (11KV)
- Temporary
- Colony Consumption (11KV, 33KV)

The LT (415 Volts) customer categories in the APSPDCL system are;

LT Customers

- Domestic – category I
- Non-domestic – category II
- Industrial – category III
- Cottage industries – category IV
- Irrigation and Agriculture – category V
- Public lighting and PWS – category VI
- General purpose – category VII
- Temporary – category VIII

Energy Sales in MU, Non- coincident demand and coincident demand data is entered for the above customer categories

The coincident demand is the estimated contribution of each category to the system peak demand and the non-coincident demand has been estimated from system load shapes derived and represents the peak demand of each customer category, irrespective of the time of day. Values used in this analysis are shown in Table 2-1.

Table 2-1

Coincident Factors and Load Factors used	Coincidence Factor	Class Load Factor
L.T Customers	Average Peak	
Domestic Category – Category – I	68.0%	72.4%
Non-Domestic – Category – II	65.6%	74.9%
Industrial – Category – III	74.9%	98.1%
Cottage Industries – Category IV	74.9%	98.1%
Irrigation and Agriculture – Category V	53.9%	95.5%
Public Lighting – Category VI	65.2%	58.4%
General Purpose – Category VII	65.2%	58.4%
Temporary – Category VIII	65.2%	58.4%
H.T Consumers		
Industrial– Category I	11KV	82.4%
	33KV	82.4%
	220/132 KV	82.4%
HT Others – Category II	11KV	62.4%
	33KV	59.4%
	220/132 KV	73.3%
Irrigation and Agriculture – Category IV	11KV	62.4%
	33KV	59.4%
	220/132 KV	73.3%
Railway Traction – Category – V (132KV)	75.4%	92.8%
Colony Consumption – 11KV	62.4%	69.9%
Colony Consumption – 33KV	59.4%	71.2%
Temporary	62.4%	69.9%
RESCOs - 11KV	83.1%	0.0%

The DISCOM peak demands, both coincident and non-coincident are estimated using basic load shape synthesis model. Load shapes of different categories of consumers are constructed based on the Load Shapes data collected from the field. The following paragraph & table provides a derivation of the coincident peak demand, along with the assumptions for APSPDCL used in that derivation:

SPDCL	Energy (MU)	Average Coincident Demand (MW)
Sales	33,691	3,844
Loss as % of input	9.30%	
Losses	3,456	586
Sub Total	37,146	4,430

The load factor and coincidence factor included in the Model for each category are assumed based on a review of the characteristics of the loads and load mix in APSPDCL. One of the key assumptions is on the assessment of the timing of the system peak in the test year and this has a significant bearing on the coincidence factor for each of the customers. Recent data indicate that:

- The system peak demand of APSPDCL is occurring during Morning hours due to Agricultural loads.
- During the morning peak occurrence , the coincidence factor of agriculture is 100% and the same is reduced to zero at the time of evening peak

Based on above considerations, it is felt that average demand method would be suitable for allocation of costs to consumer categories since it allocates the cost equitably on all consumer categories based on morning and evening peak loads. In the average demand method, as the name suggests, average of coincident morning peak and coincident evening peak is taken. In the model there is provision to calculate the cost based on the coincident morning peak, evening peak and average. The current option selected in the model is the average method.

Expenditure Functionalization

The new model is developed keeping in view the unbundled nature of the power sector in A.P, hence the expenditure pertaining to SPDCL is taken as per the ARR in the financial input sheet.

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- Power Purchase Cost
 - Transmission & SLDC Charges
 - Repairs and maintenance
 - Employee costs
 - Administration and general expenses
 - Depreciation
 - Interest and financial charges
 - Other expenses
-

Expenditure Classification

This section classifies the expenditure into demand, energy and customer related items. The options with respect to classification are;

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- Demand
 - Energy
 - 80% Demand , 20% Customer
 - Customer
 - Manual entry
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The fixed costs in the power purchase are treated as demand related expense and the variable cost of power purchase is treated as energy related expense.

Entire transmission cost is considered to be a demand related expense. The O & M expenditure in distribution is classified into demand and customer related in the ratio of 80:20. The same has been arrived at based on subjective judgment, as it is felt that some portion of the assets and employee expenses are used for catering to the needs of the customer such as customer service/call centers. The other cost elements in distribution viz ROCE, depreciation and other costs have been fully considered under demand related costs.

Expenditure Allocation

The expenditures which have been classified into demand, energy and consumer related are apportioned to the individual customer categories.

Power Purchase Cost Allocation:

Demand related costs of Power Purchase are primarily driven by the system peak. Hence they are allocated to customer categories based on the Coincident Demand. Energy costs in Power Purchase are allocated based on the loss-adjusted category energy consumption.

Transmission Cost Allocation:

The transmission costs (including PGCIL and ULDC) are considered as demand related cost and the same is allocated to LT categories based on Non-coincident demand and contracted demand (CMD) for HT categories

Distribution Cost Allocation:

a) Operation and Maintenance Expenditure

The demand related portion of O & M expenses are allocated to LT consumer categories based on non -coincident demand and contracted demand (CMD) for the HT consumer categories.

The customer related costs are allocated to customer categories based on the number of customers in each category.

b) ROCE

Return on capital employed is driven by assets and it is fully considered as demand related expense. ROCE is allocated to LT consumer categories based on non -coincident demand and contracted capacity for the HT consumer categories.

c) Depreciation

Depreciation expense is driven by the level of fixed assets in the utility and is entirely considered under demand related expenses. Depreciation is allocated to LT consumer categories based on non -coincident demand and contracted capacity for the HT consumer categories.

d) Interest on Consumer Security Deposit

This is allocated to consumer categories based on the energy consumption grossed up for losses.

A summary of the results of the model are the outputs and these are discussed in the next section and a comparison of revenues and costs by customers is made in this part of the computation.

Results

The following tabulation summarizes the results of the process:

- APSPDCL needs to handle 37,146 MU, which consist of sale of 33,691 MU to its customers and losses of 3,456 MU.
- Average Peak demand required by APSPDCL is 4,733 MW, which consist of 4,095 MW to serve the customers, and 638 MW of losses in the system.
- The average unit cost of supplying the customers of APSPDCL is estimated at 5.92Rs/kWh.
- The expected unit revenue from APSPDCL customers at proposed tariff is 4.52Rs/kWh.

Table-3.1 compares the cost of service and revenue expected from proposed tariffs for the major categories:

Table – 3.1

CONSUMER CATEGORIES	Revenue from Sale of Power		Non- Tariff Income	Cost of Service	
	Revenue from Sale of Power	Average realisation per unit (paise/kWh)		Allocated Expenditure (Rs/Crs)	Cost of Service
ension Supply					
Domestic - Category I	2,430	3.59	76.4	4,386.4	6.47
Non-domestic Supply - Category II	1,360	9.43	9.3	932.9	6.47
Industrial Supply - Category III	975	7.08	4.0	873.2	6.34
Cottage Industries - Category IV	14	4.30	0.2	21.7	6.47
Irrigation and Agriculture - Category V	60	0.07	30.2	5,999.2	6.79
Public Lighting - Category VI	304	5.62	2.1	358.0	6.62
General Purpose - Category VII	59	7.29	0.7	55.6	6.87
Temporary - Category VIII	1	10.00	0.0	0.7	6.56
Total Low Tension Supply	5,203	2.73	123	12,628	6.62
ension Supply					
Industrial - Cat- I	1,837	8.77	4.9	1,208.2	5.77
Industrial Segregated - Cat- I (33KV)	3,156	6.89	9.8	2,276.5	4.97
Indusl. Segregated - Cat-I (220/132KV)	2,413	6.64	7.5	1,760.7	4.84
HT Others - Cat-II	614	9.89	1.4	360.1	5.80
Indusl. Non-Segregated - Cat- II (33KV)	95	9.26	0.2	57.1	5.59
Indusl. Non-Segre - Cat-II (220/132KV)	21	8.99	0.0	13.2	5.58
Irrigation and Agriculture - Cat-IV	87	5.12	0.4	116.5	6.85
Irrigation and Agriculture - Cat-IV (33KV)	113	5.34	0.5	130.0	6.17
Irrigation and Agriculture - Cat-IV (132KV)	1,063	5.69	3.9	747.7	4.00
Railway Traction - Cat V (132KV)	559	6.74	1.7	413.5	4.98
Colony Consumption (11KV)	28	6.12	0.1	23.7	5.22
Colony Consumption (33KV)	1		-	-	
Temporary	15	9.61	0.0	8.7	5.56
RESCOS Cat VI	31	0.76	0.9	197.1	4.79
Total High Tension Supply	10,033	6.87	31	7,313	5.01
L	15,236	4.52	154	19,941	5.92

Table - 11

CONSUMER CATEGORIES	Cost to Serve
	Rs /KWH
<i>Low Tension Supply</i>	
Domestic - Category I	6.47
Non-domestic Supply - Category II	6.47
Industrial Supply - Category III	6.34
Cottage Industries - Category IV	6.47
Irrigation and Agriculture - Category V	6.79
Public Lighting - Category VI	6.62
General Purpose - Category VII	6.87
Temporary - Category VIII	6.56
<i>Total Low Tension Supply</i>	6.62
<i>High Tension Supply</i>	
Industrial - Cat- I (11KV)	5.77
Industrial Segregated - Cat- I (33KV)	4.97
Indusl. Segregated - Cat-I (220/132KV)	4.84
HT Others - Cat-II (11 KV)	5.80
Indusl. Non-Segregated - Cat- II (33KV)	5.59
Indusl. Non-Segre - Cat-II (220/132KV)	5.58
Irrigation and Agriculture - Cat-IV	6.85
Irrigation and Agriculture - Cat-IV (33KV)	6.17
Irrigation and Agriculture - Cat-IV (132KV)	4.00
Railway Traction - Cat V (132KV)	4.98
Colony Consumption (11KV)	5.22
Colony Consumption (33KV)	
Temporary	5.56
RESCOS Cat VI	4.79
Total High Tension Supply	5.01
TOTAL	5.92