

# **Load Management Certificates as an Enabler of DSM in the Context of Retail Competition**



**July 2018**

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## ABBREVIATIONS

APTEL	Appellate Tribunal for Electricity
ARR	Annual revenue Requirement
AT&C	Aggregate Technical and Commercial
BEE	Bureau of Energy Efficiency
CAPEX	Capital Expenditure
CEA	Central Electricity Authority of India
DISCOM	Distribution Company
DL	Distribution Licensee
DSM	Demand Side Management
EEFP	Energy efficiency financing platform
ESCCerts	Efficiency Saving Certificates
FEEED	Framework for energy efficient economic development
GHG	Green House Gas
Gol	Government of India
INDC	Intended Nationally Determined Contributions
IPDS	Integrated Power Development Scheme
M&V	Measurement and Verification
MoP	Ministry of Power
MTOE	Metric Tonne of Oil Equivalent
MYT	Multi Year Tariff
NAPCC	National Action Plan on Climate Change
NCEF	National Clean Energy Fund
NMEEE	National Mission for Enhanced Energy Efficiency
PAT	Perform Achieve Trade
PRGF	Partial Risk Guarantee Fund
R&M	Renovation & Modernization
RPO	Renewable Energy Purchase Obligations
SDA	State Designated Agencies
SERC	State Electricity Regulatory Commission

T&D	Transmission and Distribution
UDAY	Ujwal DISCOM Assurance Yojana
VCFEE	Venture Capital Fund for Energy Efficiency

## ABSTRACT

Electricity distribution companies (DISCOMs) are the primary source of cash inflow into the power sector. If customer payments do not cover electricity supply costs, the gap is usually met through Government subsidies, chronic indebtedness or bankruptcy. Hence the sustainability, which includes financial viability of DISCOMs, is of great importance.

Efficiency improvements such as Demand Side Management (DSM) programs are a useful tool to prevent DISCOMs from going into further losses and enhance their financial position. However, Indian DISCOMs are not keen to undertake DSM, due to the perceived threat of efficiency improvements leading to a reduction in revenue from the most profitable consumer segments- commercial and industrial.

This paper reviews existing measures by the Government to improve utility finances and uses a financial model to evaluate the impact of implementation of DSM on the financial health of the DISCOMs. Using data from Maharashtra, Haryana, Andhra Pradesh, Gujarat, UP and Pondicherry, we analysed the impact of DSM programs on DISCOM finances if there are changes in the consumer mix. Data analysis results showed that when the number of commercial and industrial consumers increases, there is an increase in the revenue of the DISCOMs, post implementation of DSM. This improvement was more evident in states with a power deficit and states where DISCOMs relied more on short term power purchase planning. The results of the modelling exercise indicate that contrary to apprehensions by DISCOMs that implementing DSM programs would lead to a drop in revenue, they are expected to improve the DISCOM's financial position.

## 1. INTRODUCTION

DISCOMs provide the only consumer interface in the electricity sector. They are also the primary source of cash inflow. Customer service and financial health must mutually reinforce each other in improving DISCOMS finances and services provided. If customer payments do not cover electricity supply costs, the gap is usually met through Government subsidies, chronic indebtedness or bankruptcy (USAID, 2005). Hence sustainability, which includes financial viability of DISCOMs, is of great importance.

In India, poor financial health of the DISCOMs is a major concern today. The AT&C losses as of 2014-15 are 24.62%, which is high as compared to the international standards. This fails to encourage investment in the power sector; making it tough for utilities to be financially viable. Various schemes viz. R-APDRP, UDAY, Power for All have been implemented to bring improvements in the financial position of the DISCOMs. Amendments have also been made to the Tariff Policy to improve efficiency, safeguard the environment (target of RPO of 8% by 2022) and enhance the ease of doing business through changes in duties, levies, cess and taxes. This paper aims to assess the financial challenges faced by DISCOMs related to their cash-flows, compliance mechanisms, resistance to change, political economy and organizational changes required and its link with implementing and promoting end-use efficiency measures. The areas explored under this paper are:

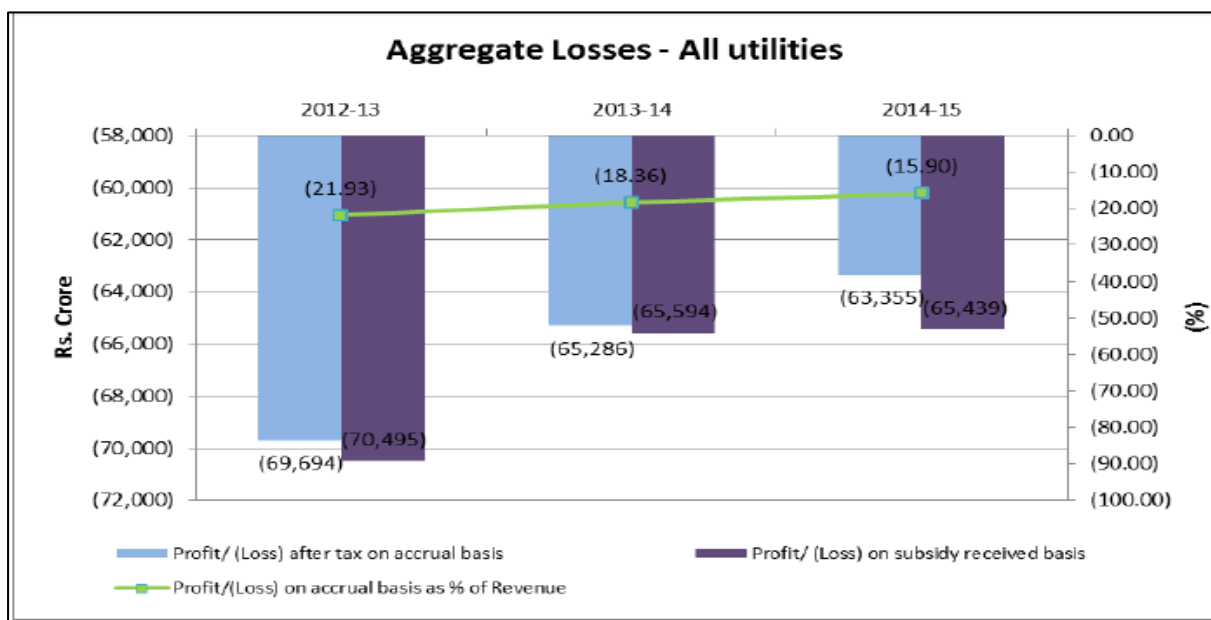
- Reviewing existing Government programs to improve DISCOM sustainability
- Providing an overview of the tariff setting process, debt restructuring reforms and impact of UDAY and Open Access on DISCOMs
- Reviewing DSM programs and modelling the impact of DSM programs on DISCOM finances after changing the consumer mix in selected states

## 2. LITERATURE REVIEW

Since the objective of the paper is to understand the impact of End use efficiency on DISCOM finances, the authors of this paper have explored the literature on examples, DISCOM finance ultimately. This included reports on financial status of DISCOMs, factors and regulatory processes which affect their finances, DISCOMs financial restructuring and reforms and examples of demand side management (End Use Efficiency). This also required studying the various aspects of electricity sector such as open access and its impact on DISCOM finances, power outages conditions and extent in India and how DSM can help to reduce power outages as well as to avoid the opportunity cost of alternate captive sources for power generation existing in the region where load shedding is practiced. Further, due to reduced capacity requirement, DSM also contributes to improvement in DISCOM Finances by avoiding investment in capacities for energy accounting. The various aspects are discussed in subsection below.

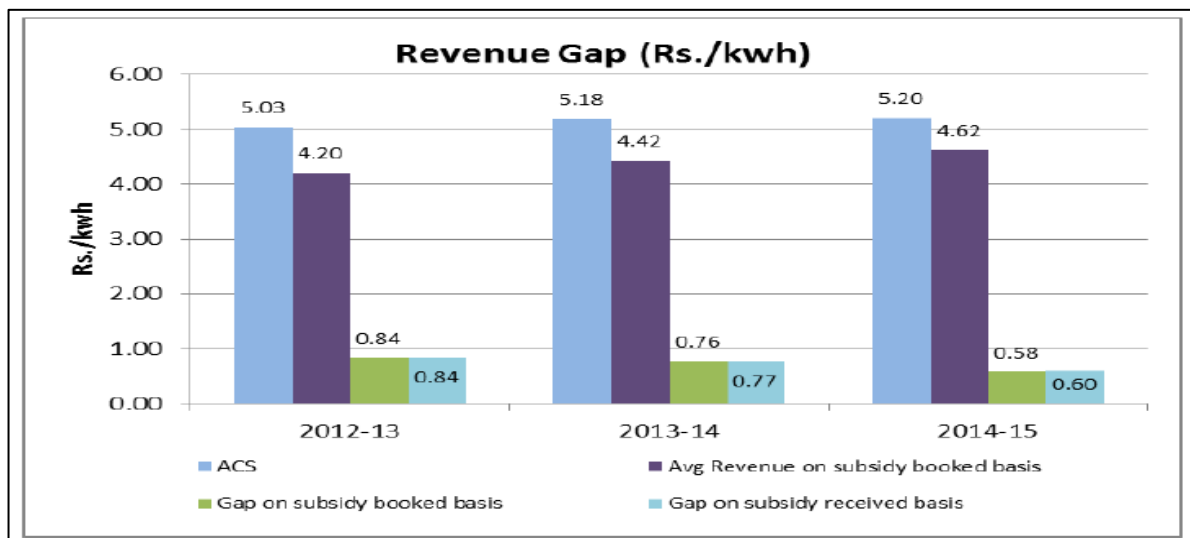
### 2.1 Tariff setting Process

Figure 1: Aggregate Losses



Source: PFC report on Performance of DISCOMs - 2015

Figure 2: Revenue Gap



Source: PFC report on Performance of DISCOMs - 2015

Determining a DISCOM's annual revenue requirement (ARR) is a key part of the tariff setting process. The ARR is arrived at by taking into consideration cost of supply and estimated demand for the power, which is based on the data of the previous years. ARR has two categories viz. operational and financial. The operational parameters deal with the functional aspects of the utility such as sales, power purchase, losses. Financial parameters enable the DISCOM to perform its duties and functions, financial parameters include CAPEX, debt/equity ratio, depreciation, interest. Furthermore, the ARR for DISCOMs is segregated into Wheeling and Supply business; with the cost of network related to the former and distribution of electricity to end user related to the latter.

*ARR = Cash collections including subsidy received / Units Input)] and*

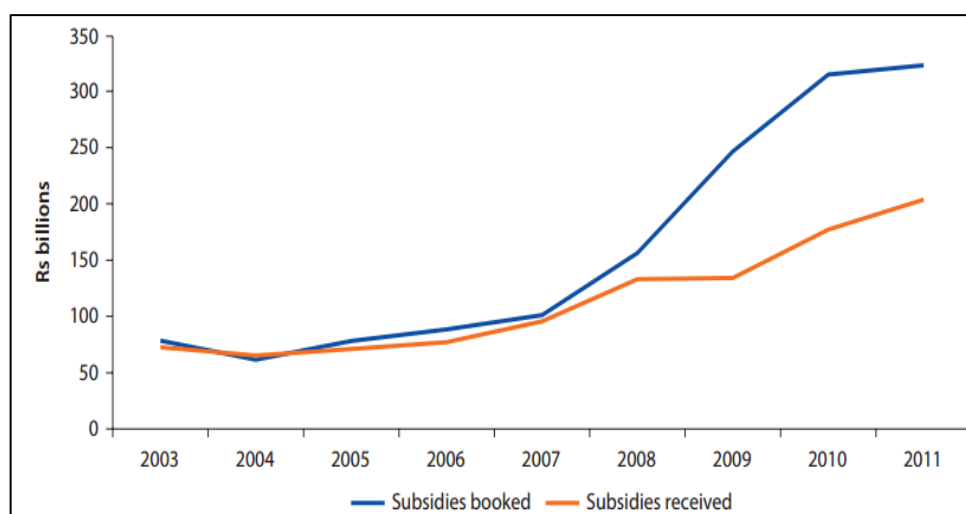
*ACoS = (Power purchase cost + O&M cost + Interest + Depreciation) / Units Input.*

*The ARR and ACoS play an important role in identifying the cost coverage ratio which holds a high weightage.*

DISCOMs are evaluated every year based on an Integrated Rating Methodology formulated by Ministry of Power (MoP), this evaluation is done with the help of credit rating agencies

ICRA and CARE and Power Finance Corporation (PFC) co-ordinates this exercise. This is done to track performance of the DISCOMs and gauge the impact of several schemes implemented by the government. Operational and financial parameters play a major role in contributing to the weak financial state of DISCOMs. Among the operational parameters AT&C losses, efficiency of power purchase cost carries more weightage. With the introduction cross-subsidization post the Electricity Act, tariff for agriculture and residential category consumers is highly subsidized to achieve the target of availability of power to all, but this has in turn affected the commercial and industry (C&I) category consumers as they end up paying higher rates for power. Though the Electricity Act, 2003 mandates State Government to pass on the subsidies to the DISCOMs upfront, ACoS and the revenue recovered from the Agriculture sector have gaps, leading to under recovery. As such, despite the subsidies passed on the State Governments to the DISCOMs, with respect to Agriculture (and other subsidized sectors), the DISCOMs suffer from the lack of revenues/cash on table. In such cases, if the C&I consumers contribute less to the revenue base and if during the same financial period the saved energy is directed to the subsidized sectors, there is a likelihood of further under-recovery from those sectors adding to the DISCOMs' financial problems. The graph shows AT&C losses level at 25% between 2012 and 2015. The losses translate into reduced cash available to the DISCOM. As we can see the revenue gap between ARR and ACoS in 2014-15 was INR 0.58 per unit. Figure 5 shows the gap between subsidies booked for the DISCOMs by state government and the actual subsidies received by the utility.

**Figure 3: Subsidy Booked and Received**



**Source: World Bank report on problems of electricity distribution in India, 2014**

## 2.2 Debt Restructuring Reforms

The distribution of electricity is considered to be the weakest section of the power sector in India. India in the recent decade has made great strides in improving the generation and transmission segments of the electricity sector; leaving the distribution sector to catch up. Recent reports state that India is expected to become a power surplus generator with the ability to meet peak demand.

DISCOMs are the backbone of the electricity supply market, connecting end users with generators of electricity. DISCOMs usually purchase electricity from a wholesale market and sell it to the consumer at a retail tariff, that is a mark up from the cost of supply. However, the operational characteristics of a DISCOM are far more complex. Since the 70s, State Electricity Boards (SEBs) have been incurring losses due to a variety of reasons, including underutilization of generating resources, mismanagement, political interference (in setting of tariff) and poor industrial relations. Furthermore, distortion in cross-subsidy mechanisms, theft, loss of revenue accountability through bad billing techniques and deteriorating supply infrastructure exacerbated the situation even more. Due to their abject performance, SEBs were heavily reliant on budget allocations from the government to expand, maintain and operate their assets.

Being unable to effectively operate, the central government created the National Hydro Power Corporation (NHPC) and National Thermal Power Corporation (NTPC) to help build new generating stations to match the growing need for electricity in the country.

Throughout 1980 and to early 1990s, the financial conditions of the SEBs worsened. In 1991 with the onset of liberal trade policies and opening doors to foreign investment, there was opening of privatization of the generation sector through the Independent Power Producers (IPP) policy. From then on, the need for liberalization of the market was realized and in 1998, an Electricity Regulatory Act was passed, leading to the creation of CERC and SERCs. Both regulatory commissions were responsible for overseeing the operations with the electricity industry and provide other regulatory as well advisory support to the government. In 2003, the Electricity Act was passed to the unbundling of SEBs into different generation companies, transmission companies and distribution companies. So far, major private sector interventions have been in the generation and distribution segment of the industry.

In 2001, a committee submitted a comprehensive report on the health of SEBs and provided recommendations to alleviate the problems faced by SEBs. The report highlighted the issue of SEBs not generating enough revenue to pay electricity suppliers and consequently impacting the operations of the suppliers as well. It also examined the operational viability of SEBs. The outstanding payables stood at INR 41,473 Cr with INR 25,727 Cr in principal and INR 15,746 Cr in interest.

### 2.3 Government Schemes to Improve Sustainability of DISCOMs

The three major factors that contribute to the increase in demand of power are: rural electrification, GDP growth rate, demand for 24x7 power for all (PFC, 2016). Various issues viz. unavailability of fuel, power purchase agreement (PPA) issues, and poor financial health of DISCOMs make it difficult to meet this increasing demand for power. Hence to meet energy demand, the Government has taken several initiatives. A summary of the major initiatives has been given below in tabular form. A detailed explanation of each scheme is in Annexure – I.

**Table 1 Details of Government schemes for financial restructuring of Discoms**

Scheme	Year of Approval	Financial Outlay	Objectives
<b>R- APDRP- Restructured Accelerated Power Development and Reforms Program</b>	2008	INR 44,011 Cr	<ul style="list-style-type: none"> <li>• IT integration for energy accounting</li> <li>• Consumer services.</li> </ul>
<b>IPDS- Integrated Power Development Scheme</b>	2014	INR 32,612 Cr	<ul style="list-style-type: none"> <li>• Strengthening of sub-transmission and distribution networks in the urban areas;</li> <li>• Metering of distribution transformers / feeders / consumers in the urban area.</li> <li>• IT enablement of distribution sector and strengthening of distribution network</li> </ul>
<b>UDAY- Ujjwal DISCOM Assurance Yojana</b>	2015	States shall take over 75% of DISCOM debt as on 30 September 2015 over two	<ul style="list-style-type: none"> <li>• Financial Turnaround</li> <li>• Operational improvement</li> <li>• Reduction of cost of generation</li> <li>• Development of renewable energy</li> <li>• Energy efficiency &amp; conservation</li> </ul>

		years - 50% of DISCOM debt shall be taken over in 2015-16 and 25% in 2016-17	
<b>DDUGYJ- Deen Dayal Upadhyay Gram Jyoti Yojana</b>	2014	INR 44,033	<ul style="list-style-type: none"> <li>• Separation of agriculture and non-agriculture feeders</li> <li>• Strengthening of sub-transmission and distribution networks in the rural areas;</li> <li>• Metering of distribution transformers / feeders / consumers in the rural area.</li> <li>• Rural Electrification</li> </ul>

Source: MP Ensystems Analysis

## 2.4 Demand Side Management and Available Opportunities

Demand side management (DSM) is defined by the Forum of Regulators (FOR) as ‘the planning, implementation and monitoring of utility’s activities designed to encourage customers to amend their electrical consumption patterns, both with respect to timing and level of electricity demand so as to help the customers to use electricity more efficiently’. With the ever-increasing demand of power, utilities face this issue of power deficiency. Increasing generation capacity is not a feasible solution considering various aspects such cost of expansion, supply of fuel, and other threats this expansion would pose to environment. In such a case, management of demand of power seems to be cost effective option. Considering the current state of the Indian power sector, efficiency improvements become a crucial factor in order to protect the DISCOMs from going into further losses and enhance the financial position of the utilities. As discussed above, various scheme/initiatives have been undertaken by the Government, but due to inadequate efforts in its implementation have proved to be a hindrance in procuring the benefits out of it.

With the growing demand of power and existing loopholes in the power sector, it gets difficult to meet the present energy demands. This leaves the sector with the option of demand side management (DSM) programs, which saves the sector from the financial burden of investing into new resources to meet the current energy demands.

DSM programs work on the following objectives:

- Power shortage mitigation
- Seasonal peak reduction
- Cost effective strategy for energy savings
- Lowering the cost of electricity
- Reduction in emission of GHG

The Bureau of Energy Efficiency (BEE) and Ministry of Power (MoP) has implemented several schemes during 11<sup>th</sup> Five Year Plan for DSM. Such as Energy Efficiency in existing building, Bachat Lamp Yojana (BLY), Agriculture and Municipal DSM, National Mission for Enhanced Energy Efficiency (NMEEE), etc. BEE provides technical assistance to DISCOMs for establishment and capacity building of DSM cells. The following points explain lays down DSM strategies for utility's DSM cells:

- Load Survey: This is to study the consumption pattern of the consumers, used to develop city level load profiles.
- Load Strategies: these are adopted by DISCOMs to reduce peak demands. Includes demand response, load management programs (dynamic real time pricing, time of use ToU rates, etc.
- Demonstration studies: direct installation programs that provide complete services to design, finance, and install a package of efficiency measures.
- Advanced metering: adoption of smart metering, online communication, accurate measurements, this helps in implementing DSM specially Demand Response Activities.
- DSM financing: Improving financial cash flow of Indian utilities.

#### **2.4.1 Example for Energy Savings and Loss Reduction through DSM**

The example of such DSM measure is provided in Box 1. The DSM program for replacement of agricultural pump sets with energy efficient pumps can reduce the energy consumption of the state by 2.5 % with similar level of reduction in T&D losses.

### Box 1 Impact of DSM through replacement of agricultural pump sets

#### Example: Replacement of agriculture pump-sets in Haryana

- 2,290 MUs consumed by 2 lakh agriculture consumers
- Average consumption per pump-set per year is 11,450 kWh (5-7 HP pump-set running for 6 hours a day, 330 days a year)
- Save 10% energy (~1,145 kWh per year/pump set) or 300 MUs for agriculture consumer base
- Approximately 2.5% reduction in overall consumption and thus T&D losses.

If we assume the average unit cost of electricity at INR 5 / KWh, then the total cost of energy saved (300 Million units) would be of the tune of INR 150 Cr. Thus, it is established that DSM measures have very high potential for energy and thus financial saving.

#### 2.4.2 Avoided cost of deferred capacity due to DSM measures

Due to reduction in capacity requirement, the investment on energy accounting is also reduced to maintain the same level of supply quality and collection efficiency<sup>1</sup>. If we look at the quantum of investment made in order to improve the quality of supply and collection efficiency, DSM provides huge incentives in terms of avoided investment in deferred capacity. Study conducted by ISGF (India Smart Grid Forum) provides statistics on investment made through IPDS to improve energy accounting and quality of supply<sup>2</sup>.

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<sup>1</sup> (Department of Science and Technology, 2017)

<sup>2</sup> (India Smart Grid Forum, 2015)

## Box 2 Avoided Cost of deferred capacity

### Example: Avoided Cost of Deferred Capacity

- A. By Govt. of India – through APDRP: INR 20,000 Crore approx. + R-APDRP: INR 15,000 Crore (approx. value of work executed by March 13) = Total: INR 35,000 Crore
- B. By States/ Utilities: INR 35,000 Crore (Assuming similar level of investment)
- C. Total (A+B): Rs 70,000 Crore (Investment in reducing 9% AT&C losses)
- Future investment envisaged: It is assumed that for next 9% (AT&C) reduction from 26.15% to 17% the investment will be almost double from 70,000 Crore to 1,40,000 Crore
  - Investment made for reduction from 17% to below 10% will again be double i.e., 2,80,000 Crore
  - Equal amount will be required to reduce transmission loss to 3% level. Thus, to reach at the T&D losses at par with developed countries, total investment required is close to 10 lac Crore. If we could avoid investment by 10%, it could save INR 1,00,000 Cr, which is approximately 12% of total annual revenues of electricity sector in the country.

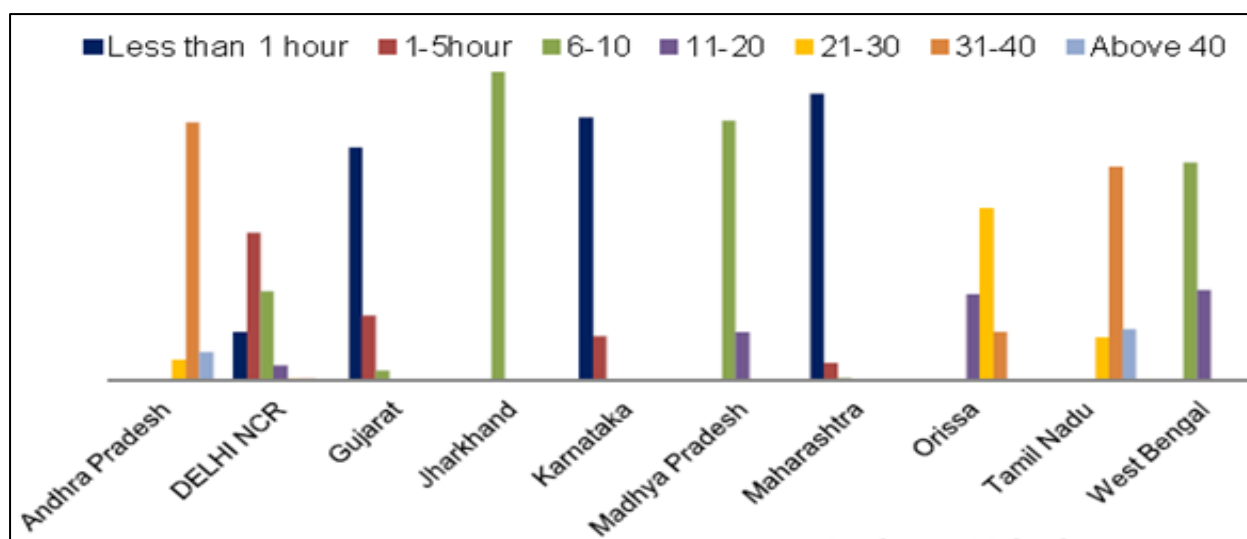
AT&C losses reduced from 34.78% in 2003-04 to 26.15% in 2010-11 (at India level). For this loss reduction of around 9% (AT&C), computation of approximate investment made in electrical network are provided in Box 2. It is estimated that DSM programs which can reduce the overall consumption by 10 %, can also help to avoid the investment of more than 1,00,000 Cr only related to energy accounting infrastructure, while not interfering with the quality level of supply. This is the biggest factor DISCOMs can utilise, while filing the tariff petitions. The financial estimation of benefits (through avoided cost) can be put up against the investment required for DSM programmes to evaluate the proposals.

### 2.4.3 Power Outage and Losses to DISCOMs

There is a deficit of 5855 MU of power as of 2017-18 (CEA). This gap in the demand and supply compels DISCOMs to resort to power cuts. The reasons for this deficit in power supply could be attributed to 4 main factors such high AT&C losses, shortage of fuel, low plant load factor and poor financial health of the DISCOM (FICCI 2013). With the exponential population growth, intermittent supply of power could prove to be a major setup for most of the supply-driven industries. Power cuts or power outages have been a critical issue in the power sector history. There have been massive power outages in the years 2001 and 2012 affecting large parts of the country. The major outage of 2012 resulted in complete black-out in 22 states, 3 grids viz. northern, eastern and north-eastern were shut for several hours resulting in complete black-out in 22 states affecting 620 million people. Apart from these pan-India events, frequent power cuts are experienced all over the country at an average of 7 hours per month. Post this incident, in 2013 Federation of Indian Chambers of Commerce and Industry (FICCI) conducted a survey of 650 firms, both manufacturing and service groups, to study the impact of power cuts on various parameters and to understand the ways/ measures adopted by these firms to tackle frequent power cuts faced by them. Production losses, investment on power backups, additional burden of inventory and maintenance cost, cost escalation and expenditure on captive generation are the impacts that were studied for these firms.

An all-India level study on power cuts was conducted in the year 2013 by FICCI in which 650 firms including both manufacturing and service industries were surveyed to understand the ways of tackling the frequent power cuts being faced by them. This report reveals that industries do not face shortfall in their production due to irregular power supply at their end, this is because the industries have adapted to the supply patterns of the sector. This has resulted in industries making provisions of back up of power in order to mitigate the risk of loss of production; this has eventually resulted in the cost escalation due to investment in power backups at the consumer end, maintenance cost and inventory cost, etc. Also a very major impact is on the environment, since these power back up provisions lead to various ill effects such as loss of biodiversity, health issues due to air pollution, deforestation and so on.

Figure 4: No. of Hours of Power Failure - State wise



Source: FICCI, 2013

Some of the key findings of the study:

1. Cost of captive sources: It was observed that 21% of companies are ready to invest around Rs 20-25 lakhs in installing power back-ups or generators, and average fuel consumption is a good indicator to gauge the cost incurred by companies in their efforts to mitigate their shortfalls in production, it is observed that firms spend an average of INR 2501-5000 per hour and the share consists majorly small industries. It is also necessary to understand the cost of using electricity from captive sources as compared to government sources, while combining avg. fuel consumption costs, maintenance costs and inventory costs to understand cost escalations.
2. Loss of revenue: Due to revenue power outages the industries suffer revenue loss, apart from this they also suffer revenue loss due to voltage fluctuations or erratic power supply which potentially result in stagnation or decline in industrial growth. The analysis revealed that 64 % of firms feel that erratic power supply affects their competitiveness in domestic and international markets.
3. Willingness to pay more for better power: In Andhra Pradesh, Tamilnadu and Odisha, more than 85 % of the firms were willing to pay an additional amount to avail an uninterrupted power supply. This trend could also be attributed to increase in cost of production activity by using power backup facilities can be considered more for small

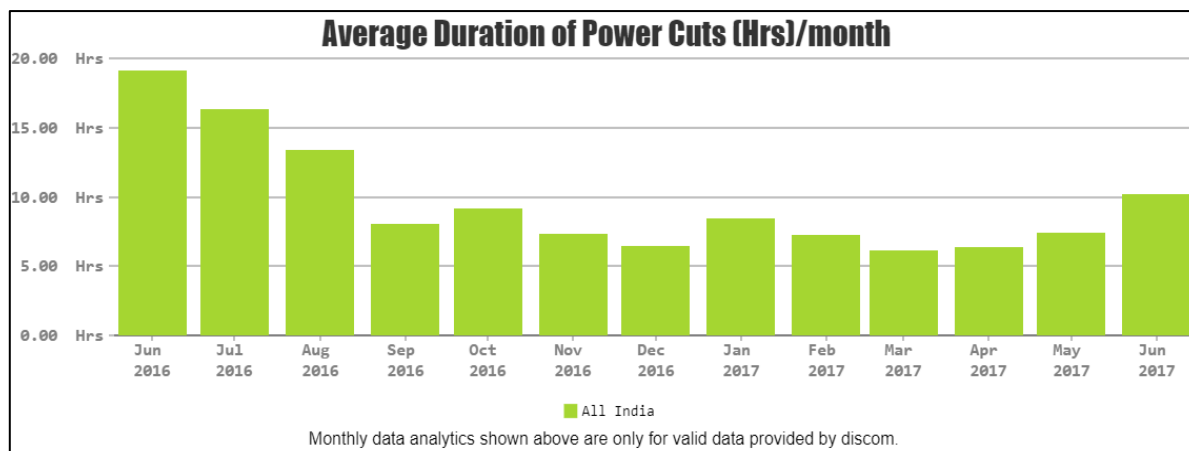
scale firms. Firms using upgraded technology, optimized their levels of electricity consumption, decreased their electricity consumption per unit output and saved on electricity cost. In states like Maharashtra where power shortage is not major issue, only 15 to 18 % of firms were willing to pay more for uninterrupted power supply.

**Figure 5: Production loss in various industries due to power outage (%)**

<b>Sector</b>	<b>Less than 2 %</b>	<b>2-5 %</b>	<b>6-10 %</b>	<b>11-20 %</b>	<b>Above 20 %</b>
Food & Beverage	9.09	9.09	27.27	38.36	18.18
Diamond Processing	33.33	33.33	0	0	33.33
Textile & Apparel	55.58	11.11	14.81	7.41	11.1
Telecom & Equipment	11.11	22.22	22.22	11.11	33.33
Ceramics/Glass	10	10	10	30	40
Iron and Steel	4	8	8	36	44
Aluminium	0	22.22	11.11	22.22	44.44
Fertilizer	0	0	16.67	33.33	50
Cement	0	0	20	20	60
Pulp & Paper	0	0	15.38	38.46	46.15
IT Enabled Services	8	8	20	24	40
Infrastructure and Capital Goods	19.23	3.85	3.85	30.77	42.31
Automobiles and Componenta	23.33	10	0	36.67	30
Hotels	6.67	40	26.67	20	6.67
Chemicals	1.65	29.41	23.53	29.41	0
Plastic/PVC	7.14	21.43	7.14	28.57	35.71
Electronics and equipments	9.09	9.09	9.09	22.73	50
Trading Units	19.23	23.08	11.54	26.92	19.23
Hospitals	4.35	4.35	4.35	43.48	43.4
Other Service Industry	9.09	9.09	18.18	54.55	9.09

**Source: MOP, Urja – Urban Jyoti Abhyan 2017**

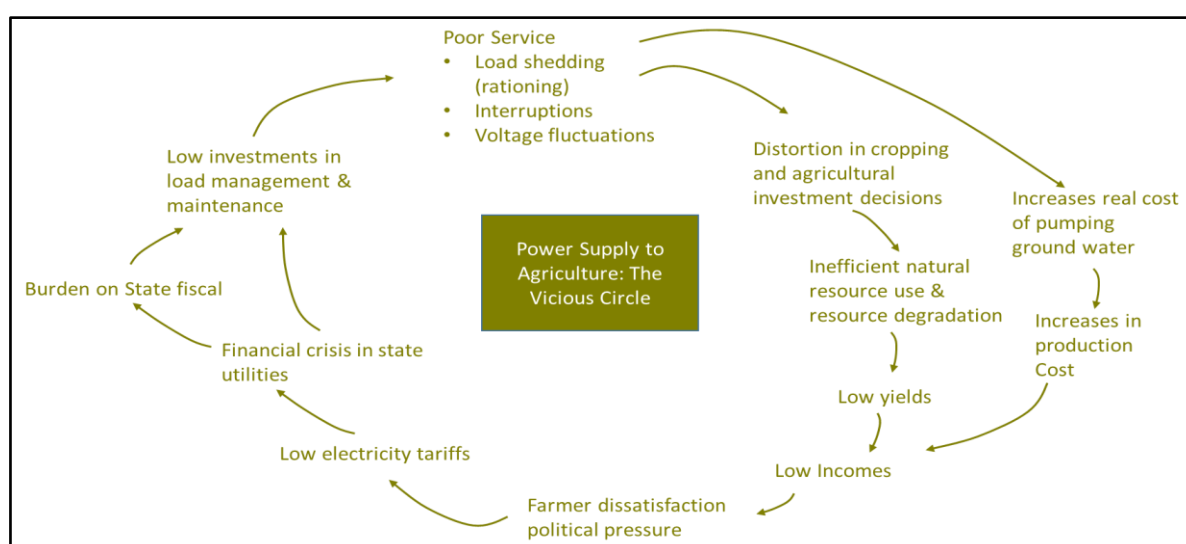
**Figure 6: Average duration of Power Cuts Hours per month**



**Source: MOP, Urja-Urban Jyoti Abhyan 2017**

The above figure shows the annual data for average duration of power cuts during 12 months for the year 2016-17. The overall average value for duration of power cuts for India is approximately 7 hours per month captured on the 11 kV feeders (Urja, MoP dashboard). As evident from the data that the problem of power cuts is frequent and persistent, this scenario forces the industrial sectors to opt for power back up options in order to mitigate the loss of production and eventual loss of revenue for them.

**Figure 7: Causal Loop: Power supply to Agriculture**



**Source: Chinmay Chhatbar, TISS 2017 (Adopted from World Bank 2001).**

Another example of the negative impact of power sector inefficiencies on the various sectors is evident in the agriculture sector. The above figure shows a causal loop showing different

factors affecting the agriculture business due to poor quality power supply. This loop represents a cycle of all operational, political and functional parameters that contribute to the issues faced by the agricultural sector. These factors shown here point towards the same problems of low productive faced by other sector due to power cuts. Agriculture sector is highly subsidised, the utilities are burdened as they have to supply power at cheap rates comparatively and bear the losses which poses a challenge to their financial sustainability.

#### **2.4.4 Captive generation**

Captive Power refers to generation from a unit set up by industry for its exclusive consumption. The State Governments have been concerned about the growing importance of Captive Power Plants on account of the following reasons:

1. Captive plants may have adverse impacts on the finances of the utility, such as industrial load is the main source for cross-subsidising revenue flows.
2. Billing and collection is much more efficient for HT consumers
3. SEBs ability to service escrow accounts for security packages is also reduced.
4. Problems in grid management especially in case of states with surplus power
5. Adverse environmental impacts arising from types of fuels used and from higher emissions per unit of production, as compared to large power plants
6. Reliability of power supply from captive and co-generation plants as a source of firm power

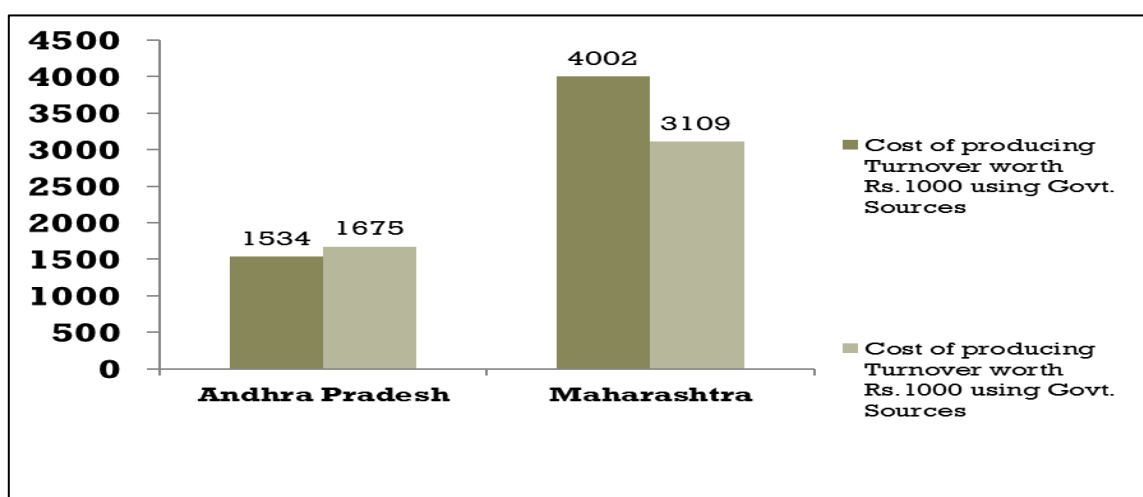
The rise of captive plants in India can be due to the following reasons-

- Need for backup power arrangement,
- Requirement of better quality supply,
- The co-generation benefits of steam and electricity from production process of industries, and
- Need to generate electricity at costs lower than the high industrial tariff s set to cross subsidize other categories of consumers.

There are various reasons due to which captive generation seems to be suitable option for consumers; some of the concern of the owners of captive generation can be stated as follows:

- (a) Non-remunerative tariff structure for surplus power produced by them
- (b) No risk sharing in case of non-availability of fuel, change in variable cost due to switching of fuel after entering into power purchase agreement (PPA), etc
- (c) Inadequacies in wheeling and banking facilities
- (d) High contract demand charges.
- (e) High level of duties and taxes on sale of power
- (f) High wheeling losses assumed for power to be sold to grid by captive or cogen plant
- (g) Need to devote time and energy to an activity, which is not their core business
- (h) Restrictions on the minimum amount of power to be wheeled
- (i) If the captive power plant (CPP) fails, charges for back-up or standby power from the grid are twice the normal rate for captive plants
- (j) No formal policy for purchase of cogenerated power (in most of the states)

**Figure 8: Comparison of per unit electricity cost from government and captive sources (INR)**



**Source: FICCI Report, Lack of Affordability & Quality Power**

As per CEA, installed capacity of captive power plants (greater than 1 MW) is nearly 47,200 MW as on 31 March 2016. It is estimated that about 30% of total energy requirement is met through in-house captive plants. The cost of electricity from captive sources ranges between Rs. 12-16 per unit. For Andhra Pradesh, Maharashtra, Odisha, and Tamil Nadu, it is relatively higher. It was also revealed that 61 percent of the firms were willing to pay more for reliable and uninterrupted power supply while 39 percent were not willing to pay an additional amount for a reliable and quality access power supply. As per state wise analysis that in

Andhra Pradesh more than 85 percent of the firms were willing to pay an additional amount to avail an uninterrupted power supply. Assuming the consumers meet part of their energy demand through captive generation, this could reduce the revenue for DISCOMs. However, because of captive generation the DISCOMs can avoid the purchase of expensive short-term power; thereby driving down their average power purchase cost. The reduced dependency on short term power could improve quality of power supply to consumers. DISCOMs could also earn nominal revenues through open access charges applicable for captive generation.

#### **2.4.5 Open Access and its Impact on DISCOM Finance**

Section 2(47) of the Electricity Act 2003 defines open access (OA) as “non-discriminatory provision for the use of transmission lines or distribution system or associated facilities with such lines or system by any licensee or consumer or a person engaged in generation in accordance with the regulations specified by the Appropriate Commission”. The main objective of the provision of open access is to provide freedom to consumers to choose their supplier introduce competition in the generation business.

This provision of open access allows large users of power consumers to buy cheaper power from the open market. The idea is that the customers should be able to choose among a large number of competing power supplier companies instead of being forced to buy electricity from their existing electric utility monopoly. This helps various industries such textile, cement, and steel industries to ensure regular supply of power at suitable rates, they get a freedom to choose their power supplier and are not forced to stick to the state DISCOM.

Open Access on Transmission and Distribution on payment of charges to the Utility will enable number of players utilizing these capacities and transmit power from generation to the load centre. This will mean utilization of existing infrastructure and easing of power shortage. Trading, now a licensed activity and regulated will also help in innovative pricing which will lead to competition resulting in lowering of tariffs.

There are two types of OA:

1. Inter-state OA: sale and purchase of power between different states, this follows regulations of CERC. This is further categorized based on duration such as – short term (less than a month), medium term (period of 3 months to 3 years) and long term (period of 12 to 25 years).

2. Intra-state OA: Sale and purchase of power within the same state. These trades follow SERC regulations and can also be categorized depending on the duration. But in this case the duration varies according to the respective state regulations.

While the provision of OA has helped in introducing competition at the generation end, at the same time it has resulted in loss in the revenue<sup>3</sup> for the DISCOM.

Two major reasons for this are: 1) Loss of cross-subsidy revenues that were being provided by the exiting consumers to fund subsidised supply to the majority of LT consumers (agricultural and residential highly subsidised consumer category) 2). Change in the consumer mix because the power that is freed-up will now be used to supply low paying consumers (Daljit Singh, 2005).

Cross subsidy surcharge (CSS) is to be levied on the exiting HT consumers so that the loss for the revenue is compensated that helps the utility to continue its supply of power to the LT category consumers at subsidised rates. The CSS to be levied should be within 20% of tariff as per the National Tariff Policy and the tariff to be +/-20% of Cost of supply as per the amendments of 2010-11.<sup>4</sup>

As per the regulations, CSS is not levied if the supply is to be taken from captive generators; this makes it cheaper for the consumer and adds on to the loss of revenue for the DISCOMs.

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<sup>3</sup> Loss in the revenue due to the switch over of an HT consumer is calculated as:

Revenue Loss = Revenue from Exiting HT Consumer – Revenue from Sale to Existing (or New) LT Consumer – Revenue from exiting (open access) consumer for wheeling and back-up charges

<sup>4</sup> The Cross-Subsidy surcharge is given by the following formula as mentioned in the National Tariff Policy

$$S = T - [C (1 + L/100) + D]$$

Where, S is the surcharge, T is the Tariff payable by the relevant category of consumers; C is the Weighted average cost of power purchase, D is the Wheeling charges, L is the System losses for the applicable voltage level, expressed as percentage

### 3. METHODOLOGY

The study aims to provide examples of Demand Side Management through which DISCOMs' financial status can be improved. The analysis through secondary data is thus divided into three major parts.

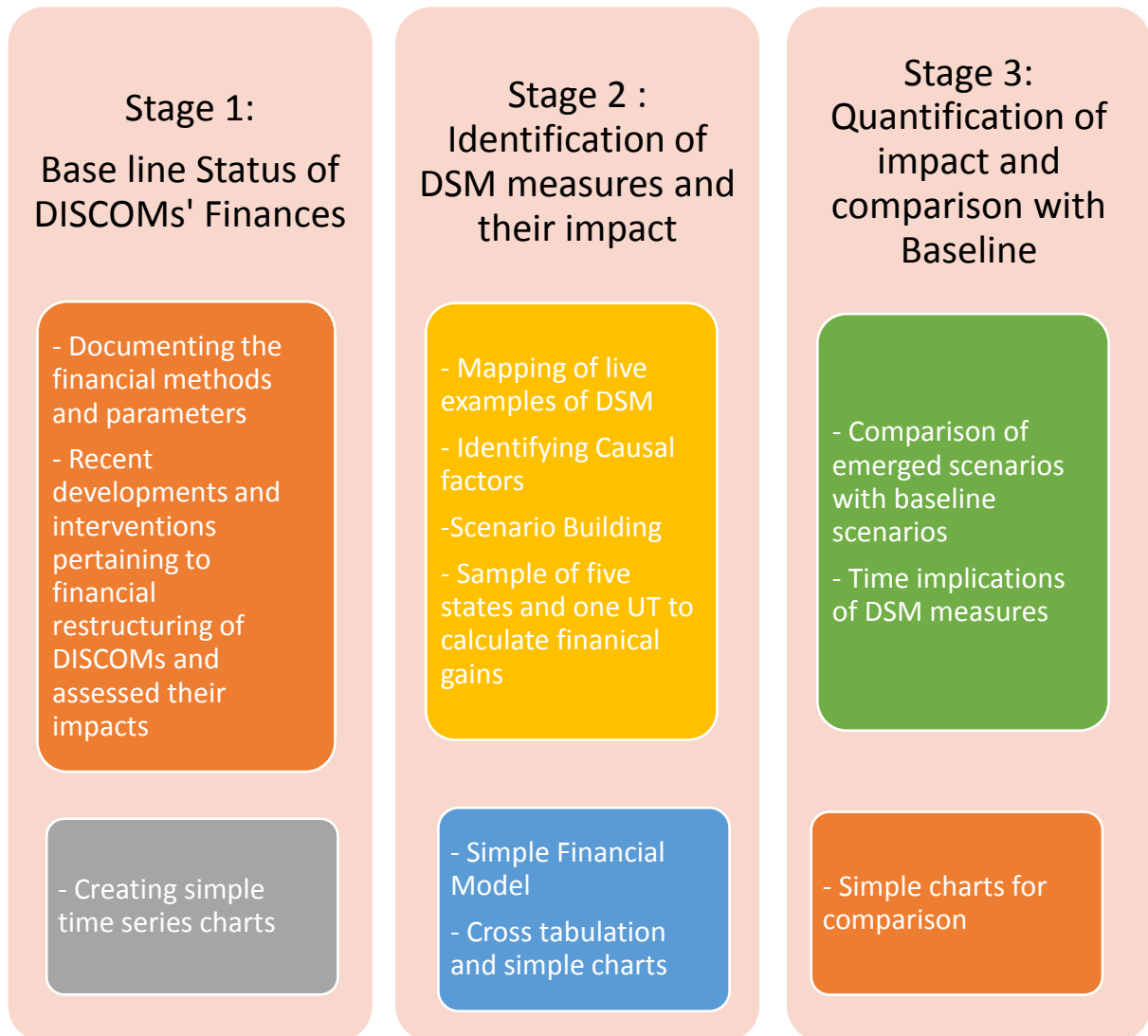
In the first part, we are going to provide base line information on financial status of DISCOMs. This will require documenting the financial methods and parameters used to assess the status of DISCOMs. Financial methods of accounting are identified from various tariff setting processes and orders. The financial parameters are average revenue requirement (ARR), average cost of supply (ACoS), The gap between ARR and ACoS, aggregate losses, profitability, and debt, etc. The study draws threads from critical reports on financial status of DISCOMs such as Shunglu Committee report (2009) and reports produced by Planning Commission, Ministry of Power, Power Finance Corporation, World Bank, Federation of Indian Chambers of Commerce, and Industry etc. We have put together time series data on the performance from year 2012 onwards for DISCOMs and states and create simple charts which provide us the base scenario. Further, we have enlisted developments and interventions pertaining to financial restructuring in the electricity sector and assessed their impacts.

In the next part, the study maps various concepts and perceived causal factors, especially DSM measures, which contribute towards the financial performance of DISCOMs. To find out and understand the impact of DSM interventions, the study builds up various scenarios based on the identified causal factors. The major opportunities identified are reduced cost of peak power, reduced consumption of subsidized consumers, increased and added supply to subsidizing consumers in the power deficit states where load shedding occurs and avoided cost of alternative captive sources. The sample for study consists of five states namely Maharashtra, Gujarat, Andhra Pradesh, Uttar Pradesh, Haryana and one Union territory of Pondicherry. Here, it is considered that Gujarat, Andhra Pradesh, and Maharashtra represent states which have higher development of regulation of electricity sector, whereas, Uttar Pradesh and Haryana are considered as relatively less developed state in terms of regulation of electricity sector. The data is obtained from various government and non-government sources such as Tariff orders of central and state electricity regulatory commissions, UDAY

and other portals of Government of India. The data will be analysed through cross tabulation and simple charts.

In the final part of analysis, we will determine the extent of impact of DSM measures, through comparison of emerged scenarios with baseline scenarios. The comparison will be done on same parameters which are identified in the first part.

**Figure 9 Methodology**



## 4. ANALYSIS

### 4.1 Section 1 Base Line Scenario

#### 4.1.1 Impact of UDAY on Financial Parameters

In 2015, the Government launched UDAY with the aim of achieving financial turnaround of state owned DISCOMs dealing with financial instability. In this section, we study the impact of implementing UDAY on financial parameters.

**AT&C Losses:** As observed from Figure 6, there has been a reduction in AT&C loss in states of Gujarat, Haryana, and Maharashtra. An approx. rise of 3% can be seen for Pondicherry, there has only been a slight increase in AP.

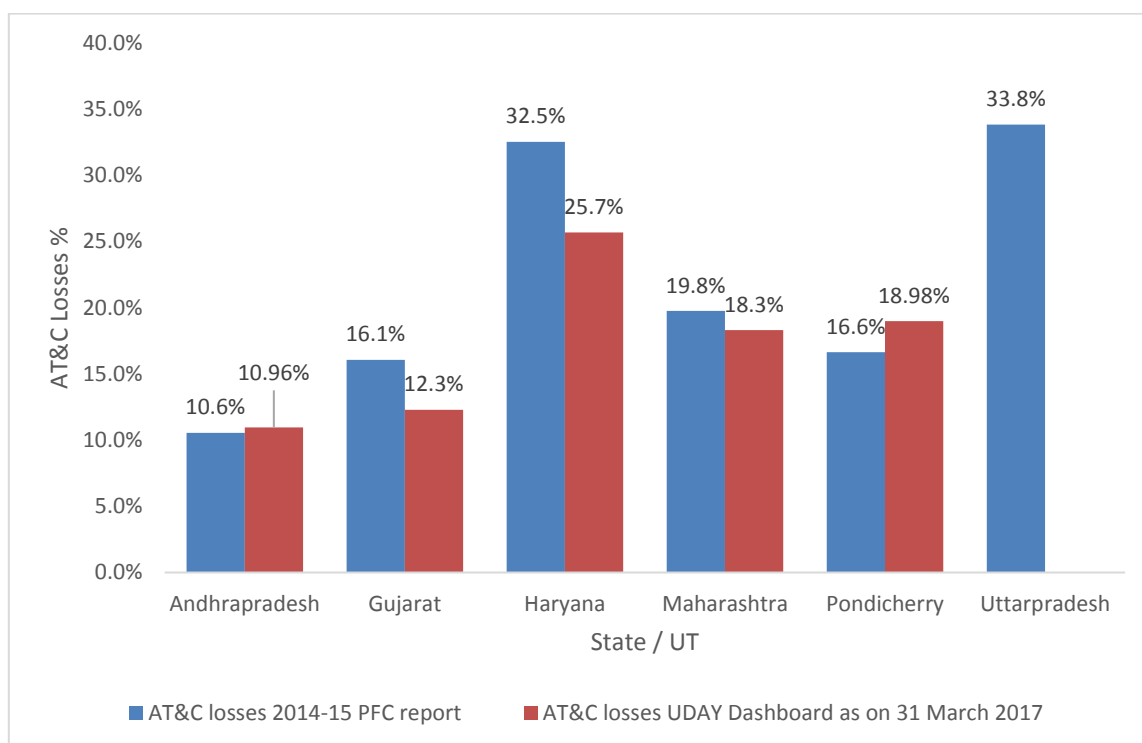
It is to be noted that the states of Haryana and UP have very high losses, which is far greater than the 15% target of UDAY. These states do not seem to have benefitted from UDAY scheme. Losses for Maharashtra also exceed the desired level however Gujarat has met the target of 15% post implementation of UDAY.

**ARR and ACoS GAP:** Effect of higher levels of AT&C losses is apparent in Figure 8 showing the gap between ACOS and ARR in Rs per unit. Here, one can observe that in spite of having the lowest loss levels, Andhra Pradesh has a considerably higher gap between ACoS and ARR. This can be attributed to the reluctance to revise tariffs to bring them to ACoS levels. Maharashtra's increase in gap can be attributed to MERC's disapproval of very high figures of agricultural consumption shown in the petitioned filed by MSEDCL. The Commission did not approve 2400 MUs. UDAY scheme has also changed the methodology for computation of AT&C losses and its components, which has implication on ACoS-ARR gap as well as other financial parameters<sup>5</sup>. The change in the methodology of computation will reduce the level of losses and ACoS-ARR gap, creating virtual picture of higher improvement in the financial position of DISCOMs, rather than actual improvement.

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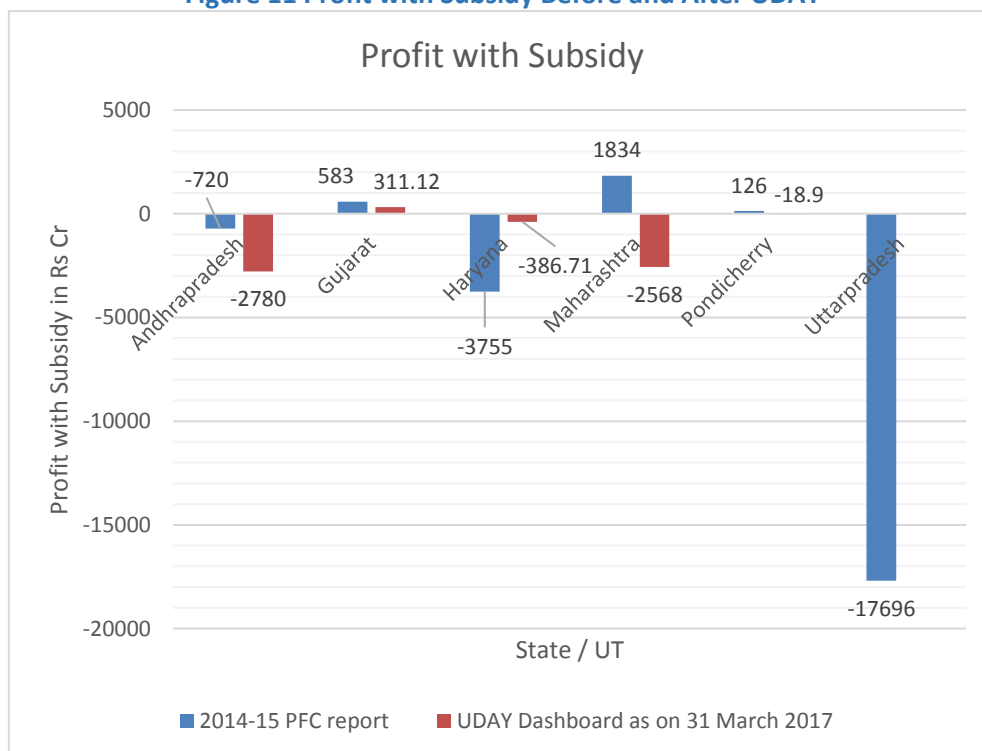
<sup>5</sup> (Source: Presentation on Ministry of Power) For example, 'Revenue/ Tariff Subsidy' now forms part of 'Revenue from sale of Power'. For calculating Collection Efficiency – 'Subsidy Received' figure also forms part of 'Revenue from Sale of Energy' and 'Subsidy Booked' forms part of 'Billed Amount'. As per the concerned authorities, this change will reflect the true position of "Collection Efficiency". Additionally, ACOS-ARR gap computation is to be done based on "Total Input Energy" instead of "Sold Energy".

**Figure 10 AT&C losses before and after UDAY**



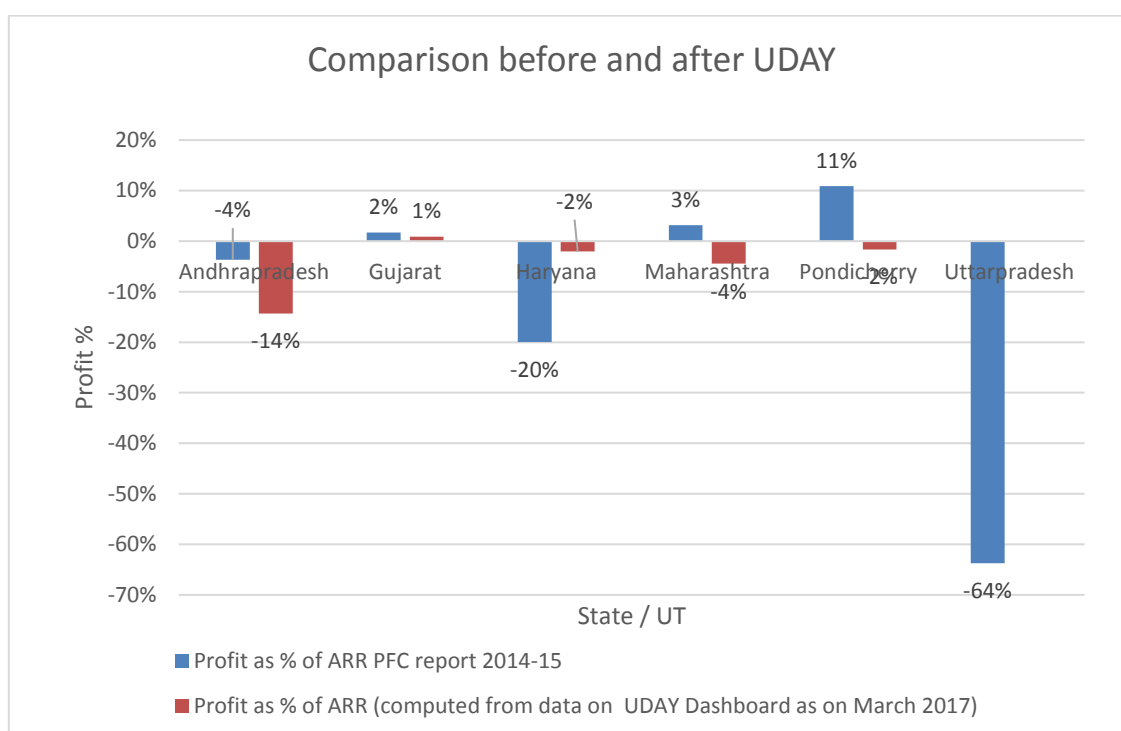
Source: PFC report and UDAY dashboard

**Figure 11 Profit with Subsidy Before and After UDAY**



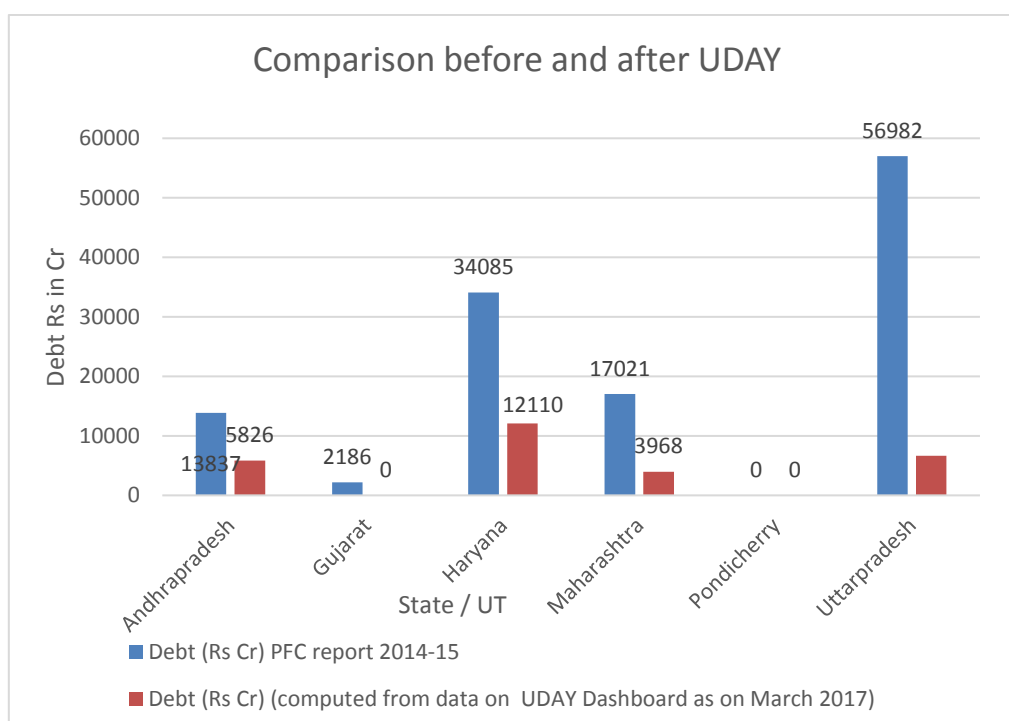
Source: PFC report and UDAY dashboard

**Figure 12 Profit as % of ARR, Before and After UDAY**



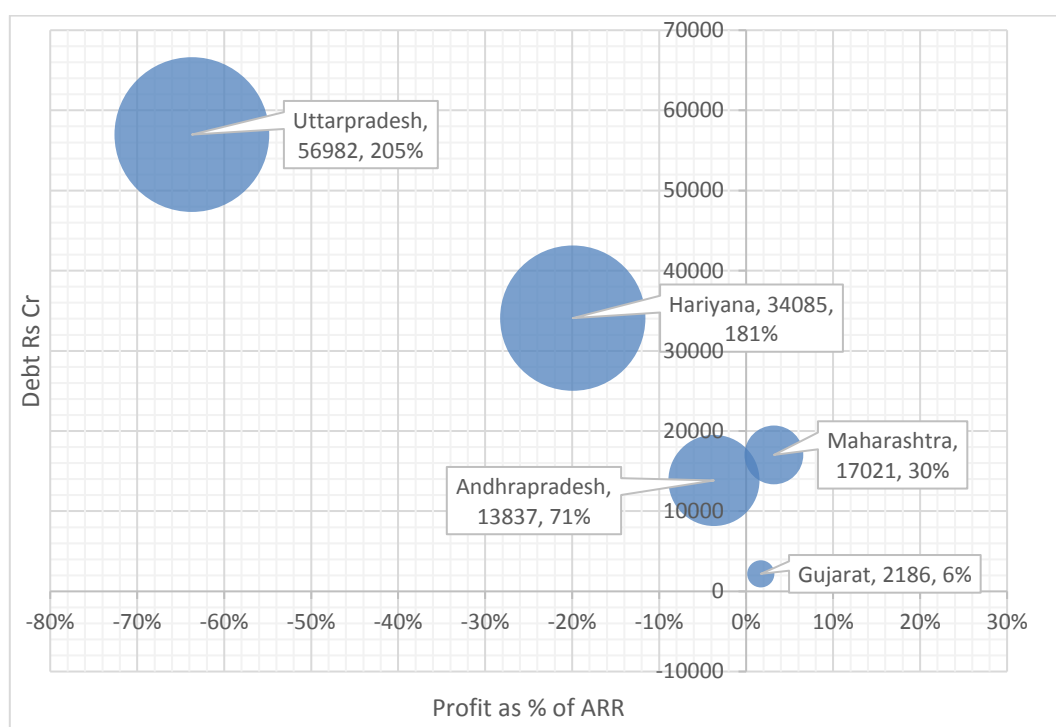
**Source: PFC report and UDAY dashboard**

**Figure 13 Debt as % of ARR, Before and After UDAY**



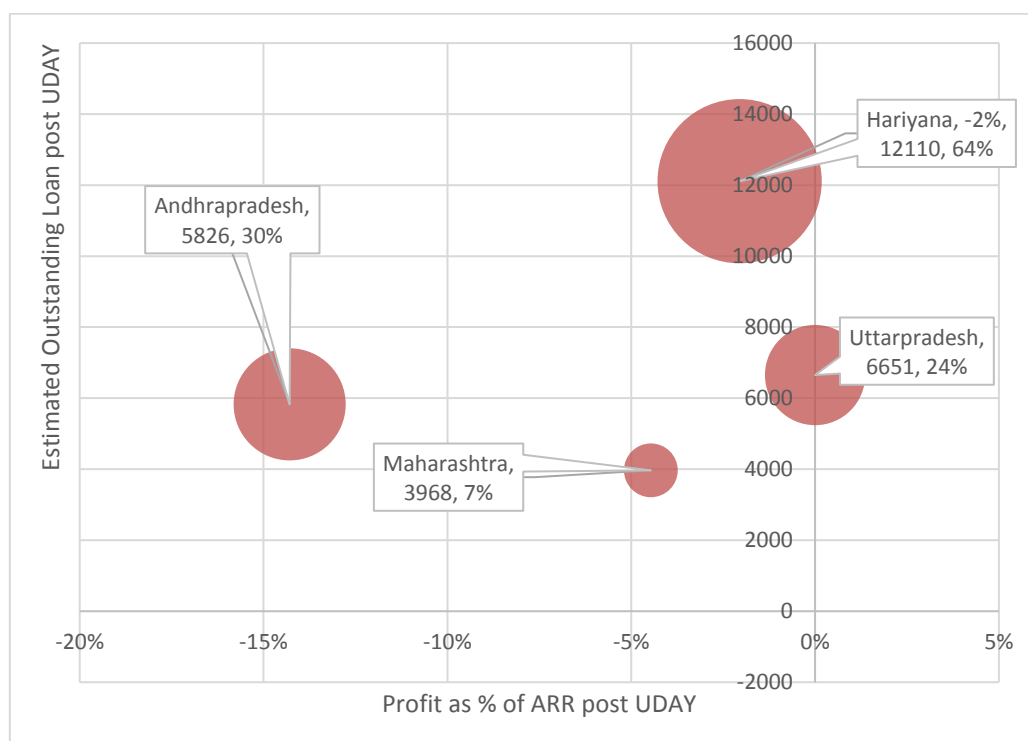
**Source: PFC report and UDAY dashboard**

**Figure 14 Debt as % of ARR before UDAY**



Source: PFC report

**Figure 15 Debt as % of ARR after UDAY**

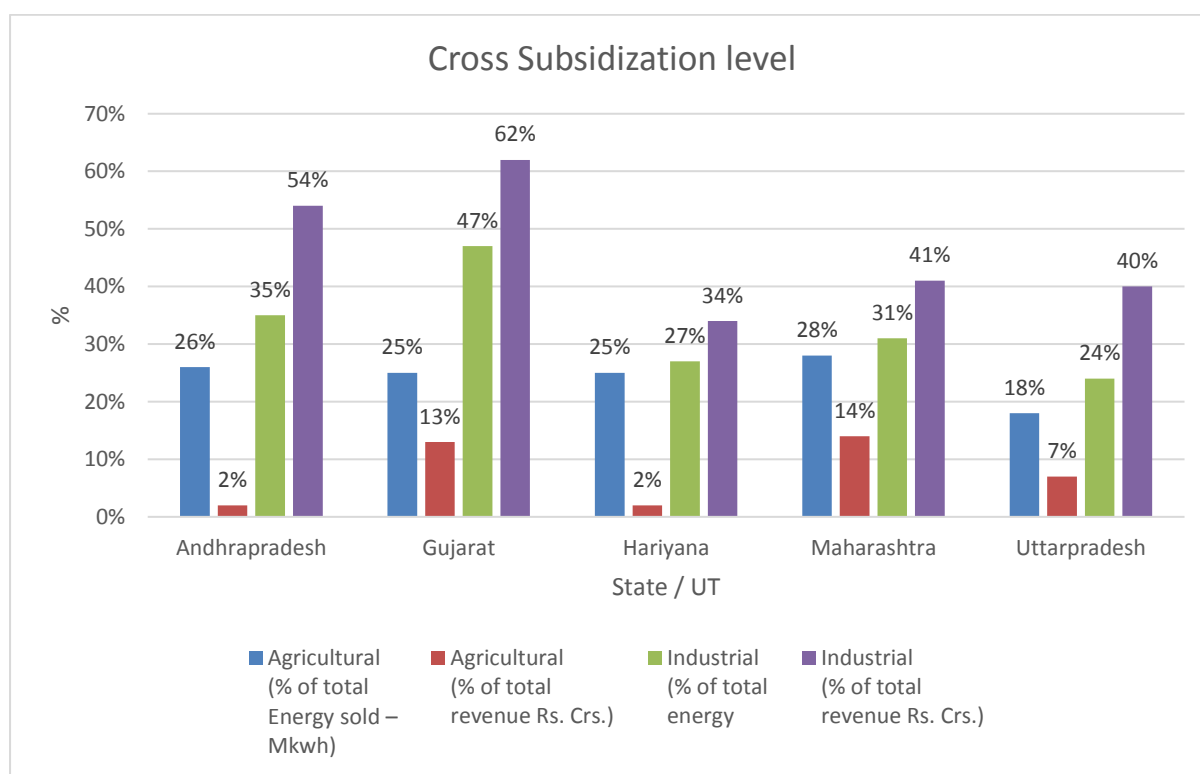


Source: UDAY dashboard

Debt as % of ARR: Maharashtra's disproportionate variation can be attributed to unaccounted agricultural consumption (MERC order 48 of 2016). Andhra Pradesh's increase in losses post UDAY can be attributed to state bifurcation and thus license area and accounts bifurcation.

It can be seen that UDAY has helped reduce the burden of debt and thus interest cost on DISCOMs significantly. Uttar Pradesh's estimated debt reduced from INR 56,982 Cr to 6,651 Cr as the percentage of ARR reduced from 205% to 24%. UDAY dashboard does not show data on Uttar Pradesh. Similarly, for Haryana, debt reduced from INR 34,085 Cr to 12,110 Cr, which as share of ARR fell from 181% to 64%. Its loss with subsidy received reduced from 20% to 2%. Similar trends can be observed with other states as well.

**Figure 16 Cross Subsidization levels across the states**



**Source: PFC report**

### Cross subsidization level:

For the states of AP and Haryana it can be observed that agricultural consumption is 25% but revenue realized is only 2%. And at the same time, contribution by industrial category consumption towards the revenue exceeds the share in energy consumption by at least 10%, in case of AP it is 19%.

Similarly, in case of Gujarat and Maharashtra, revenue obtained from agriculture is only 50% of its energy consumption. For Uttar Pradesh, it can be observed that percentage of energy consumption of industrial category is approx. 50% lower than the contribution towards the revenue. This reiterates the point that subsidized charges for agricultural consumption leads to under recovery and in turn burdens the HT consumers. This leaves no incentive for the utility to improve service and efficiency levels, in such case, subsidy from the State governments can also be effective in making DISCOMs financial viable.

Higher the cross-subsidization level, the more difficult for the DISCOM to implement DSM due to the larger impact on revenue losses as a result of change in consumer mix and restricted cross subsidy surcharge. This exerts strain on the industry in the region to pay higher prices for electricity. The only way to keep the prices lower is through state sponsored subsidies.

#### **4.2 Section 2 – Identifying the Impact of DSM on DISCOMs**

The Electricity Act forms the basis of a regulatory framework for DSM. Model regulations have been issued by Forum of Regulators (FOR) for DSM in India. The main objectives of the DSM activities have been to change the shape of the peak load curve in order to lessen the burden on utilities to provide constant and quality power to all the sectors. Given below are the objectives that the utilities try to achieve via implementation of DSM programs:

- Power shortage mitigation – reducing cost of power outages or load shedding
- Avoided cost of additional infrastructure – Due to the current state of power supply patterns, industries tend to rely on additional power resources as back up in order to avoid losses in production or delay in work. Captive generation using renewables forms one of the objective of DSM
- Higher revenues for improved quality of supply – for Industries to avoid loss of production, labour and delivery failures, for domestic users avoid loss of standard of living, leisure and developmental activities.
- Possibility of reduced cash flow due to change in consumer mix and revenue losses due to restriction on Cross Subsidy surcharge
- Providing boost to future policy framework such as separation of carriage and content
- Additional utilization of existing capacity and thus higher sales
- Reduced highest marginal cost of power

- Effects of Open Access: Open access gives provision to the HT consumers to

In order to gauge advantages of the following objectives, 4 scenarios have been considered. The details of these scenarios have been given in the following tables. The impact of DSM activities was studied by making changes in the consumer mix by changing the percent of three categories viz. industrial, commercial and agriculture. The rationale for modelling the impact of a change in consumer mix is the DISCOMs' perception towards DSM programs. There is a general belief that DSM implementation will lead to reduction in energy consumption by industrial and commercial consumers, leading to a loss in revenue from the HT category consumer whose revenue contribution is higher as compared to the residential and agriculture consumer categories. The model adopted here helps in developing understanding as to how the consumer mix impacts the revenue of the DISCOMs post DSM implementation.

The impact on the revenue has been tracked with the help of a financial model. The data has been taken from MERC order number 48 of 2016.

**Table 2: Scenario Building**

Scenario Building	Change in Consumer Mix	Situation where applicable	Effect
<b>Base Case</b>	No	Without implementing DSM	No
<b>Scenario 1</b>	Share of consumption of Industry and commerce decrease by 1% each and agriculture increase by 1%	General threat perceived by DISCOMs for DSM implementation in power surplus states	Revenue loss of 1485 Cr
<b>Scenario 2</b>	Share of consumption of Industry reduced by 1% and commerce increase by 1% and agriculture remain same.	Achieved through load management through DSM	Revenue gain of 451 Cr.

<b>Scenario 3</b>	Share of consumption of Industry increase by 1% and commerce increase by 1% and agriculture remain same.	State is power deficit and load shedding occurs for industries as well.	Revenue gain of 1110 Cr
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**Source: MP Ensystems Analysis**

**Table 3: Base case**

Consumer type	MERC order consumption	share of sales as per order	Increase or decrease in share (% points)	Target Share %	Target share consumption	ABR (Rs/ Kwh)	Sales Revenue INR
Industry	31998	32.77%	0%	32.77%	31998	8.33	26655
Agriculture	30251	30.98%	0%	30.98%	30251	3.04	9193
Residential	19629	20.10%	0%	20.10%	19629	6.33	12422
Public Work	10733	10.99%	0%	10.99%	10733	5.76	6180
Commercial	5030	5.15%	0%	5.15%	5030	12.95	6516
Sale of Power	97641	100.00%	0%	100%	97641	6.10	60965
Losses	17739	15.37%	0.00%	15.37%	17739		
Total power Purchase	115380				115380		
Change in revenue in Cr Rs							<b>0</b>
Unaccounted power in MU							<b>0</b>

**Source: MP Ensystems Analysis**

*Scenario 1: Share of consumption of Industry and commerce decrease by 1 % each and agriculture increase by 2%. This will result in revenue loss of INR 1485 Cr.*

This scenario is applicable for states with comparatively developed DISCOMs where load shedding for I&C do not take place. In such a case, via the application DSM measures, a reduction of 1% each in industry and commercial category can result into increase in power supply of 2 % for agriculture consumers. As observed in Table no 3 (refer to Annexure I) this change in consumption pattern results in a revenue loss of 1485Cr for the utility. Due to under recovery and cross subsidization supplying power to this highly subsidized category does not stand in favour of the DISCOMs.

*Scenario 2: Share of consumption of Industry reduced by 1% and commerce increased by 1 % and agriculture remains same. This will result in revenue gain of INR 451 Cr.*

There is a huge difference between ABR of industry and commerce category, in this case if through DSM programs a decrease of 1% in industry and an increase of supply of 1% for commerce category, with no change in agriculture category can result in an increase in revenue of INR 451 Cr. The peak demand management is a more feasible option for industrial category consumer and hence load shifting techniques could be applied there more effective than the commercial category as they have a constraint on time of consumption, due to this rigid pattern of consumption, DSM measures for industrial category seems to have work, as the result shows a gain of INR 451 Cr in the revenue.

*Scenario 3: Share of consumption of Industry increased by 1% and commerce increased by 1 % each and agriculture remains same.*

This represents the case where state is power deficit and load shedding occurs for industries as well. DSM for power deficit states could help in filling the gap of power supply to I&C consumers and hence would help in reduction of production losses for these consumers. This will result in revenue gain of INR 1110 Cr

#### **4.3 Section 3 Comparison of Impact with Base Line scenario**

The impact of these scenarios was studied on five key states and one Union Territory. Two parameters viz. ARR and revenue were considered to study the changes of the consumer mix.

The following figures represent the changes in ARR and revenue of various utilities and also state wise changes. Post implementation of DSM, we see an impact on debt reduction for the 5 states and increase in profitability.

Post implementation of DSM, the variation in share of increase in ARR can be observed. Other factors such as per capita consumption, population, consumer mix and computation methods for CSS and additional surcharge across the states varies, huge variation can be observed among the DISCOMs. The variation depends upon the share of sales and revenues from different categories of consumers. As a thumb rule, it can be said that the more the cross subsidization in the state, the more will be the increase in revenues through DSM implementation.

- As observed in Figure 17, there is an increase in revenue as a result of DSM, the minimum percentage increase in ARR is 1.73% and maximum rise is seen to be 3.16%. For all the utilities of the 5 states considered, there is at least 1% rise in ARR. A maximum rise of 3871 INR can be seen in case of increase in revenue which is an increment of 2.31%.
- In the state wise scenario, maximum percentage increase in ARR is observed for Maharashtra that is a rise of 3.16% whereas the least is for Gujarat which is 1.82%. In terms of absolute figures for increase in revenue, Andhra Pradesh has INR 6067 Cr which is the highest and Gujarat has INR 509 Cr as can be seen from Figure no.20.
- It can also be observed from Source: [MP Ensystems Analysis](#)
- 
- Figure 18, that though for some states the % increase could be more but the absolute change in the revenue is less, as seen from the figure, Andhra Pradesh shows an increase 2.24% which is an increase of INR 6067 Cr whereas for Bihar an increase of 2.48% shows only a rise of INR 2151 Cr. These changes also depend on various other parameters such as consumer mix, population, and also on the current status of the utilities of the states.
- Financial parameters: Changes can be seen for all states except UP, where the share of debt reduction has been more than 10%. While the increase in profit with subsidy can be seen to be exceeding 100% for the states/UT of Gujarat, Haryana and Pondicherry,

for the rest the figures are comparatively low. Table no. 6 given above sums up values for all the financial parameters taken into consideration for the 5 states and one UT.

- As seen from Figure 19, for the state of Haryana, although the increase in profitability is 115% the reduction in debt is only 1%. This can be attributed to various other reasons such as high AT&C losses, low billing/collection efficiency, cost coverage ratio, etc.

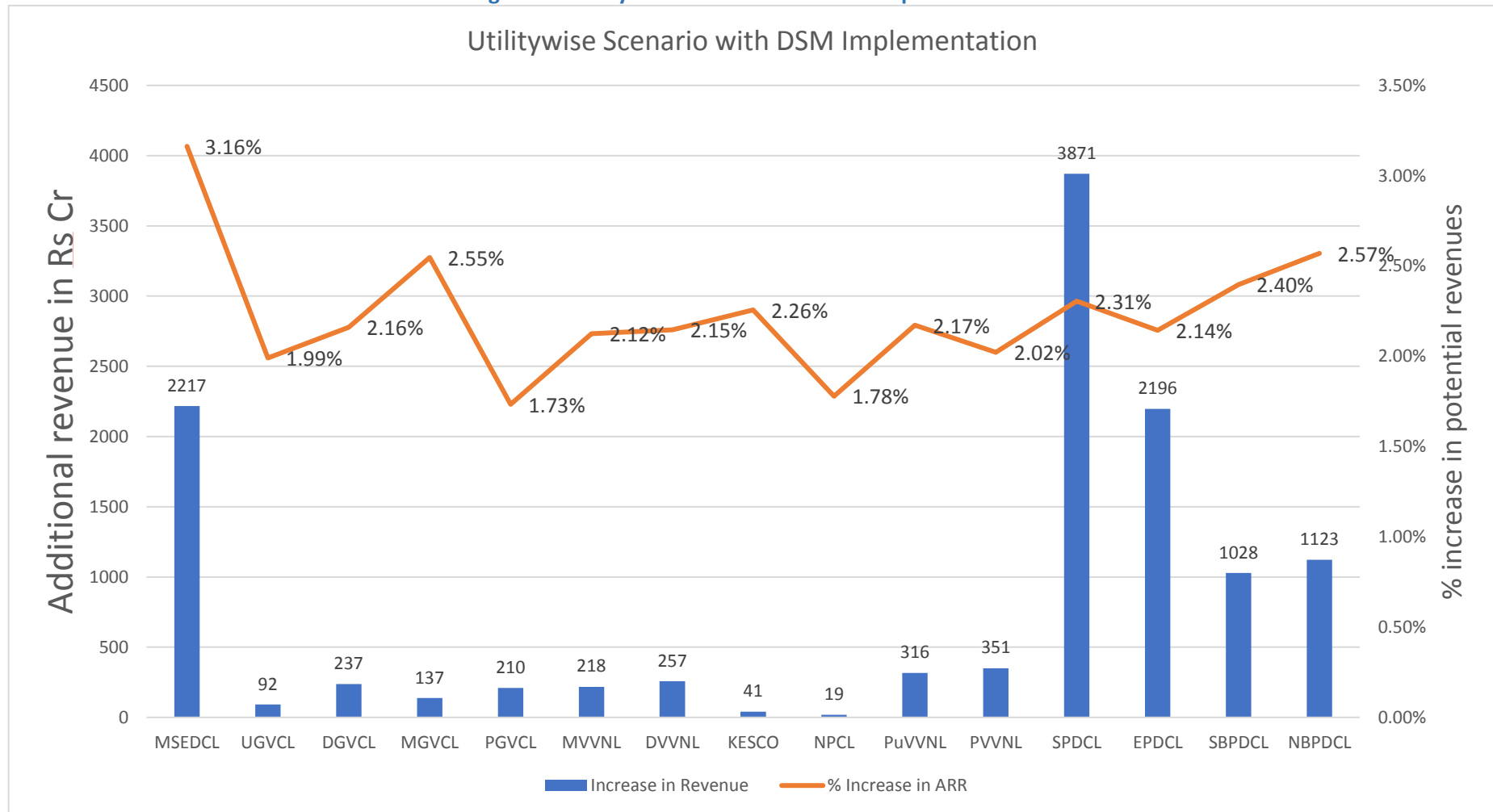
**Table 4: Changes in financial parameters post DSM implementation**

State	Increase in Profit with subsidy	Debt reduction in one year	Profit with subsidy	Debt	Increase in revenues
<b>Andhra Pradesh</b>	79%	16%	-2780	13837	2196
<b>Gujarat</b>	164%	23%	311	2186	509
<b>Haryana</b>	115%	1%	-387	34085	447
<b>Maharashtra</b>	86%	13%	-2568	17021	2217
<b>Pondicherry</b>	145%		-19	0	27
<b>Uttar Pradesh</b>	7%	2%	-17696	56982	1202

**Source: MP Ensystems Analysis**

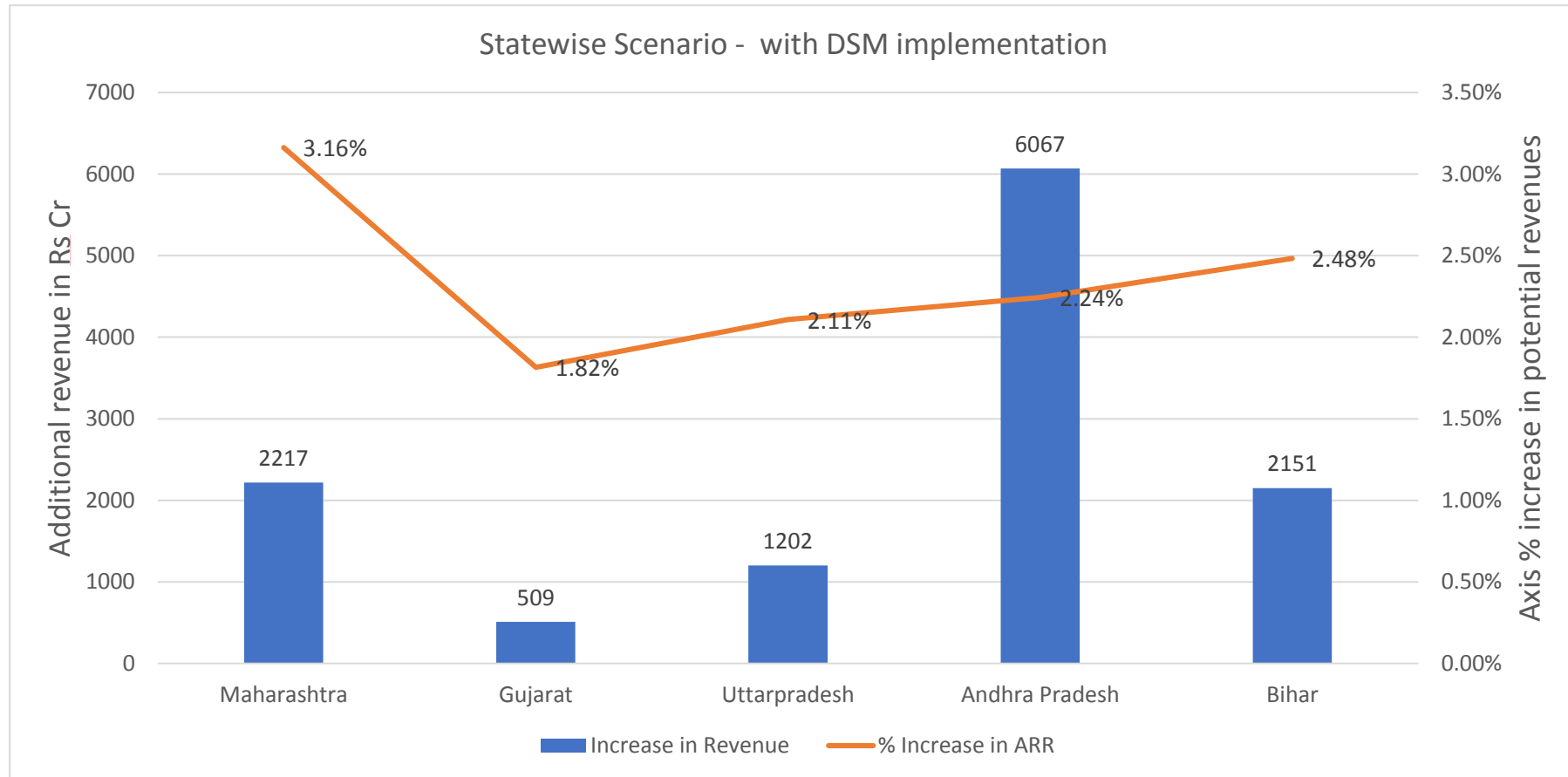
As it can be seen in Figure 20, the increase in revenues for our sample size is at 2.57% more due to DSM implementation which increased the consumption of electricity for industrial and commercial consumers by 1% each.

Figure 17 Utility wise Scenario with DSM Implementation



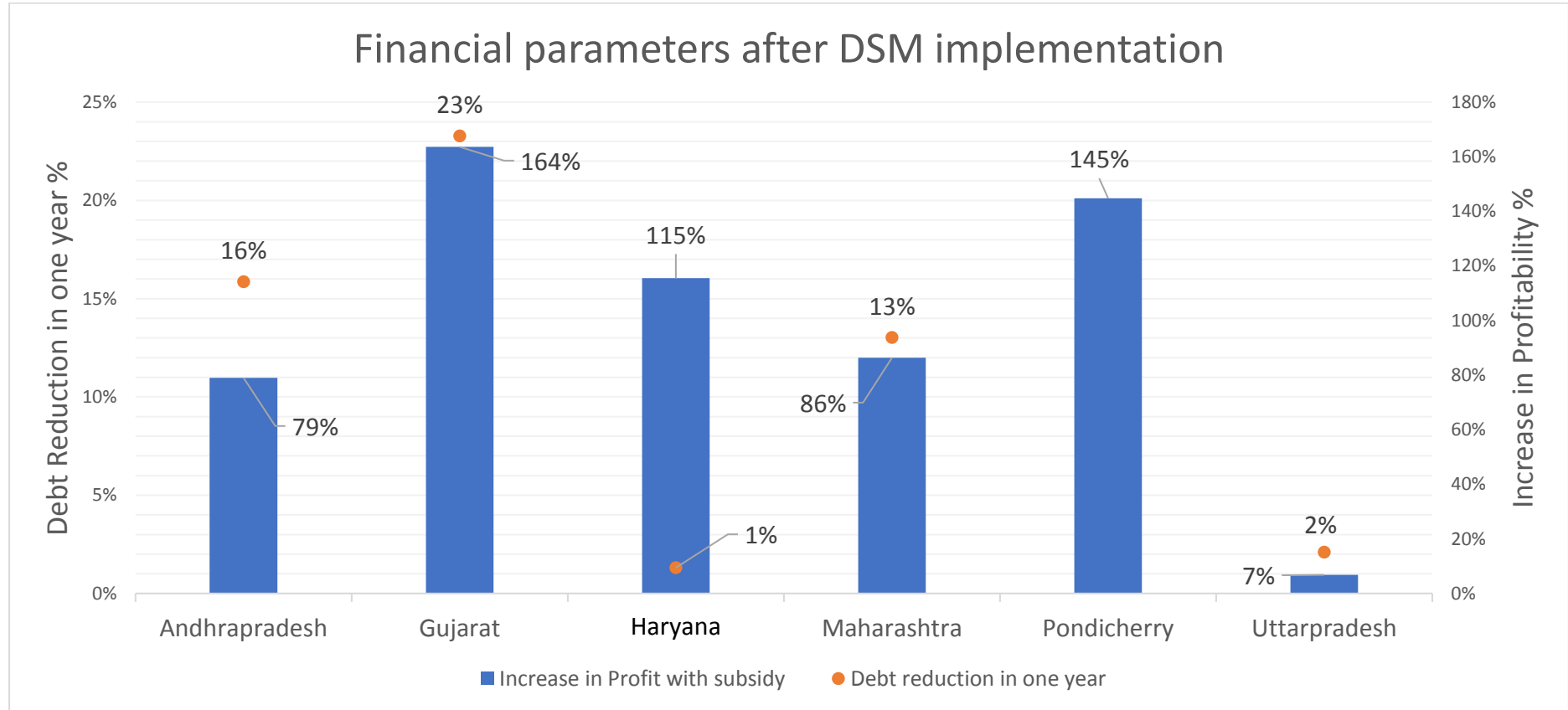
Source: MP Ensystems Analysis

Figure 18 State wise Scenario - with DSM implementation



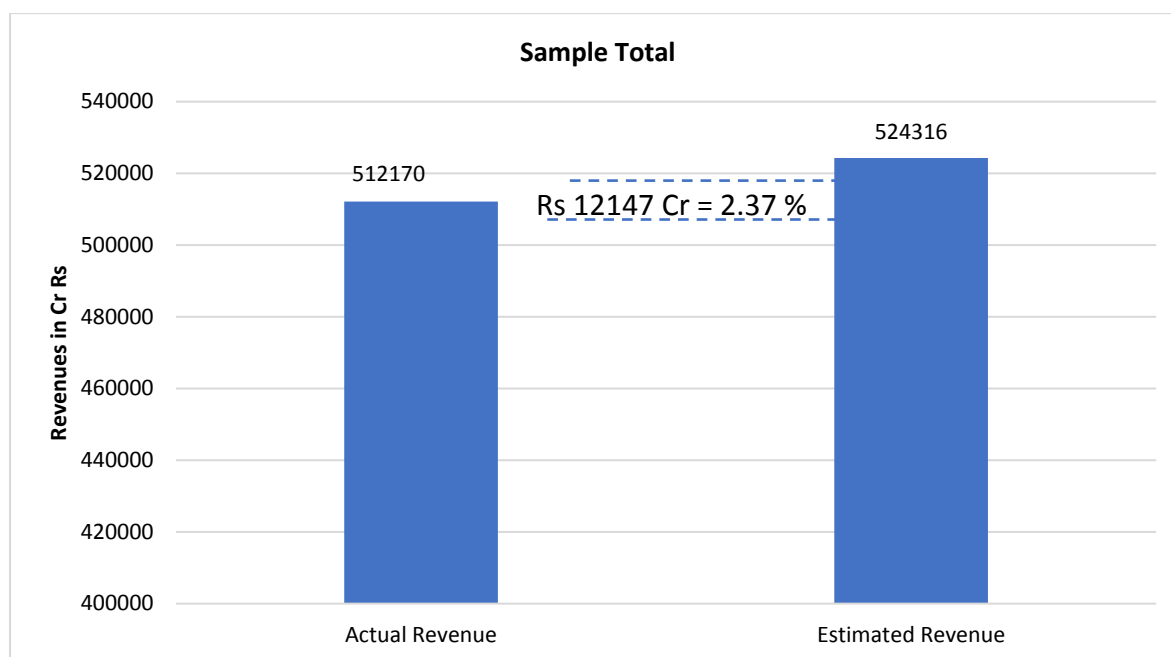
Source: MP Ensystems Analysis

Figure 19 Financial parameters after DSM implementation



Source: MP Ensystems Analysis

**Figure 20 DSM Impact on Revenues for Sample**



**Source: MP Ensystems Analysis**

## 5. OBSERVATIONS

Type of Analysis	Observations
<b>Section 1 – Baseline Scenario</b>	
<b>Financial Status of DISCOMs</b>	<ul style="list-style-type: none"> <li>Overall loss in revenue of DISCOM due to under recovery from agriculture consumers and high levels of technical losses</li> <li>DISCOMs are under vicious cycle of under recovery and increasing debt</li> </ul>
<b>Impact of Restructuring through UDAY</b>	<ul style="list-style-type: none"> <li>Overall efforts to reduced AT&amp;C losses in states to meet 15% target under the scheme of UDAY. There is incremental but sluggish progress.</li> <li>Reduced burden of debt and interest cost on DISCOMs. Still the burden is making Distribution business unsustainable without direct bail out from government.</li> <li>Rise in cross subsidization level as a result of state subsidy</li> <li>Decrease in ARR and ACoS gap</li> </ul>
<b>Section 2 – Impact of End Use Efficiency on DISCOM Finances</b>	
<b>Power Outages</b>	<ul style="list-style-type: none"> <li>DSM effects Reduction on cost of power backup arrangement / captive generation.</li> <li>Hampered production as a result of unavailability / poor quality of power supply. This provides opportunity to pay more for reliable service.</li> <li>Loss of assured potential revenue due to load shedding protocols in Industrial areas in power deficit states.</li> </ul>
<b>Reduced need for Captive Generation</b>	<ul style="list-style-type: none"> <li>Reduction in investment of captive generation due increased reliability of supply</li> <li>Increased revenue for DISCOM in the absence of captive generation. Positive impact on revenue due to re-gaining revenue lost to captive generation</li> </ul>

	<ul style="list-style-type: none"> <li>Increased cross subsidization for agriculture.</li> </ul>
<b>Increase in Industrial and Commercial consumer base</b>	<ul style="list-style-type: none"> <li>DSM measures result in overall increase in the subsidizing category consumers i.e. industrial and commercial (as observed a rise of 1% for both categories in this exercise) which would lead to revenue gain for the DISCOM</li> <li>Surplus power could be supplied to subsidized category consumers – agriculture and residential- with power saving through DSM initiatives.</li> </ul>
<b>Changes in consumer mix</b>	<ul style="list-style-type: none"> <li>Marginal increment in subsidized category – Industry and Commerce</li> <li>Adequacy of power supply to subsidizing category- mainly agriculture.</li> </ul>
<b>Avoided cost of deferred capacity</b>	<ul style="list-style-type: none"> <li>Approx. 10 % saving – both on energy and finance- as an impact of end-use efficiency measure.</li> <li>Reduction in T&amp;D losses for overall state due to complying with DSM measures.</li> <li>- E.g. Replacement of agricultural pump sets with energy efficient pump sets (a case of Haryana) resulted in approx. 10% power saving and 13% saving on finance.</li> </ul>
<b>Reduction in Losses</b>	<ul style="list-style-type: none"> <li>Reduction in AT&amp;C losses due to improved quality of power</li> <li>T&amp;D losses decrease as improved quality of end use equipment as a part of DSM measure.</li> </ul>
<b>Section 3 – Comparison with Baseline for Quantification of Impact</b>	
<b>Estimated Financial Gains</b>	<ul style="list-style-type: none"> <li>Resultant increment in revenue</li> <li>- The overall estimated gain for the sample (5 states and 1 union territory) in absolute figure is INR 12147 Cr, which implies a percentage increase of 2.37%.</li> </ul>

Source: MP Ensystems Analysis

## 6. CONCLUSION

It is a well-established fact that DISCOMs are under severe financial stress. There are many schemes and programmes run by state and central government to target the factors responsible for the current status of DISCOMs. DISCOMs too are putting in efforts to improve the situation through improvement in energy accounting. However, one major channel of revenue generation left behind in the process of developing infrastructure and providing access to remote areas- demand side management.

The paper shows a direct and strong relationship between implementation of DSM programmes and improvement in financial performance of DISCOMs through increase in revenues and reduction of losses. This improvement would be more evident in states with a deficit of power and which practice load shedding in the industrial areas. The improvement will also be more in states where DISCOMs rely more on short term power purchase planning, through peak clipping. Further, our analysis shows that DSM implementation also improves access to energy, bringing in new consumers in the system which would improve the collection efficiency and thus eventually improve the DISCOM's financial condition. DSM can also reduce the investment required for infrastructure pertaining to energy accounting, with better distribution efficiency per unit of capacity addition. Overall we find that well planned DSM implementation can improve the financial situation of DISCOMs drastically over a period of few years.

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## ANNEXURE – I

Table 5: Scenario 1

Consumer type	MERC consumption	order share of sales as per order	Increase or decrease share points)	Target Share %	Target consumption	share ABR (Rs/Kwh)	Sales Revenue INR
Industry	31998	32.77%	-1%	31.77%	31022	8.33	25841
Agriculture	30251	30.98%	2%	32.98%	32204	3.04	9786
Residential	19629	20.10%	0%	20.10%	19629	6.33	12422
Public Work	10733	10.99%	0%	10.99%	10733	5.76	6180
Commercial	5030	5.15%	-1%	4.15%	4054	12.95	5251
Sale of Power	97641	100.00%	0%	100%	97641	6.10	59481
Losses	17739	15.37%	0.00%	15.37%	17739		
-	115380				115380		
Change in revenue in Cr Rs							<b>-1485</b>
Unaccounted power in MU							<b>-2434</b>

Source: MP Ensystems Analysis

**Table 6: Scenario 2**

Consumer type	MERC order consumption	Share of sales as per order	Increase or decrease in share (%) points)	Target Share %	Target share consumption	ABR (Rs/Kwh)	Sales Revenue INR
Industry	31998	32.77%	-1%	31.77%	31022	8.33	25841
Agriculture	30251	30.98%	0%	30.98%	30251	3.04	9193
Residential	19629	20.10%	0%	20.10%	19629	6.33	12422
Public Work	10733	10.99%	0%	10.99%	10733	5.76	6180
Commercial	5030	5.15%	1%	6.15%	6007	12.95	7781
Sale of Power	97641	100.00%	0%	100%	97641	6.10	61417
Losses	17739	15.37%	0.00%	15.37%	17739		
Total power Purchase	115380				115380		
Change in revenue in Cr Rs							<b>451</b>
Unaccounted power in MU							<b>740</b>

Table 7: Scenario 3

Consumer type	MERC order consumption	share of sales as per order	Increase or decrease in share (% points)	Target Share %	Target share consumption	ABR (Rs/Kwh)	Sales Revenue INR
Industry	31998	32.77%	1%	33.77%	32974	8.33	27468
Agriculture	30251	30.98%	1%	31.98%	31227	3.04	9489
Residential	19629	20.10%	0%	20.10%	19629	6.33	12422
Public Work	10733	10.99%	0%	10.99%	10733	5.76	6180
Commercial	5030	5.15%	0%	5.15%	5030	12.95	6516
Sale of Power	97641	100.00%	2%	102%	99594	6.10	62076
Losses	17739	15.37%	-1.69%	13.68%	15786		
Total power Purchase	115380				115380		
Change in revenue in Cr Rs							<b>1110</b>
Unaccounted power in MU							<b>1820</b>

Source: MP Ensystems Analysis

**R-APDRP**

In 2002, under the Accelerated Power Development and Reform Program, the government provided assistance of 50% (25% loan and 25% grants) up to 100% in special states (90% grants and 10% loans) to State Electricity Boards (SEBs) to renovate and modernize old power plants and upgrade other evacuation infrastructure. However, this assistance hinged on the progress made by states to create State Electricity Regulatory Commissions (SERCs), complete 100% metering and create separate distribution circles to consolidate the system. Each distribution circle was to be well defined and was expected to operate to provide good quality electricity, reduce losses, theft and improve customer satisfaction.

However, in spite of the assistance provided by the government, most DISCOMs struggled to make the necessary changes to augment their operations and a one-time settlement scheme was designed, where:

- a) 60% of the interest on the delayed payments to be paid was waived off.
- b) Remaining 40% of the interest and principal were converted into tax free – bonds, with a loan period of 15 years and moratorium period of 5 years.

The results of the assistance package were far from satisfactory. Although certain DISCOMs achieved 100% metering, revenue collection had dropped with a lower than expected AT&C loss drop.

There were several limitations in the implementation of the program that ranged from procedural delays, over-ambitious targets to lack of review mechanisms resulting in the implementation of sub-standard work. The positive outcome was many DISCOMs initiated procedures to improve their operations.

Later on, in 2008, APDRP was restructured and renamed Restructured Accelerated Power Development and Reforms Program. The scheme was approved with a budget of INR 51,577 Cr for improving and integrating IT into the distribution sector. The scheme was focused on urban areas with populations over 30,000 (10,000 in special states).

The scheme had two focus areas

- IT integration for energy accounting

- Consumer services.

Part A: The Government provided 100% of the project cost as a loan; which could be converted into a grant, provided the IT systems were implemented and functioning within 3 years of commissioning the project.

Part B: Focus on upgrading the distribution infrastructure. The Government provided 25% of the initial cost as a loan (90% for special states). If DISCOMs were able to reduce their AT&C losses to 15% for 5 consecutive years and complete infrastructure projects on time, 50% of the loan could be converted as a grant.

As of December 2014, projects in 1,412 towns worth INR 39,252 Cr have been commissioned.

Although R-APDRP attempted to overcome the shortcomings of the earlier APDRP, it floundered as well, particularly schemes under Part A. The IT system work was outsourced to service firms, which led to issues of monitoring and lack of ownership and the lack of IT knowledge amongst DISCOM employees compounded the failure. As a result, most loans provided to states remained as loans, adding to the financial burden.

No amount of intervention or reform had helped DISCOMs substantially improve their financial prospects, so in March 2012 the government prepared a new bailout package. The bailout package was organized to offset a cumulative loss of INR 1.9 trillion, which crippled the ability of DISCOMs to finance their services.

The bailout package has the following suggestions outlined:

- a) State Governments take over 50% of the outstanding short-term liabilities (STL) (as on March 31, 2012) and convert them into bonds, which the utilities can issue to lenders. The maturity period for those bonds is 15 years with a moratorium period of 3 to 5 years on the principal amount.
- b) The other 50% would be converted into loans to be repaid by DISCOMs. The loan tenure will be scheduled on a case by case basis and will have a moratorium period of 3 years.
- c) The central government would provide a grant equal to the value of energy saved by reducing AT&C loss beyond the losses specified by R-APDRP. Furthermore, 25% of principal repayment support would be given towards state governments that take over the entire 50%

of liabilities. However, the support given by the government was dependent on several criteria, such as:

- 1) Elimination of gap between ACOS and ARR within 3-5 years.
- 2) No short term borrowing from banks to finance deficits.
- 3) By March 2013, all large and government consumers should have meters installed, with timelines prepared for meters installed for other consumers.
- 4) Tariff orders to be approved by April 30 of the subsequent year.
- 5) Accounts to be audited and subsidy for agriculture to be released based on transformer data.
- 6) A state level monitoring committee should be established.

As on December 2014, bonds worth INR 56,908 Cr have been issued by DISCOMs and STL worth INR 51,204 Cr have been absorbed by the states.

This FRP scheme was not as big a success as anticipated, since DISCOMs weren't able to comply with mandatory guidelines set by the government. Most states weren't able to absorb the DISCOMs debt as expected and in addition, coal prices increased and due to political pressure (election time), DISCOMs weren't allowed to increase the tariffs, hence they were forced to buy expensive power and sell it cheaply.

Notwithstanding the introduction of various reforms at different intervals to consolidate the electricity sector, there was no respite from the increasing debt and burden that plagued the distribution sector.

Various impeding factors such as curtailed fuel sources, fluctuating fuel prices, faulty pricing mechanisms, poor management techniques, political influence, poor infrastructure, increase in capital expenditure amongst others have pushed DISCOMs further into the abyss of financial instability.

## **IPDS**

The Integrated Power Development Scheme (IPDS) was an initiative by the Ministry of Power (MOP) for the urban power distribution sector. This scheme aimed at: 1) strengthening of sub-transmission and distribution network, 2) metering of distribution

transformers/feeders/consumers 3) IT enablement of distribution sector and strengthening of distribution network under R-APDRP (which was subsumed under IPDS). The estimated outlay of IPDS was INR 32,612 Cr, in addition to outlay of INR 44,011 Cr of R-APDRP carried forward to IPDS. All states and private DISCOMs are eligible to get financial assistance under this scheme. The nodal agency for this scheme is Power Finance Corporation (PFC). The projects undertaken this scheme need to be completed within 24 months.

## UDAY

Ujjwal DISCOM Assurance Yojna (UDAY) is an initiative launched by the Ministry of Power in 2015. The aim of this initiative is financial turnaround of state owned DISCOMs which are dealing with financial instability. Under this scheme, the state government would take over 75% of the state DISCOMs debt as of 30<sup>th</sup> September 2015 and will issue bonds for the remaining 25%. So far, 28 states and 1 UT have signed the MoU with the Central Government (UDAY website). This scheme targets bringing the AT&C losses down to 15% and get the ACoS-ARR gap to zero by the end of this scheme by 2018-19. Due to the highly subsidized rates for agricultural and domestic (in some regions) category consumers, the DISCOMs face the issue of under recovery and hence the Average Cost of Supply (ACoS) is not covered by them. This makes it difficult for utilities to procure power in future or to pay existing purchase power cost, therefore reduction of the gap between ACOS and ARR becomes mandatory in order to safeguard the financial health of the DISCOMs

In return the participating utilities have to meet certain operational and financial targets set by the government as part of this scheme. The targets to improve operational efficiencies are as follows:

1. Compulsory feeder and distribution transformer (DT) metering by states.
2. Consumer indexing and GIS mapping of losses.
3. Upgrade or change of transformers, meters, etc.
4. Smart meter installations for all consumers having monthly consumption more than 200 units.
5. Demand Side Management (DSM) programs such as installing energy efficient LED bulbs, agricultural pumps, fans and air conditioners. Efficient industrial equipment to be installed as a part of the Perform Achieve Trade (PAT) scheme.
6. Quarterly tariff revision to offset fuel price increase to be permitted

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7. Check on power theft, assure increased power supply in areas where the AT&C losses are reduced.

The scheme had the following provisions:

- a) States to take over 75% of DISCOMs debt as on 30<sup>th</sup> September 2015 over two years: with 50% of debt in 2015-16 and 25% in 2016-17.
- b) This debt will not be included in the estimation of state fiscal deficit by the central government.
- c) States will issue non-SLR and SDL bonds to banks and other financial institutions holding the debt.
- d) The remaining 25% of the debt shall be converted into loans or bonds by banks and shall be charged at base lending rate plus 0.1%
- e) No prepayment charge to be levied on the debt by banks, which shall also waive of any applicable penal charges.
- f) States should take over future losses of DISCOMs without any support from FRBM act. as per trajectory in a graded manner. [0% of loss of 14-15 & 15-16; 5% of 16-17; 10% of 17-18; 25% of 18-19 & 50% of 2019-20] Balance losses to be financed through State bonds or DISCOMS bonds backed by State Govt guarantee, to the extent of loss trajectory finalised with MoP.
- g) The central and state government should work together to reduce the cost of power.
- h) Compulsory metering of feeder and distribution transformer by Jun 30<sup>th</sup> 2016 and June 30<sup>th</sup> 2017.
- i) Smart metering for all consumers using above 500 units per month by December 2017 and consumers in the 200 to 500 units bracket shall have meters installed by December 2019.
- j) Undertake DSM measure by March 31, 2019.

UDAY is optional for states. If states do accept UDAY and achieve certain targets, they shall receive support and funding through Deendayal Upadhyaya Gram Jyoti Yojana (DDUGJY), Integrated Power Development Scheme (IPDS), Power Sector Development Fund (PSDF) or any other scheme. In addition, the states shall also be given coal at notified prices and low-cost power in high capacity utilization scenarios by thermal power plants.

The impact of UDAY on the financial parameters of five states/UT has been discussed in the following sections.

### **Deen Dayal Upadhyay Gram Jyoti Yojana (DDUGJY)**

The objectives of this scheme are: feeder segregation (separate line for farmers) for continuous power supply and strengthening sub T&D in rural areas. The outlay of the scheme is INR 70.56 Cr, whereas the sanctioned amount is INR 68.67 Cr. USD. This scheme aims to achieve the target of 8 hours of quality power supply to farmers and 24-hour supply to households.

### **Push to Renewables**

A major target is to increase the share of renewables, 100 GW of solar and 60 GW of wind energy.

- Solar projects 20,900 MW tendered
- Green Energy Corridors of \$ 5.6 billion envisaged for transmission of renewable energy
- 33 Solar parks in 20 states are envisaged

### **24x7 Power for All (PFA) by 2019**

Aims to provide uninterrupted power supply, enhance operational efficiency and envisage building generation, transmission and distribution capacities. The 1694 villages are targeted to be electrified post 2019 (Power Minister R K Singh). This scheme targets to reduce the transmission and distribution (T&D) losses of power from the current 21% to 15% by January 2019.

**FRBM Act**

Given the decrepit state of finances in India, the FRBM act was introduced; with an aim of improving finances across India. The Act was passed by the Parliament of India in August 26<sup>th</sup> 2003. The main objectives of the Act are:

1. To introduce transparent fiscal management systems in the country
2. To introduce a more equitable and manageable distribution of the country's debts over the years
3. To aim for fiscal stability in the long run

The fiscal targets set under this Act was to progressively reduce the fiscal deficit of both central and state governments to 3% of GDP, while bring the revenue deficit to zero, by March 2009 along with bringing down the total debt to 9% of the GDP. The minimum annual reduction for revenue deficit and fiscal deficit was 0.5% and 0.3% of the GDP respectively.

The targets were considered based on two factors:

Forecast trend of household savings

Target for reducing the stock of outstanding government liabilities to 50% of GDP within 10 years.

The Act is non-governmental dependent; (i.e.) future governments irrespective of political agenda are bound to the aims of the Act.

The regulations also intended to impart fiscal discipline at state level and the finance commission gave incentives (like conditional debt restructuring) to state governments for the introduction of FRLs for their respective regions.

In the Union Budget of 2016-17, the Finance Minister called for the formation of a committee to review the relevance of FRBM Act to the current financial situation.

The committee was formed in May 2016, led by Mr. N.K. Singh amongst other prominent members. The committee is expected to review the existing FRBM Act, past outcomes, standards and practices in other countries and recommend a suitable framework and

timeline. In addition, the committee also had to review certain financial recommendations from other commissions as well.

The conclusions made by the committee are:

- 1) Achieve a Debt to GDP ceiling limit ratio to 60% by FY 23 (Threshold limit: 40% for center and 20% for state)
- 2) Gradual reduction of fiscal deficit to 2.5% of GDP (from 3.5% FY 2016-17) and revenue deficit of 0.8% (from 2.3% from FY 2016-17) by FY 23.
- 3) Create a new fiscal council and replace the existing FRBM Act with a new Debt and Fiscal Responsibility Act.
- 4) The fiscal council will prepare multi-year forecasts for the central and state governments. In addition, it will also independently review the performance of central government and its compliance to targets.
- 5) In case of natural calamities or other unforeseen circumstances, a deviation of 0.5% from the timeline is allowed.

The Act prohibits borrowing by the government from RBI or other sources to reduce the deficit.

The government is mandated to present three policy statements to the parliament namely:

- a) Medium Term fiscal policy: 3 year rolling targets for fiscal indicators (given below)
- b) Fiscal policy strategy: statements on government policies regarding taxes, expenditure, borrowing and on other activities that may affect the union budget
- c) Macroeconomic Framework Policy: Implications of the union budget on the larger economy.

Under the medium term fiscal policy statement, the ministry should specific the following estimates:

- Revenue deficit as a percentage of GDP
- Fiscal deficit as a percentage of GDP
- Tax revenue as a percentage of GDP

- Outstanding liabilities as a percentage of GDP

In addition, the government is obligated to reform the accounting system implemented and should disclose information on revenues, assets and other information.

The Finance ministry shall review the performance of relevant bodies, take appropriate counter measures and present their report to the parliament with substantial explanations, if any deviations from the regulations were made.

On implementation, the fiscal deficit targets for both center and state were achieved by 2007-08, a year ahead of its expected timeline. In the case of revenue deficit, it was at 1.1% of GDP; however, other experts viewed the values to be under reported and far from reality. CAG in particular, felt that the deficit estimates were not computed as per the FRBM Act and thus add to the veracity of the reported values.

Nevertheless, due high GDP growth, increase in tax revenues through VAT adoption in states and low interest charges on loans, state governments were able to improve their financial standing.

With the onset of global financial crisis in 2008-09, the Finance ministry sought to temporarily abstain from the FRBM Act; which was duly granted.

In 2012, the Finance ministry proposed several amendments to the FRBM act, that included pushing target deadlines from 2009 to 2015 and introducing a new fiscal indicator effective revenue deficit. Effective Revenue Deficit (ERD) is the difference between revenue deficit and -grants for creating new assets. The target for ERD reduction was set at 0.8% of GDP per year. In addition, the government should furnish 3 year rolling target for expenditure indicators. Also, the Government of India may trust CAG to review the implementation of the legislation. However, the finance ministry postponed the deadlines for meeting the targets from 2015 to 2018, as proposed in Finance Act of 2015.



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