TRENDS OF DISTRIBUTION LOSSES OF ELECTRICITY COMPANIES IN ODISHA: AN EMPIRICAL STUDY

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Abstract:

Power sector reformation in India started in 1996. Odisha was the first state to start reformation in power sector. The government of Odisha allowed the private players to work in transmission and distribution of electricity within the state but it keeps power generation under its own control. For the generation of power the government establish two different companies. Odisha Thermal Power Corporation take care the thermal power generation whereas Odisha Hydro Power Corporation engaged in hydro power generation. In 1990's state run electricity board (OSEB) incur huge loss as regards to Transmission and Distribution Loss(T and D loss) and Aggregate Technical & Commercial Loss(AT&C Loss). In order to improve the efficiency and minimise the loss the entire state divided into four segments and different private players are allowed to operate in the T&D of electricity. The present study is undertaken to find out the trends of distribution losses and performance of private players in this sector.

Keywords: *Power Sector,*
Thermal power,
Hydro power,
Nuclear power,
Renewable energy,
T&D Loss

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INTRODUCTION:

India is the major player in the electricity generation and consumption. It ranked third position in the world. Thus over the period in this sector immense changes had taken place. Till 31st December 2019 the installed grid capacity is around 368.79 GW, this comprising hydro, thermal and renewable energy. As on 31st July 2019 out of the total power generation of 360,456.37 MW, Hydro electricity constitute 12.6%, Thermal 63%, Nuclear 2%, other renewable 22.4%. India achieved milestone in generation but lacks adequate infrastructure for distribution. In order to fulfil the objective for uninterrupted power supply and minimize the distribution loss, government of India has taken initiative to provide fund to different state to develop power distribution infrastructure in order to minimize the transmission and distribution loss. This paper considers the trends of distribution loss in Odisha after reformation in power sector where the private players play an important role in distribution of electricity. As the transmission and distribution loss has a direct impact on the cost of electricity, this paper keeps its socio economic objective to reflect the trends of electricity cost and loss over the period. The prime objective in the restructure in power sector controlled by the Central and State government is to minimize extremely high distribution loss.

POWER SECTOR IN INDIA:

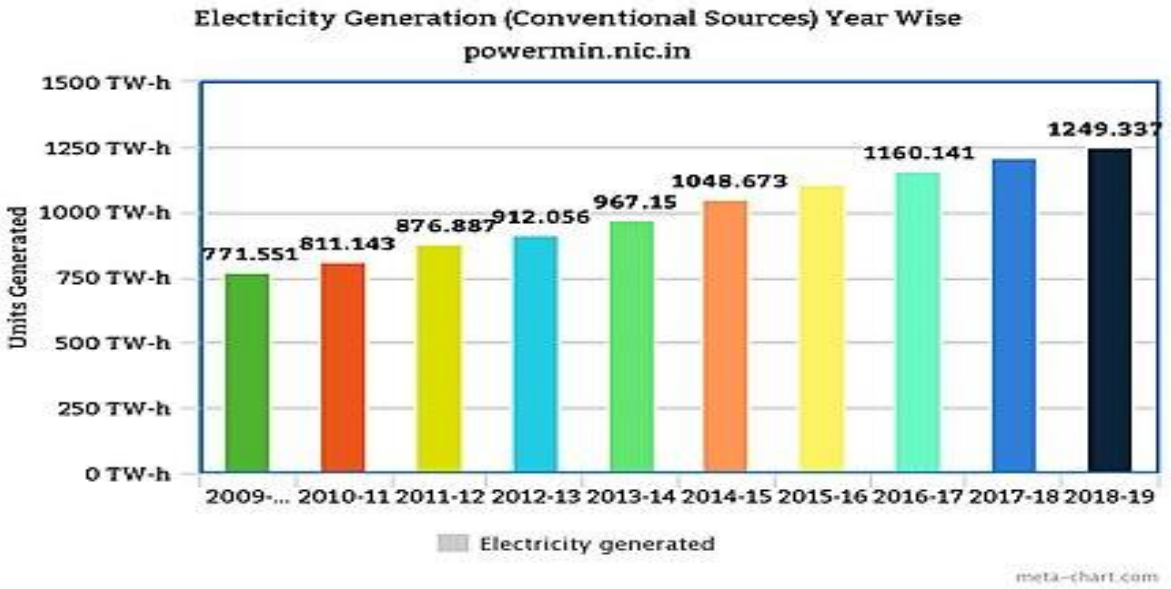
The present power sector in India is under the regulation of Electricity Act,2003. The average electricity use in 2018-2019 is 1,181 kwh per capita. The electricity coverage is 99.7 % in 9 January 2019, out of this share of private sector in generation is 46%. The industrial consumption in 2018-2019 is 41.16%. The traction consumption in 2018-2019 is 1.52% and share of renewable energy is 17.3%. The trends of power generation over the last decade show an increasing trend.

TABLE 1- ELECTRICITY GENERATION

YEAR	ELECTRICITY GENERATION(TW-H)
2009-10	771.551
2010-11	811.143
2011-12	876.887
2012-13	912.056
2013-14	967.150
2014-15	1048.673
2015-16	1080.009
2016-17	1160.141
2017-18	1201.456
2018-19	1249.337

Sources: Powermin.nic.in

Figure- 1



Sources: Powermin.nic.in

Table-1 and Figure- 1 shows an increasing trend in electricity generation. In 2009 electricity generated 750 TW-h units and gradually it is increasing to 1250 TW-h units in 2019. India has adequate power generation capacity however it has poor distribution infrastructure. The government of India has launched a program called “Power For All” in 2016 where it covers 99.7% of the total populations.

REVIEW OF LITERATURE

Over the period a large number of literatures were developed in order to address the power distribution loss. Some of the important related literatures includes the following.

Parameswaran (1990) says that even during the energy deficiency till 1983, the state of Kerala was capable to export electricity to other states. For two decades from 1962 only profit making had been the prime motto through abundant hydro-power/ export of energy for the Kerala State Electricity Board. This deterred the board from thinking about thermal power. Today the state depends entirely on the hydro-system for its electricity needs. However, realistic hydro-energy estimates fall for short of the projected electricity demand.

Partha, Pratim, Mibca (1996) wrote in issues and challenges in Power Sector in India. They examined the various facilities and place them in perspective physical and financial achievements in the power sector and highlights the major issues which are presently

engaging attention of policy makers in this sector. They also tried to prioritize the challenges so that various impediments could be overcome as early as possible.

The Government of India reports in the Ninth Five Year Plan (1997-2002) that "the major cause of the problems being faced in the power sector is the arbitrary and unremunerative tariff structure". The state governments not only desire to provide power at concessional rates to certain sectors, especially to agriculture without subsidizing SEBs for the issues arising out of it but also constantly interfere in tariff setting, even though the tariff is fixed and realized by SEBs.

Anthonethe, Narasimha Murthy, Amuly, Reddy (1999) viewed that the Indian Power Sector was opened kept for private participation in 1991 to hasten the increase in generating capacity and to improve the system efficiency as well. Several plants are under construction. Till early 1999, generation had commenced at private plants totally less than 2,000 MW, in contrast some state undertaking had completed their projects even earlier than scheduled. The authors observed that Independent Power Producers (IPP) claim that their progress has been hindered by problems such as litigation financial arrangements, and obtaining clearness and fuel supply agreements. On other hand the state electricity boards have been burdened by Power Purchases Agreements (PPA) that favour the IPP's with such a clauses as availability payment irrespective of plants utilization, tariffs reflecting, high capital costs and returns on equally etc. They also explained the process of inviting private participation in power sector the problems experienced and suggested on the restructuring of the power sector including the formation of Central and State Electricity Regulation Commission. But still, some important problems have not been addressed. Improving the generation capacity without corresponding improvement of the transmission and distribution facilities likely to further undermine system efficiency. They have also opined that the most important investment in infrastructures has been the state's responsibility because the intrinsically long gestation coupled with the relatively low rates from serving the needs of all categories of consumers have rendered such projects commercially under-editable.

Abey George (2000) has observed that the States have been looking for options to meet the demand for power from non-hydro sources such as coal, diesel etc. The statistics indicate the growing shift towards non-hydro options. However, the search for non-hydro options is not going to be very smooth, on the following grounds. The coal bearing regions being situated far from the state, it may not be economically viable to operate coal-based systems. It is not easy to find out locations for coal based power stations anywhere near the sensitive coastline or with in the densely populated midlands. Per unit high cost of power production not the

case of any option other them hydro including diesel and naphtha made it less attractive. However the state has decided to go in for non-hydro option. By 2002 AD, as much as 50% of the states electricity needs would be met from nonhydro sources. This is an outline of the pattern of electricity generation in Kerala, and the proposed plan for the future. It is at this present contest of deleting priority given to hydropower, that are needed to evaluate the history, potential and the future of SHP's in Kerala.

John Byrne YU-MI Mun (2001) explained that electricity was first introduced in the 1880s in the United States and Europe, its use expanded dramatically throughout the world, transforming almost every aspect of daily life. It is now essential to the operation of most modern technological systems, and, for this reason, has attained the status of a 'metatechnology'. The inner logic of this metatechnology has shaped contemporary development patterns – grid expansion and urbanisation are nearly synonymous; national and local politics – progrowth and pro-electrification coalitions significantly overlap; social values, culture and identity – to be modern is to be electrified; and community life – our connection to one another (in industrial countries especially is often electrical (telephone, television, e-mail). It is not surprising, therefore, that electricity supply is often viewed as an essential public good in contemporary society.

Yasushi Suzuki (2002) made an attempt to throw light on indigenous structure as well as foreign aid policy towards India's electricity power development in this light of the outputs of rent seeking process in India. It is concluded that Japan's official development Assistance should be carefully monitored taking into consideration the impact output relationship in the unique rent seeking process in India which is characterized by the political power among the dominant proprietary classes, that prevents political week

take payers who ought to criticize and oppose this inefficient structures, from organizing the political powers against the classes.

Sylvie Choukroun (2002) reported that Maharashtra state government built a 2,015 megawatt power station. The Dabhol project, requiring $2.8 billion in capital investment represented the largest contract ever signed in India and the first foreign investment in its power sector. In the aftermath of India's economic crisis of 1991, Enron was proposing to build a modern power plant that would satisfy India's electricity needs at a time when most foreign companies could not conceive of managing the risks of investing in India. According to one banker, "to think that Enron planned to raise, as it had originally contemplated, $1.75 billion in the debt markets at a time when international banks were making loans to India no longer than 365 days was nothing short of inspired lunacy. It was visionary." Enron was

rewriting the rules of power plant development for both the India government and the international investment community.

Joel Ruet (2002) wrote that improvement in the Plant Load Factor (PLT) and reduction in the non-technical loss at least worth with present tariffs and increase 17 present energy level. There will enable us not to go in for unpopular measures such as tariff increase.

Government of India in its Tenth Five year Plan (2002-07) focuses on the serious problems that the power sector has been suffering from which were identified as early as ten years ago. However, no corrective action has been taken and the result is that the power sector faces an imminent crisis in almost all States. No State Electricity Board (SEB) is recovering the full cost of power supplied as a result they make continuous losses on their total operations. He also expressed that that state electricity boards are operated based on self enforcing political executive instructions absence of focus on costs and budgets in actual decision making and absence of properly designed information system.

Navroz K. Dubash (2003) explained that in 1990s, conventional wisdom about the electricity sector was turned on its head. Previously, electricity had been considered a "natural monopoly," and the electricity sector in most countries was either owned or strictly regulated by the government. Particularly in developing countries, government leadership in the development and use of electricity was part of a broader "social compact". Also analysed imperative is to embed public debate over electricity sector reforms in a system of sound governance, featuring transparent, open, participatory decision-making processes. Reforms that exclude voices that deserve to be heard have not proven to be sustainable-financially, socially, or environmentally. Reforms that are supported by a robust process of discussion and debate are much more likely to produce the social consensus needed to consolidate a better, more sustainable electricity future.

Madhav Godrole (2004) has expressed that several state governments, including Maharashtra, have announced free power for farmers. In this rush towards competitive populism, the past experience of states that adopted the suicidal policy of giving free power for agriculture appears to have been lost sight of completely. Moreover, considering that subsidies for agricultural consumption largely benefit big farmers and other well-to-do people, the subsidization of these sections by common tax payers militates against all cannons of the welfare state.

Sudhir Kumar Kativar (2005) has expressed the view that a primarily agricultural electricity distribution subdivision in South Rajastan reveals that distribution losses are not only very high, but they are mostly commercial in nature, illegal hooking in both the

domestic and agriculture categories is rampant and probably constituents the largest proportion of unaccounted energy. The reasons for this can be traced back to factors linked to the performance of the utility and the wider socio-political environment. It will not be possible to bring about improvements in the current set-up through primarily technological measures, instead reform packages must adopt a frame work for intervention that encompassed technical, commercial, social and institutional aspects of the problem.

Shahi (2005) analysed that the power sector poses a serious challenge to infrastructure development in India. A recent forecast made by the Planning Commission indicates that India requires an investment of US$ 300 billion for the development of power sector. In terms of per capita power consumption, India is well below China, the US, Russia, France, Germany, Japan and several other countries of the world. The inadequate generation of power and its supply has crippled industry, agriculture, trade, commercial, and domestic sector consumers. The exorbitantly high transmission and distribution losses have made power an expensive input and constrained India's global competitiveness. Globalization, macro and micro economic reforms and outmoded framework governing functioning of power sector in India ushered in its privatization. This book also explained developed countries would also stand to gain from the debate by reflecting on the various models they have chosen to assist the developing countries in the growth of their power sector. On micro front, the book has successfully flagged issues of vital import to power sector ranging from debt-equity mix, escrow, and risk management to repatriation of dividends, technological up-gradation, reduction of technical losses and thefts.

David Newbery (2005) reveals that modern infrastructure, particularly electricity, is critical to economic development. Deficits cause shortages that constrain total output, magnifying the return to their elimination. South Asia, faced with inefficient and bankrupt state-owned vertically integrated electricity supply industries, was under strong pressure to reform. An imperfect diagnosis encouraged private investment in generation to address shortages, with IPPs selling power under long-term contracts to the largely unreformed state electricity boards (SEBs). Buying IPP power at prices above retail tariffs when the SEBs could not even cover the cost of under-priced electricity from state-owned generators exacerbated financial distress and was a recipe for conflict. Reforming the SEBs, though unbundling, full metering, effective accounting and management structures creating commercial discipline, under multi-annual regulation insulated from client list political pressures, is an essential first step.

UNEP (2005) explained that the dual challenge of ensuring electricity for national economic development and at the same time provide increased electricity access to the poor parts of the population. The aim of the workshops was to stimulate new, cost-effective approaches to help create a sustainable energy future. Special focus was put on the role of energy in achieving the Millennium Development Goals (MDGs).

Jaskiran Kaur Mathur, Dhiraj Mathur (2005) have stated in their paper that state electricity boards are commercially unviable and is responsible for the financial mess that the state electricity boards are in. This paper examines rural electrification from a socio developmental perspective and argues that the direct and indirect benefits of rural electrification in reducing the burden on women, its positive impact on health, education and farm income, justifies the expense of network expansion for universal access. It also advocates multiple uses of electricity as this would enhance these benefits have a beneficial effect on the environment, increase the viability of rural electrification and result in savings on household (total) energy expenditure.

The study made by Carreon, et. al. (2006) found that electrification is most closely correlated with economic growth and urbanization. Their study further reveals that Residential and agricultural tariffs declined in the 1970s, which aided electrification, but progress in electrification has continued even through the flat and rising tariffs of the 1980s. Even as the sector has experienced enormous financial difficulties in the 1990s, electrification continued apace. By 1997, 94.7% of the Mexican population had access to electric power. Today, penetration has reached 96%, despite the country's complicated geography and remoteness of small settlements in diverse rural areas.

Bishnu Dash (2010) studied that The National Thermal Power Corporation (NTPC), the state owned power generator, has evinced interest to set up solar and wind projects in Orissa with aggregate generation capacity of 500 MW. NTPC aims to become accompany of 75,000 MW plus company by 2017. Since the public sector company plans to add 1000 MW through renewable energy sources, it is keen to develop some renewable energy based projects in the state. Orissa, which has untapped potential in wind and solar energy sectors at locations like Chanidpur, Gopalapu and Paradeep, is considered as an attractive investment destination. In the recent meeting with NTPC, it was decided that OREDA would select land for these projects either in the identified locations or any other potential locations, NTPC team would finalise the pre-feasibility study of wind and solar based projects at potential sites selected by OREDA.

OBJECTIVE OF STUDY

Following are the objectives of electricity companies are undertaken.

1. To study the purchase efficiency.
2. To study the sale efficiency.
3. To study the distribution loss.
4. To study the overall performance.

ANALYSIS AND INTERPRETATION

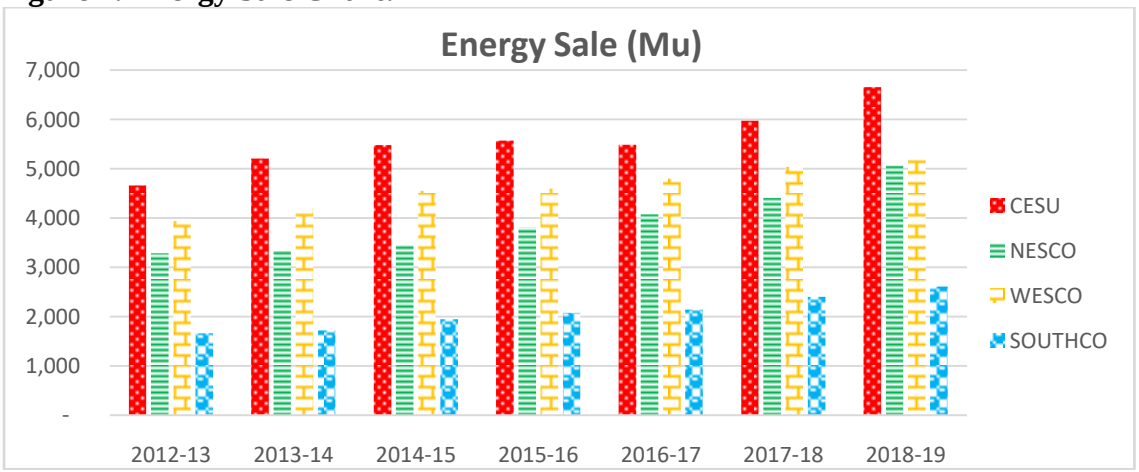
A statement of Energy Purchase, Sale and Overall Distribution Loss from FY 2012−13 to 2018-19 as submitted by DISCOM of Odisha namely Central Electricity Supply Utility of Odisha (CESU), North Eastern Electricity Supply Company of Odisha Ltd (NESCO), Western Electricity Supply Company of Odisha Ltd (WESCO) and Southern Electricity Supply Company of Odisha Ltd (SOUTHCO) is given below.

Table-2: Trends of Energy Sale of Electricity Distribution Company in Odisha

		(Actual)	(Actual)	(Actual)	(Actual)	(Actual)	(Revised)	(Est.)
Particulars	**DISCOMs**	**2012-13**	**2013-14**	**2014-15**	**2015-16**	**2016-17**	**2017-18**	**2018-19**
Energy Sale (MU)	**CESU**	4,663	5,212	5,484	5,571	5,489	5,979	6,661
	NESCO	3,283	3,338	3,456	3,807	4,077	4,412	5,068
	WESCO	3,945	4,201	4,552	4,598	4,799	5,040	5,190
	SOUTHCO	1,661	1,720	1,948	2,078	2,141	2,405	2,613

Sources: Compiled from collected data

Figure 2. Energy Sale Chart:



Sources: Compiled from collected data

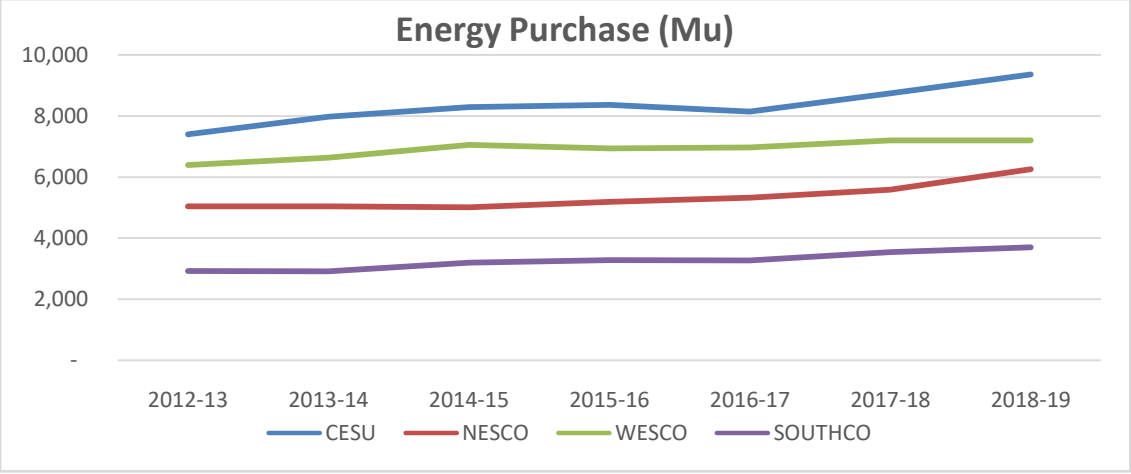
All of the four DISCOMs in Odisha reported a significant growth in Energy Sale as shown in Table-2 and Figure- 2 with an overall increase of 5,981 mu (44%) in 2018-19 as compared to 2012-13. The total sale for 2018-19 was estimated at 19,533 mu which has soared from a mere 13,552 mu in 2012-13. Of the overall growth CESU contributed 33% of the total growth followed by NESCO with 30%. CESU registered the maximum growth in units among all DISCOMs with a hike of 1,998 mu over past 7 years, which translates to 44% growth for the DISCOM. In terms percentage growth SOUTHCO registered a highest with 57% with 953 mu increase in 2018-19 over the same comparative period. NESCO achieved the second highest growth in terms of units and percentage with 1,785 mu & 54% respectively during the period. WESCO ended up their 2018-19 year also on a high with 5,190 units as compared to 3,945 mu in 2012-13. As compared to the previous year the overall growth for all four DISCOMs put together was 1,697 mu which showed a 10% in line with the trends, in part few years. CESU registered the maximum growth in units among all DISCOMs with a hike of 682 mu over previous year, which translates to 11% growth for the DISCOM. In terms percentage growth WESCO registered a lowest with 3% with 150 mu increase in 2018-19 over the same comparative period. NESCO achieved the second highest growth in terms of units and highest in terms of percentage with 657 mu & 15% respectively compared to last year. SOUTHCO ended up their 2018-19 year also on a high with 208 units (9%) as compared to 2017-18.

Table 3. Trends of Energy Purchase of electricity Distribution Company

DISCOMs	Parameter	CESU	NESCO	WESCO	SOUTHCO
2012-13	**(Actual)**	7,402	5,045	6,391	2,930
2013-14	**(Actual)**	7,973	5,045	6,635	2,916
2014-15	**(Actual)**	8,292	5,015	7,054	3,193
2015-16	**(Actual)**	8,366	5,196	6,942	3,283
2016-17	**(Actual)**	8,139	5,330	6,969	3,273
2017-18	**(Revised)**	8,738	5,584	7,200	3,540
2018-19	**(Est.)**	9,354	6,257	7,200	3,700

Sources: Compiled from Collected data

Figure 3. Energy purchase Chart



Sources: Compiled from Collected data

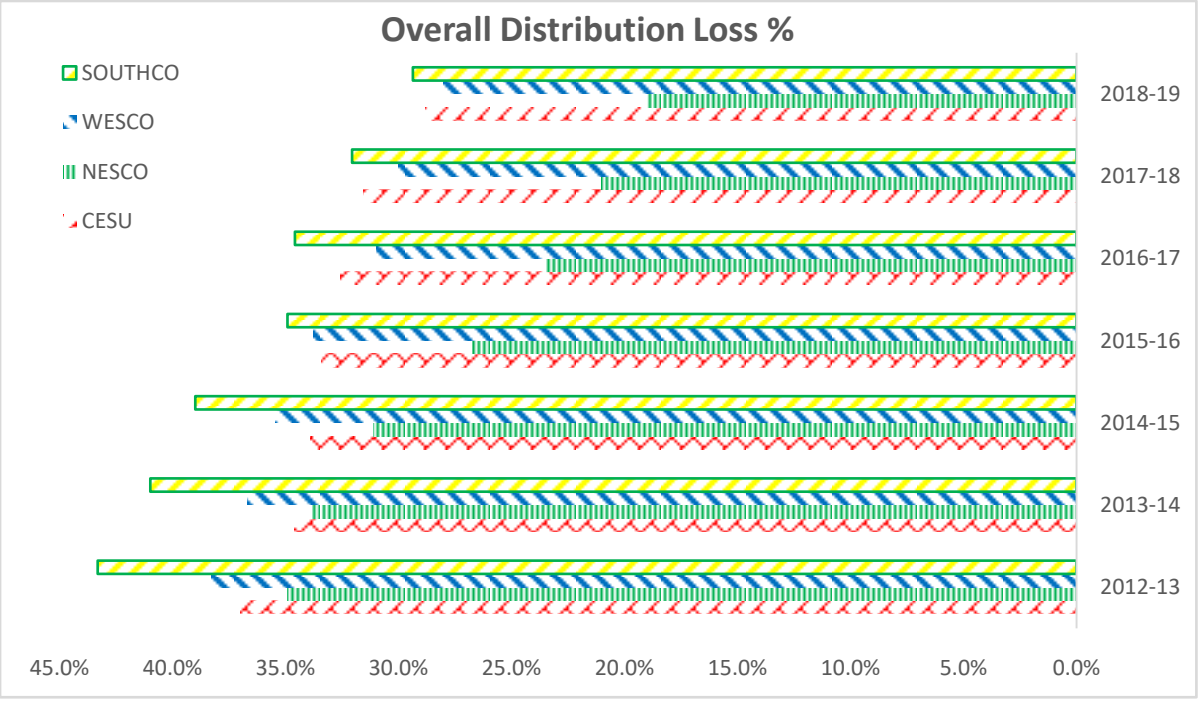
Due to increase in the supply we can see in Table-3 and Figure- 3 a corresponding increase in electricity purchase as well. Across DISCOMs in Odisha we can notice increase in Energy Purchase with an overall increase of 4,743 mu (22%) in 2018-19 as compared to 2012-13. The total sale for 2018-19 was estimated at 26,512 mu which has substantially increased from 21,768 mu in 2012-13. Of the overall growth CESU contributed 41% of the total growth followed by NESCO with 26%. Among all DISCOMs CESU showed the maximum growth in with a rise of 1,953 mu over past 7 years, which translates to 26% growth for the DISCOM. In terms percentage growth SOUTHCO registered a exactly the same as CESU with 26% with 770 mu increase in 2018-19 over the same comparative period. NESCO achieved the second highest growth in terms of units with 1,212 mu & 24% respectively during the period. WESCO ended up their 2018-19 year also on a rise with 7,200 units as compared to 6,391 mu in 2012-13. As compared to the previous year the overall growth for all four DISCOMs put together was 1,449 mu which showed a 6% in across part years. NESCO registered the maximum growth in units among all DISCOMs surpassing CESU with a rise of 673 mu over previous year, which translates to 12% growth for the DISCOM. In terms percentage growth WESCO remained flat over the same comparative period. CESU achieved the second highest growth in terms of units and highest in terms of percentage with 616 mu & 7% respectively compared to last year. SOUTHCO ended up their 2018-19 year also on a high with 160 units (5%) as compared to 2017-18.

Table 4. Trends of overall distribution loss of electricity distribution companies

DISCOMs	2012-13 (Actual)	2013-14 (Actual)	2014-15 (Actual)	2015-16 (Actual)	2016-17 (Actual)	2017-18 (Revised)	2018-19 (Est.)
CESU	37.0%	34.6%	33.9%	33.4%	32.6%	31.6%	28.8%
NESCO	34.9%	33.8%	31.1%	26.7%	23.5%	21.0%	19.0%
WESCO	38.3%	36.7%	35.5%	33.8%	31.0%	30.0%	28.0%
SOUTHCO	43.3%	41.0%	39.0%	34.9%	34.6%	32.1%	29.4%

Sources: Compiled from Collected data

Figure 4. Overall distribution Loss Chart



Sources: Compiled from Collected data

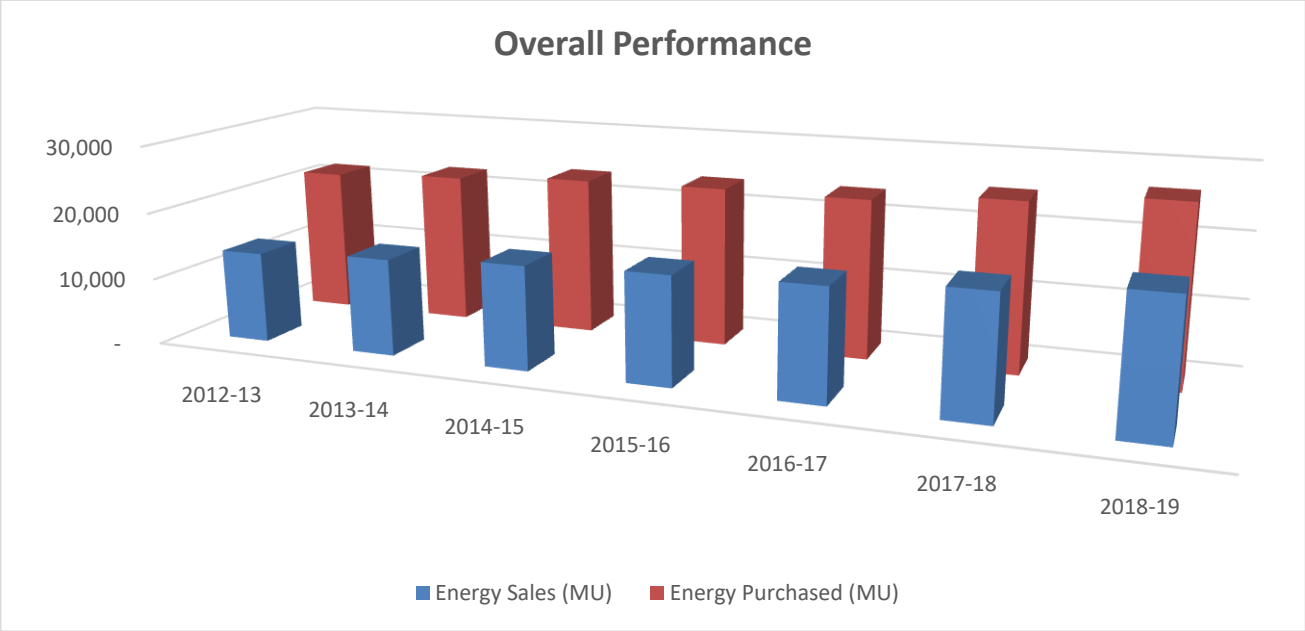
As shown in Table- 4 and Figure- 4 electric distribution losses include losses in transmission between sources of supply & points of distribution to consumers, including pilferage. Losses in the distribution cannot be removed, but can be reduced by proper planning of the distribution systems so that electricity remain within limits. Few ways to minimise losses include; Using of proper jointing techniques, & keeping minimum number of the joints. Over the last decade there has been substantial efforts to minimise the loss and as a result we can see that around 2012-13 the overall distribution was close to 40% which has been decreasing year on year and is below 30% by 2018-19. In 2012-13 SOUTHCO reported maximum distribution loss of 43.3% whereas NESCO reported lowest with 34.9% of loss. Currently in 2018-19 also SOUTHCO reported maximum distribution loss of 29.4% whereas NESCO reported lowest with 34.9% of loss. CESU has reduced its overall loss from 37% to 28.8% and WESCO from 38.3% to 28% during the same comparative period. NESCO has remained the leader with minimum distribution loss across seven year and managed to reduce its loss by 16% from 2012-13 with translates to 46% efficiency. SOUTHCO though has been reporting the highest loss each year among DISCOMs, however that have manages to reduce the loss by 14% in last seven year achieving an efficiency of 32%. CESU even though being the highest purchase & seller of the power, have managed to achieve least efficient of 22% by reducing their loss by only 8% compared to 2012-13. WESCO has also made noticeable reduction of 10% during the period. Comparing to the loss % to previous year CESU & SOUTHCO have both managed to reduce the loss by approximately 3% followed by NESCO & WESCO at 2% each.

Table 5. Overall Energy Sale, Purchase and Loss

	(Actual)	(Actual)	(Actual)	(Actual)	(Actual)	(Revised)	(Est.)
Particulars	**2012-13**	**2013-14**	**2014-15**	**2015-16**	**2016-17**	**2017-18**	**2018-19**
Energy Sales (MU)	13,552	14,471	15,440	16,053	16,506	17,836	19,533
Energy Purchased (MU)	21,768	22,569	23,554	23,786	23,711	25,062	26,512
Overall Distribution Loss %	37.7%	35.9%	34.4%	32.5%	30.4%	28.8%	26.3%

Sources: Compiled from collected data

Figure 5. Overall Energy Sale & Purchase Chart



Sources: Compiled from collected data

With the growth that we have seen over last decade supported by substantial increase in irrigation, allied agriculture and agri-industrial activity. Also we have noticed increase in demand is due to electrification under RGGVY, BSVY & BGJY and growth in domestic category consumers. Overall we have seen in Table-5 & Figure-5 that energy sale has seen a substantial rise in 2018-19 to 19,553 mu from 13,552 mu in 2012-13, which translates to 5,981 mu rise. We have equally seen a hike in the energy purchase as well by 4,743 mu from 21,768 mu to 26,512 mu during the same comparative period. Though during the period there was an increase in purchase & sale but a considerable gap in terms of percentage rise during the period. When the sale has increase by 44%, the purchase has increased by only 22% during last seven years. This may be the major contributing factor we see such a dip in the overall distribution loss from 37.7% to 26.3% in seven years. There has been 11% efficiency shown during the period which is an exceptional performance due to lot of efforts. As compared to previous year there has been an increase of 1,697 mu (10%) in energy sale and increase of 1,449 mu (6%) in energy purchase. As seen in all previous years there has been also a reduction in overall distribution loss % by 3%.

CONCLUSION:

Access to reliable, affordable electricity is a key driver of economic growth in modern economies. The electric power sector, once a predictable and slow-moving industry, is now a complex system undergoing rapid transformation. Countries are in various stages of

reforming and transforming their power sectors to better incorporate modern technologies, assure reliability and affordability, reduce harmful air emissions, meet a wide range of environmental goals, and achieve critical developmental objectives. Power sector plays a vital role in an economy. For power generation huge resources are required i.e. land, money, manpower, coal etc. While fuelling the progress of the nation, this sector should highly responsible towards society and environment. This study is conducted to know how responsible this sector is towards community.

There are four DISCOMs in Odisha, by area WESCO & SOUTHCO covers close to 32% of area each and CESU & NESCO covers rest of area close 18% each. However CESU has been the DISCOM which has been the DISCOM with highest energy sale & purchase. During 2018-19 CESU contributed to approx. 34% of the total energy sale of Odisha, followed by NESCO & WESCO who contributed approximately 26% each and rest 13% by SOUTHCO. During same year CESU contributed to approx. 35% of the total energy purchase of Odisha, followed by NESCO & WESCO who contributed approximately 25% each and rest 14% by SOUTHCO.

It is established that there has been an overall increase in the sale & purchase and also seen a reduction in the overall distribution loss %.

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