Powering Growth: An Empirical Analysis of Power Sector of Punjab and Haryana

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ABSTRACT

India, an emerging superpower, comprises approximately 145 crore population (17.8 percent of the world) and overtook China in April 2023. While India has become an economy of $3.89 trillion in Gross Domestic Product (GDP) in 2023, India needs to cater to the growing need of electricity and a sustainable environment for the nation. Without sustainability, growth is short-lived and has negative externalities. Energy availability and utilization are crucial to the evolution of humans. Energy has facilitated progress from the earliest days of fire and animal power, which enhanced life, to the modern era, when electricity and cleaner, sustainable fuels are used for a variety of uses. Energy is a basic necessity for everything from technology for communication and information and machinery in every sector of the nation to the basic services of cooking, cooling, heating, lighting, mobility, and appliance functioning. One of the biggest obstacles to enhancing human well-being globally is now thought to be the lack of availability of clean and dependable energy sources. Global action has been taken to minimize emissions in response to growing worries about the impact of greenhouse gases on the global climate.

The power Sector is an essential and major part of the energy sector. We in this study, will focus mainly on the power sector of Panjab and Haryana, comparing their generation, consumption, capacity, and working. Various policy initiatives by their respective governments will also be studied.

Keywords: Power sector, Punjab and Haryana, Renewable Energy, Power Generation, Power consumption.

INTRODUCTION

Power sector plays an important role in the economy of the states of Punjab and Haryana. Following the unbundling of the Haryana State Electricity Board (HSEB) in 1998, the four fully State-owned corporations that make up the Haryana electricity sector—Haryana Power Generation Corporation Limited (HPGCL), Haryana Vidyut Prasaran Nigam Limited (HVPNL), Uttar Haryana Bijli Vitran Nigam Limited (UHBVNL), and Dakshin Haryana Bijli Vitran Nigam Limited (DHBVNL) are in charge of electricity generation, transmission, distribution, and trade within the State. The Department of Power, led by the Principal Secretary, Power, is in charge of overseeing the operations of these utilities as well as the Haryana Electricity Regulatory Commission (HERC). Hisar, Fatehabad, Bhiwani, Sirsa, Faridabad, Gurgaon, Mewat, Rewari, and Narnaul districts are served by DHBVN, which has a 20,105 MW capacity, while UHBVNL is in charge of Panchkula, Ambala, Yamunanagar, Kurukshetra, Kaithal, Karnal, Panipat, Sonepat, Rohtak, Jhajjar, and Jind districts with capacity of 14,943.92 MW. Approximately 41 lakhs consumers across various categories are currently served by the distribution companies. The Haryana Power Utilities (HPUs) are contributing appropriately to the state's overall development. Overall production has increased, and the grain yield has significantly improved. The same can be said for the state-of-the-art, modern, and sophisticated industrial hubs of Panipat, Faridabad, and Gurgaon.

Established in 1967 by the government of Punjab under the energy (Supply) Act 1948, Punjab State Electricity board (PSEB) is a vertically integrated utility that is in charge of producing, transmitting, and distributing energy throughout the Punjab State. The Punjab government has unbundled PSEB on 16th April 2010 into two

companies named as Punjab State Power Corporation Ltd. (POWERCOM) and Punjab State Transmission Corporation Ltd. (TRANSCO). The districts of Patiala, Sangrur, Barnala, and Ropar are included in South zone, which is roughly 11,900 square kilometres in size. Additionally, it encompasses portions of the districts of Mansa, Bathinda, Nawan Shahar, Ludhiana, and Fatehgarh Sahib. Rajpura Thermal electricity facility with a 1400 MW electricity capacity, is situated in Rajpura. The Talwandi Sabo generating project is a facility with a 1980 MW generating capacity that is situated near Mansa. The Guru Gobind Singh Super Thermal Power Plant, which has a 1260 MW power capacity, is situated near Ropar. The Guru Hargobind Thermal Plant is a 920 MW power plant situated in Lehra Mohabbat, Bhatinda. The Goindwal Sahib Power Plant can generate 540 megawatts of electricity. This study will focus mainly on the power sector of Punjab and Haryana state. For this purpose, secondary data will be utilized from various reliable sources such as Central Electricity Authority (CEA) reports, State power utilities' annual reports Punjab State Power Corporation Limited (PSPCL) for Punjab and HPGCL / UHBVN/ DHBVN for Haryana. Renewable energy development agency reports (Punjab Energy Development Agency known as PEDA and Haryana Renewable Energy Development Agency for Haryana known as HREDA) and reports from organizations like National Institute for transforming India (NITI) Aayog, the Ministry of Natural and Renewable Energy (MNRE), and the World Bank.

LITERATURE REVIEW

Singh and Kaur (2020), discussed current contemporary issues and challenges of the power sector in Haryana such as transmission and distribution losses, tariff rates, financial constraints and Non-Performing Assets (NPA's) , capacity constraints, and aggregate technical and commercial losses and suggested legitimate actions for The Haryana Power Utilities (HPUs). **Chauhan and Singh** (2020) have determined the economic efficiency occurred due to power sector reforms in Haryana using Data Envelopment Analysis DEA for the pre and post reform period. It shows that while the power sector's reforms have greatly increased input utilisation efficiency, the sector still has quantifiable shortcomings in terms of scale efficiency. Haryana's power industry continues to function at an inappropriate scale. **Raj and Gupta (**2013), studied the non-conventional energy sources in agriculture in Haryana through the variations in electricity usage, fertiliser and pesticide use, the quantity of tractors, tube-wells, and pumping sets .**Bhargava and Gupta** (2006), has enquired into the Punjab State Electricity Board's (PSEB) operations and output, as well as the state's power reform developments. Similarly, Priyanka (2019) has analysed the structure and growth of power sector of Punjab. **Rana and Gandhar** (2024), has represented a shift from non- renewable energy sources to renewable energy sources in last decade. **Singh & Singh**, (1998) has examined the nexus of energy sector and agricultural growth in Punjab through perspective which is historical and contemporary. Thus there is a lack of study concerning both the states with respect to the power sector.

Historical perspective

The Punjab province was split between India and Pakistan during the 1947 Indian partition. Haryana and other Punjabi regions controlled by Hindus and Sikhs were incorporated into India as East Punjab. On the advice of the Sardar Hukam Singh Parliamentary Committee, Haryana was carved out of Punjab due to linguistic differences as Hindi-speaking areas on November 1, 1966. The Shah Commission, chaired by Justice J. C. Shah, was established by the Indian government on April 23, 1966, based on the Committee's suggestion, to partition and delineate the borders of Punjab and Haryana (Kumar, 2016). Punjab and Haryana share the city of Chandigarh as their capital. The administrative centres of both states are located there, making it the first planned city in Asia. These both states are among the first to reap the benefits of green revolution. A comparative analysis of basic characteristics of both states has been done in the table below:

Table 1 : Basic comparison of India Punjab and Haryana 2023

Parameter	Unit	India	Punjab	Haryana	Source
GDP/NSDP[1]	Crores	29535667	424824	561368	RBI[2] handbook
Population	No.[3]	1,455,837,967	31,670,000	30,870,000	projected by census 2011

[1] Gross Domestic Product/ Net State Domestic product

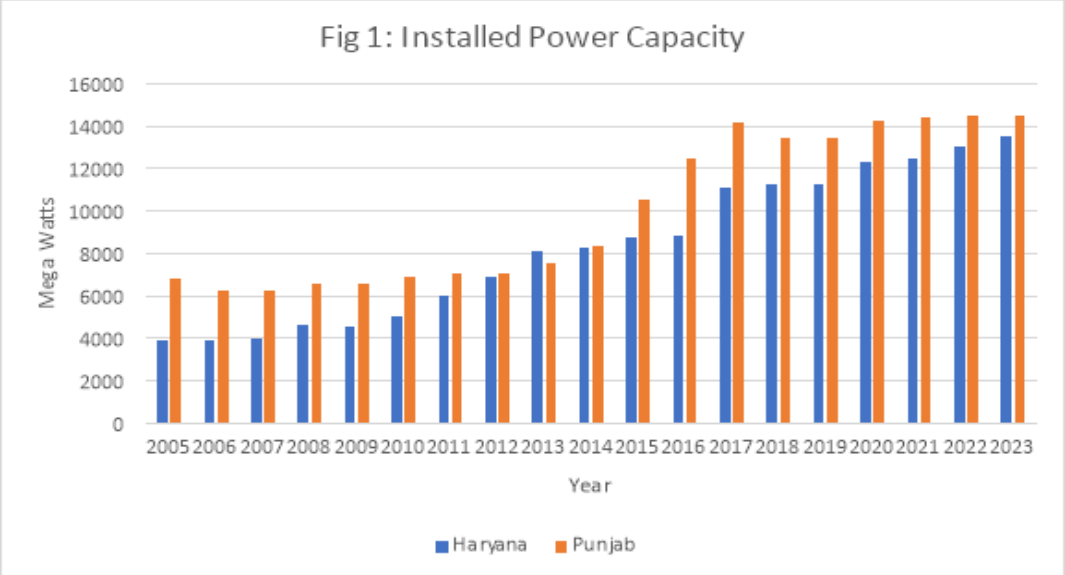
[2] Reserve Bank of India

PCI[4]	No.	211725	225356	325758	CEIC (MOSPI)[5]
Area	Sq. Km[6]	32,87,263	50,362 (1.53%)	44212 (1.34%)	Census of India 2011
Sex Ratio	No.	1020	989	916	NFHS-5 Survey
Literacy rate	Percentage	77	83.7	75.5	NSO[7] survey

Source: Author's Compilation

Installed capacity and energy mix (thermal, hydro, renewable energy sources).

Haryana was the first State in India to achieve 100 percent electrification of all its 6,764 villages and 154 towns (according to 2011 Census). There is an upward trend in the installed capacity of power generation in both the states: Haryana and Punjab from the year 2005 to 2022 as shown by Fig 1. The installed capacity of Punjab is more than that of Haryana except in 2013.The Compound Annual Growth Rate (CAGR) of Punjab is 4.29% and that of Haryana is 6.86 %The present scenario and energy mix of Punjab and Haryana is shown by Table 2.



Source: PSPCL, HPGCL (various issues)

Table 2: Mode wise breakup of power sector in Haryana and Punjab in MW (as on 31/10/2024)

State	**Ownership**	**Thermal Energy**					**Renewable energy**			**Total**
		Coal	**Lignite**	**Gas**	**Diesel**	**Total**	**Hydro**	**RES**	**Nuclear**	
Haryana	*Public Sector*	2510	0	0	0	2510	0	69.30	0	2579.30
	Private Sector	1320	0	0	0	1320	0	2193.88	0	3513.88
	Central Sector	1500	0	431.59	0	1931.59	0	5.00	0	1936.59
	Total	5330	0	431.59	0	5761.59	0	2268.18	0	8029.77
Punjab	*Public Sector*	2300	0	0	0	2300	941	127.80	0	3368.80
	Private Sector	3380	0	0	0	3380	0.00	1991.34	0	5371.34
	Central Sector	0	0	0	0	0	155.30	0	0	155.30
	Total	5680	0	0	0	5680	1096.30	2119.14	0	8895.44

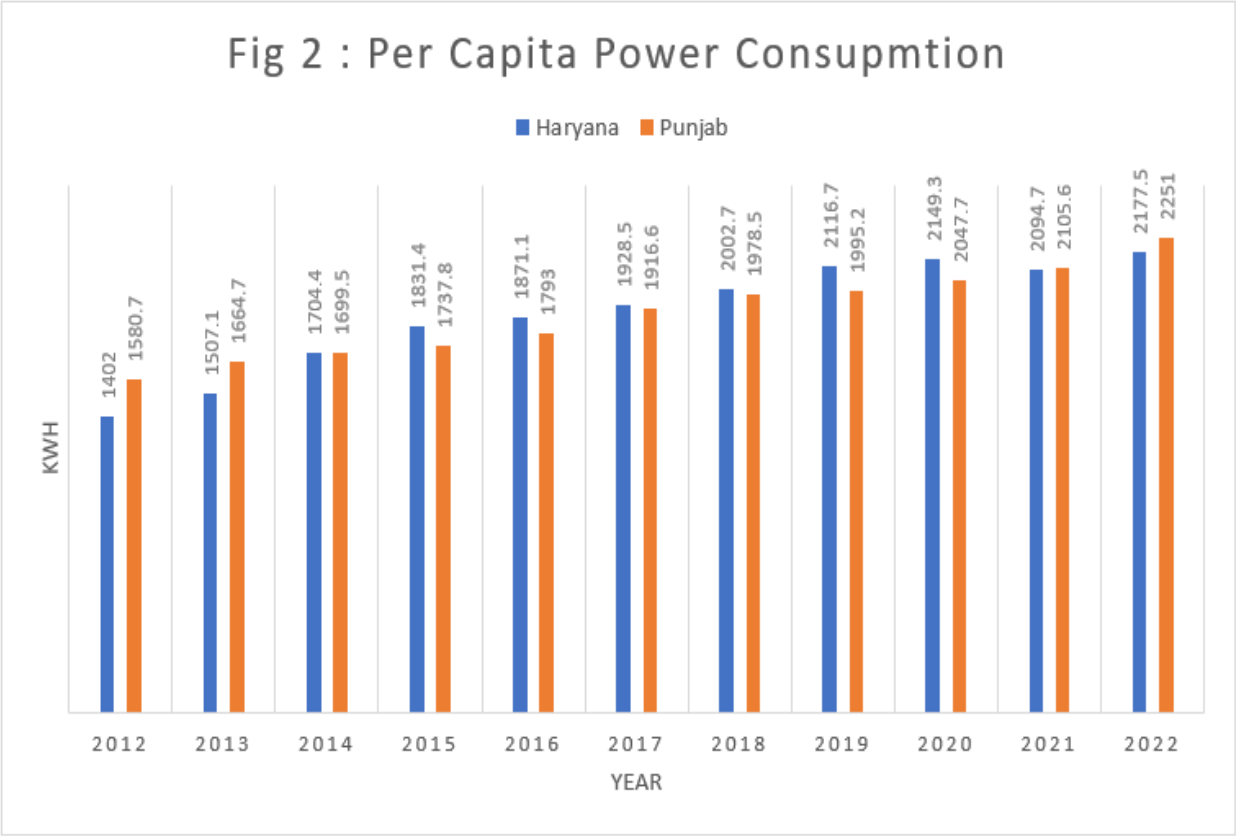
Source: National Power Portal

[3] Number
[4] Per Capita Income
[5] Ministry of Statistics and Programme Implementation
[6] Square Kilometre
[7] National Statistical Office

In the above table we can infer that though Punjab is a bigger region than Haryana but the thermal capacity generation of Haryana is higher than Punjab. Also the renewable energy installed capacity is more in Haryana then in Punjab but when we include hydel generation Punjab is ahead of Haryana. The rooftop solar capacity of Haryana is 590.67 MW and Punjab is 356.65 MW in 2023-24 (India Climate and Energy dashboard, NITI AYOG) .

VI Per Capita Power Consumption:

Per capita power consumption is calculated by dividing the total power consumed with population. The following figure 2 compares the per capita consumption in Punjab and Haryana.



Source: CEA 2022

In the above figure, we have seen that the per capita consumption of Punjab was higher than per capita consumption of Haryana except for the years 2018 to 2020. The CAGR for Haryana is 4.08 percent and the CAGR for Punjab is 3.26 percent. The Compound Annual Growth Rate of per capita consumption is more in case of Haryana than in Punjab.

VI Sectoral consumption patterns:

The following two figures shows the sectoral distribution of electricity sale for Haryana and Punjab:

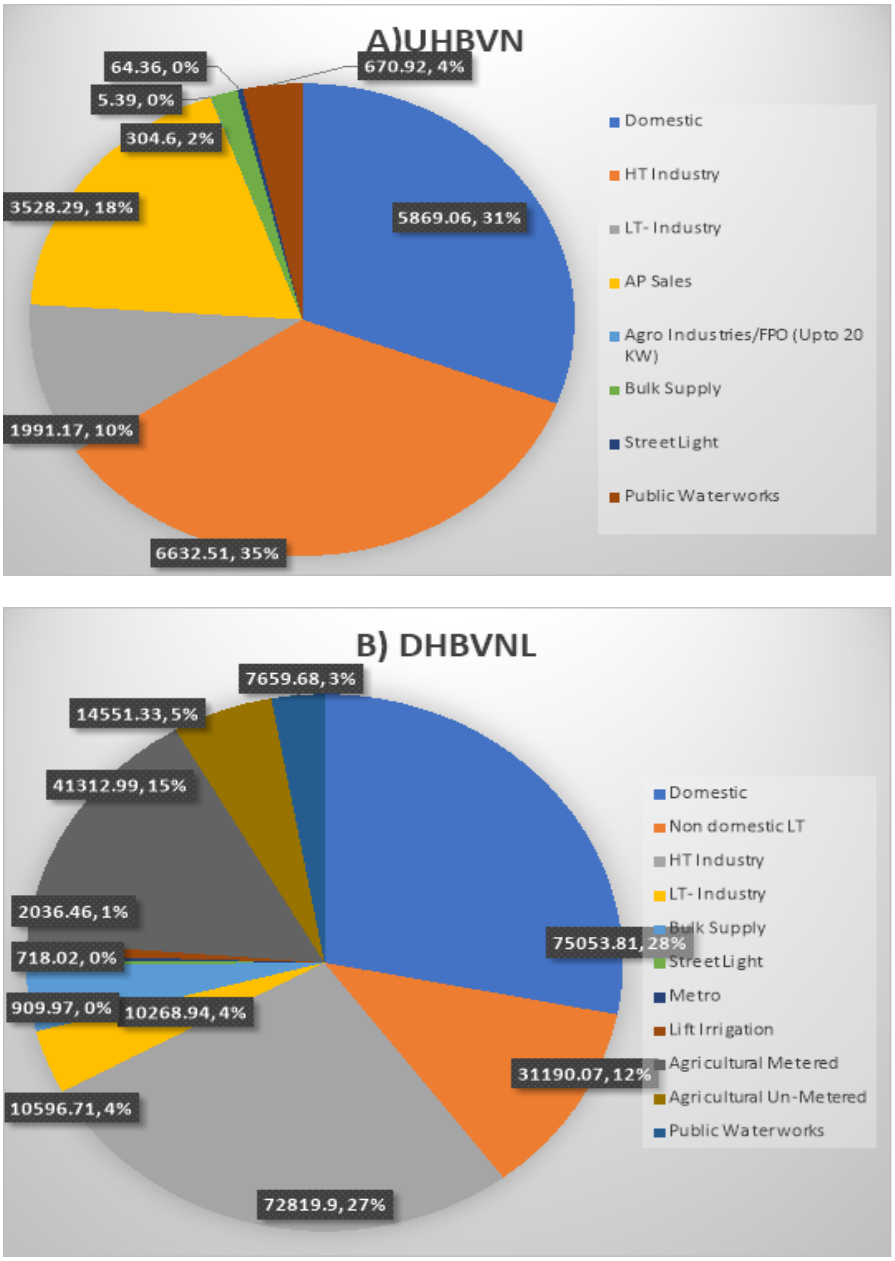
Fig-3: A) Haryana UHBVN-Sector wise sale of electricity 2021-2022 in Million units (19066.31 units)

B) Haryana DHBVN-Sector wise sale of electricity 2021-2022 in Million units (267117.9 units)

The sale of electricity is highest for heavy industry in case of UHBVN and domestic in case of DHBVN

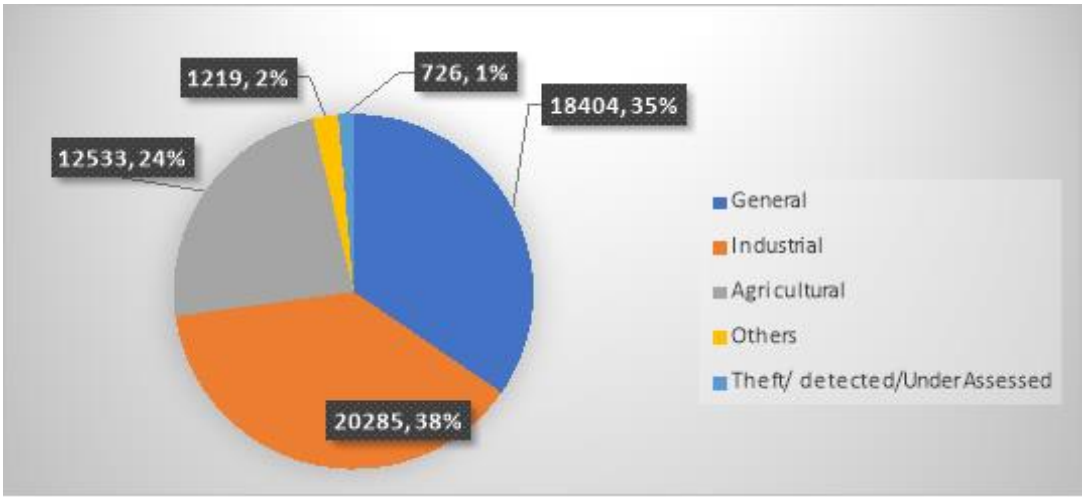
On the other hand, the lowest sale of energy is for agro industry in UHBVN and metro in DHBVN

The both distribution companies DISCOM's has a fair share of sale for the domestic sector. 31% in UHBVN and 28 % in DHBVN. Together they sold 267117.9 MU of electricity in the year 2021-22.



Source: HERC

Fig-4: Punjab-Sector wise sale of electricity 2021-2022 in Million units



Source: PSPCL statistics

Punjab sold total 53167 MU of electricity in 2021 to 2022.

Total electricity sale of Haryana 53963.81 MU and of Punjab is 59211.02 in the year 2023-24. The Average Cost of Supply (ACS) and Average Realised Revenue (ARR) gap is 0.60 Rs/kwh for Haryana and 0.61 Rs/kwh for Punjab. (India Climate and Energy dashboard, NITI AYOG)

Transmission losses

The following represents the transmission losses[8] of Haryana and Punjab

Table 3: Energy losses in Million Units and percentage loss

Year	State			
	Haryana' AT&C[9] in Percentage		Punjab T&D losses	
	DHBV	UHBV	in Million Units	Percentage
2010-11	24.20	-	6063.938	18.71
2011-12	24.28	-	7235.12	17.42
2012-13	23.29	-	7306.70	16.78
2013-14	24.25	-	7619.96	16.95
2014-15	26.11	35.88	7237.43	15.19
2015-16	26.89	34.17	7084.15	14.63
2016-17	21.14	30.71	7960.849	15.25
2017-18	17.90	25.46	7508.44	13.68
2018-19	14.90	21.12	7791.34	14.11
2019-20	16.30	20.10	8845	15.67
2020-21	13.63	15.80	8709	14.98
2021-22	10.98	11.74	8987	14.46
2022-23	9.17	8.32	-	11.26

Sources: Multiple issues of Haryana statistical abstract, DHBV website and PSPCL

Financial performance of state utilities

After increasing its revenue and reducing its expenses, mostly from less power purchases, Punjab State Power Corporation Limited (PSPCL) improved its financial situation and recorded a profit of ₹830.37 crore in the fiscal year 2023–2024.According to the comprehensive audited balance sheet that the PSPCL presented, it represents an incredible rebound from a deficit of ₹4,775.93 crore the previous year. According to the study, PSPCL made ₹830.37 crore in 2023–2024 after accounting for ₹43,988.65 crore in total revenue and ₹43,157.77 crore in expenses.

The rise in income revenues, which increased by ₹3,002 crore from ₹21,989.90 crore in 2022–2023 to ₹24,991.4 crore in 2023–2024, was a major contributor to this financial turnaround. Furthermore, the PSPCL has been able to successfully cut costs, mostly as a result of less power purchases. There was a ₹1,447 crore drop in the power purchase bill. In 2023–2024, the PSPCL spent ₹28,802 crore for energy, up from ₹30,249 crore the year before. PSPCL officials said that the ₹1,003 crore profit was from the selling of power through free market exchanges (Prakash, 2024).

Since 2017–18, DHBVN has consistently reported profits. It has a collection efficiency of more than 100%. Additionally, in 2017–18, it closed the average cost of supply–average revenue realised (ACS–ARR) gap, two

[8] "the loss of power of a transmitted current in passing along a transmission line or path through a circuit device" – Merriam Webster Dictionary
T&D losses refer to electricity that is generated but doesn't reach the intended customers
[9] Aggregate Technical & Commercial Losses combines technical and commercial losses that provides a real scenario of energy and revenue loss in the power sector
NOTE- T&D data for Haryana is not available.

years ahead of the Ujwal Discom Assurance Yojana's aim. This impressive performance is reflected in DHBVN's rankings in the Ministry of Power's yearly discom rating exercise. DHBVN has received the highest A+ rating in the Ninth and Tenth Annual Integrated Rating and Rankings for the 2019–20 and 2020–21 years, respectively. Additionally, in 2020–21, its customer satisfaction percentage was 97%. In 2020–21, DHBVN reported a profit after tax (PAT) of Rs 2.4 billion, up 110.8% from Rs 1.14 billion the year before. From 2016–17 to 2020–21, DHBVN's PAT grew at a CAGR of 111.6 percent. While DHBVN's overall revenue for 2020–21 was Rs 161.02 billion, it was down 9.4% year over year from Rs 177.76 billion the year before. In 2020–21, DHBVN spent Rs 158.63 billion, a 10.2% decrease from the Rs 176.63 billion spent the year before. At Rs 135.62 billion, or 85.5%, the cost of electricity accounted for the greatest portion of the spending. In 2021–2022, the company's PAT was Rs 1.79 billion. In the meantime, its ACS-ARR gap decreased from Re 0.08 per kWh in 2020–21 to Re 0.05 per kWh in 2021–22. The company's overall capital expenditures for 2021–2022 were Rs 10.76 billion, up 12.3% from Rs 9.58 billion the year before. Its capex increased from Rs 8.08 billion in 2017–18 at a compound annual growth rate (CAGR) of more than 7.4%. Around Rs 13.8 billion is the discom's projected capital expenditure for 2022–2023 (Sharma,2023).

During the same time span, UHBVN increased its collection efficiency from 95% to 100% and its billing efficiency from 69.4% in FY 2015 to 82.8% in FY 2021. Investments in distribution infrastructure, the establishment of a commercial back office for prompt resolution of customer complaints, and a concentrated effort on rural household feeders to prevent theft and lower energy loss all contributed to an increase in the effectiveness of billing and collection. By FY 2018, the Average Cost of Supply (ACS)-Average Revenue Realised (ARR) gap was reduced to zero thanks to the debt takeover under the Ujjwal Discom Assurance Yojana (UDAY) and its conversion to equity. Additionally, it made money available for infrastructure improvement investments. UHBVN's financial turnaround was largely attributed to the backing of political officials and upper management, as well as the Haryana Electricity Regulatory Commission's proactive discom surveillance (Sharma et al., 2023).

Policy measures and suggestions:

Haryana's Policy measures

1. **Mahra Gaon Jag Mag Gaon (MGJG)** was crucial in improving the operating characteristics of discoms, upgrading rural infrastructure, and boosting supply quality and dependability (Sharma et al.,2023).
2. The state's **solar power policy** encourages the use of renewable energy sources, such as biomass, wind, and solar also cut back on emissions of carbon dioxide and other harmful gases. It promotes the involvement of the public and commercial sectors in power initiatives. It also permits the Haryana Power Purchase Centre (HPPC) to purchase electricity from independent power producers (IPPs)and offer storage system incentives for utility-scale solar energy projects. Haryana will need about 6000 MW of solar energy to align with national targets for 2030.
3. **The Haryana Renewable Energy Development Agency** (HAREDA) is the state designated agency (SDA) for the Energy Conservation Act. The act is coordinated, governed, and enforced by the SDA.

Punjab's policy measures:

1. **Punjab State Energy Action Plan:** This strategy calls for actions to increase industrial energy efficiency and use clean and renewable energy sources. It also covers steps to increase motor fuel efficiency, switch to alternative forms of transportation, and save energy in buildings (PEDA).
2. To support both new and established enterprises, the state will supply electricity for five years at **a set and reasonable rate**.
3. **Automated Meter Reading (AMR):**

Real-time interface data communication is done through the AMR system.

4. **Subsidies given by Punjab and Budget allocation**: A sum of Rs 7,780 crore was set aside in the 2024–25 budget to give residence customers free electricity. The budget for 2023–2024 included Rs 7,779 crore for subsidies (PRS.India.org).

The initiatives to lower AT&C losses through smart metering and infrastructure improvements be stepped up in order to support the power sectors in both states. Reducing the ACS-ARR gap through sensible tariff changes and prompt subsidy payments can enhance financial health. To improve sustainability, both governments should increase their investments in renewable energy, especially solar and biomass, in order to diversify their energy sources. More efficiency can also be achieved by boosting demand-side management, raising consumer knowledge, and fortifying regulatory capability. Last but not least, promoting private sector involvement and public-private partnerships may help to unleash the innovation and funding required for sustained sectoral growth.

CONCLUSION

In conclusion, Punjab and Haryana's power industries are vital to their economic growth, with a rising focus on infrastructure upgrades and renewable energy. Even though both states have made great progress in increasing their capacity to generate electricity and decreasing losses, issues including transmission losses, financial sustainability, and effective energy use still exist. Mass awareness can be created through government and private bodies for energy saving, no electricity theft and use of renewable energy sources through various mediums. For both states to have a sustainable and dependable power supply in the future, ongoing policy changes and investments in renewable energy are crucial.

CONFLICT OF INTEREST:

There is no conflict of interest in this document.

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I provide consent to participate and publish this document.

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