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An Overview of National Hydro Power Plant in Jammu and Kashmir

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ABSTRACT
Hydropower has continued to be an important source of electricity generation in India, contributing to the country's energy needs and promoting sustainable and renewable energy sources. They do not consume fossil fuels, emit carbon dioxide, or contribute to air pollution. However, it is important to consider the potential, environmental and social impacts associated with large-scale hydroelectric projects and implement proper mitigation measures to ensure their sustainability. Hydropower has indeed played a crucial role in the development of India since the establishment of the first power plant in Darjeeling in 1897. Presently 22 power plants of National hydroelectric power corporation are under operation among those 6 are in Jammu and Kashmir only. This paper is about one of the six plants which are 27.27% of total plants namely Dul Hasti and descriptive in nature. Therefore, purpose of this study is to explore the few aspects of Dul Hasti power plant, Kishtwar (Jammu & Kashmir). CSR and sustainable development activities undertaken demonstrate its commitment to the social, economic, and environmental well-being of the communities and regions. It may cover areas such as community engagement, environmental conservation, socio-economic development projects, and initiatives aimed at benefiting the local population.
Keywords: Carbon dioxide, Electric Power, NHPC, CSR, Sustainable Development

INTRODUCTION

Hydropower or hydraulic power is the force or energy of moving water. It may be captured for some useful purpose. A water wheel is a means of extracting power from the flow (or fall) of water; otherwise known as hydropower. Electricity generated through the use of waterwheels or hydraulic turbines is known as hydroelectric power (Ummar Ahad, 2017). The allocation of the 390 MW Dul Hasti project on the river Chenab to NHPC in Jammu and Kashmir (J&K) is a significant development (CEA Annual Report, 2013). The project is situated in the Plateau of Kishtwar, with Kishtwar town serving as the district headquarters of the region. Prior to the development of the project, the region faced challenges related to road infrastructure, including frequent disruptions due to landslides and the poor condition of roads (CSR & SDA Report NHPC, 2016).

As part of the project development, NHPC has contributed to improving the road connectivity in the Kishtwar region. Specifically, a regular all-weather road spanning 125 km from Batote to Kishtwar has been widened and metalled (CSR & SDA Report NHPC, 2016). This road improvement initiative has enhanced transportation accessibility in the region, facilitating smoother movement of people, goods, and construction materials to support the project activities (Butt, 2013).

The Dul Hasti project is the second project on the Chenab River that has been allocated to NHPC, following the Salal project (Arun Kumar & MK Singhal, 2007); The allocation of these projects to NHPC highlights the organization's expertise and experience in hydropower development, as well as its contribution to the energy sector and overall development in the Jammu and Kashmir region (Butt, 2013), By undertaking the Dul Hasti project, NHPC is not only contributing to the generation of clean and renewable energy but also playing a role in the socio-economic development of the region by improving infrastructure and creating employment opportunities during the construction and operation phases of the project (CSR & SDA Report NHPC 2016), (JKPDD Annual Report, 2014).

Brief History of DULHASTI Project

- 1970-1971: First investigation made by the central water and Power commission(CWPC), along with a first estimate of cost of project clearance of the project by the Technical Advisory Committee and Planning Commission.
- 1972: Clearance of the project by the Technical Advisory Committee and Planning Commission. 1977: Estimates updates by the Central Water Commission.
- 1979: New estimate update by Central Water Commission.
- May,1979: Technico-economic clearance of the new estimate update by Central Electricity Authority(CEA)
- August,1980: Hand over of the project to the National Hydroelectric Power Corporation ltd(NHPC), for execution in the Central sector by the Government of India. Taking into consideration the price escalation, the estimated cost was reassessed by NHPC. This new estimate was subsequently approved by the public investment Board (PIB) in December 1980.
- 1981: Topography survey, Geological investigation by NHPC (Project execution depending finalization of power sharing agreement).
- 1982: Agreement on power sharing formula.
- 1983: Call for Bids on Turn-key basis for execution, completion and commissioning of the 3×130 MW Dul-Hasti Hydroelectric project, on the basis of a basic design proven by NHPC.
- 1985: Submission of coordinated bid by a French consortium.
- 1989: Signature, on the 8th of September of an overall agreement as well as five separate contracts by NHPC, owner, and French companies, contracting parties, namely *DUMEZ, SOGEA, BORIE, or DSB*, as civil contractor, *CEGELEC* as Hydro-Mechanical and Electro-Technical manufacturing contractor, *Coyne Et Bellier* as design contractor, *CEGELEC* as hydro mechanical and electromechanical erection contractor, and SEITP as a technical services for execution, completion and commissioning on a Turn-key basis of the 3×130MW Dul Hasti Hydroelectric project. Negotiations were going on with Russia regarding turn- key execution of the 4000 kV Dul Hasti transmission system which passes through the snow-bound area in Jammu and Kashmir. (Indian Express, 11th October, 1990).
- 1992: Suspension of site work on 24th August by the French civil contractor DSB.
- 1994: Signing of memorandum of understanding (MOU) on the 29th June between NHPC and French companies, for settling the situation raised by the suspension of site work. Signing of a rescission agreement on the 10th of December between NHPC and French civil contractor DSB, while the other companies, *CEGELEC, COYNE ET BELLIER, COMELEX* and *SEITP* will on with the project, as continuing companies.
- 1995: Notice for tender for resuming the civil work by Indian civil work companies, on the 23rd April. 1995: Signing of amendments between NHPC and the four French continuing companies, on the 27th June.
- 1997: Signing of contracts between 'NHPC' and 'Jaiprakash-Statkraft Anlegg AS' joint venture for resuming civil work on 9th April.
- 1998: Construction activities resumed with the appointment of a new Indian contractor for carrying out the remaining civil works. Earlier, the French contractor had abandoned the site and the arrangements had to be terminated.
- 2003: Achievement of Head race tunnel excavation on the 27th August. 2007: First filling Head Race Tunnel (HRT) on 29th and 30th January. May 2007: Project in commercial operation.
- 2009: Conferred with iso-9001:2000 (for quality management) and Occupational Health And Safety Assessment Series (OHSAS) – 18001:2007 (for occupational and safety management) with effect from 29th March and 15th April respectively.
- 2014: Closure of Kiru & Kawar hydroelectric project as separate accounting unit and has been merged with the accounts of Dul Hasti Power Station.

Accessibility: The Dul Hasti Power Station is located on river Chenab in District Kishtwar of UT J&K. The Dul Hasti hydroelectric project with an installed capacity of 3×130 MW in a first stage in Kishtwar district (formerly in Doda district), near the city of Kishtwar. Total land acquired for construction of Dul Hasti 4069 Kanal and 11 Marla. The network of roads being laid by NHPC is also being used by the local population. Kishtwar is connected to Jammu-Srinagar national highway NH44 at Batote, 123 km from Jammu by road. (Source: Detailed Project Report- Dul Hasti Project).

Geography of the Dul Hasti Project

Location	:	Lesser Himalaya of Kashmir 233kms north of
Jammu State	:	Jammu and Kashmir
District	:	Doda
Project H.Q.	:	Chenab Nagar Kishtwar – 182208
Site	:	Dam-Dul Power House-Hasti
Altitude	:	1100 to 1500 meters
Rainfall	:	15th June to 15th September
Snowfall	:	15th December to February
Approach	:	From Jammu to Batote (NH1A) 123km From Batote to Kishtwar (NH1B) 110km
Total	:	233km

REVIEW OF LITERATURE

The Dul Hasti project, handed over to NHPC Limited by the government of India in August 1980, is a significant hydroelectric power project located in a remote area along the Chenab River (Butt, 2013); The project involves the construction of a 65 m high Concrete Gravity Dam at Dul, which serves the purpose of impounding the water up to elevation 1266.5 FRL (Full Reservoir Level). The water from the Dul Dam is then diverted through a 10586 m long water conductor system, including a surge shaft and a pressure shaft, to reach the underground Power House located at Hasti. The power house consists of three generating units, each with a capacity of 130 MW. Construction activities at the Dul Hasti project, executed on a Turn-Key basis by a French consortium, have gained momentum. (CSR & SDA Report NHPC, 2016), (CEA Annual Report, 2013).

Notably, the project has achieved a significant milestone by launching an 8.3 diameter tunnel boring machine for tunneling, which is the first of its type in the country. In the 1990s, negotiations were underway with Russia for the turn-key execution of the 400 KV Dul Hasti transmission systems, which pass through snow-bound areas in Jammu and Kashmir. The project aims to benefit multiple regions and states, including Jammu and Kashmir, Punjab, Haryana, Chandigarh, Delhi, Rajasthan, Uttar Pradesh, and Uttarakhand, by providing a stable and reliable source of hydroelectric power. However, due to its remote location and frequent inclement weather conditions, the construction and operation of the Dul Hasti project pose unique challenges.

Overall, the Dul Hasti project is a significant endeavor in harnessing the hydroelectric potential of the Chenab River and contributing to the energy needs of the region while overcoming the geographical and climatic constraints NHPC is the largest investor in J&K and has invested put in ₹ 20778 crore there over the past four decades (CSR & SDA Report NHPC, 2016). It has paid around ₹ 5387.51 crore to Jammu and Kashmir for water usage charges only. In addition to supplying 789MW to the J&K from its power projects, NHPC also gives 12% free power to J&K and 1% free power towards local area development fund (JKPDD Annual Report, 2014), (CEA Executive Summary, 2014).

Transmission Line

During the construction of the Dul Hasti project, NHPC also undertook the laying of a 132 kW Udhampur-Kishtwar Transmission line in the mid-eighties (Butt, 2013). The transmission line was established at a cost of ₹13,37,68,939. Prior to the completion of this transmission line, power supply to the Doda district was provided by the J&K Power Development Department (PDD) at the 33kV level. Once the 132kV transmission line was operational, it also facilitated the transmission of power to both the Doda and Kishtwar districts. To support this arrangement, a 132/33kV substation was constructed by J&K PDD at Khelani. This setup continues to supply power to both districts until this date. For the operation and maintenance of this transmission line, an expenditure of ₹28.35 lakhs was incurred. Additionally, in 2015-16, the Dul Hasti power station spent ₹3350 lakhs on various aspects such as the construction of retaining walls, foundations, towers and the procurement of materials for the 132 KV line (JKPDD, Annual Report 2013),(JKPDD Annual Report, 2014).

These investments and expenses demonstrate the commitment of NHPC and other stakeholders in ensuring a reliable transmission network to support the power supply requirements of the Doda and Kishtwar districts in Jammu and Kashmir (CSR & SDA Report NHPC, 2016), (CEA Annual Report, 2013).

METHODOLOGY

This article is based on published material i.e. journals, books, articles related to hydro power development in India as well as in Jammu and Kashmir. Extensive literature review is carried out at national level but less material at UT level, is segregated and a detail discussion is presented against hydropower unit of NHPC Ltd. i.e. Dul Hasti in J&K. This article is divided into five sections which covers history of plant, financial/operational status of power station, amount paid to Jammu and Kashmir Government, corporate social responsibility & sustainable development activities done by plant and conclusion. The article covers various aspects related to the power plant mentioned below:

History of the Plant: This section provides an overview of the historical background and development of the Dul Hasti hydropower plant in Jammu and Kashmir. It may include information on the establishment of the plant, its capacity, and any significant milestones or events related to its operation.

Financial/Operational Status: This section focuses on the financial and operational aspects of the power station. It may include details on the plant's performance, electricity generation, and operational efficiency. Financial indicators such as revenue, expenses, profits, and investments may also be discussed. Payments to Jammu and Kashmir Government: This section highlights the financial contributions made by the power plant to the Jammu and Kashmir Government. It may include information on royalties, taxes, or any other payments made by the plant as part of its operations and agreements with the local government.

Corporate Social Responsibility and Sustainable Development: This section explores the corporate social responsibility (CSR) initiatives and sustainable development activities undertaken by the power plant. It may cover areas such as community engagement, environmental conservation, socio-economic development projects, and initiatives aimed at benefiting the local population.

Therefore, summarizes the key findings and implications of the article. It may provide an overall assessment of the Dul Hasti hydropower plant's performance, contributions to the region, and its role in sustainable development. Recommendations or suggestions for further improvement or research may also be included.

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ANALYSIS: FINANCIAL INDICATORS AND CSR ACTIVITIES OF DUL HASTI POWER PLANT

Financial Indicators: NHPC Dul Hasti Project provides electricity by using renewable hydro energy and supply it to various beneficiaries. This plant gives excellent benefits with 25% (Avg.) of profit since 2010 to 2015 (Figure 1).

Table 1: Operational & Financial Indicators of Dul Hasti

Year	Generation (MU)	(Amount in ₹ Crore)		
		Revenue	Expenditure	Profit
2010-11	2234.00	1063.68	304.15	759.53
2011-12	2199.00	1525.16	596.96	928.20
2012-13	2043.00	1159.78	634.94	524.84
2013-14	2150.00	1188.86	683.09	505.77
2014-15	2176.00	1133.33	669.60	463.73
2015-16	2361.00	1145.49	650.51	494.98
Total	13163.00	7216.30	3539.25	3677.10

Based on the information (Table 1), Profit means excess of total revenue over total expenditure for accounting period. Average generation, Revenue, expenditure and profit of the plant was 2193.833 MU (Million Units), ₹1202.717 cr., ₹589.875 cr. and ₹612.8417 cr. respectively of the six years from 2010 to 2015. Figure (1) Represents the graphical representation of the above data.

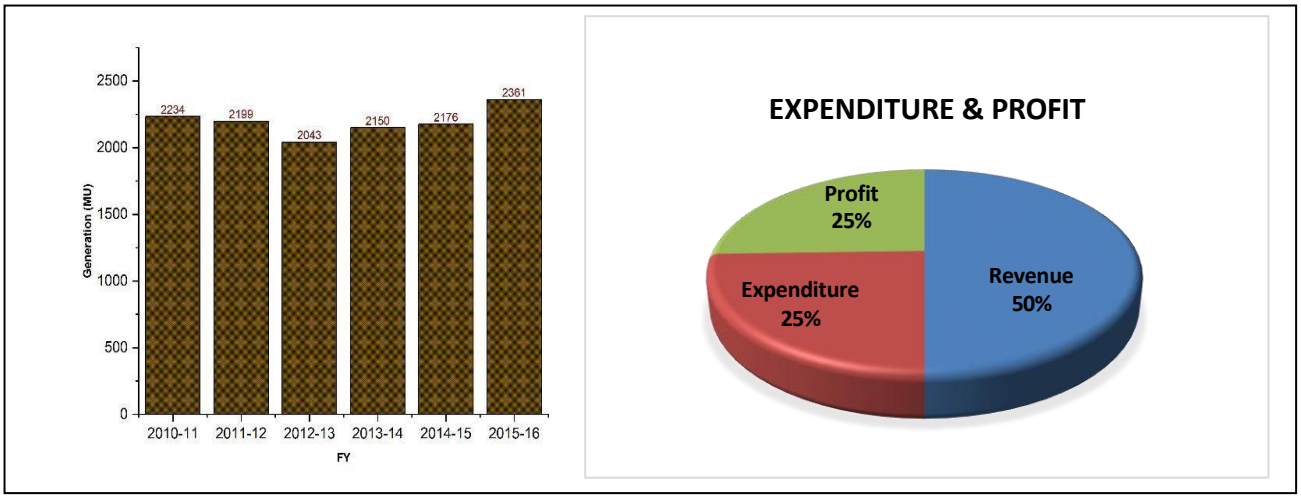

Figure 1: (a) Power Generation, (b) Revenue, Expenditure & Profit

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CSR activities by NHPC:

Table 2: Initiatives taken by NHPC Dul Hasti for smooth functioning in Kishtwar

Sector	2007-08	2008-09	2009-10	2010-11	2011-12	2012-13	2013-14	2014-15	2015-16	2016-17	2017-18	2018-19	Total
Education & Skill Development	4.00	6.02	5.83	4.67	11.84	5.87	21.18	30.71	1.65	1.82	9.14	14.78	**117.51**
Health Care &Sanitation	3.99	3.34	9.79	3.54	2.36	2.55	6.24	9.41	6.96	6.36	16.17	7.45	**78.16**
Women Empowerment/ Senior Citizen	-	1.50	2.82	-	-	-	-	0.30	-	-	-	-	**4.62**
Environment	3.84	-	2.23	-		-	6.00	3.74	-	-	-	-	**15.81**
Peripheral Development	5.51	6.00	-	13.44	6.83	-	24.32						**56.10**
National Welfare Fund/ Disaster Management	-	3.00	-	-	-	-	-	3.78	-	-	-	-	**6.78**
Sports, Art & Culture and other initiatives	-	2.30	-	2.73	296.30	0.73	3.02	-	-	-	-	2.32	**307.40**
SVA+SBA	-	-	-	-	-	-	-	1.42	98.00	16.19	14.78	12.26	**142.65**
Total	**17.34**	**22.16**	**20.67**	**24.38**	**317.33**	**9.15**	**60.76**	**49.36**	**106.61**	**24.37**	**40.09**	**36.81**	**729.03**

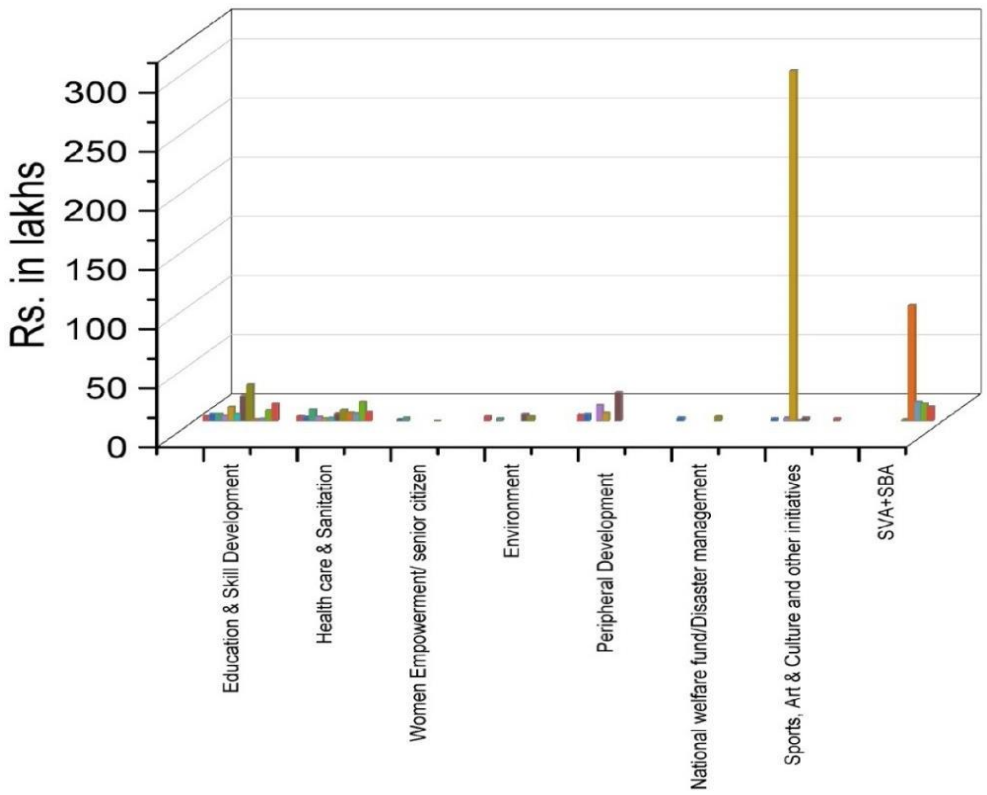

Figure 2: Sector wise CSR Initiatives taken by NHPC Dul Hasti

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Table 3: Contribution made by Dul Hasti Power station to J&K (Amount in ₹ Cr.)

Particulars	2010-11	2011-12	2012-13	2013-14	2014-15	2015-16	Total
Free Power (12%)	152.63	148.86	122.42	127.57	129.49	160.28	**841.25**
Water Cess	20.53	105.47	97.98	103.09	104.36	113.23	**544.66**
CSR	0.24	3.17	0.09	0.61	0.49	1.07	**5.67**
WCT	1.08	1.581	1.31	1.66	1.82	2.19	**9.641**
Building Cess	0.08	0.13	0.09	0.06	0.12	0.13	**0.61**
Total	**174.56**	**259.211**	**221.89**	**232.99**	**236.28**	**276.90**	**1401.831**

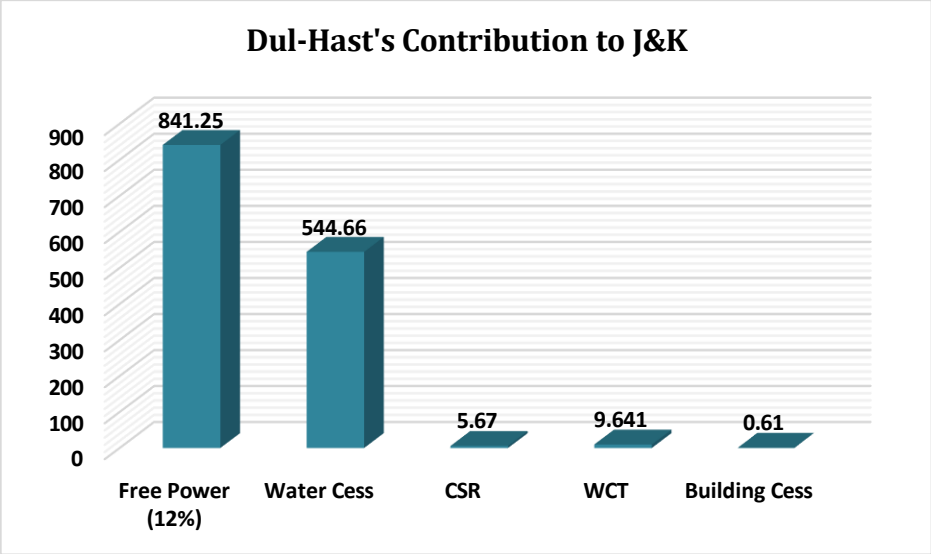

Figure 3: Graphical Representation Contribution made by Dul Hasti Power Station to J&K

NHPC Ltd. paid a total of ₹3164.98 crore as water cess to the Jammu and Kashmir Government over a six-year of period. Out of this total amount, ₹544.66 crore was paid specifically by the Dul Hasti power station (Table 3). This amount represents approximately 17.21% of the total Water Cess paid by NHPC Ltd. across all seven power projects.

Dul Hasti NHPC has undertaken several CSR initiatives in different sectors. Here are some of the initiatives mentioned:

Hospital: The power station has a well-equipped hospital that was initially established as a dispensary in 1984 and later inaugurated as a project hospital on November 29, 1990. The hospital is equipped with facilities like an X-ray lab, ECG equipment, and an operating theater. It has a dedicated medical staff including resident doctors, pharmacists, lab assistants, dressers, staff nurses, and ANM (Auxiliary Nurse Midwife). Additionally, there are two dispensaries located in Dul and Shalimar, providing round-the-clock services including free OPD consultations, free medicines, and free vaccinations.

School: Dul Hasti power station has established a project nursery school for children aged 3 to 5 years, with the objective of providing basic quality education. Additionally, the power station has contributed to the development of a playground in Kendriya Vidyalaya School in Kishtwar.

Furthermore, two free water supply scheme has been implemented, ensuring access to drinking water tapped through a natural source at Dul Dam and another one in town Kishtwar i.e three stage integrated drinking water supply scheme. All the three stages of pump houses are provided with two motors and two pumps for interrupted water supply. These initiatives in the sectors of healthcare and education demonstrate NHPC commitment to contributing to the well-being and development of the community.

CONCLUSION

The utilization of water resources in an environment-friendly manner is indeed crucial to address the electricity needs of remote and hilly/rural areas in Jammu and Kashmir. The development of large upcoming hydropower projects in Kishtwar, such as Pakal-Dul and others, is a significant step towards meeting the energy requirements of the region. These projects, which were signed under a Memorandum of Understanding (MOU) between NHPC, JKSPDC, and PTC, aims to develop hydroelectric projects in the Chenab river basin with a total installed capacity of 2100 MW through a joint venture company. The completion of these projects is expected to alleviate the issue of electricity shortage in Jammu and Kashmir. It is anticipated that the increased power generation from these hydropower projects will contribute to resolving the electricity needs of the region, particularly in remote and underserved areas. This paper serves as an academic source that can provide valuable insights for both academicians and managers involved in the development and management of hydropower projects in Jammu and Kashmir.

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