GOVERNMENT OF INDIA

MINISTRY OF JAL SHAKTI

DEPARTMENT OF WATER RESOURCES, RIVER DEVELOPMENT & GANGA REJUVENATION

RAJYA SABHA

UNSTARRED QUESTION NO. 101

ANSWERED ON 21.07.2025

IMPACT OF CLIMATE CHANGE ON WATER

101. SHRI SANT BALBIR SINGH

Will the Minister of **Jal Shakti** be pleased to state:

(a) whether Government has assessed the impact of climate change on water availability and distribution, and if so, the policies being implemented to enhance resilience against droughts, floods, and erratic monsoons;

(b) the details of interlinking of river projects currently under execution or under consideration, along with their expected benefits and any challenges faced in their implementation; and

(c) whether Government has strategy for ensuring sustainable groundwater management, and the promotion of rainwater harvesting techniques?

ANSWER

THE MINISTER OF STATE FOR JAL SHAKTI

(SHRI RAJ BHUSHAN CHOUDHARY**)**

(a) The Government has assessed the impact of climate change on various river basins. In this regard, details of climate change studies conducted for different river basins under the scheme “Research and Development Programme in Water Sector and Implementation of National Water Mission" is given at **Annexure I.**

Climate change affects water availability due to changes in the water cycle. Changes in rainfall patterns, rising temperatures, and accelerated glacial melt are disrupting the hydrological cycle, impacting both surface and groundwater resources.

The Department of Water Resources, River Development and Ganga Rejuvenation under Ministry of Jal Shakti, Government of India, through the **National Water Policy (2012)**, acknowledges the increasing hydrological variability associated with climate change and outlines a range of adaptation measures to address these emerging challenges.

The National Water Policy, 2012, has inter-alia, following provisions relevant to water management & climate change:

4.1 Climate change is likely to increase the variability of water resources affecting human health and livelihoods. Therefore, special impetus should be given towards mitigation at micro level by enhancing the capabilities of community to adopt climate resilient technological options.

4.2 The anticipated increase in variability in availability of water because of climate change should be dealt with by increasing water storage in its various forms, namely, soil moisture, ponds, ground water, small and large reservoirs and their combination. States should be incentivized to increase water storage capacity, which inter-alia should include revival of traditional water harvesting structures and water bodies.

4.3 The adaptation strategies could also include better demand management, particularly, through adoption of compatible agricultural strategies and cropping patterns and improved water application methods, such as land leveling and/ ordrip / sprinkler irrigation as they enhance the water use efficiency, as also, the capability for dealing with increased variability because of climate change. Similarly, industrial processes should be made more water efficient.

4.4 Stakeholder participation in land-soil-water management with scientific inputs from local research and academic institutions for evolving different agricultural strategies, reducing soil erosion and improving soil fertility should be promoted. The specific problems of hilly areas like sudden run off, weak water holding capacity of soil, erosion and sediment transport and recharging of hill slope aquifers should be adequately addressed.

4.5 Planning and management of water resources structures, such as, dams, flood embankments, tidal embankments, etc., should incorporate coping strategies for possible climate changes. The acceptability criteria in regard to new water resources projects need to be re-worked in view of the likely climate changes.

The Department of Water Resources (DoWR), Ministry of Jal Shakti, integrates climate change adaptation and mitigation into all its initiatives, ensuring water security and resilience against climate impacts. Programs like **Atal Bhujal Yojana** promote sustainable groundwater management, while Namami Gange and the National River Conservation Plan focus on river rejuvenation and pollution control. The Jal Jeevan Mission and Swachh Bharat Mission enhance climate-resilient water supply and sanitation, while **PMKSY** and **CADWM** improve irrigation efficiency and agricultural resilience. The Flood Management Programme addresses disaster mitigation, and campaigns like J**al Shakti Abhiyan – Catch the Rain** & **Jal Sanchay and Jan Bhagidari** encourage rainwater harvesting. **National Aquifer Mapping and Management Programme (NAQUIM)** under the scheme of Ground Water Management and Regulation (GWMR) with an aim to delineate aquifer disposition and their characterization for preparation of aquifer/ area specific ground water management plans with community participation. Through integrated water resource management, and policy frameworks, DoWR strengthens water sustainability, aligning with India's climate commitment.

Annual assessments of groundwater resources are being carried out by Central Ground Water Board (CGWB) to analyze trends in groundwater recharge and extraction. The comparative Ground Water Resource Assessment for the Country from the year 2017 to 2024 is presented below:

S. No.	Parameter	GW Resource Assessment in	
		2017	2024
1	**Annual GW Recharge**	431.86 bcm	446.90 bcm
2	**Annual Extractable GW Resource**	392.7 bcm	406.19 bcm
3	**Annual GW Extraction for all uses**	248.69 bcm	245.64 bcm
4	**Stage of GW Extraction (SoE)**	63.33%	60.47%

The perusal of assessment from 2017 to 2024 indicates that the total Annual Ground Water Recharge has increased substantially (15 BCM) and Extraction has declined by 3 BCM from 2017 to 2024 assessment.

Further, CGWB under Ground Water Management and Regulation (GWMR) Scheme, a continuing Central Sector Scheme, carry out activities related to ground water exploration, monitoring of water level and water quality, and assessment of ground water resources nationwide to assess the broader impacts of climate change on ground water resources. Additionally**,** CGWB is engaged in efforts to enhance groundwater monitoring, which includes studying the potential impacts of climate change on groundwater. As part of this initiative, construction of 7,000 piezometers (monitoring wells) has been undertaken, with plans to equip them with Digital Water Level Recorders to facilitate high-frequency water level observations.

Beyond water level fluctuations, factors such as climate change-induced sea-level rise may contribute to increased salinity in coastal aquifers. To monitor these changes, a network of 60 piezometers with probes for measuring groundwater levels and salinity has been established in the coastal regions of Tamil Nadu and Puducherry.

A Centre for Cryosphere and Climate Change Studies is operational in National Institute of Hydrology, Roorkee, to facilitate the effective management of snow and glacier resources in the country to address the concern of water availability.

(b) Government of India formulated a National Perspective Plan (NPP) in year 1980 and National Water Development Agency (NWDA) has been entrusted with work of Interlinking of Rivers (ILR) under NPP. Details of ILR Projects are enclosed at **Annexure-II.**

Out of 30 link projects as identified under NPP, five links under NPP have been identified as priority links, viz; Ken Betwa Link Project, Modified Parbati-Kalisindh-Chambal (Modified PKC) and 3 links under Godavari - Cauvery link project { Godavari (Inchampalli) – Krishna (Nagarjunasagar) link, Krishna (Nagarjunasagar) – Pennar (Somasila) link and Pennar (Somasila) – Cauvery link}.

The Ken-Betwa link project (KBLP) is the first link of NPP that is under implementation.

Modified Parbati-Kalisindh-Chambal link project: Modified Parbati - Kalisindh - Chambal (Modified PKC) link, incorporating the components as proposed by Govt. of Madhya Pradesh in Kuno, Parbati and Kalisindh sub-basins along with components of ERCP has been framed. MoU for preparation of DPR was signed by both the States (MP and Rajasthan) on 28.01.2024 and MoA for implementation has been signed in December, 2024.

Benefits to MP - Annual irrigation of about 6 lakh ha and drinking water supply of about 71 MCM to 15 districts. Benefits to Rajasthan- Drinking water to 21 districts of Eastern Rajasthan and en-route towns, tanks and villages and industrial water for Delhi Mumbai Industrial Corridor (DMIC) and other industries. The link project is planned to provide irrigation to more than 2.5 lakh ha of new command area as well as stabilizing the existing command area of about 1.5 lakh ha in Rajasthan.

Godavari - Cauvery link project: The link project is comprised of 3 segments.

The project proposal envisages transfer of 4189 MCM from Godavari along with combining the proposal for supplementation in Krishna basin through Bedti-Varda link (524 MCM). The unutilised flows of 4189 MCM (148 TMC) of Indravati sub-basin of Godavari basin of Chhattisgarh State is only planned to be diverted. The link project is planned to provide annual irrigation to 6.78 lakh ha area and provide 1679 MCM of drinking and industrial water supply to population of 214 lakh. Draft MoA for the link project has been circulated to party States in April, 2024.

Kosi Mechi Intra-State Link Scheme (Bihar) : The project proposal envisages diversion of 2050.15 MCM surplus water of Kosi river to Mechi river in Mahananda basin during monsoon period (June to October) which would meet irrigation requirement of new command in Araria, Purnea, Kishanganj and Katihar districts of Bihar. The project would provide irrigation facilities annually to an area of 2,10,516 ha and would reduce flood impact in the downstream of the Kosi river.

Details of **ILR Project** under execution:

- The Ken-Betwa link project (KBLP) is the first link of NPP that is under implementation.
- The Govt. of India has approved the implementation of KBLP in December, 2021 with an estimated cost of Rs 44605 crore (year 2020-21 price level) with central support of Rs 39317 crore through a Special Purpose Vehicle viz; Ken Betwa Link Project Authority (KBLPA).
- Work for the main component of the project i.e. Daudhan dam has been awarded.
- The project is planned to be completed in a period of 8 years, by March, 2030.

Expected benefits of KBLP: The project is planned to provide annual irrigation of 10.62 lakh ha out of which 8.11 lakh ha lies is Chhattarpur, Tikamgarh, Niwari, Panna, Damoh, Vidisha, Sagar , Datia, Raisen and Shivpuri districts of Madhya Pradesh and 2.51 lakh ha lies in Jhansi, Mahoba, Lalitpur and

Banda districts of Uttar Pradesh. It would provide domestic water supply for 62 lakh (MP- 41 lakh, UP-21 lakh) population. Project will generate will be 103 MW of Hydro and 27 MW of Solar power.

Challenges in implementation of ILR Projects : Interlinking of Rivers (ILR) programme is being pursued in a consultative manner building consensus amongst party states for the implementation of these projects. The cooperation of States is paramount in the implementation of Interlinking of Rivers projects. The consensus building amongst states is the most challenging task due to apprehensions of States related to water sharing.

(c) The Government is actively promoting rainwater harvesting (RWH) and artificial groundwater recharge through a combination of policy interventions, community mobilisation, and infrastructure development. A key initiative in this regard is the Jal Shakti Abhiyan: Catch the Rain (JSA:CTR), now in its sixth edition since its launch in 2021, following the Hon'ble Prime Minister's 2019 call—"Jan Shakti 4 Jal Shakti." The campaign is guided by the motto: "Catch the Rain, Where It Falls, When It Falls."

Under JSA:CTR, over 1.83 crore water conservation structures have been created, 140 crore saplings planted, and ₹1.18 lakh crore mobilised through convergence with schemes such as MGNREGA, AMRUT, and PMKSY. The initiative is supported by a digital ecosystem including 712 Jal Shakti Kendras, real-time dashboards, and GIS-based District Water Plans, enabling decentralised yet coordinated implementation.

These efforts have contributed significantly to groundwater recharge. As per the Ground Water Resources Assessment Report 2024, there has been an increase of 11.36 billion cubic metres (BCM) in annual groundwater recharge since 2017—surpassing the live storage capacity of the Indira Sagar Dam (9.75 BCM). This increase is largely attributed to community-led structures such as tanks, ponds, soak pits, and recharge wells constructed across schools, industries, and residential areas.

Awareness campaigns, workshops, and local outreach under JSA:CTR have facilitated the widespread adoption of rainwater harvesting and recharge structures, including:

i. Installation and revival of rooftop RWH systems in schools, government buildings, and industrial campuses;

ii. Construction of recharge pits, percolation tanks, and soak wells in residential and institutional premises;

iii. Voluntary adoption of water audits and water use efficiency measures by citizen groups and local bodies.

Further, the Jal Sanchay Jan Bhagidari (JSJB) initiative was launched under JSA:CTR on 6th September 2024 in Surat, Gujarat. JSJB set a target of creating 1 million recharge structures by 31st May 2025, which was exceeded—with 2.7 million structures identified and 2.3 million completed. These include contributions from Government premises, schools, industrial campuses (via CSR), and Urban Local Bodies.

All structures are geo-tagged and monitored through the Jal Sanchay Dashboard, with 1% undergoing third-party audits by CGWB and CWC experts to ensure transparency and quality. The initiative adopts a convergent funding model drawing on government schemes, CSR, philanthropic, and community contributions, offering a sustainable model of recharge-based water management.

Additionally, Central Ground Water Board (CGWB) has completed the National Aquifer Mapping (NAQUIM) Project in the entire mappable area of about 25 Lakh sq. km. The Aquifer maps and management plans have been prepared and shared with the respective State agencies for implementation. The management plans include various water conservation measures through recharge structures.

CGWB has taken up Heli-borne survey, a state-of-the-art technology for high density aquifer mapping in semi-arid/arid areas of Northwest India to address the current water crisis and to scientifically derive aquifer geometry of principal aquifer with demarcation of de-saturated and saturated fresh / saline aquifers, 3D geophysical model, geophysical thematic maps at horizontal and vertical plane, identification of suitable sites for groundwater withdrawal and water conservation through managed aquifer recharge.

CGWB has prepared a Master Plan for Artificial Recharge to Groundwater- 2020 in consultation with States/UTs which is a macro level plan indicating various structures for the different terrain conditions of the country including estimated cost. The Master Plan envisages construction of about 1.42 crore Rain water harvesting and artificial recharge structures in the country to harness 185 Billion Cubic Metre (BCM) of monsoon rainfall. DPR has to be prepared by the concerned line department of the respective State Government at an implementable level like any other water supply project or city development project. Implementation has to be done through existing schemes of the respective State Government only and no separate scheme/fund has been envisaged for implementation. The Master Plan for Artificial Recharge to Groundwater- 2020 circulated to all the States/UTs for implementation.

Above all, as per MoJS guidelines, dated 24.09.2020 and amendments thereof dated 29.03.2023, Project Proponents (Industry, Infrastructure and Mining) have to submit 'Copy of Rain Water Harvesting Plan submitted to Government agency by the applicant or a proposal for rain water harvesting/ recharge in the project premises as per the prevailing Model Building Bye Laws issued by Ministry of Housing & Urban Affairs, Government of India' for obtaining NOC from CGWA for GW extraction. Further, DoWR, MoJS has recently (31.03.2023) issued advisory to Chief Secretaries/ Administrators of all States/ UTs regarding implementation of RWH and AR along with SOP and Dos and Don'ts. BIS document on standards for RWH has also been included in the advisory. CGWA also forwarded the advisory to all SGWAs and concerned State Principal Secretaries.

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ANNEXURE-I

ANNEXURE REFERRED TO IN REPLY TO PART (a) OF UNSTARRED QUESTION NO. 101 TO BE ANSWERED IN RAJYA SABHA ON 21.07.2025 REGARDING "IMPACT OF CLIMATE CHANGE ON WATER".

Studies related to impact of Climate change on various river basins

S. No.	Name of the Studies	Research Institute	Status
1	Impact Assessment of Climate Change on Hydro-meteorological processes and Water Resources of Mahanadi River Basin	IISC Bangalore(Lead Institute) IIT Bhubaneswar	Completed.
2	Climate change impact studies for Rajasthan Area of inland drainage and Mahi basin	MNIT Jaipur (Lead Institute) CU Ajmer Rajasthan IIT Delhi	Completed.
3	Impact of Climate Change on Water Resources of Tapi Basin	SVNIT Surat (Lead Institute) MNIT Jaipur MANIT Bhopal	Completed.
4	Effects of Climate Change and landarse/land cover changes on spatial and temporal water availability in Subarnarekha Basin	IIT Kharagpur	Completed.
5	Impact of Climate Change on Water Resources of Sabarmati Basin	IIT Gandhinagar(Lead Institute) SVNIT Surat	Completed.
6	Impact of Climate Change on Water Resources in River Basins from Tadri to Kanyakumari	IIT Mumbai (Lead Institute) NIT Surathkal CWRDM Kozhikode	Completed.
7	StatisticalDownscalingforHydro-climaticProjectionswithCMIP5SimulationstoAssessImpactofClimateChange	IIT Mumbai(Lead Institute) IIT Guwahati IISc Bangalore IIT Gandhinagar IIT Kanpur	Completed.

ANNEXURE-II

ANNEXURE REFERRED TO IN REPLY TO PART (b) OF UNSTARRED QUESTION NO. 101 TO BE ANSWERED IN RAJYA SABHA ON 21.07.2025 REGARDING "IMPACT OF CLIMATE CHANGE ON WATER".

STATES BENEFITTED FROM INTER BASIN WATER TRANSFER LINK SCHEMES

(As per FR/PFR/DPR) Peninsular Component

Sl. No	Name	States benefited	Annual Irrigation (Lakhha)	Domestic & Industrial (Mm^3)	Hydro power (MW)	Status
1	a) Mahanadi (Manibhadra) - Godavari (Dowlaiswaram) link	AP & Odisha	4.43	802	445	FR completed
	b) Alternate Mahanadi (Barmul) - Rushikulya – Godavari (Dowlaiswaram) link	AP & Odisha	6.25 (0.91+ 3.52+ 1.82**)	700 +125**	210+ 240**	FR completed
2	Godavari (Polavaram) - Krishna(Vijayawada) link ##	AP, Karnataka, Maharashtra & Telangana	1.94	33.41	--	FR Completed
3	a.) Godavari (Inchampalli)- Krishna (Nagarjunasagar) link	Telangana	2.87	237	975+ 70= 1045	FR completed
	b.) Alternate Godavari (Inchampalli)-Krishna (Nagarjunasagar)	Telangana	2.38	232	26	DPR completed
4	Godavari (Inchampalli/ SSMPP)-Krishna (Pulichintala)link	Telangana & AP	4.74 (0.36+ 4.38)	346	90	DPR completed
5	a.) Krishna (Nagarjunasagar) - Pennar(Somasila)link	AP	5.81	124	90	FR completed
	b.)Alternate Krishna (Nagarjunasagar) - Pennar (Somasila) link *	AP	1.71	236	40	DPR completed
6	Krishna(Srisailam) –Pennarlink	AP	1.79	58	11	Draft DPR Completed
7	Krishna(Almatti)– Pennar link	Karnataka	0.69	466.31	--	Draft DPR Completed
		AP	1.57	30.60		
8	a.)Pennar(Somasila) - Cauvery (GrandAnicut) link	AP, Tamil Nadu & Puducherry	4.91 (0.49+ 4.36	1105	--	FR completed

			+0.06)			
	b.) Alternate Pennar (Somasila) - Cauvery (Grand Anicut) link *	AP	0.51	43		DPR completed
		TamilNadu	1.14	618		
		Puducherry	--	62		
9	Cauvery(Kattalai)-Vaigai-Gundarlink	TamilNadu	4.48	218	--	DPR completed
10	a) Parbati – Kalisindh -Chambal link	MP &Rajasthan	Alt.I = 2.30 Alt.II = 2.20	- 13.2	--	FR completed
	b) Modified Parbati–Kalisindh-Chambal link (duly integrated with ERCP)	MP &Rajasthan	3.38(as Per draft PFR) MP–2.58 Rajasthan-0.8	Rajasthan-Domestic-1723MCM Industrial-286MCM MP-Domestic-36MCM	-	Draft PFR completed
11	Damanganga- Pinjal link	Maharashtra (only water supply to Mumbai)	--	895	5	DPR completed
12	Par-Tapi-Narmada link	Gujarat	2.28	76	21	DPR completed
		Maharashtra	0.04	--	--	
13	Ken-Betwalink	Uttar Pradesh&Madhya Pradesh	10.62 (2.51 +8.11)	194	103 MW (Hydro) &27MW (Solar)	DPR completed & project is under implement ation
14	Pamba-Achankovil -Vaipparlink	Tamil Nadu	0.91	--	3.87	FR completed
		Kerala			504.5	
15	Bedti-Vardalink#	Karnataka	1.05	38	----	DPR completed
16	Netravati – Hemavatilink***	Karnataka	0.34	--	--	PFR completed

**Benefit to Odisha from Six Projects of Govt.of Odisha For PK Clinksat Serialno.10(a): AltI-Linking with Gandhisagar Dam, Alt.II- Linking with Rana Pratapsagar Dam

*Due to pending consensus on Mani bhadra and In champalli dams, Phase-I of Project to divert unutilized waters of Godavari river was carried out and DPR of Godavari

(Inchampalli/ Janampet) – Krishna (Nagarjunasagar) - Pennar (Somasila) – Cauvery (Grand Anicut) link projects combinedly called as Godavari-Cauvery link completed. The report has further been updated terminating the link canal at Manimukhtanadi, a Tributary of Vellar river flowing adjacent of Cauvery basin.

Bedti – Varda Link- DPR was prepared directly after preparation of its PFR, no FR was prepared.

Godavari (Polavaram)- Krishna (Vijayawada) Link- the project has been taken up by Govt. of Andhra Pradesh and has been under execution by Polavaram Project Authority.

*** Further studies are not taken up since after implementation of Yettinahole project by Govt.of Karnataka, no surplus water is available in Netravati basin for diversion through this link.

Himalayan Component

Sl. No	Name	States / Countries benefited	Annual Irrigation (Lakhha)	Domestic &Industrial (Mm^3)	Hydro power (MW)	Status
1.	Kosi-Mechi link	Bihar & Nepal	4.74 (2.99+1.75)	24	3180	PFR completed
2.	Kosi-Ghaghra link	Bihar,U.P &Nepal	8.35 (6.05+1.20 +1.10)	0	--	FR completed
3.	Gandak - Ganga link	U.P & Nepal	34.58 (28.80+5.78)	700	4375 (Dam PH)& 180 (Canal PH)	FR completed
4.	Ghaghra - Yamuna link	U.P & Nepal	27.84 (25.30+ 2.54)	1391	10884	FR completed
5.	Sarda - Yamuna link	U.P & Uttarakhand	2.95 (2.65+0.30)	3054	6620	FR completed
6.	Yamuna-Rajasthan link	Haryana& Rajasthan	2.51 (0.11+2.40)	30	--	FR completed
7.	Rajasthan-Sabarmati link	Rajasthan &Gujarat	11.53 (11.21+0.32)	102	--	FR completed
8.	Chunar-Sone Barrage link	Bihar & U.P	0.67 (0.13+0.54)	--	--	Draft FR completed

9.	Sone Dam - Southern Tributaries of Ganga link	Bihar &J harkhand	3.07 (2.39+0.68)	360	95(90 Dam PH)&5 (Canal PH)	Draft FR completed
10.	Manas- Sankosh-Tista- Ganga (M-S-T-G) link	Assam, W.B & Bihar	3.41 (2.05+1.00+ 0.36)	--	--	FR completed
11.	Jogighopa-Tista-Farakka link (Alternative to M-S-T-G)	Assam, W.B & Bihar	3.559 (0.975+ 1.564+1.02)	265	360	PFR completed (Theproposal hasbeen dropped)
12.	Farakka-Sundarbans link	W.B	1.50	184	--	FR completed
13.	Ganga(Farakka)-Damodar-Subarnarekha link	W.B., Odisha& Jharkhand	12.30 (11.18+0.39+ 0.73)	432	--	FR completed
14.	Subarnarekha-Mahanadi link	W.B. & Odisha	2.16 (0.18+1.98)	198	20	FR completed

Out of 30 link projects, 4 FRs are not required to be prepared:

1. Kosi-Mechi Inter State link- PFR prepared and proposal dropped
2. Jogighopa-Tista-Farakka link- PFR prepared and proposal dropped
3. Bedti - Varda link – DPR was prepared directly after preparation of its PFR, no FR was prepared.
4. Netravati–Hemavatilink-Further studies after PFR preparation, are not taken up since after implementation of Yettinahole project by Govt. of Karnataka, as no surplus water is available in Netravati basin for diversion through this link.

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