

INTERNATIONAL JOURNAL OF LAW MANAGEMENT & HUMANITIES

[ISSN 2581-5369]

Volume 9 | Issue 3

2026

© 2026 International Journal of Law Management & Humanities

Follow this and additional works at: <https://www.ijlmh.com/>

Under the aegis of VidhiAagaz – Inking Your Brain (<https://www.vidhiaagaz.com/>)

This article is brought to you for free and open access by the International Journal of Law Management & Humanities at VidhiAagaz. It has been accepted for inclusion in the International Journal of Law Management & Humanities after due review.

In case of any suggestions or complaints, kindly contact support@vidhiaagaz.com.

To submit your Manuscript for Publication in the International Journal of Law Management & Humanities, kindly email your Manuscript to submission@ijlmh.com.

Hydropower Governance in India: Constitutional Federalism, Regulatory Gaps, and Technology-Driven Sustainability

SUSHANT UNIYAL* AND VATSAL CHAUDHARY**

ABSTRACT

In India, hydropower administration is subjected to a complex and fragmented legal framework, where laws pertaining to water, forests, electricity and the environment are sometimes inconsistent to each other and sometimes leave large gaps. A major part of the confusion comes from the Grundnorm (the Constitution of India): States control “water power,” but the Union has authority over “inter-state rivers.” This tension has already resulted in different decisions from the High Courts of Himachal Pradesh and Uttarakhand on the same issue of “water cess”, causing significant financial uncertainty for the states. This paper highlights some of the gaps in this legal landscape. Discussing the current Environmental Impact Assessment (EIA) system, it looks at each project separately and, in doing so, it fails to take into account the larger, combined impact on the river basin. Latest amendments to the Forest Act, carves out an exemption for certain “strategic” projects, further reduce environmental oversight. This paper also explores the practical problems related to public safety such as weak pollution control enforcement and dam safety rules that focus more on the structure than on the actual risk to people. The study concludes by suggesting reforms to improve hydropower governance. To ease federal tension, it suggests equitable benefit-sharing mechanisms in hydropower governance. It further advocates for the adoption of cumulative impact assessment, grounded in the Valued Environmental and Social Components framework. The paper also recommends the implementation of a holistic and continuously monitored environmental flow (e-flow) regime to ensure the sustainability of the river ecosystem. Finally, it emphasizes the need to modernize dam safety regulation by transitioning from a size-based to a risk based framework to enhance accountability.

Keywords: Hydropower Governance, Constitutional Dichotomy, Sustainable Development Goals, Systemic Gaps, Uttarakhand, Himachal Pradesh.

* Author is a Student at Law College Dehradun, Uttaranchal University, Dehradun, Uttarakhand, India

** Author is an Assistant Professor at Law College Dehradun, Uttaranchal University, Dehradun, Uttarakhand, India.

I. INTRODUCTION

Hydropower in India is regulated by several statutes and each of them focuses on a separate aspect including water, electricity, forests, or the environment. While going through these laws, it has been found that there are several major loopholes and ambiguities which is one of the reasons why hydropower projects often get stuck in the legal or procedural difficulties. At the central of this problem lies a constitutional distinction; List II of seventh schedule empowers states to regulate “water power”, whereas List I empowers the Union to regulate inter-state rivers. This divide is not merely a technical point. It has real consequences, as can be seen from the conflicting High Court decisions on the water cess legislation in Uttarakhand and Himachal Pradesh. This has lead to considerable confusion about the extent of state powers.

The study analyze how the present Environmental Impact Assessment (EIA) framework fails to consider the cumulative effect of several hydropower projects on a single river basin. This discrepancy is further aggravated by legislative gap, like The Forest (Conservation) Amendment Act, 2023, which exempt projects in the International border areas from environmental clearance¹. These gaps results in significant deficiencies, ranging from ineffective enforcement State Pollution Control Boards to a dam safety mechanism.

This paper uses a thematic, locus classicus method to examine these interconnected gaps, employ distinct and legally illustrative case studies including public safety issue at Larji project in Himachal Pradesh and inter-ministerial paralysis after 2013 Uttarakhand flash floods, to demonstrate the governance failure in reality. Additionally this paper provides various recommendations to overcome these shortcomings.

II. CONSTITUTIONAL DIMENSIONS AND FEDERAL TENSIONS

Article 246 of Indian constitution; read with the seventh schedule, is the primary constitutional provision distributing legislative powers between Parliament and State Legislatures, provides three lists, namely Union, State and Concurrent.² The seventh schedule delineates the subjects under each list.

- Entry 17, List II (State List): Grants states exclusive power over “water supplies, irrigation and canals, water storage and water power”. This is the primary source of state authority to develop and tax hydropower.

¹ Forest (Conservation) Amendment Act 2023.

² Constitution of India 1950, art 246.

- Entry 56, List I (Union List): This entry limits state power, by giving the Union control over the “Regulation and development of inter-state rivers and river valley to the extent to which such regulation and development under the control of the Union is declared by Parliament by law to be expedient in the public interest.”³

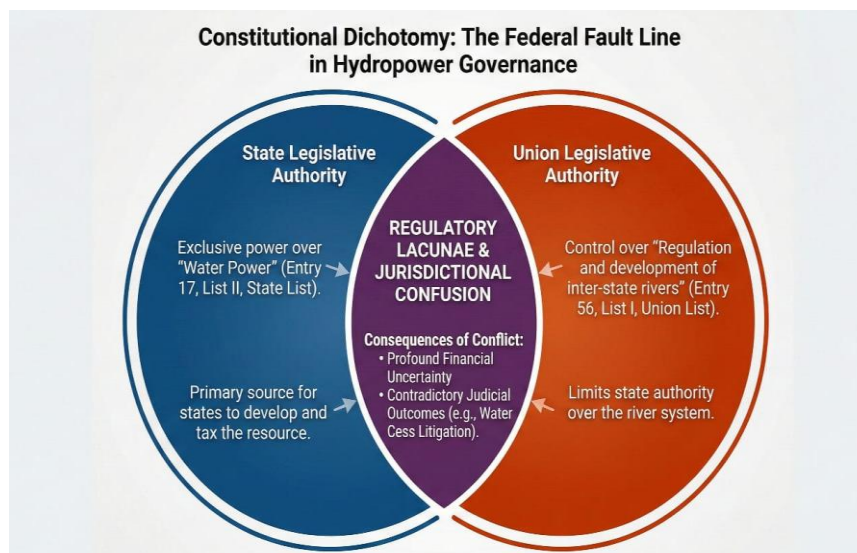


Figure 1: Constitutional Dichotomy between State and Union in Hydropower Governance.

Source: Author's own illustration.

This constitutional dichotomy where state owns “water power” but the Union regulates the “inter-state river” is a source of profound legal and financial conflicts. This abstract constitutional conflict was manifested in high profile litigation in both Uttarakhand and Himachal Pradesh. In Himachal Pradesh, exercising its power under Entry 17, state government imposed a cess on water drawn for power generation by enacting Himachal Pradesh Water Cess on Hydropower Generation Act, 2023.⁴ This was challenged by the Union Ministry of Power and project developers. Their main legal argument was that hydropower projects are on Inter-state River, bringing them under the exclusive domain of the Union via Entry 56, they also argued that cess was a disguised and therefore unconstitutional, tax of electricity. In its ruling, the Himachal Pradesh High Court declares that Act unconstitutional, upholding the Union’s primacy under Entry 56.⁵ But High Court of Uttarakhand in Alaknanda Hydro Power v. State of Uttarakhand upheld the identical water cess Act.⁶ ⁷It is ironic to note that the legislatures of

³ Constitution of India 1950, sch 7.

⁴ Himachal Pradesh Water Cess on Hydropower Generation Act 2023.

⁵ NHPC Limited v State of HP [2024] SCC OnLine HP 533

⁶ Alaknanda Hydro Power Co Ltd v State of Uttarakhand Writ Petition 631/2017 (M/S) (Uttarakhand High Court)

⁷ Water Tax on Electricity Generation Act 2012.

Himachal mutatis mutandis passed the same legislation. These judgements highlight the extreme regulatory uncertainty at the heart of “water federalism”, where state cannot reliably monetize the very resource that defines their development policy.

III. SYSTEMIC GAPS IN THE MITIGATION FRAMEWORK

A. The EIA Notification, 2006:

Issued under the EPA, this notification is the main procedural law for project approval. It sets out a four-stage process- Screening, Scoping, Public Consultation and Appraisal.⁸ The framework treats each project as a standalone activity and each proposal is examined in isolation. While Form I mentioned “cumulative effects,” in practice this requirements is interpreted very narrowly, often focusing on the immediate surroundings. As a result, the review process misses how multiple projects on the same river together change the ecology over time.

This problem becomes even more visible in the cases of small hydro power projects. Many of these projects don’t need a full Environmental Impact Assessment (EIA), and because they are considered harmless on their own, their combined impact is rarely evaluated. According to Ministry of New And Renewable Energy, the estimated potential of 21133 MW from 7133 sites for power generation in the country from small / mini hydro projects was assessed by Hydro and Renewable Energy Department (HRED) out of which hilly states constitutes around half of this potential.⁹ In states like Himachal Pradesh and Uttarakhand, where government is aggressively promoting small hydropower projects, the total pressure on river basins is much greater than what the law currently recognizes.

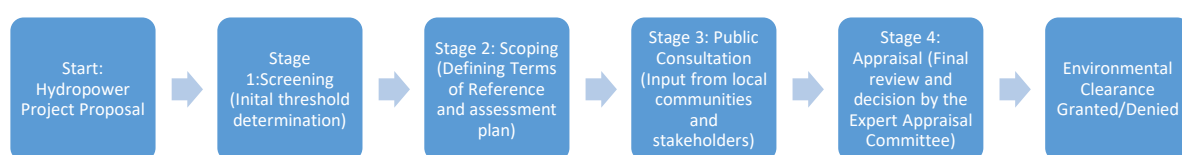


Figure 2 The Mandatory Four-Stage EIA Process under EIA Notification, 2006.

Source: Based on EIA Notification, 2006.

B. Forest (Conservation) Amendment Act, 2023

The Forest (Conservation) Amendment Act, particularly its broad exemption for 'strategic linear

⁸ Ministry of Environment and Forests, Notification S.O. 1533 (14 September 2006), Gazette of India, Extraordinary, Part II, s 3(ii).

⁹ Ministry of New and Renewable Energy, ‘Overview’ <https://mnre.gov.in/en/small-hydro-overview/> accessed 8 February 2026.

projects' within 100 km of international borders, has been critiqued for prioritizing security objectives over environmental scrutiny in ecologically sensitive Himalayan states.¹⁰ As both the states in the study are Border States, and the term “strategic linear project” is ambiguous and subject to “executive discretion,” this provision has significant regulatory implications. It gives a pathway for the executive to exempt new hydropower projects in the most ecologically fragile regions from scrutiny under FCA, effectively diluting its protective mandate and bypassing standard environmental scrutiny.

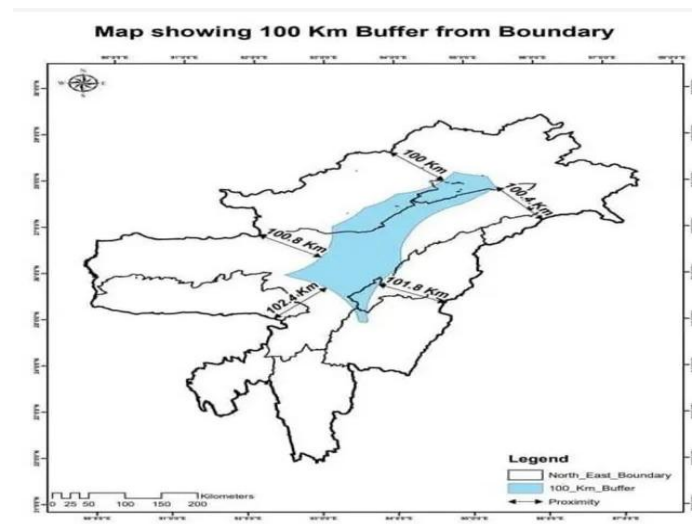


Figure 3: Map showing 100 Km buffer from borders.

Source: Morung Express, 19 May 2023 (map by Amba Jamir, independent policy analyst, Guwahati).

C. Monitoring failure

In practice implementation of environmental flow is difficult. There is usually a large difference between scientifically recommended e-flow and what is actually released from the project. From what I could understand, this gap exists partly because agencies lack strong monitoring systems to track compliance. Implementation relies on “minimum flow” standards, which do not indicate the complex and changing needs of river ecosystem. There is also lack of coordination between different managing bodies and departments and the absence of reliable, shared data makes it harder to manage e-flows effectively.¹¹

¹⁰ Garima Thakur, ‘Exigency of an Overhaul in Forest Law: How the Forest (Conservation) Amendment Act, 2023, has Transformed India’s Forest Regime’ (2023) 16(2) NUJS Law Review 285.

¹¹ Ravindra Kumar Verma and others, ‘A Review of Environmental Flow Assessment Studies in India with Implementation Enabling Factors and Constraints’ (2023) *Ecohydrology & Hydrobiology*.

IV. THE DAM SAFETY ACT, 2021

Although in India we use modern simulation technology for Dam safety, yet it heavily relies on the physical size like height and storage of the structure rather than a holistic, risk based standards which assess the risk poses to downstream population. The effectiveness of predictive software's used in India like example MIKE 11, HEC-RAS, and DAMBRK is eroded because of lack of uniformity and regulatory lapses. In many cases it has been seen that the simulations fails to include detail "inundation maps" and does not require "consequential analysis", which would assess the potential loss of life, property and financial crisis if the dam fails. In order to overcome this issue we have to built a "risk-based decision-making system" as used by U.S and Australia, like example U.S use U.S. Army's Dam Sector Analysis tool (DSAT) and in Australia we have ANCOLD system the salient feature of these international models is that they combine failure mode analysis with consequence assessment methods which provide the information of entire dam lifecycle, from design to decommissioning. India already have existing national assets, such as ISRO's Water Resources Information System (WRIS) by leveraging this framework India could also build a more coordinated, risk based system.¹²

V. THEMATIC POLICY REVIEW

It is important to clarify the method used in this analysis. Instead of comparing one variable in both states, this analysis uses a thematic approach. This section therefore, uses the clearest and most legally illustrative case study from the two-state sample to dissect each specific mechanism of failure. This thematic method moves beyond simple description to build a composite, analytical picture of the different ways the national governance architecture fails in practice. This paper also acknowledges best practices and success stories in these states.

A. Uttarakhand

The 2013 Uttarakhand flash floods exposed problems in environmental governance surrounding hydropower projects in the state. This disaster resulted in Supreme Court's intervention in the *Alaknanda Hydropower Co. Ltd. v. Anuj Joshi*.¹³ Recognizing the environmental impact of these projects, the court issued the preventive direction of August 13, 2013 (temporary halt on granting clearance) to new large hydropower projects in the state. The Additional Solicitor General informed the court that The Ministry of Environment, Forest and Climate Change, The Ministry of Water Resources; and The Ministry of Power would jointly arrive at a "common policy framework." However this framework was lost primarily due to the lack of coordination

¹² Devendra Damle, Dam Safety in India (NIPFP Working Paper No 329, 10 March 2021).

¹³ *Alaknanda Hydro Power Co. Ltd v Anuj Joshi*, (2014) 1 SCC 769 (SC 2013)

between ministries. Moreover MoWR, advocating for the river's pristine flow, filed a counter affidavit against the plea of MoEFCC and the ministry of power, advocated the pro project stance.¹⁴ The governmental failure to coordinate and to prepare common policy on this issues lead to judicial inaction, ensuring the important preventive moratorium on several hydropower projects and protection to the environment it offered was lost.

The technological performance and application of Micro and Mini Hydro Projects (MHPs) in Uttarakhand vary significantly. The Harsil 2x100kW MHP, established in 1965, demonstrates remarkable equipment longevity, with its Pelton wheel turbines and "Jyoti Limited" generators still operating after more than 50 years. However, it is facing modern technical challenge that is it does not have grid synchronization or even machine- to- machine synchronization. This creates big problem with how the load is distributed one machine ends up getting overloaded while the other is underutilized. Another example is of Gulari 2X100KW MHP this project is completely stuck due to huge technical failure. After the 2013 disaster, its civil structure like the power channel and forebay tanks were washed away or filled with silt. Debris and silt got into the penstock, its Francis turbines are also not working and the governors are in dilapidated condition, making it impossible to run the machines at a stable frequency.¹⁵

The 6.5kW Rampur multipurpose project presents a different technological model; it can be described as the reintroduction of a traditional water mill (Gharat). This project uses a low-head (5m) custom-designed cross flow turbine and is notable for its integrated application of both mechanical and electrical power. While it includes a 7.5kVA Kirloskar generator, the turbine's mechanical energy is also used to directly drive a flour mill, an oil expeller, a 2 HP water pump, and a 2 HP air compressor. This multipurpose technological approach, focused on providing direct livelihood services like milling rather than just electricity, represents a community-scaled solution where revenue is actively generated from the flour mill and oil expeller.¹⁶

B. Himachal Pradesh

The mushrooming of run-of- the river hydropower projects in the state have resulted in many, often unaddressed environmental issues and public safety hazards, one of them is unscientific and illegal debris dumping. These ROR projects require excavating long tunnels which produce a huge amount of debris which is often dumped unscientifically and illegally in easily accessible regions such as river banks or hill slopes, an acute shortage of resources within the State

¹⁴ Debadityo Sinha and Yogini Oke, Supreme Court on Sustainable Development: Hydro Power Projects in Uttarakhand (Case Brief, Vidhi Centre for Legal Policy 2021).

¹⁵ Nitish Kanetkar, 'Understanding the Governance of Micro and Mini Hydro Projects in Uttarakhand' (MTech Major Project Thesis, TERI University, June 2017).

¹⁶ Ibid.

Pollution Control Boards (SPCBs) allowing this practice to go unchecked. The soil in these places remains loose and unstable and many a times these sites become major landslide zones creating public safety threats.¹⁷

One of the most significant shortcomings of Run-of-the-River (RoR) hydro development is failure of flash flood warning systems, making RoR developments become "death traps" when floods occur. The "tragic event" at the Larji hydro power project in Himachal Pradesh where 25 engineering students were swept away in a flash flood, is an example of failure in these totally unacceptable systems. The investigation revealed that there was no adequate warning provided to notify the public. Such warning methods, like audible sirens or portable visible public signage, was not even provided for safety and emergency preparedness.¹⁸ This risk is exacerbated because the tourists "are simply not cognizant of the hidden danger" (to avoid the flood-prone area) and "do not even understand what the sound of the siren signifies, even if properly functioning" and "the warning sign boards along the bank of the river were gone or missing altogether". The failure of governance leads to a need for advancements from just simple sirens into technology-based alarms and devices like "talking hooters" to issue warnings in the local languages, a "Warning SMS service" to forward information to notify the tourists of the hazards of flooding, and a centralized "emergency public safety management systems that utilize video surveillance of monitoring and to announce alerts utilizing the same utility of the transportation process".

VI. DISCUSSION

Renewable energy from hydropower plays very important role in achieving "Sustainable Development Goals" as it directly promotes SDG 7: Affordable and Clean Energy, SDG 13: Climate Action (decarbonization), and SDG 9: Industry, Innovation, and Infrastructure. This study examined the legislative framework governing hydropower in India, including Constitution of India, EIA Notification (2006), FCA Amendment (2023), Dam Safety Act (2021) and other hydropower related regulations. The analysis reveals eight major gaps: Unresolved federal conflict creating profound legal and financial uncertainty, deterring investors and hampering the revenue generation of states, failure to access "cumulative environmental effects" of these projects, loophole in FCA Amendment (2023), failure to

¹⁷ Gaurav Bisht, 'NGT constitutes committee to investigate debris dumping into Sutlej river by SJVNL, Himachal Pradesh pollution control board to conduct inquiry' Hindustan Times (1 June 2023). <https://www.hindustantimes.com/cities/chandigarh-news/ngt-constitutes-committee-to-investigate-debris-dumping-into-sutlej-river-by-sjvnl-himachal-pradesh-pollution-control-board-to-conduct-inquiry-101685610759750.html> accessed 8 February 2026.

¹⁸ Richard Davies, 'Himachal Pradesh – 25 People Swept Away After Reservoir Flood Gates Opened' (FloodList, 10 June 2014) <https://floodlist.com/asia/himachal-pradesh-floods-25-missing> accessed 8 February 2026.

effectively implement environmental flow, lack of robust monitoring systems, the ineffective State control boards, and failure to conduct consequential analysis of dam safety to assess actual risk it poses to the people downstream. These findings align with the earlier studies highlighting statutory loopholes but extend the debate by demonstrating that this is a systematic problem and not merely a statutory one and in order to solve these problems we have to take the holistic view encompassing statutory, administrative, and implementation dimensions. The study therefore presents a more integrated picture of governance deficit. These deficits have significant implications for sustainable development. This discussion indicates the need for harmonizing the state and union interests which can be effectively done by using alternative revenue sharing mechanisms, adopting cumulative and holistic approach in impact assessment and using strong, automated monitoring systems for regulating e-flow and dam safety. While this study presents a holistic analysis of hydropower governance, it does not incorporate empirical assessments of on-ground enforcements.

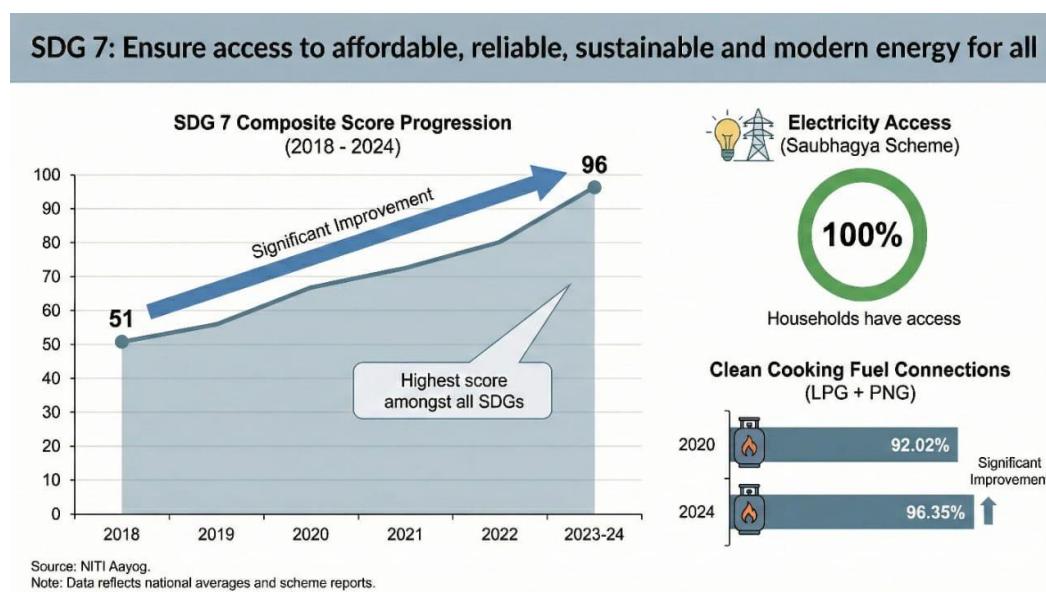


Figure 4: Progress on SDG 7 in India (2018-2024). Source: NITI Aayog.

VII. CONCLUSION AND RECOMMENDATIONS

The governance of hydropower sector is at a point where the existing legal framework and administrative arrangements are no longer sufficient. Legislative loopholes and ambiguities are giving rise to many practical difficulties. This paper demonstrates that legal ambiguity in the Constitution dividing jurisdiction over “water power” (state) and “inter-state rivers” (Union) is not merely a theoretical issue but results in significant financial instability and conflicting judgements. From an impact assessment perspective, the existing dam safety mechanism prioritizes physical dimension over measurable risk to human life and property, ineffective

pollution control agencies to disastrous breakdowns in flood alert system, the existing framework is clearly insufficient for the safeguarding river basins and the public. It is essential to shift from this disjoint, project based method to a cohesive, basin-wide, and risk conscious system. In the subsequent recommendations are suggested to establish a more equitable, resilient, and secure governance framework.

A. Resolving federal tension with equitable benefit sharing

In the states like Himachal Pradesh and Uttarakhand the water tax is important for the financial health of the states, during the assembly session the minister of Jal Shakti department in Himachal Pradesh, mentioned that the purpose of Himachal Pradesh Water Cess on Hydropower Generation Bill, 2023, is to raise the revenue of Rs 4000 crore from 172 hydro projects.¹⁹ But at the same time these Acts go beyond the constitutional mandate and even violate the expression provisions, like Entry 53 List II which permits the states to levy taxes on the consumption or sale of the electricity, but excludes to tax the generation of electricity. This distinction exists because electricity is good under Article 286, and power generated in one state like HP often sold and consumed in many other states.²⁰ Allowing state to tax generation would amount it to tax the residents of other states which is a clear violation of federal principle.

According to the International Finance Corporation states and local communities can secure significant financial benefits from hydropower projects through "benefit-sharing mechanisms" rather than by levying a direct tax on generation. These methods are designed to go beyond simple impact mitigation and align the project's success with local development aspirations.²¹

IFC also mentions that the simplest financial alternatives include Revenue Sharing and Shared Ownership. One way to do this is by making recurring payments into a Local Area Development Fund. This constitutionally sound tool already exists in Himachal Pradesh where policy mandates that the hydro power projects above 5MW contribute 1.5% of their final project cost to an LADF. Furthermore, after commissioning, 1% of their power generated is sold, with the revenue transferred to this fund. The administration of the fund vests upon a local committee including developer, government, and community representatives to finance infrastructure projects selected by the local communities.²²

¹⁹ Devansh Malhotra and Shaurya Chopra, 'Charge on generation of electricity: The states' Water Cess conundrum' (ETEnergyWorld, 21 November 2023) <http://economictimes.indiatimes.com/news/renewable/charge-on-generation-of-electricity-the-states-water-cess-conundrum/105394599> accessed 8 February 2026.

²⁰ Constitution of India 1950, art 286

²¹ International Finance Corporation, A Guide to Local Benefit Sharing in Hydropower Projects (Capturing Hydropower's Promise Report Series, IFC 2021).

²² Ibid.

Another alternative tool is Shared Ownership, where the local government or community holds an equity stake in the project. This entitles them to a direct share of the profits via dividends, as seen in models used in Canada and Nepal.

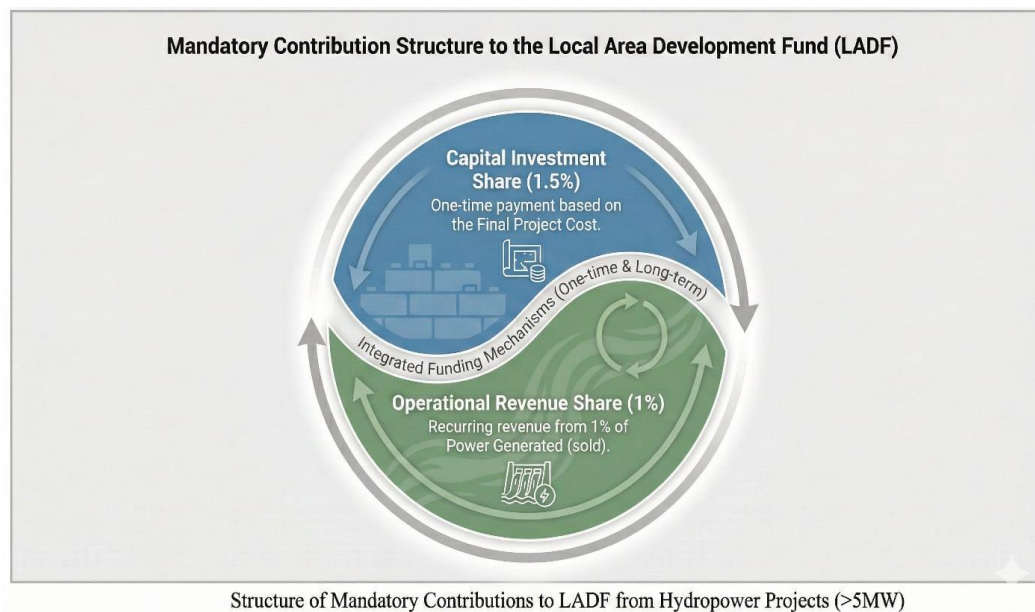


Figure 5: Mandatory contribution structure to LADF (hydropower projects >5 MW).

Source: Based on IFC (2021).

B. Adoption of (VCE) centric Cumulative Impact Assessment (CIA)

To address the current legal gap in EIA framework the adoption of Valued Environmental and Social Components (VCE) framework can address these problems. In the present system two primary failures of EIA are first its narrow, project by project assessment and its inability to assess cumulative impact from exempted small hydro power projects.

The current EIA focuses on assessing the impact of one particular impact on the environment whereas CIA which is VCE centric assesses the combined impact of all activities on the health of the river system. This assessment is focused on Valued Environmental and Social Components; VCEs are the specific, shared resources that stakeholders, scientists, and government agree are important in river basin context.²³

VCE includes ecological and social assessment; ecological assessment includes river flow, fish population, sediment transport, and water quality. Social assessment includes local livelihoods, community health and cultural traditional ceremonies.²⁴

²³ International Finance Corporation, Cumulative Impact Assessment and Management: Guidance for the Private Sector in Emerging Markets (Good Practice Handbook, IFC, August 2013).

²⁴ Ibid.

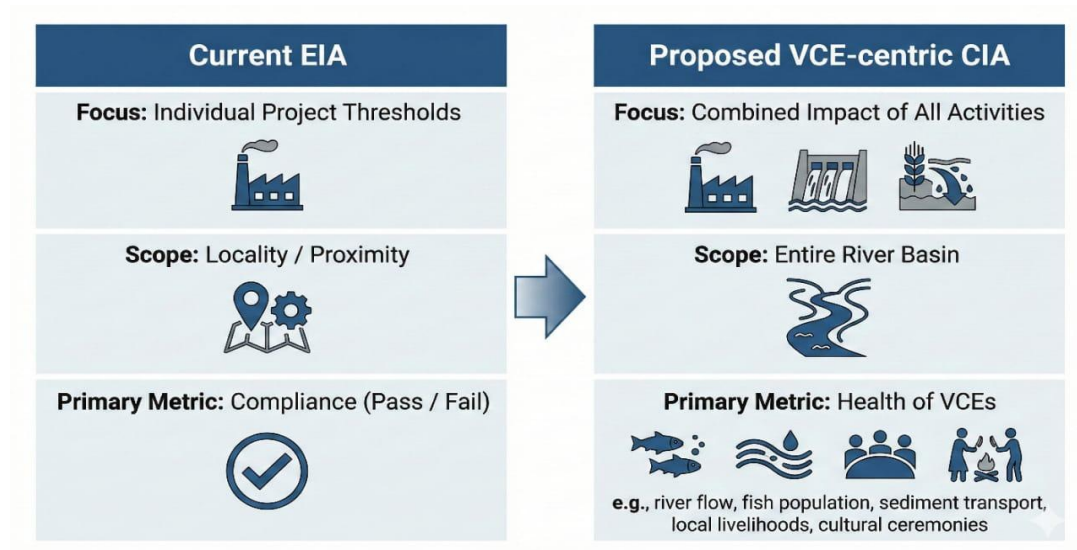


Figure 6: Comparison between the current EIA approach and the proposed VCE-centric CIA approach.

C. Implement a Holistic and Monitored E-Flows Regime

Shift away from the static “minimum flow” standards to holistic ecological regime. This includes using advanced scientific assessment methodologies, such as the Building Block Methodology or the Metasystem Perspective, which define e-flow as the complete, dynamic framework of quantity, timing, frequency, and duration required for ecosystem.

A strong, automated monitoring system should be set up using IoT sensor networks and AI-driven analytics to track compliance with the complete dynamic flow regime. This data should go to the central dashboard that provides a single, reliable source of information. In India this system can be connected to the existing National Water Informatics Centre.²⁵

D. Modernize Dam Safety from a Size-Based to a Risk-Based Framework

India needs to develop a national Decision Support System (DSAT) by technically integrating the real time structural sensor data such as stress gauges and piezometers mandated by the Act. Much of this consequence data is already available through the ISRO Water resources information system (WRIS). By integrating these elements, India can meaningfully shift its dam safety approach from an old, size based model to a modern, consequences based, probabilistic framework.²⁶

²⁵ Silvia Liberata Ullo and GR Sinha, ‘Advances in Smart Environment Monitoring Systems Using IoT and Sensors’ (2020) 20(11) Sensors 3113.

²⁶ Biplab Munshi, ‘Beyond the “Time Bomb”: Probabilistic Failure Analysis and Remedial Prioritization for India’s Vintage Dams’ (preprint, October 2025)

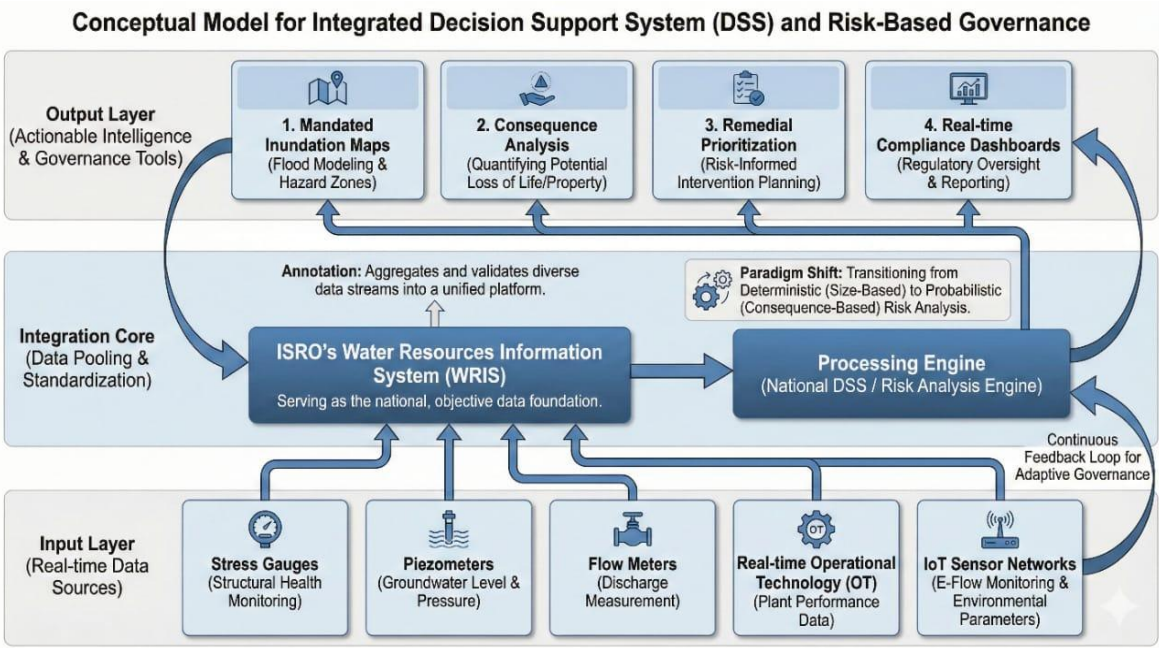


Figure 7: Conceptual model for integrated DSS and risk-based governance.

Source: Based on Biplab Munshi (2025).
