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Responsible Hydropower Development in India

Challenges for the Future

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A study on Responsible Hydropower Development in India: Challenges for the Future.

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ABOUT CEEW

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In India he has worked with the International Water Management (IWMI) in the IWMI-Tata Water Policy Programme. His work in the IWMI-Tata Water Policy Programme focused on institutional reform in the Indian irrigation sector, specifically on the role of the panchayats, irrigation cooperatives and Water User Associations in decentralised irrigation management. He is experienced in designing multi-location research in partnership mode and has experience in undertaking field research in around ten states in the country. He also has experience of working with leading development cooperation agencies in the country. He has worked with the Sir Ratan Tata Trust in their Central India Initiative programme and later worked with the Collectives for Integrated Livelihood Initiatives. During this period he worked on water-centric livelihood enhancement programmes for the tribal population in Central India, particularly on the restoration of traditional flow irrigation systems in the region.

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Arunabha has presented to heads of state, India's Parliament, the European Parliament, Brazil's Senate, the Andhra Pradesh Legislative Assembly and other legislatures; hosted a documentary on water set out of Africa, honoured at the Webby Awards; written columns in many newspapers; and commented on radio and television across the world. He co-chaired work on geoengineering governance for the UK Royal Society; is a member of three track II initiatives with Israel, Pakistan, and the United States; and sits on the Governing Board of the International Centre for Trade and Sustainable Development, Geneva. In 2011, Asia Society named him an *Asia 21 Young Leader*.

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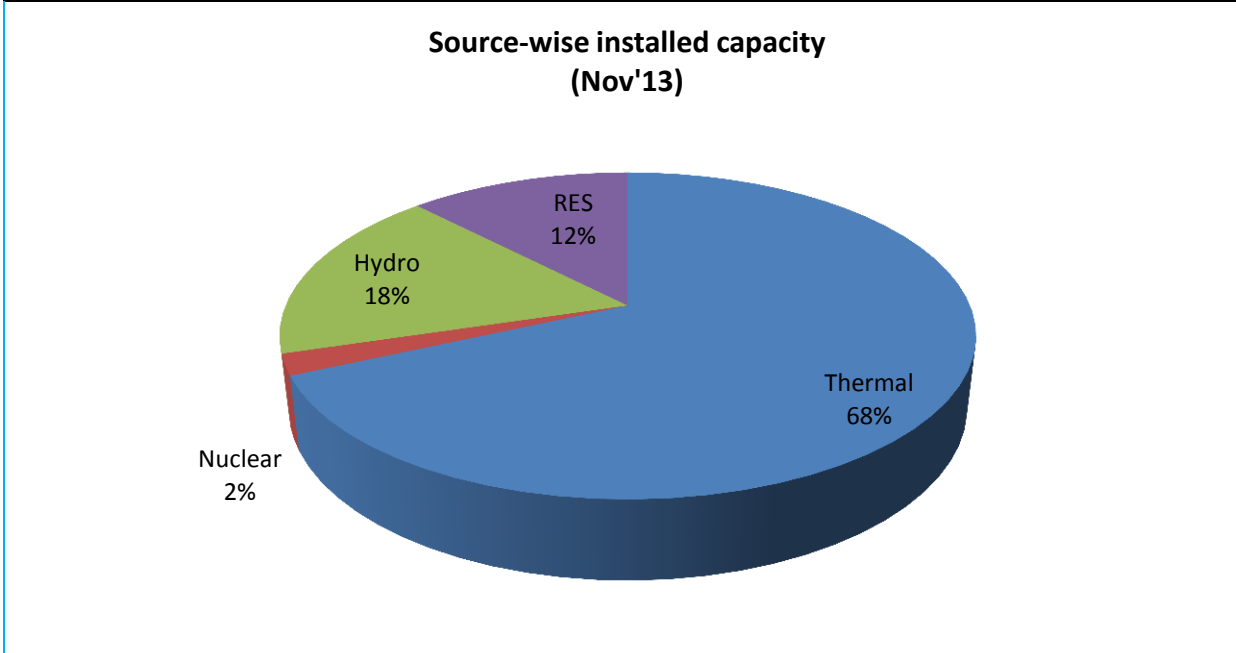
Responsible Hydropower Development in India: Challenges for the Future

Hydropower is an important source of renewable energy. In recent years, both at the national level and in various states, policy impetus has been given for increasing hydropower generation through new projects and by encouraging private sector investment. The importance of hydropower increases given that only around 16% of the hydro potential in the country has been used even as the country remains woefully short of electricity to meet growing demand. But a renewed focus on hydroelectric projects may result in a situation of “rapid” hydropower development rather than social and environmentally “responsible” hydropower development. This article argues that, although hydropower will continue to remain an important source for electricity, focus needs to be on “responsible” hydropower development. Responsible hydropower development is also likely to ensure more stable and sustainable investment in the sector over the medium-to-long term.

Hydropower generation in India: unmet potential

Hydropower generation has been an important component within the overall electricity portfolio of the country. By the end of the fourth year of the Eleventh Five Year Plan (March 2011) hydropower contributed around 22% of total generation (CEA, 2011). As on date, of the total installed capacity of 229 Gigawatts (GW) in the country, hydropower’s contribution is around 39.8 GW (CEA, 2013) or 18% of the total (Figure 1). At the same time, hydropower generation has failed to keep pace with the rapid increase in thermal power generation. As a result there has been a consistent decline in the proportion of hydropower generation within the total grid connected generation in the country.

Figure 1: Hydropower’s share in electricity generation capacity less than one-fifth

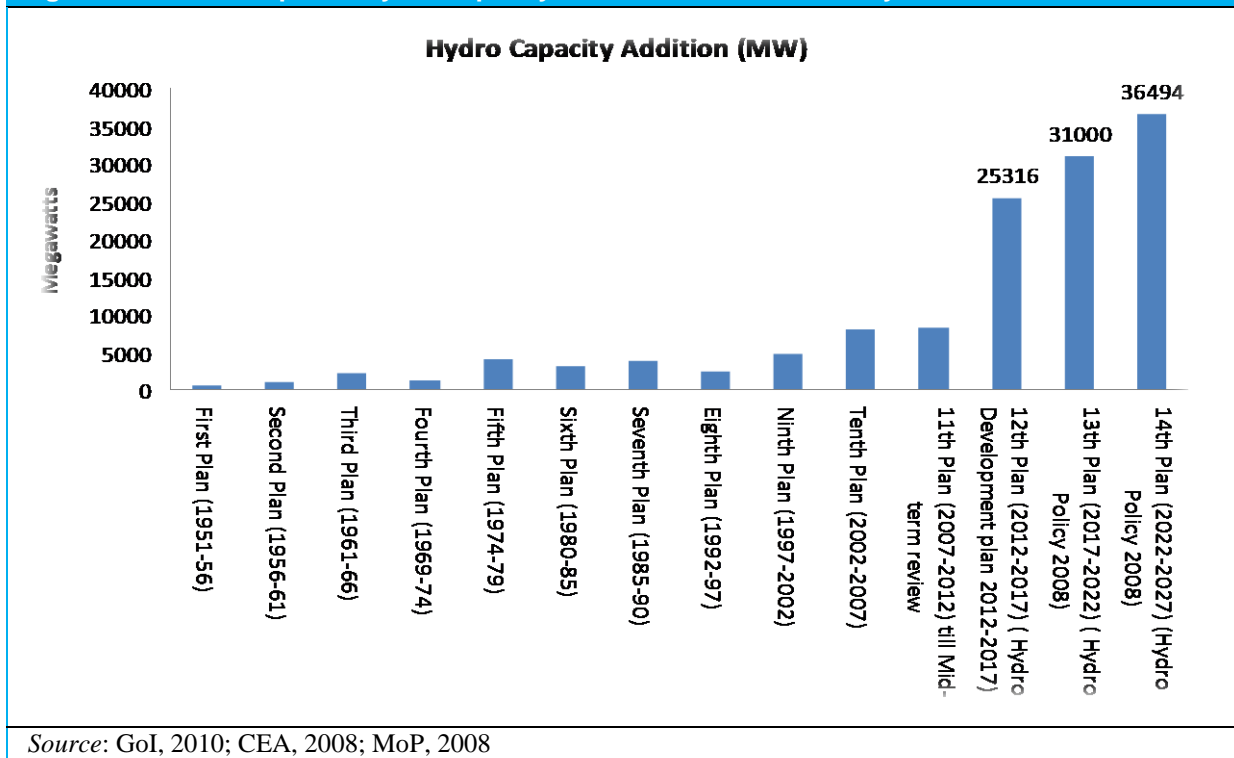


Source: (CEA, 2013)

Resurgence of hydropower in India’s energy planning

While hydropower’s contribution in the overall portfolio has declined over the years, the sector is beginning to make a comeback – at least in the vision articulated in plan documents. While only 8237 megawatts (MW) of hydropower generation was envisioned in the Eleventh Five Year Plan, three times that amount (around 25316 MW) are planned during the Twelfth Plan (2012-2017), followed by 31000 MW and 36494 MW in the Thirteenth (2017-2022) and Fourteenth (2022-2027) Plans, respectively (CEA 2008; MoP 2008; GoI 2010). Until 2007, a total of 34653 MW of hydropower had been installed. By contrast, each of the five year plans starting from the Twelfth to the Fourteenth is expected to add new hydropower capacity of around 30000 MW, with the aim of harnessing the entire hydropower potential of the country by 2027(Figure 2).

Figure 2: Ambitious plans: hydro capacity addition in India over the years



Private sector seen as an important actor for hydropower development

Traditionally hydropower generation has been the forte of public sector generation companies. Around 97% of the hydropower generation companies are from the public sector (IDC 2013). But the current plan period envisages that the private sector will emerge as one of the leading participants in hydropower development. According to the Hydro Development Plan for the Twelfth Five Year Plan, around 39% of new capacity addition (12007 MW) is expected to be installed via private investment (CEA 2008).

That private sector is seen as an important driver for hydropower development in the future is best witnessed in the states where a bulk of the hydropower potential exists: Arunachal Pradesh (34% of the total potential in India), Himachal Pradesh (13%), Uttarakhand (12%), and Sikkim (3%). A significant share of new hydropower projects in these “hydropower states” are to be developed through the private sector (Table 1). At the national level also, the Hydro Policy 2008 aimed to provide incentives to the private sector to make hydropower projects as attractive as thermal power projects for private sector investment (MoP, 2008).

Table 1: Hydropower development plan in the “hydropower states” of the country

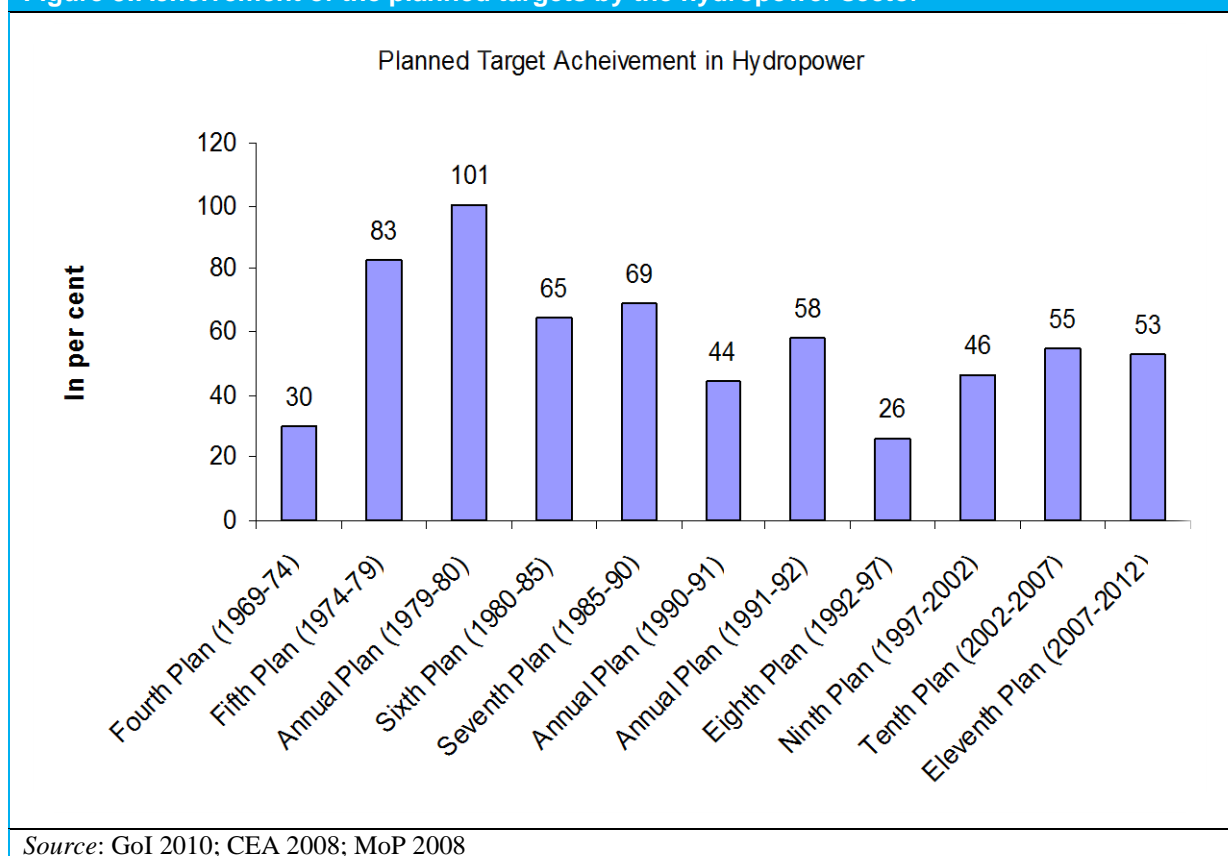
State	Arunachal Pradesh	Himachal Pradesh	Uttarakhand	Sikkim
Total Hydropower Potential (in MW)	57072.5	23000	25000	8000
Total Hydropower Potential realised [Under construction/operation] (in MW)	59.215	6728	3163.85	100.7
Total hydropower projects under Central Sector (in MW)	8735	9095	7302	1300
Total hydropower projects under State Sector (in MW)		3428	2815.3	24.5
Total hydropower projects under Private Sector/JV (in MW)	32253.4	8192	2118.4	3820

Source: Based on the Annual Reports and the data available on the websites of the respective state nodal hydropower development agencies

But are these targets achievable?

Historically, the performance of the hydropower sector in achieving planned targets has been dismal. On average, the sector has only been able to achieve 57.5% of its planned targets between the fourth and the eleventh five year plans (Figure 3). Set against this historical record, the targets for the next 15 years seem unrealistically optimistic.

Figure 3: Achievement of the planned targets by the hydropower sector



There are a host of reasons behind hydropower's inability to fulfill the targets over the years. The Policy on Hydropower Development in 1998 identified that apart from technical, financial and tariff related issues, socio-political issues like land acquisition had resulted in a decline in hydropower capacity investment. This policy accepted the then reality that private sector investment in the hydropower sector was minimal. In order to boost private sector investment, it espoused that the public sector would undertake the contentious pre-construction activities, including land acquisition and Resettlement and Rehabilitation (R&R) *before* handing the project to the private sector. The policy also proposed easier transfer of statutory clearances from the public sector to the private sector (MoP, 1998).

A decade later, in the Hydro Policy 2008, among various incentives was a draft Rehabilitation and Resettlement Policy for project-affected populations. This was done to make land acquisition (a process that was delaying projects and making them more risky) smoother and project design more amenable to public acceptance and consent.

As a part of a liberal R&R mandate of the Hydro Policy 2008 several provisions were undertaken. The Project Affected Family was broadly defined as any family, even if only one household, whose "place of residence or other property or source of livelihood" had been affected by the hydropower project and which had been staying in the affected area for a period of more than two years preceding the Notification, in accordance with Land Acquisition Act 1894, including agricultural and non-agricultural labourers and squatters.

The Hydro Policy 2008 also mandated that, in addition to the 12% free electricity that would accrue to the states where the project was located, another 1% free power would be given for the purposes of financing a Local Area Development Fund (with matching grants from the state government). For the Project Affected Families, the Hydro Policy 2008 made a provision for 100 units of free electricity for a period of ten years.

The Hydro Policy 2008 did not directly argue for any employment-based compensation of the project-affected families, but it had references to skill development of the local population to increase their employability within the project.

Not “rapid” hydropower generation but “responsible” hydropower development

One of the reasons for the resurgence in interest for private sector driven hydropower development is that hydropower is less carbon intensive than thermal power. But there are still challenges that the sector needs to address not just to achieve the targets but to achieve them in a responsible manner. In other words, hydropower development in India in the coming years has to ensure not just “rapid” hydropower development but “responsible”

hydropower development. In the pathway towards responsible hydropower development it has to ensure that the fragile environmental systems within which the projects are constructed are taken care of and the social systems that project affect, directly or indirectly, are taken on board to minimise opposition. Towards these ends, the hydropower sector needs to address two priorities: going beyond environment impact assessments (EIA) to EIA follow-up; and to increase public involvement in decision-making through better processes, which go beyond public hearings.

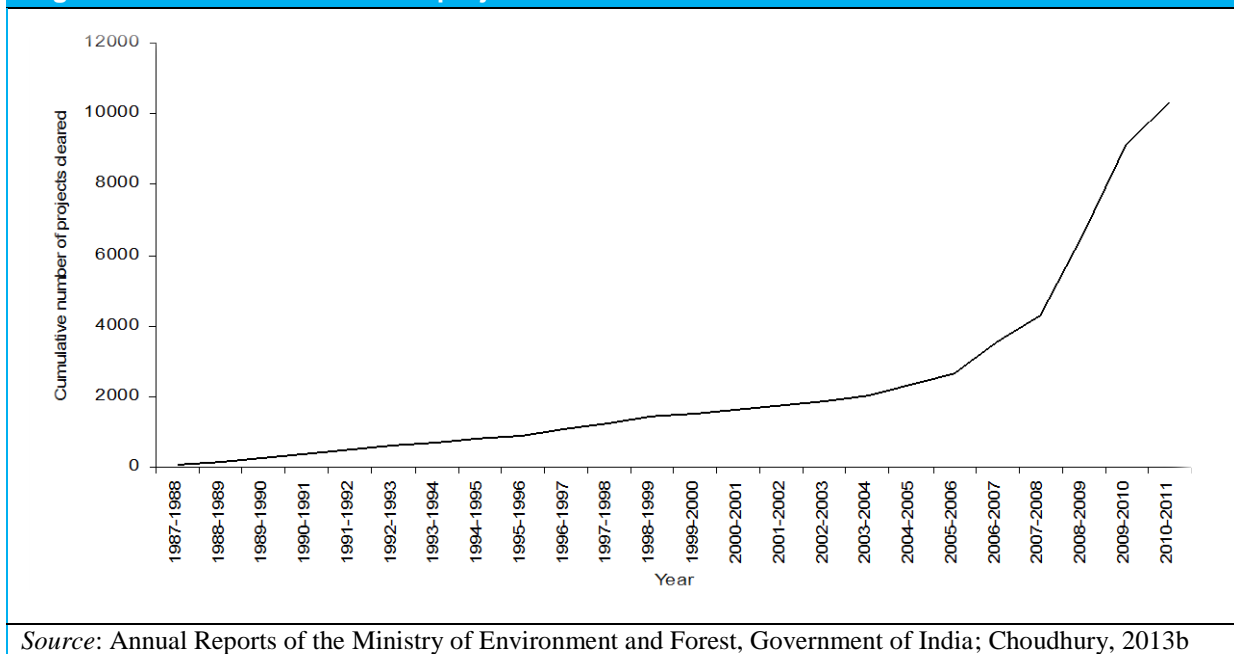
Environment Impact Assessment and follow-up

EIA follow-up is a process including a range of activities, designed during the environmental clearance stage of a project, and implemented during the construction, operation and decommissioning phases of a project (Jha-Thakur et al. 2009). These activities include: *monitoring* of environmental impacts on a real time basis through *compliance* and *outcome* monitoring; *evaluation* of the same with respect to expected impacts as mentioned during the EIA; adaptive *management* of the impacts; and – most importantly – *communication* of the same to the community (Arts et al. 2001). EIA follow-up also helps closing existing knowledge gaps. In the short and medium terms, the EIA follow-up process strengthens the planning and operation of on-going projects through monitoring and evaluation of impacts. This is often defined as *single-loop learning*. In the long term the monitoring and evaluation of real-time environmental data strengthens the understanding of *cause-effect relationships* and leads to better prediction of the environmental impacts in the future. This is often defined as *double-loop learning* (Marshall et al. 2005, Morrison-Saunders & Arts 2005, Marshall 2005, Arts & Nooteboom 1999).

Globally, EIA follow-up is seen to be driven by three factors. First, the project proponent could independently initiate EIA follow-up, also known as first-party EIA follow-up, even if the developer is not legally bound to do so. By establishing Environmental Management Systems within the organisation and compliance with ISO14000 standards a project proponent might voluntarily undertake some EIA follow-up activities. Secondly, an EIA follow-up could also be driven by a regulatory authority. In this case the permission to commence with a project is contingent upon its environmental clearance. The third important driver of EIA follow-ups is the “community”. This can take many forms, from a local community immediately affected by a project to a consortium of international pressure groups criticising large infrastructure projects (Morrison-Saunders et al. 2003, 2001; Arts et al. 2001). Within India there is no dearth of cases of local community mobilisation. From the Sardar Sarovar Project to the Jaitapur Nuclear Project superior social and environmental standards at the project level have been driven by pressure from the local community and from civil society organisations.

In India, EIA is a regulatory requirement and EIA follow-up, at least in terms of compliance, emanates from the regulatory requirement. Hence, India predominantly follows the second route. The use of the EIA process has increased over the years from being an administrative requirement, only used for multipurpose river valley and hydropower projects in the early 1980s, to a statutory requirement covering around thirty different types of projects under eight broad categories, namely coal mining, industrial projects, infrastructure and Coastal Regulatory Zone, mining, new construction and industrial estates, nuclear, thermal projects, and river valley and hydroelectric projects. This has resulted in an exponential increase in the number of projects (not just those related to hydropower), which have obtained environmental clearances over the last three decades (Figure 4).

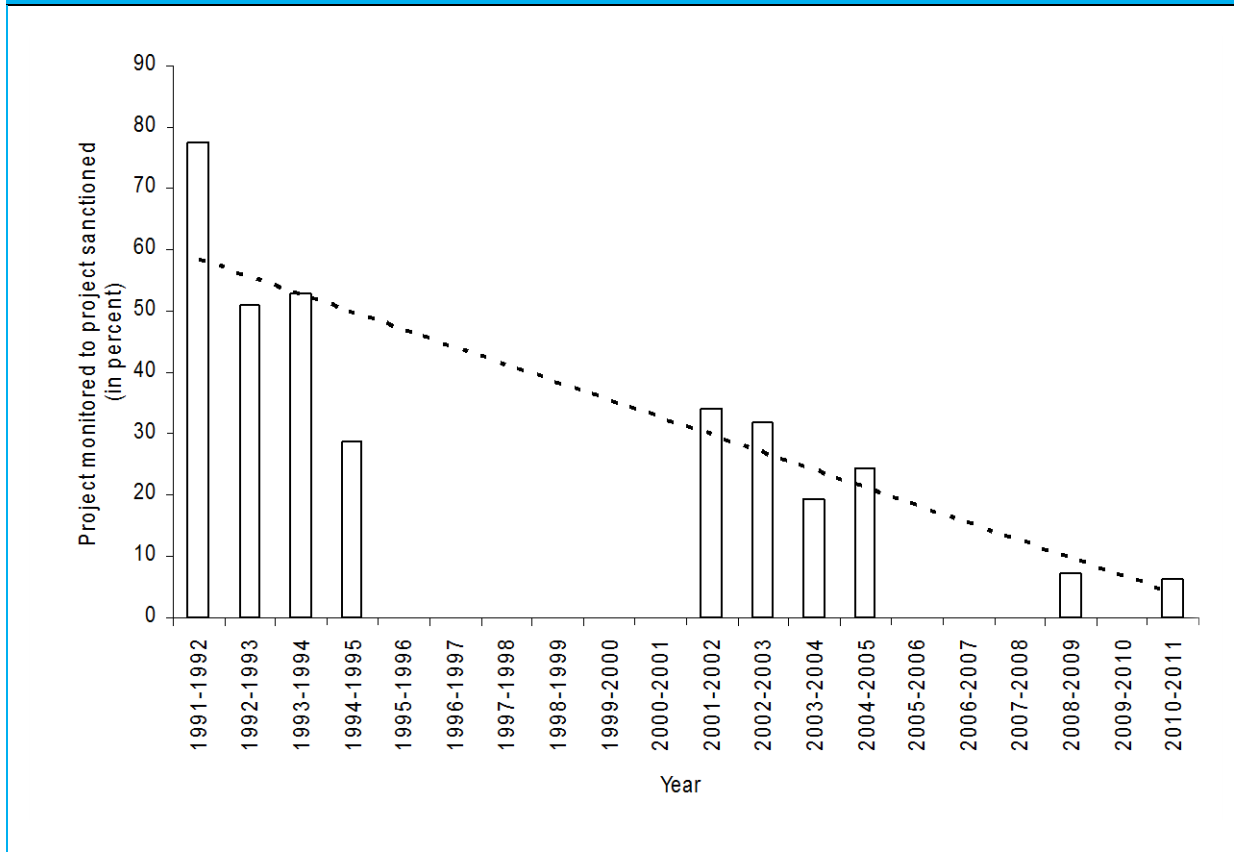
Figure 4: Cumulative number of projects that received environmental clearances



Source: Annual Reports of the Ministry of Environment and Forest, Government of India; Choudhury, 2013b

While the coverage of EIA increased consistently (in fact, exponentially in recent years) the number of projects which were subjected to compliance-monitoring decreased. Thus, the coverage of EIA follow-up – even by the limited interpretation of compliance monitoring – has consistently declined over the years. The coverage of EIA follow-up is measured by the ratio between the number of projects monitored in a particular year and the total number of projects that have received environmental clearances prior to the year under analysis. The information on monitoring of environmental clearances in ten of the last 25 years shows that the coverage of EIA follow-up over the entire period is around 36%, with high variation but with a consistently declining trend (Figure 5).

Figure 5: Declining trends in EIA follow-up in India



Source: Annual Reports of the Ministry of Environment and Forest, Government of India; Choudhury, 2013b

A decline in compliance monitoring over the years is not a good sign because it hides the rising risk of local opposition, stalled projects, delays and cost escalations, and loss of public credibility. Given that EIA in India is regulator-driven and not developer-driven, there is a danger of equating adherence to minimal regulatory demands with legitimacy for projects. If EIA follow up is weak in India, some project developers might (wrongly) interpret it as an opportunity to rush through projects, disregarding the environmental consequences or sources of community discontent. By contrast, more pragmatic project developers, with a longer time horizon, would have to be more proactive in future to initiate EIA follow up procedures, going beyond what is mandated by law. Moreover, if hydropower is to be developed in an environmentally responsible way, then the natural course of action should be the eventual strengthening of regulatory mandates and project implementation norms within the sector.

Gaining public support or facing public backlash

Hydropower projects are usually equated with large dam construction and the latter engenders an extremely polarised discourse in India – any discourse is quickly labelled as “pro-dam” or “anti-dam”. A number of hydropower projects take time to commence thanks to

stiff opposition from local communities. Some of the opposition could be on ideological grounds, with people fundamentally against construction of large projects. Finding a middle ground is difficult in such cases. But a lot of opposition takes place because projects tend to go ahead without taking the concerns of the local population on board, without gaining public acceptance and with little public involvement during the planning phase. The hydropower sector is fraught with such examples. More recently, two big projects in the North East – 2000 MW Lower Subansiri Project and 3000 MW Dibang Multipurpose Project – faced a stalemate-like situation thanks to inadequate public involvement in the planning phase.

Invariably cases where local livelihoods are threatened and adequate mitigation measures are not implemented result in social mobilisation against projects, which then get stalled or get delayed. In such a situation all stakeholders lose. The project developer and financiers lose on account of time and hence cost escalation. The project-affected populace perceive little benefit for itself. And the government falls short of achieving planned targets. Often such stalemate situations result in knee-jerk responses like a stay order on the project, promises of a better compensation package and so on. But the root cause of the problem remains unaddressed, namely that people were not adequately and effectively consulted during the project planning process and the lack of transparency and selective reporting on project-related information increases distrust.

Public involvement during project planning is important as it helps to secure information about the local populace and how they would be affected, address immediate problems and legitimise decisions. Most importantly, public involvement, through a well-designed social impact assessment and social management plan, can smoothen the way for the project proponents to get legal - and more importantly - social consent (Dore & Lebel, 2010; Petts, 1999). In the Indian context it is very difficult to find a single example, because public involvement is given the least importance. Nevertheless, in the case of the 192 MW Allain Duhangan project (in Himachal Pradesh), the public hearing process went beyond what was required under the EIA Notification 2006 (largely because project developers were pressured to adhere to a higher standard of one of the major investors, the International Finance Corporation). In this case, there was greater public acceptance. However, a lack of EIA follow up during the implementation phase again emboldened the section of the community that had initially opposed the project. This case underscores how EIA follow up and public involvement go hand-in-hand, and progress on one front can be undermined if there is lack of sincerity on the other.

One problem that affects all the stakeholders in hydropower projects is the misunderstanding of “public participation”. The phrase is interpreted differently by various stakeholders, resulting in misperceptions and mistaken expectations on all sides. Public involvement can take three forms based on the flow of information (Rowe and Frewer, 2005): public information (one-way flow of information from the project developers to the participants),

public consultation (one-way flow of information from the participants to the developers), or public participation (simultaneous bi-directional flow of information in the process, with maximum informational exchange and processing).

In India social impact assessment is still at nascent stage and the only institutionalised form of involving the public is during public hearings – a component that takes place quite late within the environmental decision-making process. Public hearings, according to the EIA Notification 1994 (post 1997 amendment) and EIA Notification 2006, are structurally not suited for being an arena for proper public deliberation, or gaining public acceptance. Given that they take place quite late in the project decision-making process, they are often seen as an arena to elicit consensus rather than deliberate on the merits of the project or those of the arguments of dissenters. Public hearings in India have limited scope. They are at best an arena for public consultation but mostly public information. But the participants of a public hearing exercise (wrongly) perceive the exercise as that of public participation. The multiple interpretations of the same exercise mean that the limited legal scope of the process is often considered inadequate and illegitimate by the participants. The mismatch of legality and legitimacy then results in a stalemate situation, at best, and escalation of conflict for worse (Choudhury, 2013a).

Public involvement in India, to be legitimate in the eyes of the participants, has to go beyond mere compliance with the limited legal mandate. At an operational level this means that the public involvement component should be made an integral part of the screening and scoping phase of the environmental clearance procedures. This also means that social impact assessments have to be given due importance and the process of undertaking social impact assessment should be participatory and transparent. The overarching value of socially responsible hydropower development should be that the project affected populace should be the first beneficiary of the project and should be able to improve their livelihoods as a result of the project.

Leveraging existing regulations for responsible hydro development

Hydropower is an important component – perhaps the most important – of renewable energy, even though large hydro projects are seldom counted in assessments of renewable energy potential and growth. The increasing demand for electricity, the current low electricity coverage and increase in coverage in future, and mismatches in electricity demand and supply mean that installed hydropower capacity has to increase in the country. Hydropower will remain an important component in the overall electricity portfolio. Also it is true that hydropower is less carbon intensive than coal-based thermal power plants, which dominate our electricity portfolio. Thus, hydropower development needs to be promoted through policy initiatives and by encouraging private investment. These are reflected in the various policy

documents and targets and increasing number of memoranda of understanding that have been signed in various states with large hydropower potential.

But the resurgence in hydropower development runs a risk of being “rapid” hydropower development at the expense of long term sustainability. For the long term benefit of the hydropower sector it is important that “responsible” hydropower development becomes the underlying philosophy in India. This article has identified two key priorities: strengthening EIA follow up, and gaining public support through greater public involvement during the planning process. The voluntary environmental, social and governance standards drafted by the Ministry of Corporate Affairs, the mandatory Business Responsibility Reports to be filed with the Securities and Exchange Board of India (SEBI) and new legal statutes like the Right to Fair Compensation and Transparency in Land Acquisition and Rehabilitation and Resettlement Act, 2013, could open up new arenas through which socially and environmentally responsible hydropower development could be promoted.

References

- Arts, J. & Nooteboom, S. (1999) Environmental Impact Assessment monitoring and auditing. In Petts, J. (ed.) *Handbook of Environmental Impact Assessment Volume 1, Environmental Impact Assessment: Process, Methods and Potential*, Cornwall: Blackwell Science, pp. 229-251.
- Arts, J., Caldwell, P., Morrison-Saunders, A. (2001) Environmental Impact Assessment follow-up: good practice and future directions - findings from a workshop at the IAIA 2000 conference. *Impact Assessment and Project Appraisal*, 19 (3), 175-185.
- Arts, J., Caldwell, P., Morrison-Saunders, A. (2001) Environmental Impact Assessment follow-up: good practice and future directions - findings from a workshop at the IAIA 2000 conference. *Impact Assessment and Project Appraisal*, 19 (3), 175-185.
- Choudhury, N. (2013a) Legality and legitimacy of public involvement in infrastructure planning: observations from hydropower projects in India. *Journal of Environmental Planning and Management*, DOI:10.1080/09640568.2012.743879.
- Choudhury, N. (2013b) *Development of Hydropower in India: Between Global Norms and Local Actions*, Doctoral Thesis, Technische Universität Berlin, <http://opus4.kobv.de/opus4-tuberlin/frontdoor/index/index/docId/3663>
- CEA (Central Electricity Authority), 2013. All India/ Regionwise Power Generation Overview. Retrieved December 4, 2013, from <http://www.cea.nic.in/reports/daily/dgr/2013/nov/27/dgr1.pdf>
- CEA (Central Electricity Authority), 2011. *Growth of electricity sector in India from 1947-2011*. New Delhi. Retrieved December 6, 2013, from

http://powermin.nic.in/indian_electricity_scenario/pdf/Growth_of_Electricity_Sector_in_India_From_1947-2011.pdf

CEA (Central Electricity Authority), 2008. *Hydro Development Plan for 12th Five Year Plan (2012-2017)*, New Delhi: Hydro Planning and Investigation Division.

Dore, J and L Lebel (2010): “Gaining Public Acceptance: A Critical Strategic Priority of the World Commission on Dams”, *Water Alternatives* 3(2): 124-141.

GoI (Government of India), 2010. *Mid-Term Appraisal of the Eleventh Five Year Plan 2007-2012* (New Delhi: Planning Commission) 312-315.

Jha-Thakur, U., Fischer, T. B. & Rajvanshi, A. (2009) Reviewing design stage of Environmental Impact Assessment follow-up: looking at the open cast coal mines in India. *Impact Assessment and Project Appraisal* 27 (1), 33-44.

MoP (Ministry of Power), 2008. *Hydro Power Policy 2008*. (New Delhi: Ministry of Power, Government of India).

MoP (Ministry of Power), 1998. *Policy on Hydro Power Development*. (New Delhi: Ministry of Power, Government of India).

IDC (International Development Centre Foundation) (2013). Alternatives in Hydropower Generation. National Brainstorming Workshop on “Alternatives in Hydropower Generation”, Friday, 27 September 2013: New Delhi.

Marshall, R., Arts, J., Morrison-Saunders, A. (2005) International principles for best practice EIA follow-up. *Impact Assessment and Project Appraisal* 23 (3), 175-181.

Marshall, R. (2005) Environmental Impact Assessment follow-up and its benefits for industry. *Impact Assessment and Project Appraisal* 23 (3), 191-196.

Morrison-Saunders, A., Arts, J., Baker J. & Caldwell, P. (2001) Roles and stakes in Environmental Impact Assessment follow-up. *Impact Assessment and Project Appraisal* 19 (4), 289-296.

Morrison-Saunders, A., Baker, J. & Arts, J. (2003) Lessons from practice: towards successful follow-up. *Impact Assessment and Project Appraisal* 21 (1), 43-56.


Morrison-Saunders, A. & Arts, J. (2005) Editorial. Learning from experience: emerging trends in environmental impact assessment follow-up *Impact Assessment and Project Appraisal* 23 (3), 170-174.

Petts, J., 1999. Public participation and environmental impact assessment. In: J. Petts, ed. Handbook of environmental impact assessment volume 1, environmental impact assessment: process, methods and potential. Oxford: Blackwell Science, 145–177.




Rowe, G. and Frewer, L., 2005. A typology of public engagement mechanisms. *Science Technology & Human Values* 30 (2), 251–290.

CEEW PUBLICATIONS


Books/Reports

- Council on Energy, Environment and Water; and World Wide Fund for Nature (2013) *RE+ Renewables Beyond Electricity*, CEEW-WWF-India Report, December, pp. i-164 
- Rudresh Sugam and Arunabha Ghosh (2013) *Urban Water and Sanitation in India: Multi-stakeholder Dialogues for Systemic Solutions*, CEEW-Veolia Report, November, pp. i-147 
- Arunabha Ghosh et al. (2012) *Concentrated Solar Power: Heating Up India's Solar Thermal Market under the National Solar Mission*, Report (Addendum to Laying the Foundation for a Bright Future: Assessing Progress under Phase I of India's National Solar Mission), September, New Delhi, Council on Energy, Environment and Water; and Natural Resources Defense Council 
- Arunabha Ghosh, with Himani Gangania (2012) *Governing Clean Energy Subsidies: What, Why and How Legal?*, August, Geneva: International Centre for Trade and Sustainable Development 
- Rudresh K. Sugam, and Arunabha Ghosh (2012) *Institutional Reform for Improved Service Delivery in Bihar: Economic Growth, Agricultural Productivity, and a Plan for Reorganising the Minor Water Resources Department*, Research Report submitted to the Government of Bihar, July, New Delhi: Council on Energy, Environment and Water, and International Growth Centre, Patna  
- Council on Energy, Environment and Water; and Natural Resources Defense Council (2012) *Laying the Foundation for a Bright Future: Assessing Progress Under Phase 1 of India's National Solar Mission*, Interim Report, April, pp. i-37 
- Arunabha Ghosh, Arundhati Ghose, Suman Bery, C. Uday Bhaskar, Tarun Das, Nitin Desai, Anwarul Hoda, Kiran Karnik, Srinivasapuram Krishnaswamy, Radha Kumar, Shyam Saran (2011) *Understanding Complexity, Anticipating Change: From Interests to Strategy on Global Governance*, Report of the Working Group on India and Global Governance, December, pp. i-70 
- Martin A. Burton, Rahul Sen, Simon Gordon-Walker, and Arunabha Ghosh (2011) *National Water Resources Framework Study: Roadmaps for Reforms*, October, New Delhi: Council on Energy, Environment and Water, and 2030 Water Resources Group, pp i-68 
- Martin A. Burton, Rahul Sen, Simon Gordon-Walker, Anand Jalakam, and Arunabha Ghosh (2011) *National Water Resources Framework Study: Research Report Submitted to the Planning Commission for the 12th Five Year Plan*, September, New Delhi: Council on Energy, Environment and Water, and 2030 Water Resources Group, pp. i-584 
- Arunabha Ghosh (2010) *Harnessing the Power Shift: Governance Options for International Climate Financing*, Oxfam Research Report, October, pp. 1-90 










Papers/Book Chapters

- Nirmalya Choudhury, Rudresh K. Sugam and Arunabha Ghosh (2013) '2030 Water Resources Group National Water Platform: Preliminary investigation of the possible roles, function and potential governance', CEEW Report, August 
- Rishabh Jain, Karthik Ganesan, Rajeev Palakshappa and Arunabha Ghosh (2013) 'Energy Storage for Off-Grid Renewables in India: Understanding Options and Challenges for Entrepreneurs', CEEW Report, July 
- Arunabha Ghosh, and David Steven (2013) 'India's Energy, Food, and Water Security: International Cooperation for Domestic Capacity', in *Shaping the Emerging World: India and the Multilateral Order*, edited 





by Waheguru Pal Singh Sidhu, Pratap Bhanu Mehta, and Bruce Jones, Washington, D.C.: Brookings Press

- Rajeev Palakshappa et al. (2012) 'Cooling India with Less Warming: The Business Case for Phasing-Down HFC's in Room and Vehicle Air Conditioners,' Council on Energy, Environment and Water; Natural Resources Defense Council; The Energy and Resources Institute; and The Institute for Governance and Sustainable Development, November 
- Vyoma Jha and Rishabh Jain (2012) 'Results-Based Financing for Off-grid Energy Access in India,' *Case-study on the Economics of Results-Based Financing in Study by Vivideconomics for Energy Sector Management Assistance Program (ESMAP)*, World Bank, Washington DC, October  
- Arunabha Ghosh (2012) 'Industrial demand and energy supply management: A delicate balance,' *Empowering growth - Perspectives on India's energy future, A report from the Economist Intelligence Unit*. 26-32, October 
- Arunabha Ghosh, Benito Müller, William Pizer, and Gernot Wagner (2012) 'Mobilizing the Private Sector: Quantity-Performance Instruments for Public Climate Funds,' *Oxford Energy and Environment Brief*, The Oxford Institute for Energy Studies, August, pp. 1-15 
- Sachin Shah (2012) 'Institutional Reform for Water Use Efficiency in Agriculture: International Best Practices and Policy Lessons for India,' CEEW Working Paper 2012/3, April 
- Arunabha Ghosh (2011) 'Seeking Coherence In Complexity: The Governance Of Energy By Trade And Investment Institutions,' *Global Policy 2* (Special Issue): 106-119 
- Arunabha Ghosh (2011) 'Strengthening WTO Surveillance: Making Transparency Work for Developing Countries,' in *Making Global Trade Governance Work for Development*, edited by Carolyn Deere-Birkbeck. Cambridge: Cambridge University Press 
- Jason Blackstock, and Arunabha Ghosh (2011) 'Does geoengineering need a global response - and of what kind?,' *Background Paper*, Solar Radiation Management Governance Initiative, Royal Society UK, Chicheley, March 

Policy Briefs & Legislative/Government Briefings

- Rudresh Sugam and Urvashi Sharma (2013) "Capacity building in the urban water sector," Issue brief for the Fifth CEEW-Veolia Water Roundtable on Urban Water Management, 5 July 
- Rudresh Sugam and Urvashi Sharma (2013) "Water data and measurement," Issue brief for the Fourth CEEW-Veolia Water Roundtable on Urban Water Management, 27 May 
- Rudresh Sugam and Urvashi Sharma (2013) "Regulatory framework for urban water management in India," Issue brief for the Third CEEW-Veolia Water Roundtable on Urban Water Management, 9 April 
- Rudresh Sugam and Urvashi Sharma (2013) "Private sector participation in water management and water for all," Issue brief for the Second CEEW-Veolia Water Roundtable on Urban Water Management, 11 February 
- Rudresh Sugam (2012) "Water Utility Management in the Urban Water Sector," Issue brief for the First CEEW-Veolia Water Roundtable on Urban Water Management, New Delhi, 20 December 
- Karthik Ganesan (2012) "Climate Change and Business Leadership: Pathways to GHG Emissions Reduction and Sustainability in the Indian Cement Industry," Paper presented at the Third National ICRN Conference on Climate Change, Indian Institute of Science, Bangalore, 4 November 
- Vyoma Jha (2012) "Trends in Investor Claims over Feed-in Tariffs for Renewable Energy," Investment Treaty News, July 
- Arunabha Ghosh (2012) "Water governance priorities in India, South and East Asia, the case for integrated energy, environment and water plans, and Rio+20 goals," Briefing to the Brazilian Federal Senate,  

Environment, Consumer Rights and Oversight Committee & Agriculture and Land Reform Committee, Rio de Janeiro, 20 June

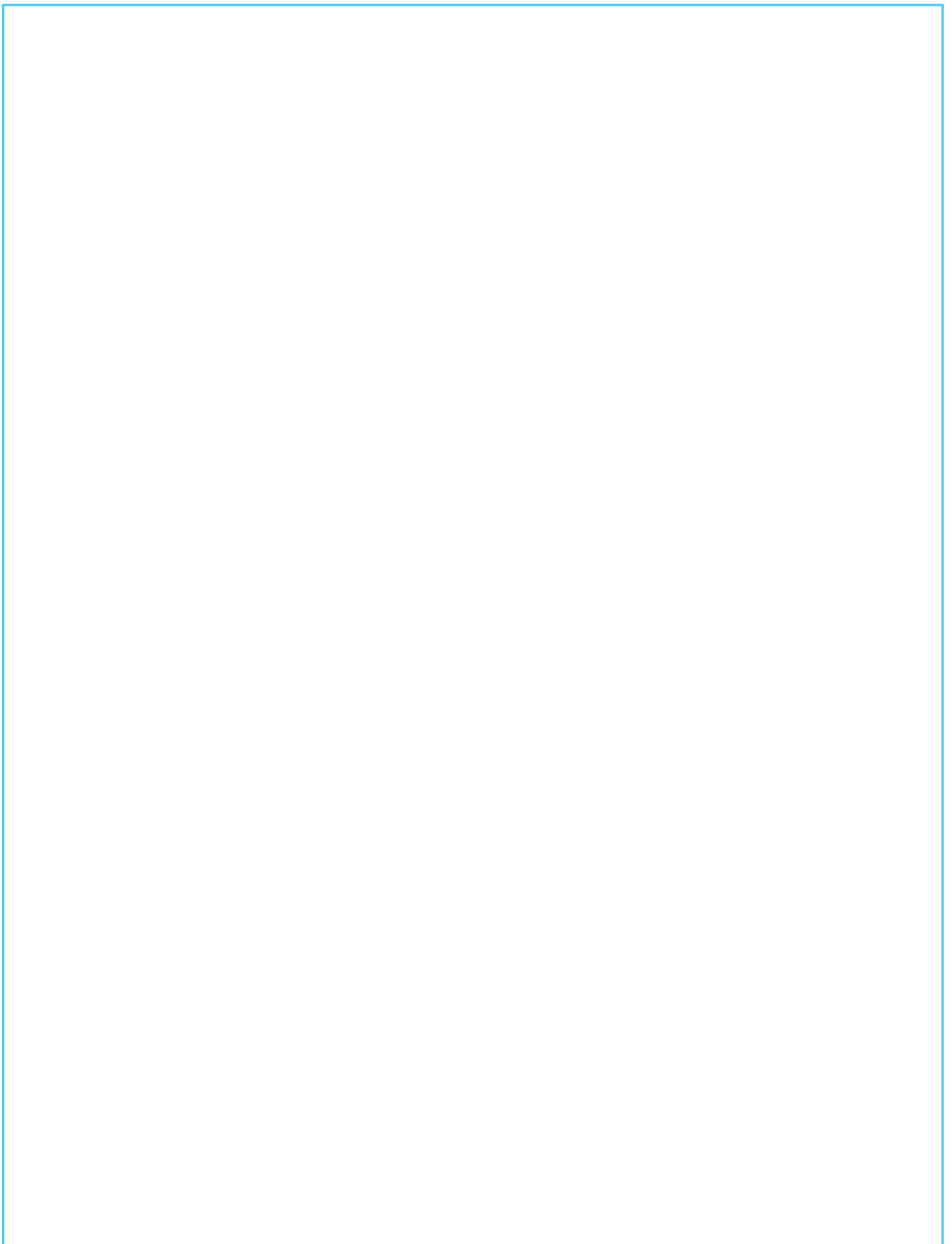
- Arunabha Ghosh (2011) "Briefing on global governance to Ambassador Shivshankar Menon, National Security Adviser, Government of India," Prime Minister's Office, 20 December 
- Arunabha Ghosh (2011) "Governing clean energy subsidies: Why legal and policy clarity is needed," *Bridges Trade BioRes*, November 
- Vyoma Jha (2011) "Cutting Both Ways?: Climate, Trade and the Consistency of India's Domestic Policies," *CEEW Policy Brief*, August 
- Arunabha Ghosh (2010) "Negotiating around Tradeoffs: Alternative Institutional Designs for Climate Finance," *European Climate Platform Report No. 10*, Centre for European Policy Studies, Brussels, 9 December 

Selected Keynote Lectures & Speeches

- Arunabha Ghosh (2013) "Towards a stress testing methodology for Short-Lived Climate Pollutants (SLCP): metrics," Workshop of the interdisciplinary working group on SLCPs, University College of London, 4 October
- Arunabha Ghosh (2013) "Resource Challenges and strategic priorities for India", Lecture at King's College London, 17 May
- Suresh Prabhu (2013) "Role of stakeholders in increasing food production," Keynote lecture at the National conference on *Doubling Food Production in Five Years*, New Delhi, 4 February 
- Arunabha Ghosh (2013) "Renewable Energies and Trade: Addressing tensions and challenges," Speech at a high-level policy dialogue at the World Trade Organisation meeting of Ambassadors, Geneva, 21 January 
- Arunabha Ghosh (2012) "India's Energy Scenarios: Planning for the Future," Lecture at the University of Petroleum and Energy Studies (UPES), Dehradun, 3 December  
- Rajeev Palakshappa (2012) "Laying the Foundation for a Bright Future," Presentation at the INTERSOLAR India 2012 Conference, Mumbai, 5 November 
- Ambassador Shiv Shankar Menon (2012) "Resources and National Security," Keynote Address by India's National Security Adviser, on CEEW's Second Anniversary, New Delhi, 23 August  
- Arunabha Ghosh (2012) "Sustainable Development in a Deeply Globalised Economy," Speech during the Rio+20 United Nations Conference on Sustainable Development, Rio de Janeiro, 20 June  
- Suresh Prabhu (2012) "Overview of India's clean energy markets," Speech at the NRDC and Environmental Entrepreneurs roundtable on Advancing Clean Energy Opportunities in India, San Francisco, 7 June 
- Arunabha Ghosh (2012) "Governing Clean Energy Subsidies: The Case for a Sustainable Energy Agreement," Global Green Growth Summit, Seoul, 11 May 
- Arunabha Ghosh (2012) "Governance in the face of uncertainties: data gaps, institutional coordination, and multiple level decision-making," Workshop on Climate Change and Water Cycle and Communicating Uncertainty, Princeton University, Princeton, 31 March  
- Arunabha Ghosh (2012) "Case for an integrated energy, environment and water approach in Rajasthan," Confederation of Indian Industry Rajasthan State Annual Session, Jaipur, 17 March 
- Suresh Prabhu (2011) "Tangible Reforms in Governance Process: Effective Leadership, is at the Heart of it All, in 21st Century India," Good Governance Dialogue Series by the Friends of Good Governace (FOGG), December 
- Arunabha Ghosh (2011) "Geopolitics of energy security: Five framings from a global Indian perspective," Lecture at Aspen España – ESADEgeo conference on The Coming Energy Market, Madrid, 24 November 

- Arunabha Ghosh (2011) “Why is climate change such a wicked problem?,” Lecture at China Foreign Affairs University, Beijing, 23 September
- Arunabha Ghosh (2011) “Governing geoengineering: Play, pause or stop, and how,” Lectures at Chinese Association for Science and Technology Annual Meeting, Tianjin , 21 September 2011; and Chinese Academy of Social Sciences, Beijing, 26 September
- Arunabha Ghosh (2011) “Four transitions in global governance,” Keynote lecture at the 10th Anniversary of the Clarendon Fund Scholarships, University of Oxford, Oxford, 17 September
- Arunabha Ghosh (2011) “International Cooperation and the Governance of Geoengineering,” Keynote lecture to the Intergovernmental Panel on Climate Change, Expert Meeting on Geoengineering, Lima, 21 June
- Arunabha Ghosh (2011) “Designing Climate Finance Institutions,” New York University-UAE Ministry of Foreign Affairs Workshop on Climate Finance, NYU Abu Dhabi Campus, Abu Dhabi, 22 January
- Arunabha Ghosh (2010) “Should bottom-up meet top-down? Lessons for institutional design in climate governance,” Post-Copenhagen Global Climate Cooperation: Politics, Economics and Institutional Approaches, Shanghai Institutes for International Studies, and Friedrich Ebert Stiftung, Shanghai, 29 September







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