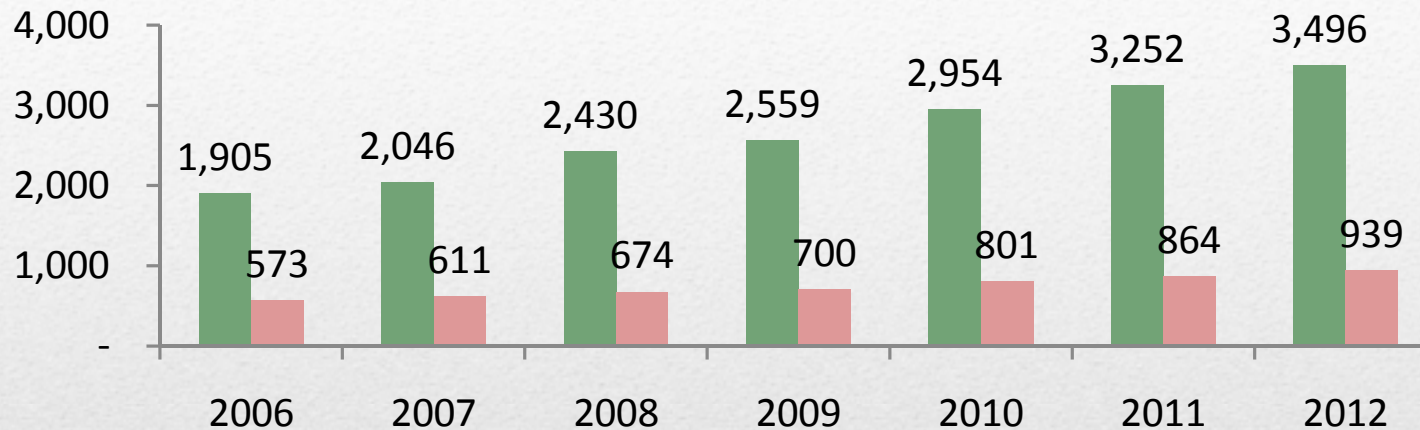


GREEN NORMS FOR SMALL HYDRO POWER

**Potential Impacts and the Need for
Green Norms**



Installed Capacity Growth (MW) & Number of Projects



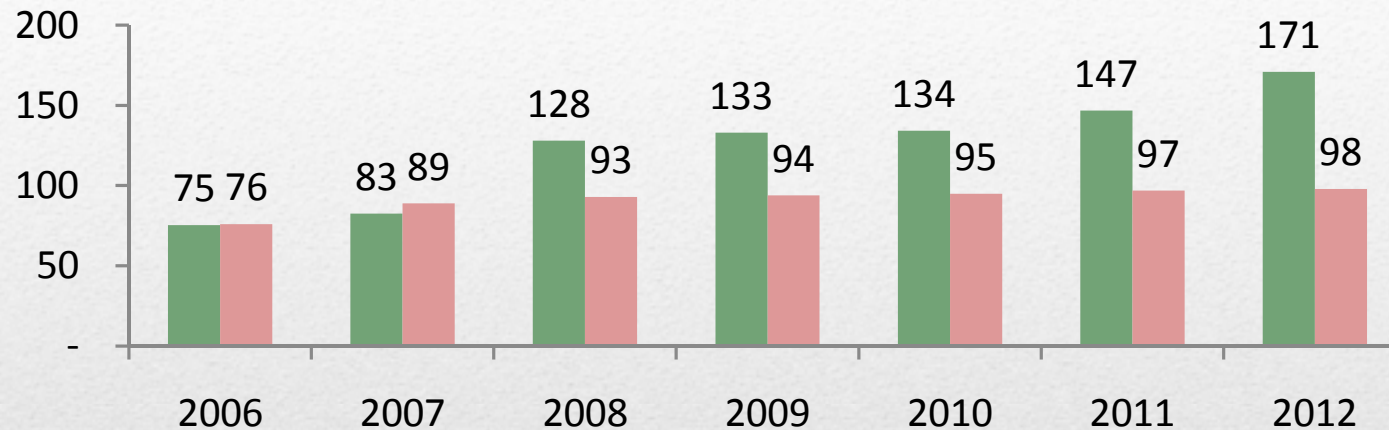
- **366 SHP worth 1600 MW installed in last 7 years. 1 SHP every week**
- **There are more than 300 projects under various stages of implementation with a capacity 1,250 MW**

India: Small Hydro Power

- The estimated **potential** for power generation from small hydro power in the entire country is **about 20,000 MW** from **about 6,500 identified sites**
- Out of this potential, **50%** lies in the states of **Himachal Pradesh, Uttarakhand, Jammu & Kashmir and Arunachal Pradesh**
- The 12th Five Year Plan targets an **addition of 2100 MW** -- **about 500 SHP projects**

Plans for the Future

Installed Capacity Growth (MW) & Number of Projects



- **Potential: 1710 MW**

- **As of Dec 2012, there were more than 40 projects under implementation with a capacity around 180 MW.**

Uttarakhand: Small Hydro Power

COUNTRY/ORGANISATION	LIMIT (IN MW)
Sweden	1.5
UK	5
United Nations Industrial Development Organization (UNIDO)	10
Norway	10
European Union	20
Australia	20
India	25
Brazil	30
China	50

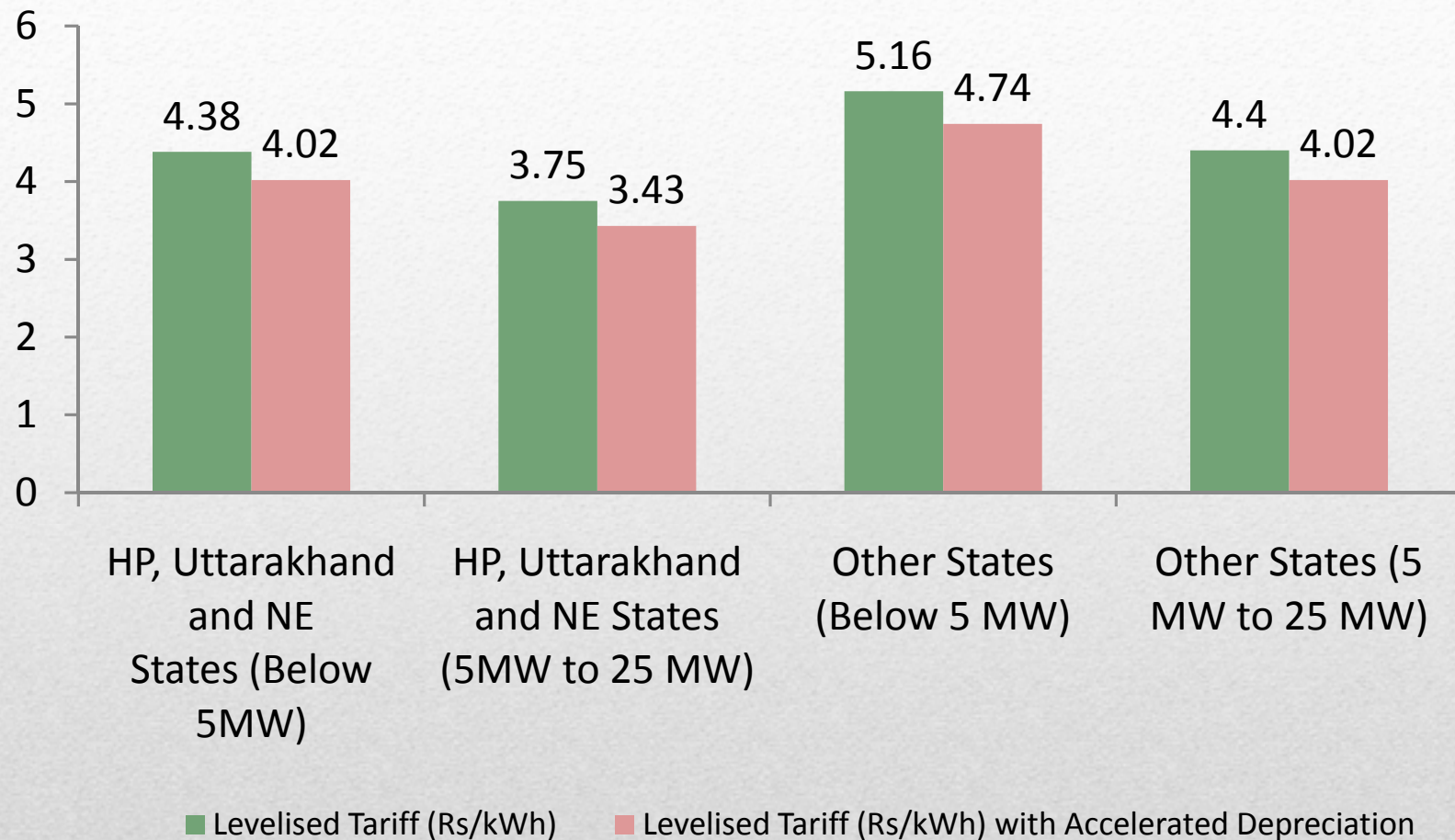
But India is the only country that considers only SHP as renewable energy and has a separate ministry for it.

Definition of Small Hydro

24 states have policies in place for private sector participation to set up SHP projects

- Return on Equity :
 - 20% pre tax per annum for first 10 years
 - 24% pre tax per annum beyond 10 years
- **Single window clearances** to facilitate statutory clearances in a time bound manner.
- State Govt. provides **guarantee for the payments** to be made by the Discoms /Transmission Companies
- **Evacuating infrastructure** shall be provided by the state.
- Royalty on **water usage**
 - Exempt for first 12-18 years.
 - 18 per cent beyond the initial period

SHP Policies: Developers' Delight



CERC Tariff FY 2013-14

Year	2010-11	2011-12	2012-13
Capital subsidy released (in Rs Crores)	151.98	154.45	158.92
Capacity Added (MW)	307.21	352.68	350 (targeted)

- In general the subsidy amounts to 10-15% of the total project cost
- In 2012-13, 14 % MNRE budget allocation went to SHP capital subsidy

MNRE's Subsidy

- **Multiple impacts on the local environment and ecology**
 - **Ecological** - Aquatic flora and fauna specifically impact on fish.
 - Impact on wildlife due to forest diversion and linear intrusion
 - **Physical** – Flow of the river, Water quality, sediment carrying capacity, erosion, ground water quality and recharge, climate, soil and geology
 - **Humans** - Interference with drinking and agriculture water availability, groundwater recharge and socio-economic impacts
 - **Cumulative impact**



Environmental Impacts

- Studies 14 hydropower plants; 4 operational SHP (2 in Chamoli, 1 in Uttarkashi and 1 in Bageshwar)
- Average diversion length of projects to be about 4 km
- Physical verification in May and July, 2009 found complete dried up river beds downstream
- Reported depletion of water resources for irrigation and domestic and reduction in groundwater recharge
 - Rajwakti SHP on Nandakini in Chamoli – lift irrigation system defunct due to diversion of the river
 - Debal SHP on Kailganga in Chamoli – drying of riverbed led to increase attack on livestock's from wild animals from the opposite forests

Uttarakhand: CAG Report-2008-09

- Improper muck disposal in all projects
 - Rajwakti SHP – muck dumped in Nandakini river
 - Accepted practice is erosion and washing of muck during monsoons
- CAG auditors also noticed that out of the four SHP projects
 - 2 projects - Loharket and Debal, reported **zero achievement with regard to afforestation**
 - Rajwakti reported 50% achievement
 - Hanuman Ganga was the only project adhering to the afforestation requirement.

Uttarakhand: CAG Report-2008-09

- CSE researchers made site visits to two SHP projects: the 4-MW Kaliganga-I commissioned in 2012 and the 6-MW Kaliganga-II under construction. Both of UJVNL.
- Project funded by ADB, hence EIA and EMP made.
- Observations:
 - No stream restoration work had been undertaken
 - No proper muck disposal plan had been made and the muck was being disposed off at the exit of the adit tunnels
 - Weir is of trench type, there is no provision for environmental flow water to be released



CSE's Site visit

- The impacts of SHP plants, dams and the drying out of river beds on fish in rivers is, to a large extent, unknown. There is a dearth of studies
- Even in large projects, it is not studied during EIA
- Hydro power projects isolates fish populations and hinders migration (ex. many fish species migrate for spawning)
- New species are still being discovered in small isolated streams on which SHPs is coming up.
- Many new discoveries In the Western Ghats

Impacts on Fish



Photo Credit: Parineeta Dandekar



- Analysis of 138 SHP projects
- Average diversion: 1 ha/MW
- 2 months for in-principal approval;
- 6.5 months for final approval from date of application
- Most ignored clearances for access road and transmission lines



Forest diversion and Impacts on Wildlife

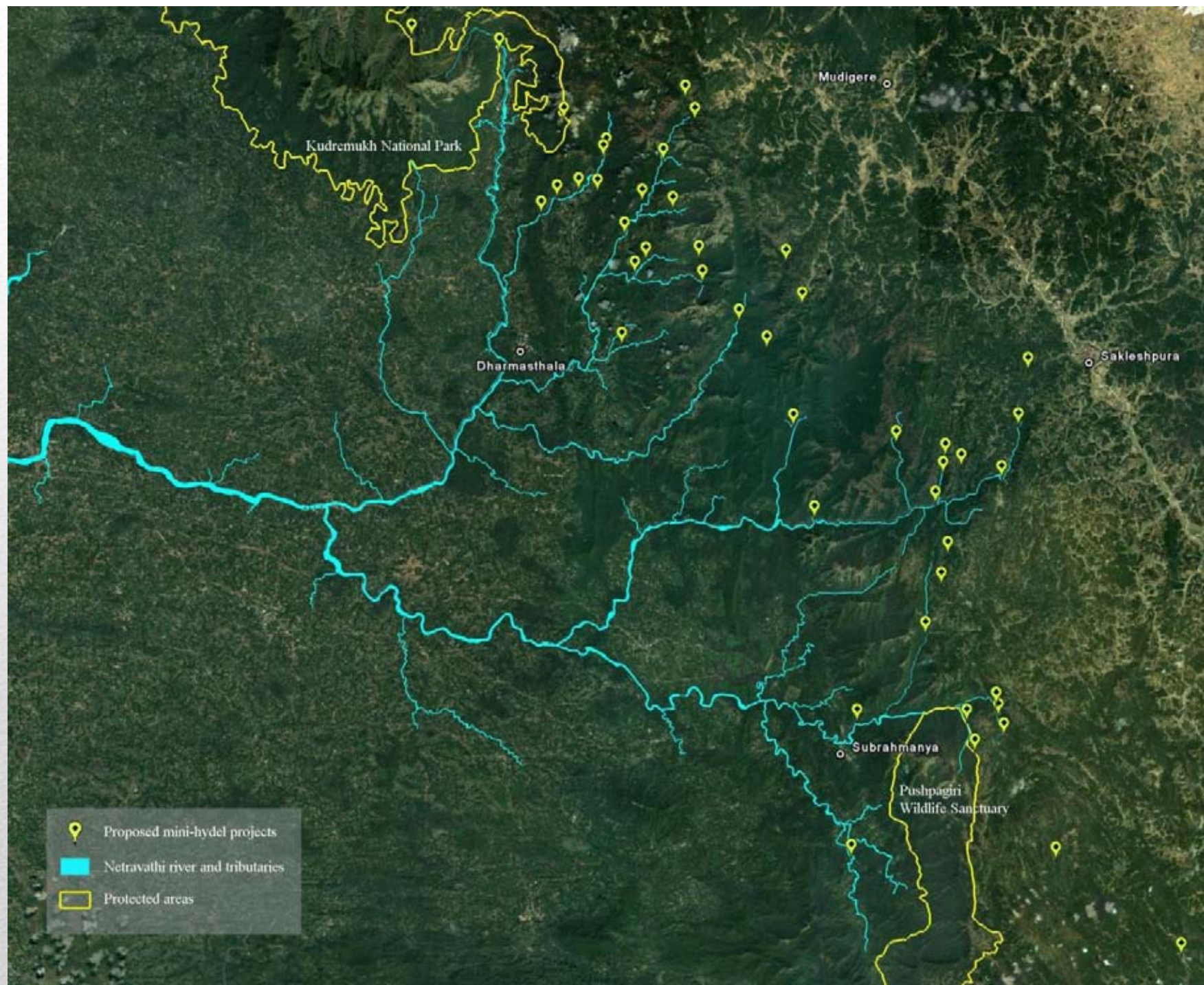


LINEAR INTRUSION: Access roads and transmission lines to and from multiple small plants lead to forest fragmentation – isolation of species and disruption of the movements of animals. **Increase in human-animal conflict**

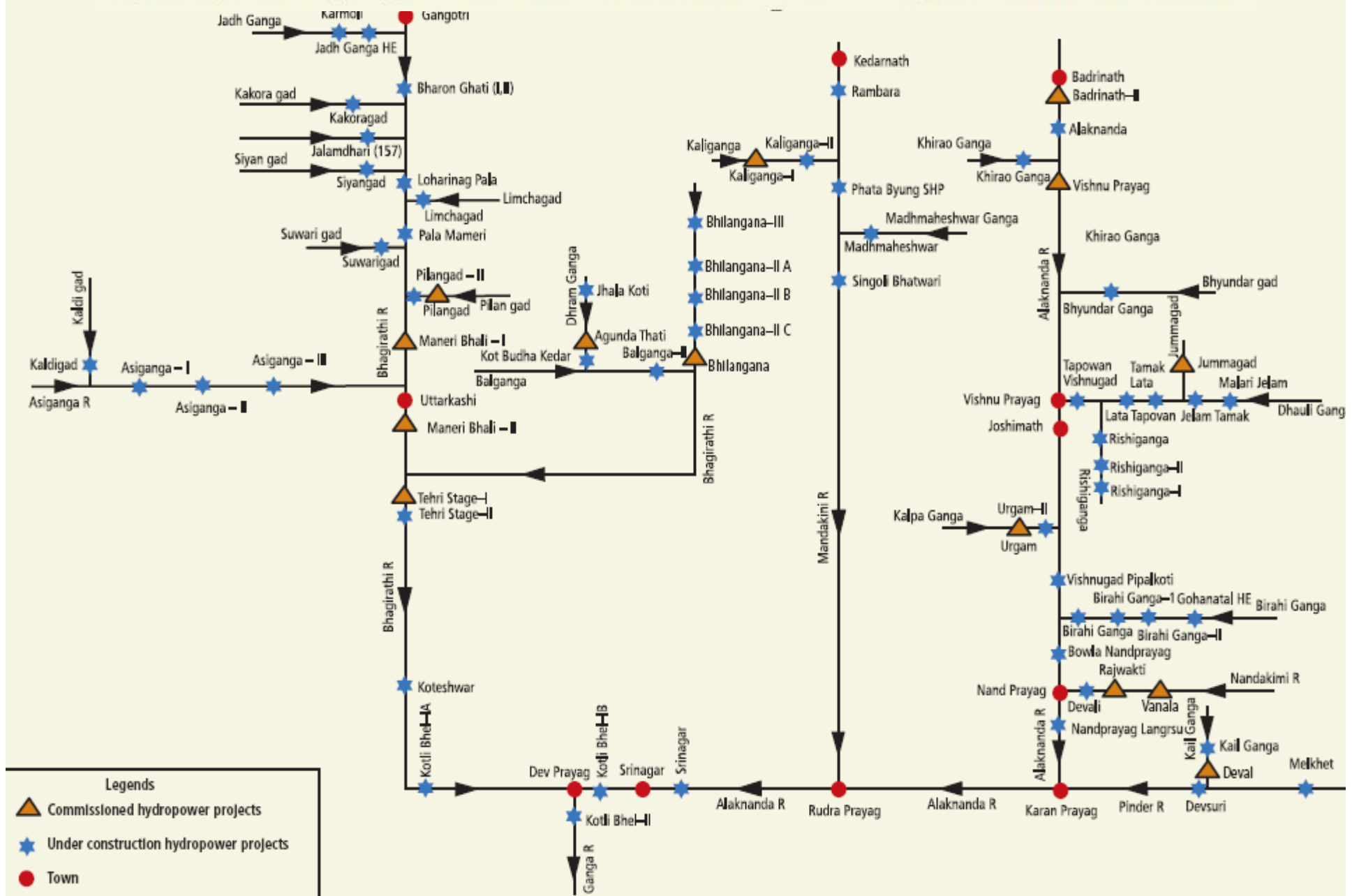
- Kempehole and Nethravati river in Karnataka: 44 SHP projects in various stages of development
- Alaknanda and Bhagirathi rivers have 70 hydro projects under various stages of development. In these 40 projects are SHP
- The impact is cumulative with many other development projects in terms of forest use and linear intrusion from roads and power lines
- Cascade operation of small hydro power stations leads to almost drying up of the natural channel of the stream during low flow periods.



Cumulative Impact



Hydro power projects in the Alaknanda and Bhagirathi river basins



- **No EIA and EC**
- **Ecological flows:** Himachal Pradesh is the only state to come up with norms for environmental flow that hydro power projects, including SHPs - **15 % of the average** of the three leanest months – **3% of the high flow**
- Projects within 10 km from any wildlife sanctuaries or national parks - **Assessment by the State Board for Wildlife and then on to the National Board for Wildlife – all cleared**
- **Forest Clearances** required. If the forest diversion is less than 5 ha, then it can be cleared at the state level.

Existing Regulations

Category of project (Red - most concern, Orange - medium concern, Green - least concern)

States	Category
Rajasthan	Green
Uttarakhand	Red
Karnataka	Green
Haryana	Green

CAG audit findings have revealed that almost 75 per cent of the projects are operating without the consent of the UEPPCB

State Pollution Control Board

पर्यावरण एवं वन मंत्रालय
GOVERNMENT OF INDIA
MINISTRY OF ENVIRONMENT & FORESTS

क्षेत्रीय कार्यालय (दक्षिण वलय)
Regional Office (Southern Zone)
Kendriya Sadan, 4th Floor, E&F Wings, 17th Main Road,
2nd Block, Koramangala, Bangalore - 560 034.

तार : पर्यावरण, बंगलूर
Telegram : PARYAVARAN
BANGALORE

दूरभाष :
Telephone : 080-25635908
Tele Fax : 080-25537184



No.4-KRB499/2008-BAN/14132
Dated the 26th March, 2009

To

The Principal Secretary to the Govt. of Karnataka,
Forests, Environment & Ecology Department,
M.S. Building, Dr. Ambedkar Veedhi,
Bangalore - 560 001.

Subject: Diversion of 4.18 ha. of forest land in Kagenari and Kanchanakumari RF in
Sy.No.1 and 16 of Yadakumari Village, Sakleshpura Taluk, Hassan District
for establishment of 18.90 MW Hongadahalla Mini Hydel Project in favour of
M/s Maruthi Power-Gen (India) Private Limited, Bangalore.

Sir,

Kindly refer to the State Government's letter No.FEE 100 FLL 08 dated 29.05.2008 seeking prior approval of the Central Government in accordance with Section'2' of Forest (Conservation) Act, 1980 for the above project. The in-principle (Stage-I) approval to the project was accorded by the Central Government vide letter of even number dated 30th June, 2008. The State Government vide letter No.FEE 100 FLL 08 dated 11.03.2009 has reported compliance to the conditions stipulated by the Central Government in the in-principle approval.

After careful consideration of the proposal of the State Government, I am directed to convey Central Government's approval (Stage-II) under Section'2' of Forest (Conservation) Act, 1980 for diversion of 4.18 ha. of forest land in Kagenari and Kanchanakumari RF in Sy.No.1 and 16 of Yadakumari Village, Sakleshpura Taluk, Hassan District for establishment of 18.90 MW Hongadahalla Mini Hydel Project in favour of M/s Maruthi Power-Gen (India) Private Limited, Bangalore, subject to the following conditions:-

1. The legal status of forest land shall remain unchanged.
2. Compensatory Afforestation shall be raised over of equivalent identified non-forest land at the cost of user agency. The State Government shall obtain prior permission of Central Government for change of location and schedule of Compensatory Afforestation, if any.
3. Non forest land for compensatory afforestation shall be notified by the State Govt. as R.F/ P.F under Indian Forest Act, 1927 or the State Forest Act within a period of 6 months and Nodal Officer (FCA) shall report the compliance within 6 months.
4. The Catchment Area Treatment Plan shall be executed at the cost of user agency as per the plan under supervision of State Forest Dept.,

MANIPULATING THE SYSTEM

पर्यावरण एवं वन मंत्रालय
GOVERNMENT OF INDIA
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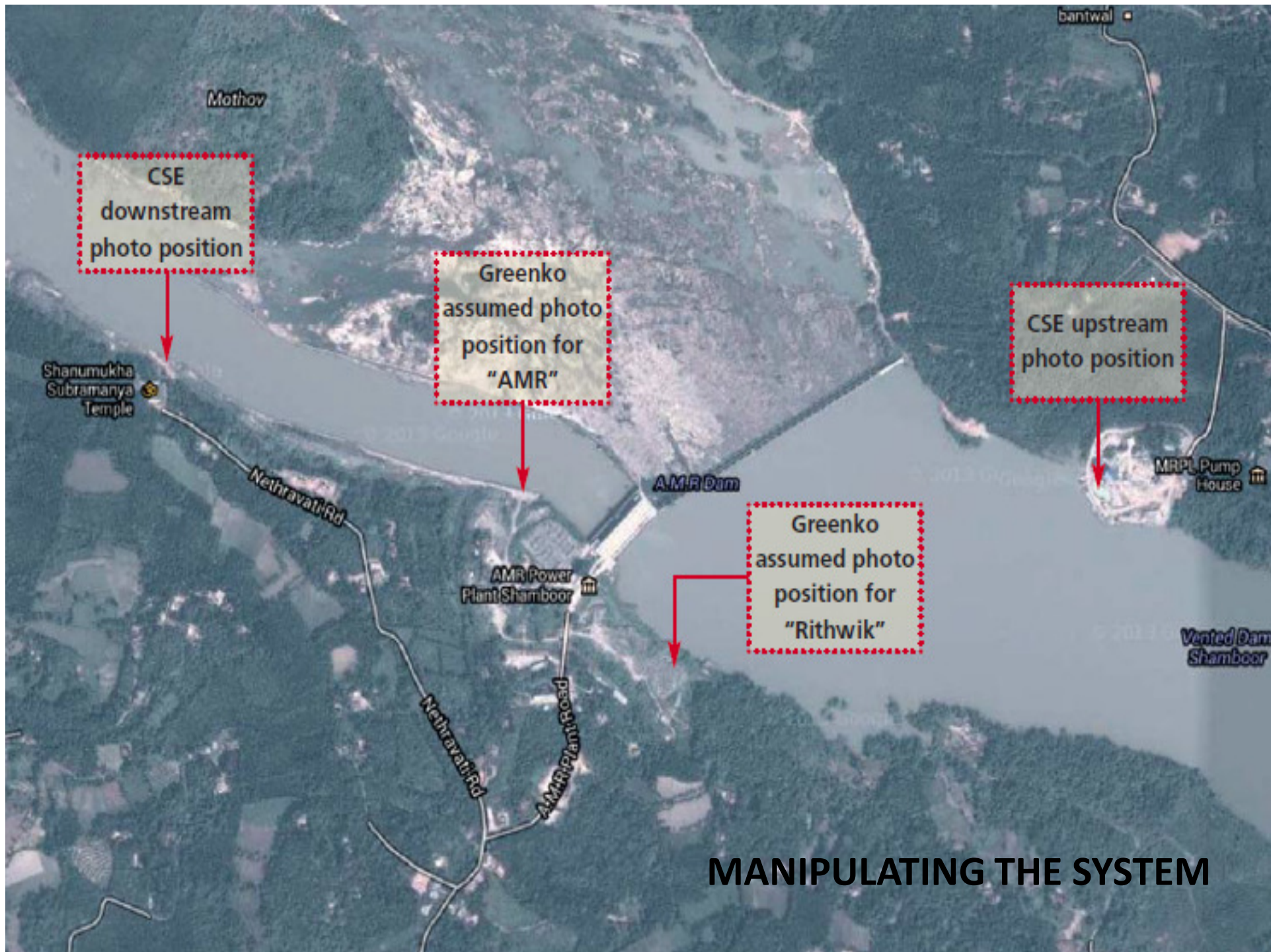
Subject: Diversion of 4.20 ha. of forest land in Kagenari and Kanchanakumari RF in
Sy.No.1 and 16 of Yadakumari Village, Sakleshpura Taluk, Hassan District
for establishment of 19.00 MW Yedakumari Mini Hydel Project in favour of
M/s Maruthi Power-Gen (India) Private Limited, Bangalore.

Sir,

Kindly refer to the State Government's letter No.FEE 99 FLL 08 dated 29.05.2008 seeking prior approval of the Central Government in accordance with Section'2' of Forest (Conservation) Act, 1980 for the above project. The in-principle (Stage-I) approval to the project was accorded by the Central Government vide letter of even number dated 25th June, 2008. The State Government vide letter No.FEE 99 FLL 08 dated 11.03.2009 has reported compliance to the conditions stipulated by the Central Government in the in-principle approval.

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MANIPULATING THE SYSTEM

भारत सरकार

नवीन और नवीकरणीय ऊर्जा मंत्रालय

Government of India

MINISTRY OF NEW AND RENEWABLE ENERGY

ब्लॉक नं. 14, केन्द्रीय कार्यालय परिसर, लोदी रोड, नई दिल्ली-110003
BLOCK NO. 14, C.G.O. COMPLEX, LODI ROAD, NEW DELHI - 110 003

Fax : 011-24361298

Telegram : RENEWABLE

सं. 20/31/2008-SHP

No.

दिनांक 20.1.2011

Dated

To

Ms. Parvathy Keshavachar
Deputy Secretary to Government of Karnataka
Karnataka Government Secretariats
Energy Department
Vikasa Soudha
Bangalore - 560001

Dear Madam,

Please refer your letter no. EN 51 EMC-2 2009 dated 23.12.2010 regarding clarification on small hydro power capacity.

As per standard practice, the capacity of a project is decided as per the power house capacity. If hydro projects are located in two different power houses, they are treated as two different projects. However, if a developer is interested in adding subsequent unit(s) in the same power house then the project capacity would stand increased. .

Thanking you,

Yours faithfully,

P. Saxena

(P. Saxena)

Director (SHP)

Tel Fax: 24362706

E-mail: psaxena_98@yahoo.com

Copy may be sent to KREDL

A copy may be kept in the concerned

Section i.e. P.P. in Guard file.

MANIPULATING THE SYSTEM



Recommendations



Ecological Flow

May-October: 30%

November-April: 50%

70 hydropower projects – capacity 9580.3 MW

Includes:

- 17 operational projects –2295.2 MW
- 26 under construction projects – 3261.3 MW
- 27 projects under development – 4023.8 MW
- 30 projects above 25 MW; 40 SHP

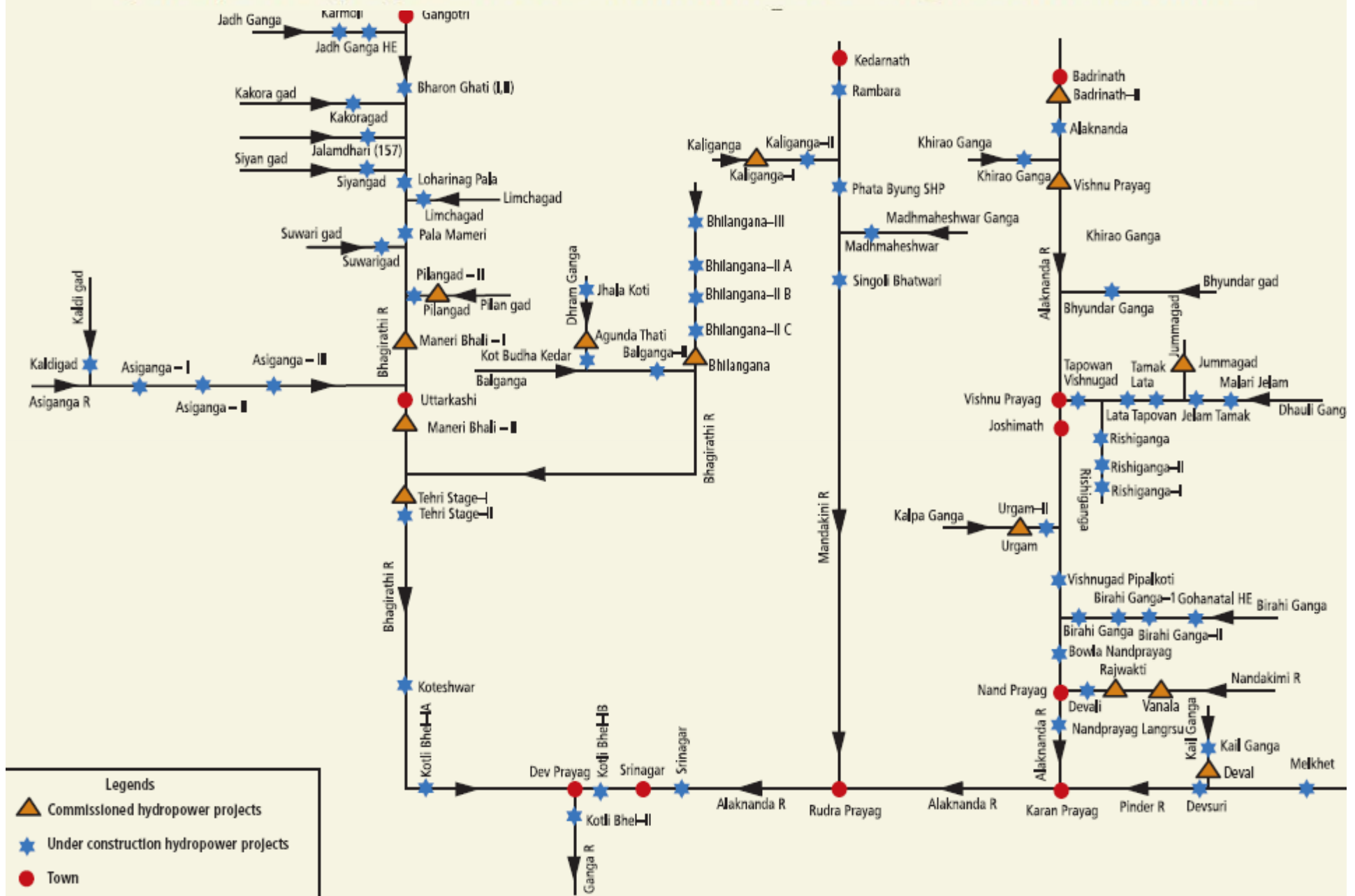
Rivers percentage affected due to these 70 HEP

- 81% of the River Bhagirathi
- 65% of the River Alaknanda

No concept of ecological flow – projects planned for 10% or less

Hydro Power Projects on Bhagirathi and Alaknanda Basins

Hydro power projects in the Alaknanda and Bhagirathi river basins

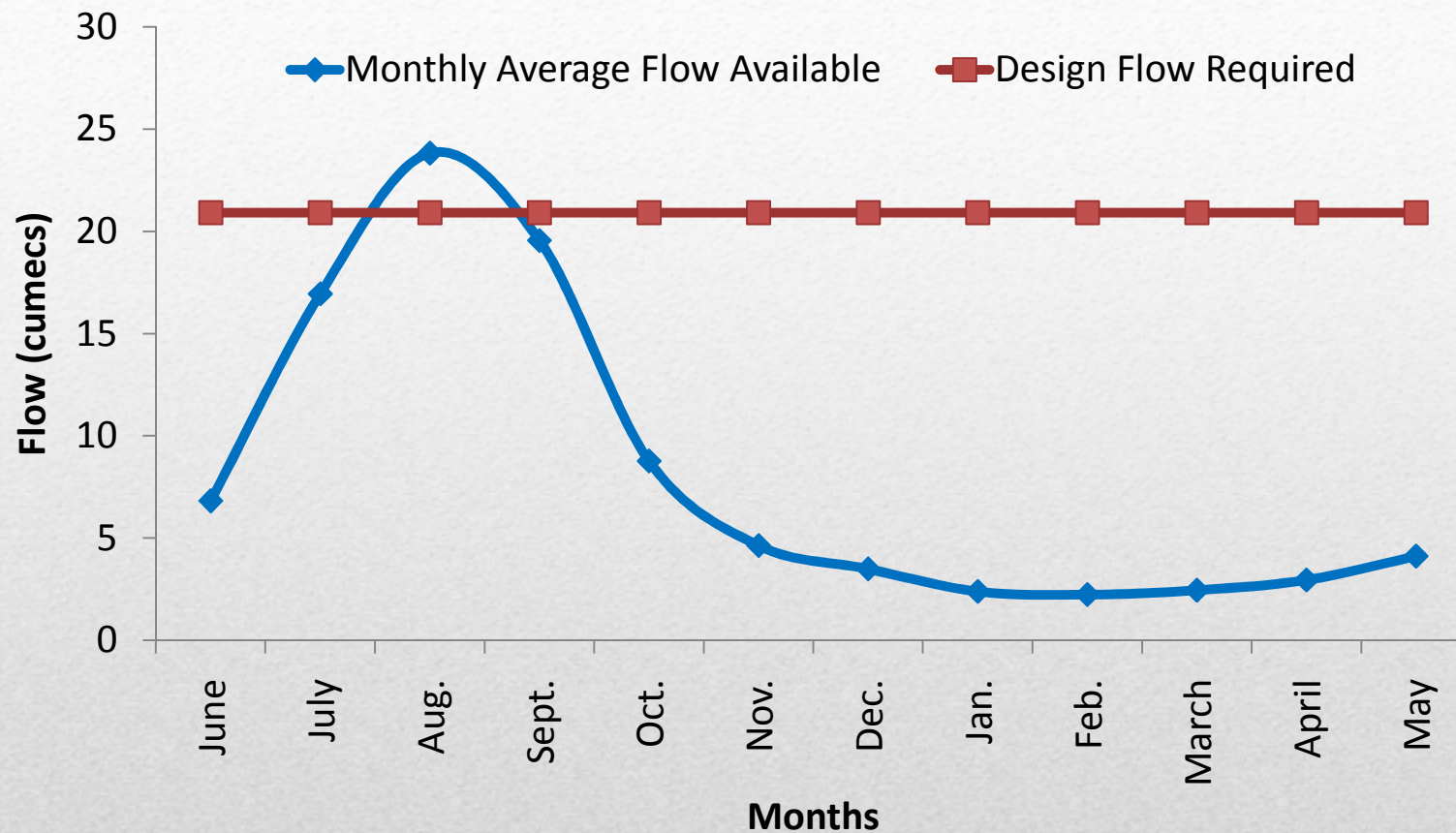


- Diversion length in SHP is 6 times the Large Hydro projects in Bhagirathi River basin projects, Uttarakhand
- ratio of head is 18 times that of large hydro per MW of generation capacity

Parameter	per MW for SHP	per MW for LHP	Ratio of Small/Large
<i>Diversion Length (m)</i>	319.61	53.45	5.98
<i>Head (m)</i>	15.84	0.89	17.85
<i>Annual Generation (MU)</i>	5.88	4.28	1.38

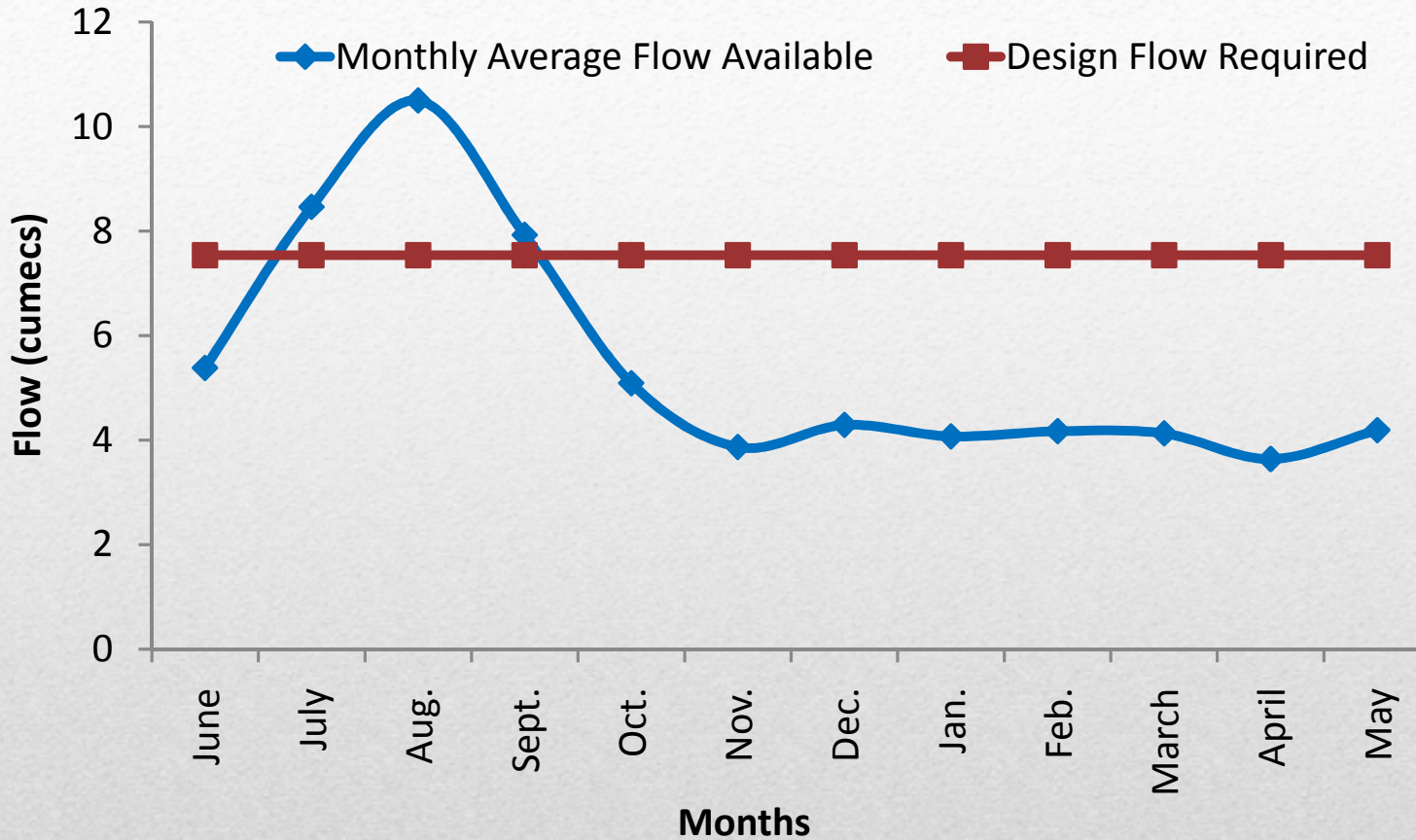
Small vs. Large ROR on River Bhagirathi

Birahi Ganga II

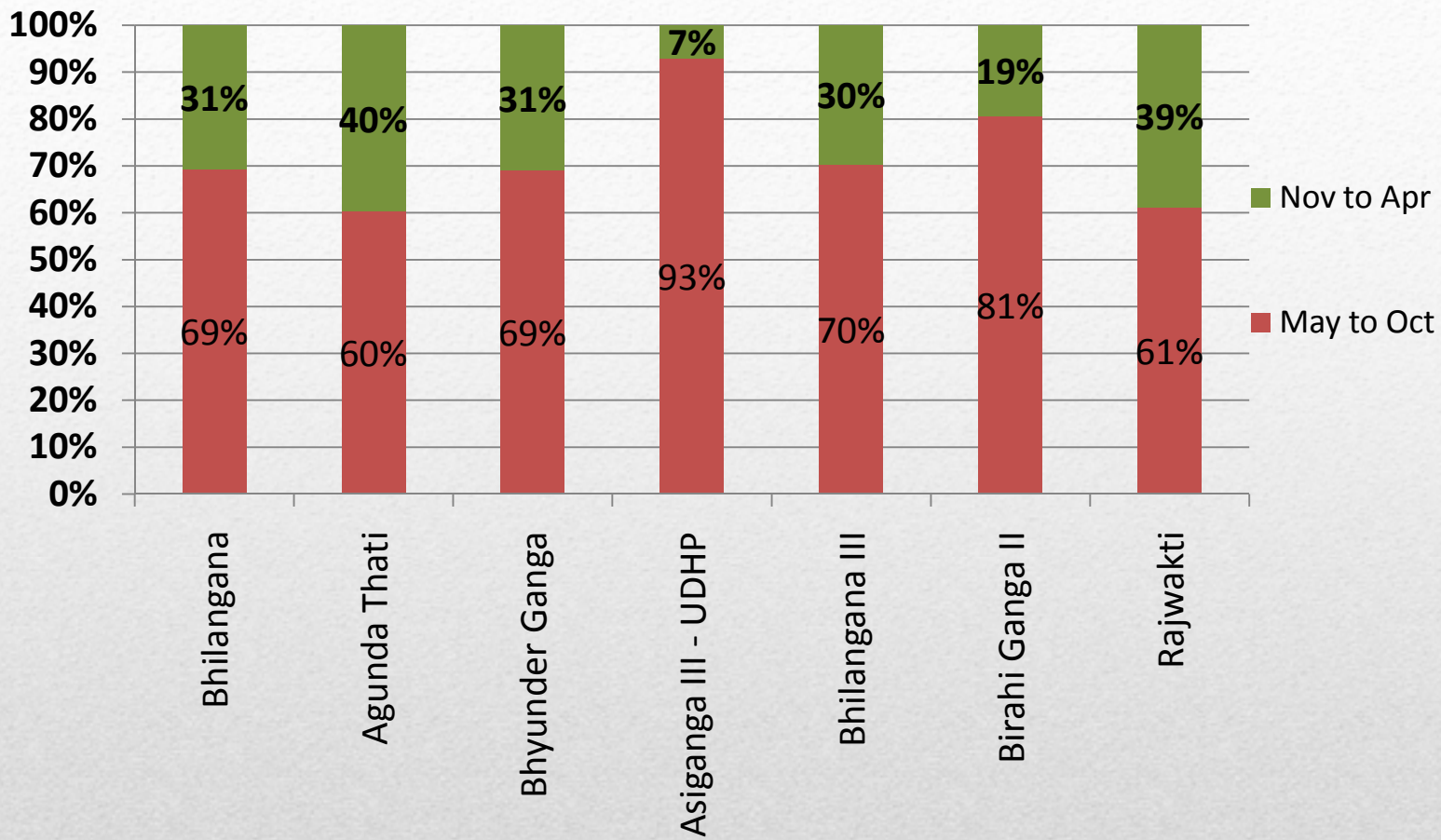


Unrestricted Flow Kills the River

Agunda Thati



Unrestricted Flow Kills the River

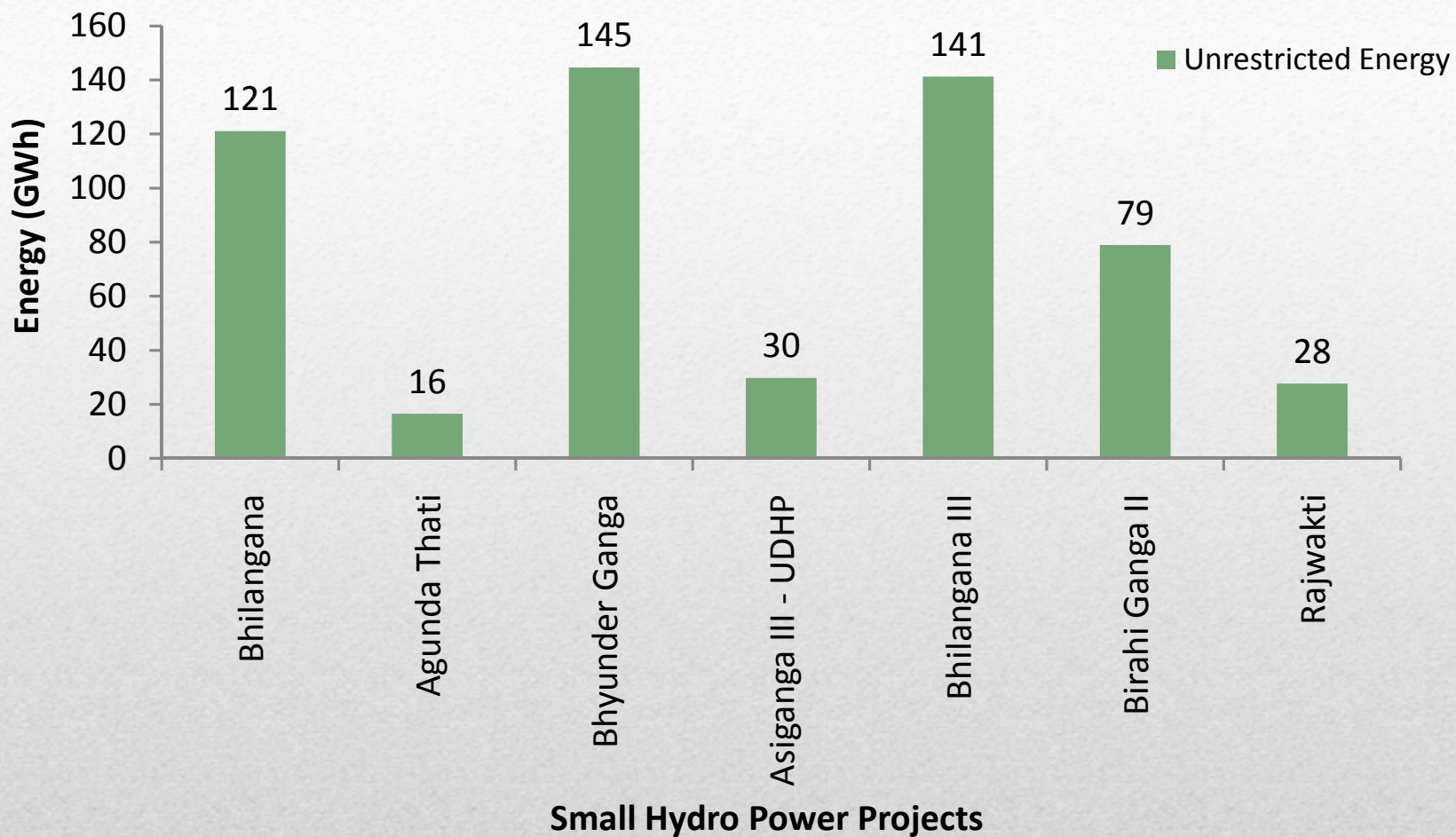


Unrestricted - % Energy Generated

Low Flow Season (Nov to Apr) and High Flow Season (May to Oct)

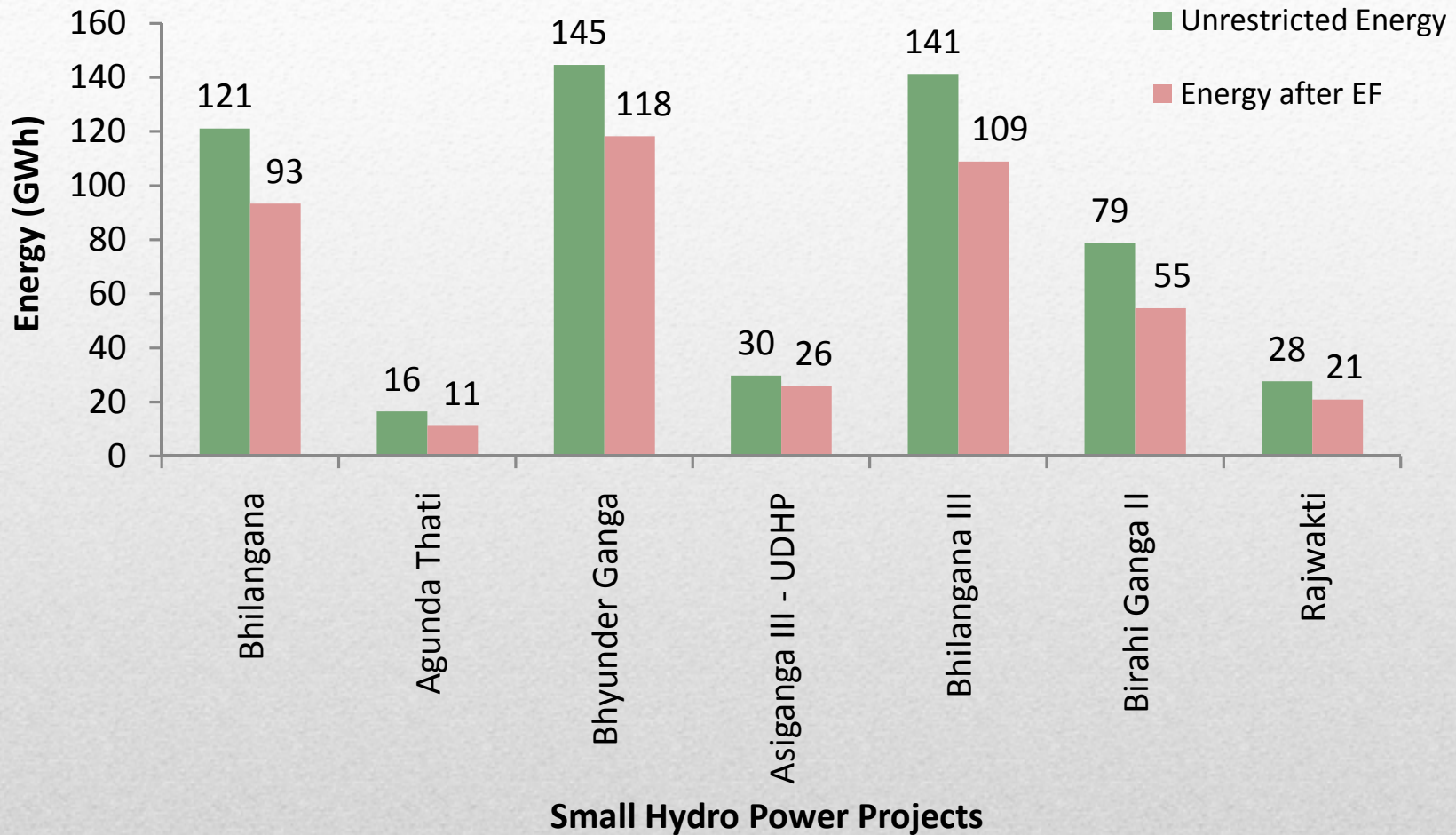
Energy Generated: Low vs.High Flow

Energy generated under unrestricted flow scenario



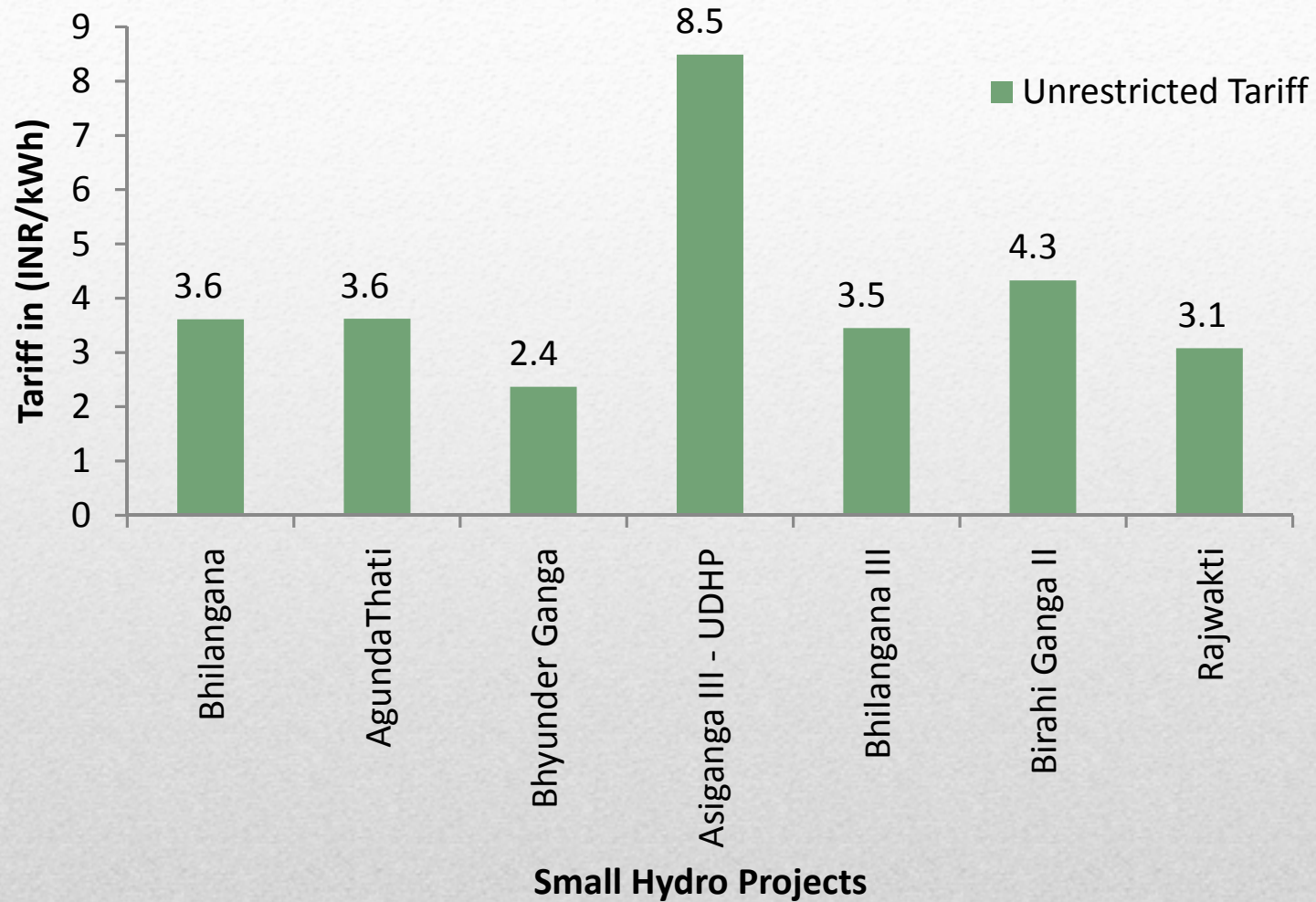
Actual Energy Generation

Comparison of energy generated for unrestricted and restricted (30-50) flow



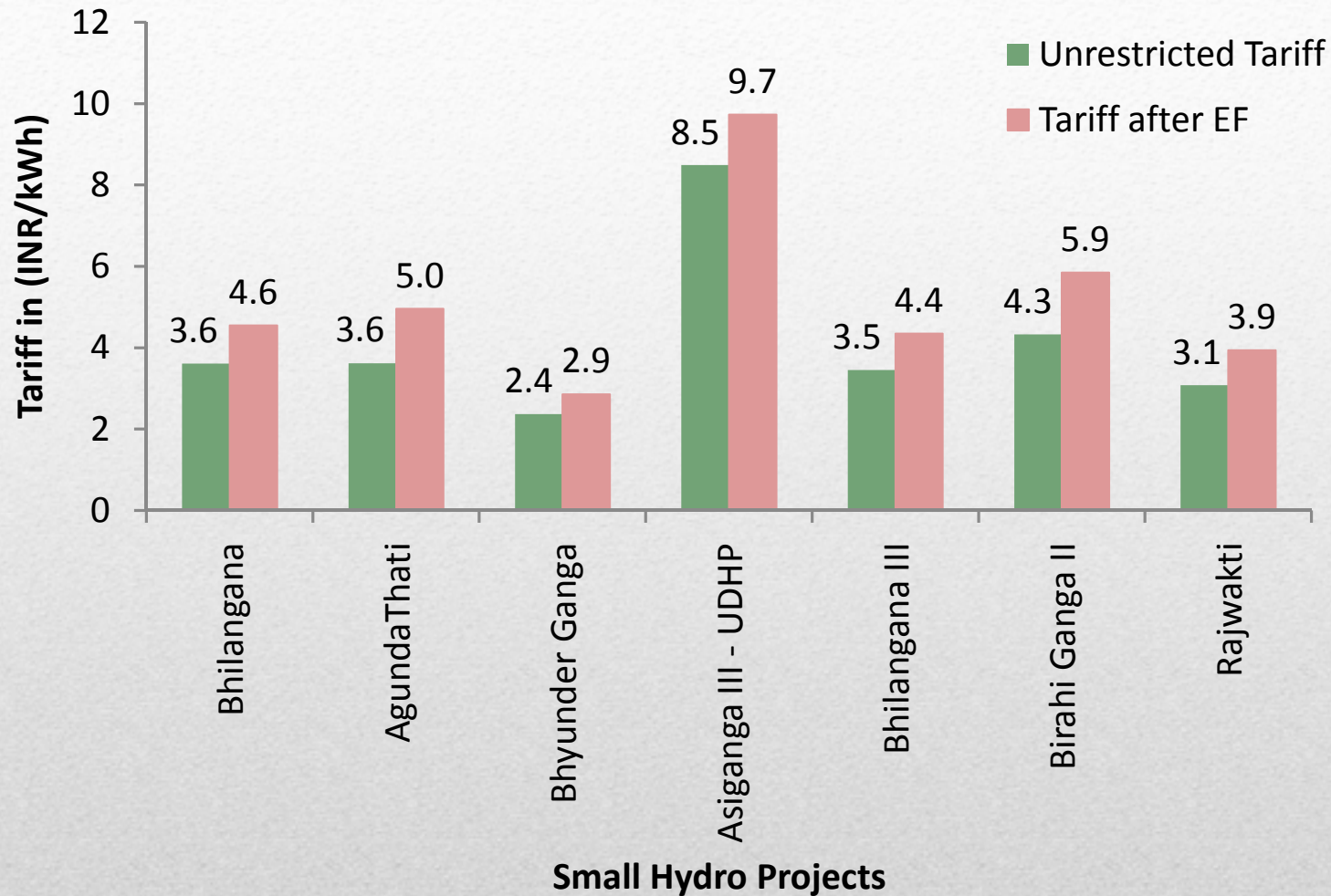
Reduction in Energy by 24%

Tariff comparison in INR/kWh - Unrestricted Flow



Actual Tariff

Tariff comparison in INR/kWh - Unrestricted and Restricted (30-50) Flow



Increase in Tariff by 27%

- SHP plants above 1 MW in size should be included **under EIA notification 2006** as Category B projects
- **Carrying capacity study** over a river basin should be executed for all rivers for sustainable development of SHP
- Forest diversion should take into consideration the forest diverted due to roads, linear intrusion etc.
- Proper implementation of existing norms (muck disposal, afforestation, stream restoration etc.)
- **Benefits from the projects** must be shared with the local communities. They should have the first right over the power generated by SHPs

Recommendations

CHANDRA BHUSHAN
Deputy Director General
Centre for Science & Environment
chandra@cseindia.org

