

# Karnataka Renewable Energy Development Limited

## RUN OF THE RIVER SMALL HYDRO PROJECTS

*Introduction* : Generation of power from perennial streams and rivers is a well-established practice over the past century and more. Due to lack of awareness about the environmental impacts, destruction of forests and displacement of rural communities has taken place during the construction of large hydro-electric projects. Public naturally have come to associate large hydro-electric projects with destruction of forests, displacement of farmers, tribals and other rural communities from their homes and hearths.

Technologists conceived of a method of generating power from the river without constructing big barrages or dams. Such projects have come to be known as "run-of-the-river" projects. Unfortunately there have been misapprehensions about the environmental impacts of even these projects. An attempt is made here to discuss the concept of run-of-the-river small hydro projects and to show how it is possible to generate power from streams and rivers with minimum adverse environmental impacts.

### A review of the history of hydro projects

The earliest projects for generation of hydro-electric power used the flow of hill streams and rivers. Small dams were built across rivers and streams flowing in hilly regions. The intercepted water was led through pipes known as penstock pipes to a powerhouse located at a suitable site much below the dam site. The water would flow back to the river after generating power. There was no consumptive use of the water for

irrigation or other purposes. Examples of such projects can be seen at Shivanasamudram, Shimsha and Mahatma Gandhi Power Stations on Cauvery and Sharavathi rivers. It was realised by engineers that economies of scale and consequent reduction of cost of producing power could be realised if large quantities of water could be impounded for generation of power. Consequently large dams were built across rivers creating large reservoirs which provided water for running turbines in big power stations. The stress here was to store enough water to last a long time after the seasonal flows in the rivers and streams had ceased, so that the requirements for generation of power and irrigation could be met from the stored water in the reservoirs. Projects generating large quantities of power round the year are Sharavathi, Kali and Varahi.

The benefit to agriculture from the use of stored water was realised leading to the construction of large multipurpose hydro-electric projects to meet the increasing energy as well as water requirements of the populace. For example, power generation became a component of irrigation projects such as Tungabhadra irrigation project at the base of which two powerhouses have been constructed. Such power houses are now being planned for other irrigation dams like Kabini, Nugu, K.R. Sagar, Hemavathi, Harangi and Tunga dams, which had been earlier conceived for irrigation only. However, the use of the dam and reservoir already available to generate power does not call for major changes to the structure of the dam or heavy investments. The water used for generation of power is returned back to the irrigation channel thus without affecting the quantity of water available for irrigation.

As has been narrated earlier, major hydroelectric projects like Sharavathi, Kali and Varahi have resulted in submersion of large tracts of pristine forests, highly productive agriculture lands, farms, gardens, orchards and habitations displacing hundreds of thousands of people. The other impacts of such projects was the hardships caused by non-availability of lands for resettlement of displaced people whose primary skills and means of livelihood were land-related. Availability of fuel, timber and fodder also declined as a result of the sacrifice of forests for construction of big multipurpose projects. Sustained agitation against big projects in other parts of the country are indicative of the mood of the people.

As an alternative to large hydro-electric projects engineers conceived of generating power from the flow of water in a stream without retaining water for any length of time. These projects have been popularly called run-of-the-river projects. Many projects have been constructed in countries around the world affecting the local people to the least possible extent. Even in Karnataka one run-of-the-river project to generate 9MW of power has been successfully completed at Chunchunakatte in Mysore district across Cauvery without causing any visible environmental damage in the areas surrounding the project. Yet there is some apprehension in the minds of people living in the vicinity of sites in some of the districts of our state where such projects have been proposed. These projects are being opposed even though facts show that small hydro projects have far lesser adverse environmental impact compared to the large projects conceived and built in the past. The proposed projects at Kelasi, Panasaguli, Sabguli, Byrekoppa,

Dugganabyle and Hosakambi on Gangavalli river are run-of-the-river. Such run-of-the-river projects have been planned in other districts also.

What is a run-of-the-river project?

Run-of-the-river project means a project based on generation of power from the flow of water as it runs in the river. The project does not envisage construction of dam or a barrage to store water for long periods of time. The structure that is constructed is only meant to collect the water and lead it into the penstock pipe. The powerhouse, the turbines and generators are small and simple in design. The generation of power is proportional to the flow of water in the river or stream. The Momentarily detained water is led through powerhouse and goes back to the original stream or river after a short distance from the weir. Thus there is no submergence of the adjacent agricultural or forestlands. The weir height can be so fixed after surveys to ensure that there is little or no submergence of adjacent lands. The detained water level before diversion will be well below the full flood level of the river and the water spread will be limited to river course only .

Several such small run of the river small and mini-hydel projects have been conceived in the master plan of Karnataka State for development of hydropower. In accordance with the policy of the government, most of these projects have been allotted to private sector developers many of whom are industrialists and entrepreneurs of our state who have come forward to develop these projects.

KREDL as a nodal agency of the government is promoting such environmentally friendly projects as this appears to be an environmentally

friendly way of developing resources available in the area to meet the power requirements for development of the state and its people. There is an urgent need for all concerned people to appreciate the emerging crisis arising out of slow growth of the economy due to a severe and persistent shortage of power and participate with the government in its development effort by means of environmentally friendly technologies to generate power for the speedier development of the state. With proper understanding, encouragement and active support to projects which are environmentally friendly, would go a long way in ensuring balanced development of the state and its people.

## Advantages of "run of the river" small hydro projects

1. Small hydro projects based at the toe of irrigation dams and existing canal drops in the irrigation system of the state paves way for power generation without creation of any infrastructure.
2. In view of the facility already being available there is practically no need for additional land except in case of diversion channels or by-passes which also mostly situated in Government/irrigation department land. However marginal requirement may be there for creating construction, operational and maintenance facility.
3. There is absolutely no submersion of lands/forests, cultivated or other useful lands as no storage is involved.
4. the irrigation patter will not be affected in any way because the generation is entirely controlled by the quantity of flow from dam sluices or in the canal which is totally ditated by irrational requirements.
5. The costs of small hydro projects is minimal as no storage facility is created.
6. No displacement of population and consequential rehabilitation expenditure.
7. The gestation period is as low as 24 months.

8. Run of the river and hill streams based small hydro projects will need low height diversion weir to divert the water through an adjacent intake through penstocks into the power house.
9. The low weir structure does not cause submersion of any lands as its height will be so designed that the water retention is limited to the river course which requires survey to be carried out.
10. The run of the river/stream small hydro functions only during the period when water is available in the river/stream under its normal flow pattern and is mainly used for meeting peak demands. Therefore there is absolutely no effect of the run of the river/stream on environment or forest or productive lands.
11. The cost of the project is minimal and the rates of generation is very low compared to other sources which are more harmful to environment like major hydro, thermal and nuclear projects.
12. The power generated being small will be totally consumed locally encouraging local industries and agricultural needs increasing the prosperity of the area.

## Karnataka Power Scenario

March 1998

Installed capacity	Total	
Hydro	: 2643 MW	
Thermal (coal and diesel)	: 968 MW	
Wind	: 12 MW	
Central stations share	: 729 MW	4352 MW
		<i>(Short by 25%)</i>

### Ongoing schemes generation capacity

Hydro	: 528 MW	
Thermal	: 420 MW	
Mini hydel	: 458 MW	
Wind (allotted to private Sector)	: 280 MW	
		1686 MW
		<i>( By 2000 A.D short fall by 20% )</i>

### Further anticipated generation capacity

Hydro	: 4000 MW	
Thermal	: 3000 MW	
wind	: 250 MW	
Mini hydel	: 250 MW	
Co-generation	: 500 MW	
Central stations share	: 1000 MW	
		9000 MW
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		15308 MW
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*Say 15000 MW by the year 2010 which may meet the states requirements.*

## Role of KREDL

1. Investigation of projects through consultants.
2. Scrutiny of feasibility reports.
3. Processing of application and passage through screening committee.
4. Selection of developers by high level committee of Government.
5. Pursuance for Government Order of allotment.
6. Assistance to developer in the preparation of DPR, detailed designs, specifications and drawings through panel of consultants.
7. assistance to developers in getting loans from IREDA, review of progress and reporting to Government.

### List of small hydro projects allotted to private developer

Sl. No.	Name of the Developer	Location	Capacity in Mw
01.	Bhoruka Power Corpn. Ltd.	Shivapura	18.00
02.	Gokak Mills Ltd.	Dhupdal	2.80
03.	L.K. Power Corpn. Ltd.	Maddur	2.00
04.	- do -	Mudhol	1.00
05.	- do -	Devarabelekere	2.00
06.	Graphite India Limited	Link Canal	1.50
07.	- do -	Chunchankatte	18.00
08.	Mittal Steel Limited	Kabini	1.95
09.	- do -	Elaneeru	15.00
10.	International Power Corpn. Ltd.	Nugu	2.00
11.	C.V. Mathew	Ceevy	6.50
12.	Dandeli Steel & Ferro Alloys Ltd.	Anveri	1.50
13.	Energy Development Co. Ltd.	Harangi	9.00
14.	Yuken India Ltd.	Attihalla	0.35
15.	Rukmini Steel Industries Ltd.	Madhavamantri	3.50
16.	Tungabhadra Steel Products Ltd.	Malaprabha	2.40
17.	Kilara Power Pvt. Ltd.	Kilara	1.30
18.	Cauvery Hydro Energy Ltd.	Shiva	3.00
19.	Bhoruka Power Corpn. Ltd.	Shahapur (1)	1.30
20.	- do -	Shahapur (2)	1.30
21.	- do -	Shahapur (3)	1.30
22.	- do -	Shahapur (4)	1.30
23.	- do -	Shahapur (5)	1.30
24.	- do -	Shahapur (6)	0.70
25.	- do -	Rajankollur	1.30
26.	- do -	Varahi	15.00
27.	- do -	Kumaradhara	48.00
28.	Dandeli Steel & Ferro Alloys Ltd.	Tunga Anicut	20.00
29.	Arun Engineering Group	Bhadra LBC	1.50
30.	Aparana Alloys P. Ltd.	Holalu	0.50
31.	Sandur Manganese & Iron Ores	Varahi tail race	15.00
32.	- do -	Hemavathi LBC	15.00
33.	Murudeshwara Power Corpn. Ltd.	Narayanpur LBC	11.60
34.	Subhash Projects & Marketing Ltd.	Kabani	20.00
35.	Subhash Projects & Marketing Ltd.	Keerthi hole	21.00
36.	Vijayalakshmi Hydro Power Pvt.	Hebbakvadi	3.00
37.	Global Industries	Balayantona hole	3.00
38.	South India Corpn. Ltd.	Dugganbail	10.00
39.	Suchindra Investments (P) Ltd.	Kelasi	10.00
40.	Uttam Steels Ltd.	Pansaguli	10.00
41.	- do -	Hosakambi	10.00

42.	Shivayogi Mandir Samsthe	Shivayogi Mandir	1.00
43.	Asia Pacific Industries Ltd.	Anandaka	9.00
44.	Vasco Builders	Kelagur	2.00
45.	Dodson Lindblom International Inc.	Seeta Nadi	3.00
46.	Atria Power Corpn. Ltd.	Mulki Dam	4.00
47.	- do -	Shimsha	12.00
48.	- do -	Seshadri Iyer	0.50
49.	Global Capital & Investments	Parpikala	6.50
50.	Sagar Power Ltd.	Dandela	10.00
51.	Amogha Power Projects Pvt. Ltd.	Sri Ramadevarakatte	1.30
52.	Kirloskar Electric Company	Karanja	1.00
53.	- do -	Madalgudi	4.00
54.	Paper Packaging (P) Ltd.	Kattepura	5.00
55.	- do -	Lokasara	3.00
56.	Davangere Cotton Mills	Hemagiri	2.00
57.	G.S. Enterprises	Harutho hole	4.00
58.	Sika Interplants System	yagachi	1.00
59.	Rephidim Power Supplies	Kutuphuza	4.00
60.	Triveni Engineering works	Manjadkar falls	4.00
61.	V. Pram Power Co.	Devaraya Anicut	0.50
62.	L.K. Power Corpn. Ltd.	Devaraj Urs Canal	6.00
63.	Universal Engineering	Iruppu falls	5.00
64.	Mudabagil Power (P) Ltd.	Hanumanthapur	0.50
65.	Milan Minerals (P) Ltd.	Vanivilas sagar	2.00
66.	Kanara Hydell Power Co.	Bairekoppa	10.00
67.	Aqua Power Inc.	Bhadra RBC	0.10
68.	Sahyadari Power Co.	Bhadra RBC 0 <sup>th</sup> KM	0.40
69.	Pearl Power Co.	Bhadra RBC 4 <sup>th</sup> KM	0.30
70.	Trinethara Energy Conversions Inc.	Mundagi hole	3.00
71.	Balaji Engineering & Const. Works	Dhanagere	2.50
72.	Magnesium Products Pvt. Ltd.	Hullahalli	2.00
73.	Narayanpur Power Co. Ltd.	Narayanpura	12.00
74.	A. Prabhakar Reddy & Co	Rodalbanda	5.00
75.	Suchindra Investments (P) LTD.	Sabguli	10.00
76.	Sandur Manganese & Iron Ores	Hemavathi River Bed	8.00
77.	Tungabhadra Steel products Ltd.	Rayabasavana	2.00
78.	Gokak Mills Ltd.	Dhupdal LBC	0.425

Small-hydro projects commissioned by private developers

Name of The Developer	Project	Installed Capacity	Month and Year
Bhoruka Power Corporation Ltd.	Shivapura MHS 1 <sup>st</sup> unit	18.00 MW	November 29, 1992
	2 <sup>nd</sup> unit		December 14, 1992
- do -	Shahapur Scheme-1	1.30 MW	March 18, 1997
- do -	Shahapur Scheme-2	1.30 MW	March 18, 1997
- do -	Shahapur Scheme-3	1.30 MW	March 18, 1997
- do -	Shahapur Scheme-4	1.30 MW	March 18, 1997
Gokak Mills Limited	Dhupdhal	2.80 MW	March 4, 1997
Dandeli Steel & Ferro Alloys	Anveri MHS	1.50 MW	August 4, 1997
Graphite India Ltd.	Chunchanakatte 1 <sup>st</sup> unit	9.00 MW	October 13, 1997
	TOTAL	36.50 MW	

### Small-hydro projects with KPCL

Location	Capacity in MW	Remarks
Kalmala	1x0.40	Commissioned
Gakenal	1x0.35	Commissioned
Sirwar	1x1.00	Commissioned
Mallapur	2x4.50	Commissioned
Mani dam	2x4.50	Commissioned
Bhadra	1x6.00	Work in progress
Brindavan	2x6.00	DPR ready and waiting for approval from Government of Karnataka
Mahatma Gandhi hydro electric	20.00	DPR under preparation
Upper Kaneri	5.00	DPR under preparation
<b>Total</b>	<b>62.75</b>	