



**Abstract:** Hydropower Development Policy promulgated in 1992 by Government of Nepal (GoN) heralded domestic and foreign private investment in hydropower projects, which was instrumental in adding 255,647 MW to the system with the investment of US\$ 493 million in a period of 23 years. While, public sector succeeded to add only 238.6 MW during the same period; thus adding a total of 489.14 MW to the system by public and private sectors. As cumulative total installed capacity of projects implemented prior to it in eight decades from 1911 through 1991 was only 239.33 MW, it manifests successful implementation of the policy with resultant mobilization of private investment.

Only 9<sup>th</sup> five-year plan period (1997-2002) succeeded to achieve 91% of the target set for the period resulting in mismatch in the growth of demand and supply; consequently load shedding. The reasons behind the failure need an in-depth analysis and critique of the policy and improvement thereof.

**Keywords:** Hydropower, Development, Public, Private, Partnership, NEA, Nepal

## Introduction

Main subsectors of power sector are generation, transmission and distribution of electricity. Hydropower Development Policy was promulgated for the first time in 1992 and another one was formulated in 2001, supplanting the previous one. These have opened all subsectors of power sector for private investment. However, no private sector has shown interest in investing in transmission line projects to generate revenue stream from wheeling charges, while apart from Nepal Electricity Authority (NEA), only Butwal Power Co. (BPC)<sup>1</sup> is involved in distribution. The focus of this paper is to conduct a comparison of hydropower development before private sector (entailing private investment, both domestic and foreign) was allowed and afterwards, in terms of projects commissioned for Nepal's internal consumption without delving into export/import of electricity. This paper does not attempt to record exhaustive history of hydropower development in Nepal.

Private investment in hydropower projects ranges from investment of, inter alia financial resources for the creation of national infrastructure assets or its upgrade/rehabilitation to management of public property entailing no capital investment. All of these are manifestations of Public Private Partnerships (PPP) under which public resources are used along with private investments (either human resources only or both financial and human resources) to deliver services/commodities. Private sector taking over the management of the assets owned by the public sector, for example, under a lease agreement is a type of PPP wherein private sector doesn't invest financial resources to create assets but manages the assets during the lease period. Whereas, private investment to build hydropower plants under build, own, operate and transfer (BOOT) mechanism is a modality of PPP, which is one of the modalities recognized by hydropower development policy of Nepal. Under BOOT modality private sector not only mobilizes funds to create hydro assets by implementing the project but also manages the assets till the time of its handover to the Government of Nepal (GoN)<sup>2</sup>.

Domestic and foreign private sector have invested its own resources (as equity) and also mobilized debt from domestic and international Financial Intermediaries (FIs) - banks as well as non banking financial institutions - to create fixed assets, for the generation of electricity, and have been successfully managing them, including selling electricity in bulk to NEA. In this respect, Nepal's power sector entered the PPP age with the advent of economic liberalization after the restoration of democracy in 1990.

## Historical Backdrop

The first hydropower project in Nepal was commissioned on 22<sup>nd</sup> May 1911 (inaugurated by late King Prithvi Bir Bikram Shah) in Pharping, about 10 km south of Kathmandu, using water from two spring sources, Satmule and Shikha Narayan<sup>3</sup>, with installed capacity of 500 kW. Through till 1991, the power sector was in the public domain exclusively – under the ownership of NEA, a public enterprise fully owned by the GoN, created on August 16, 1985 under the Nepal Electricity Authority Act, 1984; created through the merger of the then Department of Electricity under the then Ministry of Water Resources (now called Ministry of Energy), Nepal Electricity Corporation, Eastern Electricity Corporation and related Development Boards. It was established to make arrangements for supply of electricity by generating, transmitting and distributing in an efficient, reliable and convenient manner. Various projects with cumulative total installed capacity of 239,330 kilowatt (kW) were built from 1911 through 1991 under the ownership of NEA (as listed in annex 1).

As an exception to the situation obtaining at that time, hydropower enthusiasts of the United Mission to Nepal (UMN) led by an electric engineer from Norway Mr. Odd Hoftun, started building hydropower plants outside the ambit of public sector and his team was instrumental/successful in the implementation of Andhi Kholra Project, 5,100 kW (commissioned in June 1991)<sup>4</sup>. Built with the financial assistance from the Norwegian government under an agreement between GoN and UMN, this project was implemented by BPC; 98.88%

of its equity was owned by UMN, and NEA and Nepal Industrial Development Corporation (NIDC) holding 1.06% and 0.06% equity respectively<sup>5</sup>. This project was conceived and implemented prior to the formulation of policy allowing private investment in hydropower sector in 1992. Actually, the first hydropower project undertaken by this group was Tinau (1,024 kW), completed in 1972 with Norwegian government grant<sup>6</sup>, which was handed over to Nepal Electricity Corporation (predecessor of NEA) through GoN and is in operation even today under the ownership of NEA. Thus, in 80 years, till 1991, since commissioning of Pharping, Nepal's total installed capacity stood at 244,430 kW; 239,330 kW (including 4.536 MW isolated & mini hydropower plants) built and owned by NEA and 5,100 kW built with Norwegian government assistance and owned by BPC.

### Power Generation Under New Policy

When Andhi Khola project was about to be commissioned and Jhimruk project construction was halfway through, UMN conceived of implementing of Khimti Project (60,000 kW). However, for the implementation of a project of this scale, a larger quantum of financial resources was needed, mobilization of which was beyond the capabilities of UMN and, therefore, Norwegian private investors were roped in. In order to access foreign private equity and debt from the multilaterals, and in the backdrop of the implementation of modern economic concepts of Liberalization, Privatization, and Globalization (LPG) in Nepal, and adhering to the worldwide trend, the promoters of the Khimti Project wished to have necessary legal environment conducive for the purpose in early 1990s in Nepal. The Norwegian government provided technical assistance to help Nepal draft an appropriate policy and legislation for the purpose. Initially, it was thought that a special statute was needed just for the Khimti Project. This idea was later dropped, as it would have been too narrow - an enactment of statute just for one project.

Subsequent to several rounds of discussion and deliberations between Nepali and Norwegian legal experts, the policy/legal framework that we have now was introduced, viz. Hydropower Development Policy (HDP), 1992, Water Resources Act, 1992 and Electricity Act, 1992<sup>7</sup>. The unveiling of these three documents was an important milestone in the history of Nepal's power sector because it heralded entrée of private investment in the power sector, thus a significant part of infrastructure sector. This is the first policy related to the power sector in Nepal, which sets out the modality that uses public resources and private investments to deliver services.

As explained above, as against the cumulative

Project	Capacity in kW	Investment MUS\$		
		Domestic	International	Total
Khimti Khola <sup>10</sup>	60,000	5.1	136.9	142
Upper Bhote Koshi <sup>11,12</sup>	45,000	1.75	68.25	70
Syange Khola	183	0.32	0	0.32
Indrawati Khola III <sup>13</sup>	7,500	22.1	1.2	23.3
Chilime Khola <sup>14</sup>	22,000	32.9	0	32.9
Piluwa Khola <sup>15</sup>	3,000	4.4	0	4.4
Rairang Khola	500	1	0	1
Sun Koshi <sup>16</sup>	2,500	5.3	0	5.3
Chaku Khola	3,000	6	0	6
Baramchi Khola	4,200	8.4	0	8.4
Khudi Khola	3,450	8.3	0	8.3
Thoppal Khola	1,650	3.3	0	3.3
PHEME Khola	995	1.99	0	1.99
Sisne Khola	750	1.5	0	1.5
Sali Nadi	232	0.46	0	0.46
Pati Khola	996	1.99	0	1.99
Seti Khola II	979	1.96	0	1.96
Ridi Khola	2,400	4.8	0	4.8
Upper Hadi Khola	991	1.98	0	1.98
Mardi Khola	4,800	9.6	0	9.6
Mai Khola	4,500	9	0	9
Lower Piluwa Khola	990	1.98	0	1.98
Hewa Khola	4,455	8.91	0	8.91
Bijayapur-1	4,410	8.82	0	8.82
Siuri Khola	4,950	9.9	0	9.9
Lower Modi	9,900	19.8	0	19.8
Sipring Khola	9,658	19.32	0	19.32
Solar (KUKL) <sup>17,18</sup>	680.4	0	6.14	6.14
Tadi Khola	5,000	10	0	10
Middle Chaku	1,800	3.6	0	3.6
Charnawati Khola	3,520	7.04	0	7.04
Lower Chaku	1,765	3.5	0	3.5
Ankhu Khola	8,400	16.8	0	16.8
Bhairab Kunda	3,000	6	0	6
Radhi Khola	4,400	7.41	0	7.41
Chhote Khola	993	1.8	0	1.8
Mailung Khola	5,000	10	0	10
<b>Total</b>	<b>238,547.4</b>	<b>267.03</b>	<b>212.49</b>	<b>479.52</b>

Table 1: Status of Private Investment<sup>9</sup>

capacity of the power system built in eight decades since 1911 totaled 244,430 kW, 494,247 kW hydropower was added to the system in 22 years under new

policy; more than twice in 22 years compared to eight decades. During this period (1992-2014), NEA on its own added 238,600 kW to the system as detailed in Annex 2. Whereas the private sector implemented and commissioned power projects totaling 250,547 kW (excluding 5,100 kW built under the auspices of UMN) - about 5% more than implemented by NEA during the same period as detailed in Annex 3.

The electricity generated by these is sold to NEA in bulk under Power Purchase Agreements (PPAs) executed between NEA and the respective Independent Power Producers (IPPs).

As PPP is a modality that uses public resources and private investments to deliver services, the credit for the addition of 255,647 kW in Nepal's power system by the private sector goes to the PPP concept enshrined in the Electricity Act. Thus, the cumulative installed capacity built by private sector so far stands at 32% of the total installed capacity in a system of 787,087 kW (including 53,410 kW thermal and 100 kW solar, owned by NEA).

### Private Investment

Although the sector was liberalized in 1992, it succeeded to attract private investment only in 1996 upon successful financial closure of Khimti project (first project with private investment) in January 1996, for which a PPA was signed in March 1994<sup>8</sup> (the first such instrument signed in Nepal). This is a turning point in the history of infrastructure development of Nepal, which succeeded to attract private investment, both domestic and Foreign Direct Investment (FDI). The status of private investment in commissioned hydropower projects, through till mid-July 2014 is presented in Table 1.

Similarly, \$13.5 million was invested by the institutional private sector (a consortium of Nepali and Norwegian investors)<sup>9</sup> in buying 75% shares in BPC, owner of Andhi Khola (5,100 kW) and Jhimruk (12,000 kW) projects, divested by GoN, as mentioned above. Thus, in 22 years, the private sector succeeded to mobilize and invest \$ 493.02 million (\$479.52 million directly plus \$ 13.5 million in buying BPC shares) into 255,647 kW hydropower projects.

### Planned Development of Hydropower

Although hydropower sector was liberalized under the policy formulated in 1992, on-site activity to implement private sector projects only started in 1996 and first power project (Khimti) was commissioned in July 2000, during 9th Five-year plan. In this backdrop, an evaluation of each such plan period will help to compile a score-card of the policy heralding private investment in the sector and also help gauge the success or failure of each such plan as well as to diagnose problems and suggest improvement measures.

### Eighth Five Year Plan

It was in the first year of 8<sup>th</sup> Five Year Plan, for the period 1992-1997 that Hydropower Development Policy, 1992 and Electricity Act, 1992 were promulgated to allow private sector entry into hydropower sector. The target set for this period was 29.7 MW and following projects,

totaling 15.2 MW, were completed:

Installed Capacity kW		
Projects	NEA	Private Sector
Chatara	3,200	
Jhimruk		12,000

Table 2: Projects Completed in 8<sup>th</sup> Plan Period

It should be noted that 12 MW was completed by "private" sector, but the project was started in 1989, even before enabling legal environment was put in place for private sector to build hydropower projects

### Ninth Five Year Plan

Ninth five year plan, for the period of 1997-2002, had set a target of increasing installed capacity by 293 MW and following projects were successfully implemented during the period; adding about 268.7 MW to the system:

Nepal achieved 91% of the target during this period. This is stellar performance to date of planned development of hydropower in Nepal.

Projects	Installed Capacity kW	
	NEA	Private Sector
Indrawati		7,500
Kali Gandaki 'A'	144,000	
Khimti		60,000
Modi	14,800	
Puwa	6,200	
Syange		183
Upper Bhote Koshi		36,000
<b>Total</b>	<b>165,000</b>	<b>103,683</b>

Table 3: Projects Completed in 9<sup>th</sup> Plan Period

### Tenth Five Year Plan

Tenth five year plan, covering the period of 2002-2007, had aimed to add 314.6 MW installed capacity. NEA was expected to complete 70 MW Middle Marshyangdi and 30 MW Chamelia projects, totaling 100 MW. The private sector was expected to complete assortment of projects totaling 214.6 MW. Compared to ninth plan, the achievement of the tenth plan was very dismal as NEA failed to add a single MW<sup>20</sup>, while the private sector succeeded to add only 33.93 MW by completing following projects (Table 4):

Only 10.78% of the target was achieved during this period.

### First Interim Three Year Plan

A target of 105 MW was fixed for first interim 3-year plan (2007-10), of which NEA completed Middle Marshyangdi Project, 70 MW. Private sector completed following projects during the period:

Installed Capacity kW		
Projects	NEA	IPPs
Baramchi	-	980
Chaku	-	1,500
Chilime	-	22,000
Khudi	-	3,450
Piluwa	-	3,000
Rairang	-	500
Sun Koshi	-	2,500
<b>Total kW</b>	<b>-</b>	<b>33,930</b>

Table 4: Projects Completed in 10<sup>th</sup> Plan period

Installed Capacity kW		
Projects	NEA	IPPs
Mardi		3,100
Middle Marshyangdi	70,000	
Pati		996
Pheme		995
Ridi		2,400
Sali Nadi		232
Seti II		979
Sisne		750
Thoppal		1,650
Upper Hadi Khola		991
<b>Total kW</b>	<b>70,000</b>	<b>12,093</b>

Table 5: Projects completed in the first 3- year Interim Plan

In this manner, 82 MW was added to the system against a target of 105 MW which is a significant achievement; 78 percent. However, Middle Marshyangdi was supposed to be commissioned in the previous plan period - specifically 2004.

### Second Interim Three Year Plan

A target of 281 MW was set for 2<sup>nd</sup> three-year interim plan spanning from 2010 to 2013. However, only an isolated mini hydro project 400 kW Gamgad (in Mugu district) was completed by NEA. On its part, private sector completed following projects totaling 49.863 MW:

Following projects were upgraded in this plan period by the private sector to add 6.42 MW capacity as follows:

Similarly, NEA signed Supplementary PPA for additional power of 9 MW<sup>21</sup> with Upper Bhote Koshi Project Company on July 8, 2012 at Rs 1.625/kWh<sup>22</sup>, thereby adding 9 MW to the system.

Projects	Installed Capacity kW	
	NEA	IPPs
Bijayapur-1		4,410
Charnawati		3,520
Gamgad	400	
Hewa Khola		4,455
Lower Modi		9,900
Lower Piluwa		990
Mai Khola		4,500
Middle Chaku		1,800
Sipring		9,658
Siuri		4,950
Solar (KUKL)		680
Tadi		5,000
<b>Total kW</b>	<b>400</b>	<b>49,863</b>

Table 6: Projects completed in the Second 3-year Interim Plan

Project	Existing capacity kW	Added capacity kW	Total kW
Baramchi upgrade	980	3,220	4,200
Chaku upgrade	1,500	1,500	3,000
Mardi upgrade	3,100	1,700	4,800
<b>Total kW</b>	<b>5,580</b>	<b>6,420</b>	<b>12,000</b>

Table 7: Addition to Installed Capacity

Against a target of 281 MW for the 2<sup>nd</sup> Interim Plan, only 65.683 MW was added to the system - an achievement of meager 23%.

Projects	Installed Capacity kW	
	NEA	Private Sector
Ankhu Khola		8,400
Bhairab Kunda		3,000
Chhote Khola		993
Lower Chaku		1,765
Mailung Khola		5,000
Radhi Khola		4,400
<b>Total kW</b>		<b>23,558</b>

Table 8: Projects completed in first FY of Third 3-year Interim Plan

### Third Interim Three Year Plan

It was targeted to add 668 MW in the system during this plan period, 2013 to 2016. However, NEA commissioned no project in the first year of 3rd Interim Three Year Plan (FY 2013/14) while following projects were commissioned by private sector in FY 2013/14:

### Conclusion

Out of 494, 274 kW hydropower added to the system in 23-year period after promulgation of new policy, 250,547 kW was added by private sector, which signifies that the policy has been a success. Hydropower, being an important part of infrastructure, was thought to be in the public domain till the advent of this policy. An important feather in its cap is the fact that due to introduction of this policy and related legal environment, private sector invested about US\$ 500 million.

With an achievement of 91 percent of the target during 9<sup>th</sup> five-year plan period, it stands out as the Golden Era in terms of success of new policy and hydropower development. However, the achievements during subsequent plan periods have not been very encouraging. This calls for introspection and the policy and legal environment requires to be revised and refined.

Year	Power Plants	Capacity kW
1911	Pharping	500
1935	Sundarijal	640
1965	Panauti	2,400
1967	Phewa	1,000
1967	Trishuli	24,000
1972	Sun Koshi	10,050
1978	Tinau	1,024
1979	Gandak	15,000
1981	Baglung	200
1981	Doti	200
1981	Phidim	240
1982	Kulekhani I	60,000
1983	Jomsom	240
1984	Devighat	14,100
1985	Seti	1,500
1986	Kulekhani II	32,000
1988	Terhathum	100
1989	Khandbari	250
1989	Marsyangdi	69,000
1989	Ramechhap	150
1991	Surnaigad	200
1991	Tatopani	2,000
Isolated & mini hydropower plants		4,536
<b>Total kW</b>		<b>239,330</b>

Annex 1: Power Projects Built in 8 Decades since 1911

Year	Power Projects	Capacity kW
1995/96	Chatara	3,200
1999/00	Puwa Khola	6,200
2000/01	Modi Khola	14,800
2002/03	Kali Gandaki A	144,000
2007/08	Middle Marshyangdi	70,000
2011/12	Gamgad	400
<b>Total kW</b>		<b>238,600</b>

Annex 2: Hydropower Projects Commissioned by NEA till 2013/14 since 1992

Year commissioned	Project	Installed Capacity kW
2090/91	AndhiKhola	5,100
2094/95	JhimrukKhola	12,000
2000/01	KhimtiKhola	60,000
2000/01	Upper Bhote Koshi	45,000
2001/02	Syange Khola	183
2002/03	Indrawati Khola	7,500
2003/04	Chilime Khola	22,000
2003/04	Piluwa Khola	3,000
2003/04	Rairang Khola	500
2004/05	Sun Koshi	2,500
2004/05	Chaku Khola	3,000
2006/07	Baramchi Khola	4,200
2006/07	Khudi Khola	3,450
2008/09	Thoppal Khola	1,650
2008/09	Pheme Khola	995
2008/09	Sisne Khola	750
2008/09	Sali Nadi	232
2008/09	Pati Khola	996
2008/09	Seti Khola II	979
2009/10	Ridi Khola	2,400
2009/10	Upper Hadi Khola	991
2009/10	Mardi Khola	4,800
2010/11	Mai Khola	4,500
2010/11	Lower Piluwa Khola	990
2011/12	Hewa Khola	4,455
2011/12	Bijayapur-1	4,410
2012/13	Siuri Khola	4,950
2012/13	Lower Modi	9,900
2012/13	Sipring Khola	9,658
2012/13	Solar (KUKL)	680.4
2012/13	Tadi Khola	5,000
2012/13	Middle Chaku	1,800
2012/13	Charnawati Khola	3,520

2013/14	Lower Chaku	1,765
2013/14	Ankhu Khola	8,400
2013/14	Bhairab Kunda	3,000
2013/14	Radhi Khola	4,400
2013/14	Chhote Khola	993
2013/14	Mailung Khola	5,000
	<b>Total kW</b>	<b>255,647.4</b>

Annex 3: Hydropower Projects Implemented by Private Sector till mid-July 2014 since 1992

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#### Footnotes:

1. It was privatized in 2003 by GoN
2. BOOT is the only concession mechanism recognized by Electricity Act, 1992 and other forms of concession mechanisms like (a) build and transfer, (b) build, operate and transfer, (c) build, transfer and operate, (d) lease, operate and transfer, (e) lease, build, operate and transfer, (f) develop, operate and transfer, etc. aren't recognized. Private Financing of Construction and Operation of Infrastructure Act, 2006, however, does recognize all forms of concession mechanisms, which doesn't fall under the ambit of this paper.
3. Dixit, Ajay, 2002. Basic Water Science Nepal Water Conservation Foundation, p 355.
4. UMN was also instrumental in building Jhimruk project, 12,100 kW, in the similar manner as Andhi Khola.
5. Of the 98.88% equity in BPC held by UMN, 96.09% was transferred to GoN in 1996 free of cost pursuant to the agreement between GoN and UMN (thereby leaving a token 2.79% ownership with UMN). GoN divested 87 percentage points of its holding to privatize BPC in 2003; 75% to strategic investors, 10% to general public and 2% to BPC staff. GoN now holds 9.09% equity.
6. UMN through BPC built another project, Jhimruk (12,000kW), commissioned in August 1994 in the same manner as Andhi Khola.
7. However, the then secretary of Ministry of Water Resources, Mr. Surya Nath Upadhyay has denied that the policy/legal framework was prepared with the Norwegian assistance in several public forums.
8. Proponent of Khimti project refused to implement the project on the basis of the PPA signed in 1994 claiming that the project is not feasible under the tariff regime and, therefore, NEA was forced to revise the tariff upwards in January 1996.
9. Investment data in projects is based on information available in the public domain. For reasons of confidentiality, most private investors don't publicize project costs, in which case cost has been estimated at USD 2,000/kW.
10. Total cost as mentioned in HPL website (<http://www.hpl.com.np/>)
11. As EPC cost was \$ 48 million, according to Chris R. Head (mentioned in "Financing of Private Hydropower Projects" in World Bank Discussion Paper No. 420), other soft costs, including interest during construction even if were as high as \$ 20 million, the total cost could not be higher than \$ 70 million
12. In 2006, Panda Energy (original developer) divested 75% shareholding in BKPC, which was bought over by Nepali developer.
13. Source: National Hydropower Co. Ltd.
14. Source: Chilime Hydropower Co. Ltd.
15. Source: Arun Valley Hydropower Development Co. Ltd.
16. Source: Sanima Hydropower Ltd.
17. Source: KUKL
18. The cost is exclusive of cost of batteries (not used) and land used.
19. Nepali company Shangri-La Energy Ltd. (SEL) owns 68.95% and Norwegian company IKN Nepal AS (IKNN) owns 6.05%.
20. Middle Marsyangdi was completed in 2008 during the first year of 3-year Interim Plan while work on Chamelia is still going on.
21. Although licensed for 36 MW and armed with PPA for same installed capacity, the project company had commissioned 45 MW project in January 2001 but NEA refused to accept dispatch of additional 9 MW till SPPA was signed.
22. Source: <http://www.bhotekoshi.com.np/faqs.php>  
Project construction started prior to promulgation of the policy and also commissioned before policy came into force.
23. Project construction started prior to promulgation of the policy but commissioned after the policy came into force.
24. Power from additional 9 MW was accepted by NEA in addition to existing 36 MW in 2012/13
25. Installed capacity of 1.5 MW was increased by adding 1.5 MW in 2011/12
26. Existing 0.98 MW was upgraded to 4.2 MW by adding 3.22 MW in 2010/11
28. Existing 3.1 MW was upgraded to 4.8 MW by adding 1.7 MW in 2011/12
29. As an exception, NEA has signed PPA with Kathmandu Upatyaka Khanepani Ltd. for excess electricity from solar power built to pump water. Since this was also a part of PPP policy from a different source of energy, it too has been included in this study.