SAARC ENERGY CENTRE
Energy for Peace & Prosperity

Online training of SAARC Professionals on Small, Mini and Micro Hydro Power Generation
(Sept 13 - 17, 2021)

Policies and Regulations for SMMHP Development

Sept 16, 2021

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EXPERIENCE OF NEPAL IN SMALL HYDROPOWER DEVELOPMENT

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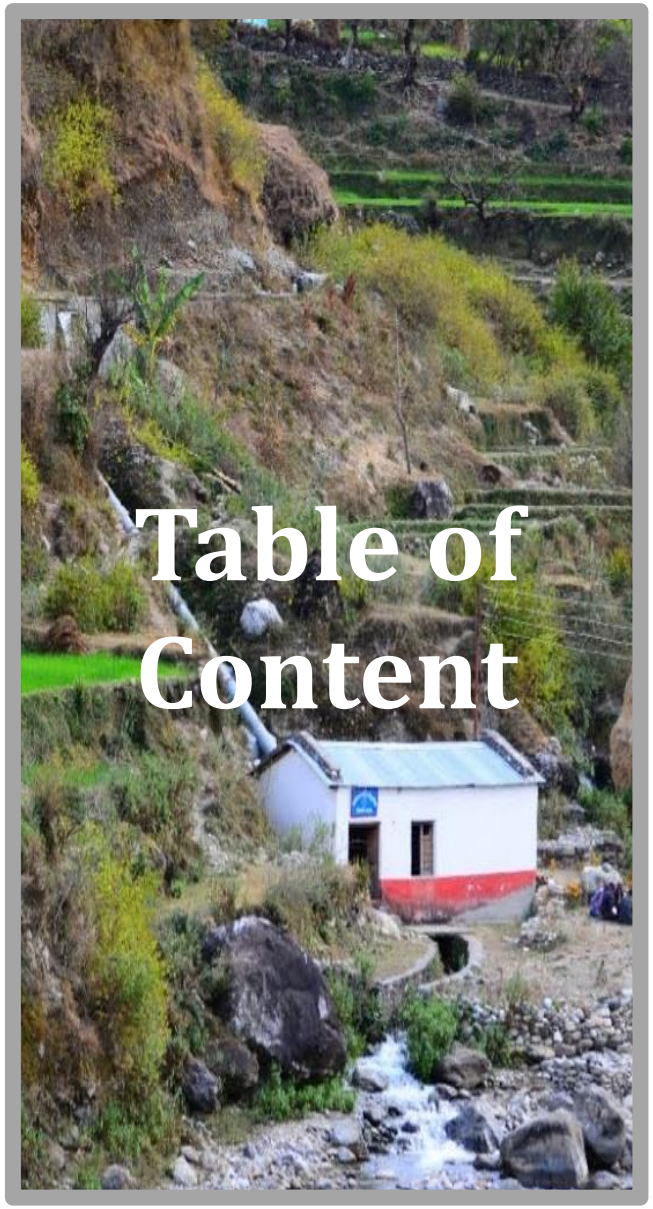


TOPICS

- Classification of Hydropower Plants in Nepal
- History of Development of Small hydropower
- Nepal's Perspective: Noticeable Features of Development History
- Why Small Hydro for Nepal?
- Project Development Process for Small and Micro Hydro
- Some Issues
- Relevant Policies
- A Case of Sick Hydropower Projects in Nepal
- Conclusion and Way Forward

LEARNING OBJECTIVES

- ❑ Small hydro power development trend in Nepal
- ❑ Status of small hydro power projects in Nepal
- ❑ Small hydro power policies and implementation modalities in Nepal
- ❑ Regulatory requirement and government commitment on electricity development in Nepal
- ❑ Business models for grid connected and isolated small hydro projects in Nepal
- ❑ Failed and success cases of small hydro projects in Nepal

CLASSIFICATION OF HYDROPOWER PLANTS IN NEPAL*

Pico

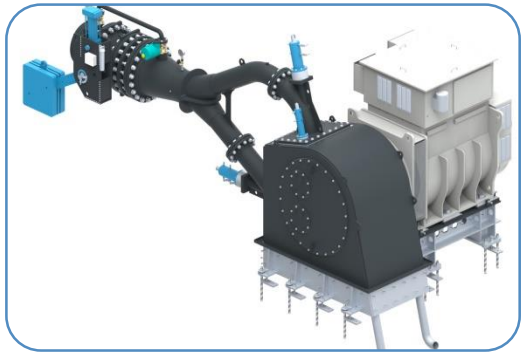
(Upto 10 kW)

Micro

(10 kW to 100 kW)

Mini

(100 kW to 1000 kW)



Small

(1 MW to 10 MW**)

Notes:

* Classification of pico and micro hydropower is done by Alternate Energy Promotion Center (AEPC), Nepal

** 1- 10 MW classification is based on existing PPAs for small hydro

HISTORY OF DEVELOPMENT OF SMALL HYDROPOWER

- First (mini) hydropower – began generation in Nepal (1911 AD)
- Chandra Jyoti Electric Power Station (500 kW)
- Second (mini) hydropower became operational in Nepal in 1934 AD.
- Sundarijal Hydroelectric Project (640 kW)
- Third (Small) Hydropower Plant Began Operational in 1965
- Panauti Hydroelectric Project (2.4 MW)
- After commissioning of Trishuli (21 MW, 1969), focus shifted out of Kathmandu
- Fewa (1 MW, 1969)
- Tinau (1 MW, 1981)
- NEA developed small projects on and off grid even after big projects were made
- Seti (1.5 MW, 1985), Puwa (6.2 MW, 2004) Tatopani (2 MW, 1995)
- After entry of private sector in 2000, many small projects began operation
- Indrawati III (7.5 MW, 2002), Piluwa (3 MW, 2003), Sunkoshi Small (2.6 MW, 2004))
- 324 MW from 80 projects

- First micro-hydro began operation in Nepal as Godavari Micro-hydro (5 kW, 1962 AD)
- Government Subsidization began in 1981 AD through Agricultural Development Bank for agro-processing.
- In the 1990s, subsidies as high as Rs. 150,000 per kW was offered for micro-hydro above 3 kW size
- Alternative Energy Promotion Center (AEPC) was formed by Nepal Government in 1996
- As of 2018, over 3000 micro and Pico hydro of almost 35 MW capacity were developed

NEPAL'S PERSPECTIVE: NOTICEABLE FEATURES OF DEVELOPMENT HISTORY

1. Early days of hydropower development in Nepal was Kathmandu-centric and dependent on small hydropower
2. Even after operation of large Hydropower Projects (HPPs), Nepal Electricity Authority (NEA) continued to make small sized hydropower plants
3. In the past, small projects would first be constructed and operated in isolated mode, and slowly get connected to grid as the central grid expanded
4. Entry of private sector in hydropower caused private sector to carry the torch for construction of small projects while NEA and its subsidiaries focused on large projects
5. While mini and small projects were constructed as commercial projects, often connected to the grid, micro-HPPs focused on community
6. Micro-hydro started late, in 1960s, But, serves greatly in remote communities for lighting, agricultural, agro-processing and some commercial activities
7. Subsidization has led to proliferation of micro-hydro plants (including pico hydro) allowing community and private sectors to come forth for construction and maintenance of such project

SMALL HYDROPOWER PROJECTS (<10 MW) IN NEPAL AND CHALLENGES

S. N.	Particulars	Less or equal to 10MW	
		No. of Projects	Capacity (MW)
1.	Survey License Received	115	578.71
2	Construction License Received	122	540.66
3.	Applied for Survey License	1	10.00
4.	Applied for Construction License	12	63.13
5.	Projects Under Operation	80	324.86
	Total	**330**	**1,517.36**

*Source: DoED Website (Last Accessed: Nov 24, 2020) and NEA's Annual Report FY 2019/20

01 Out of 122, 54 HPPs with total capacity of 254.35 MW are seeking for Financial Closure.

02 Out of 626 HPPs at different stages, 330 are small HPPs, reserving almost 6% of total capacity.

03 Despite the majority in numbers, small HPPs are forced to compete with medium and large scale HPPs with same posted tariff.

04 Comparatively higher cost and hydrological risk, almost 50 small HPPs heading towards financial woes (identified as Sick-Projects). PPAs are same for all

05 Utility's reluctance to synchronize off grid MHPs make them unsustainable

06 Regulatory framework and technical standards not in place

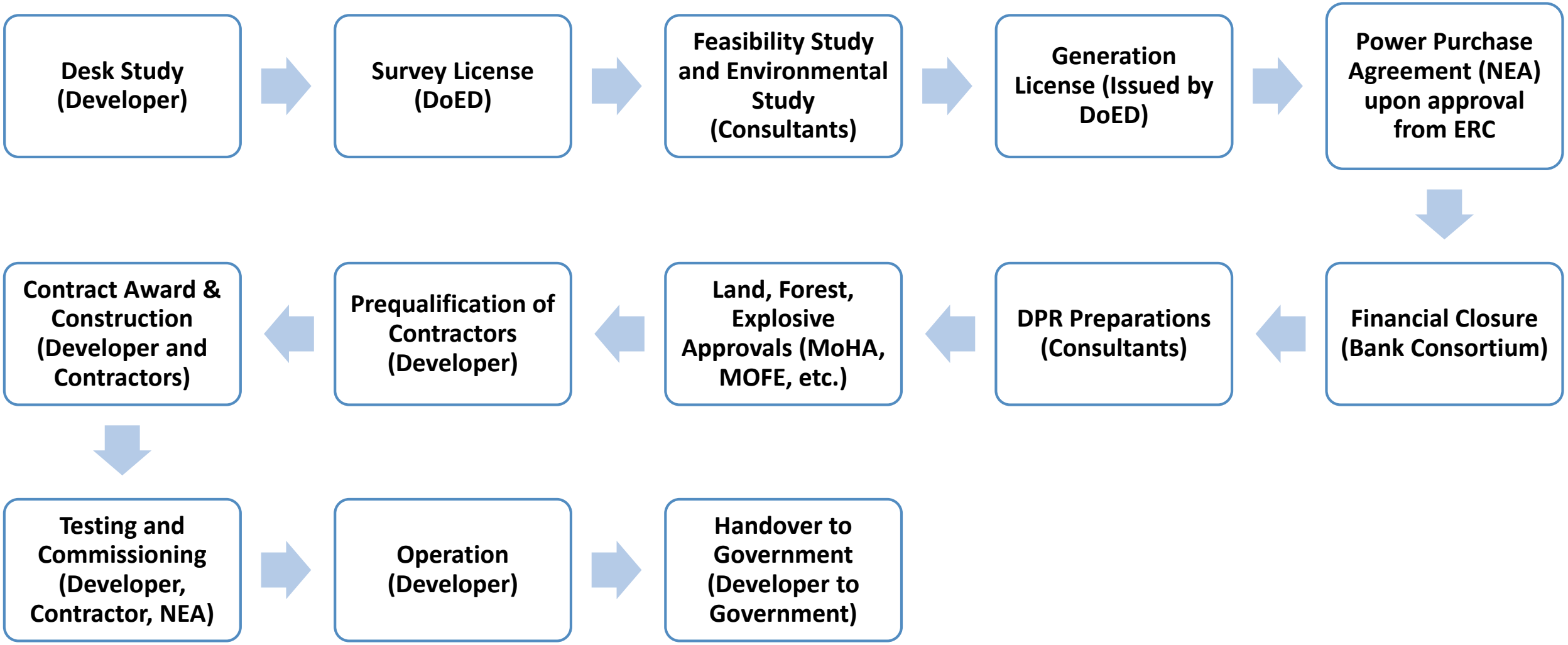
07 Difficult to compete with other cheaper and advanced RE generation

WHY SMALL HYDRO FOR NEPAL?

- Low Budget Requirement
- Quicker Construction
- Nationally available technical human resource is sufficient
- More employment opportunity than large HPPs
- Quick fulfilment of electricity needs of people
- Can also be constructed by local/community investors or local government
- Capacity development for developers to build large size projects
- Low impact on environment
- Off-grid micro hydro has increased overall quality of life of remote area's citizen
- Off-grid micro hydropower projects has supported local business and entrepreneurships

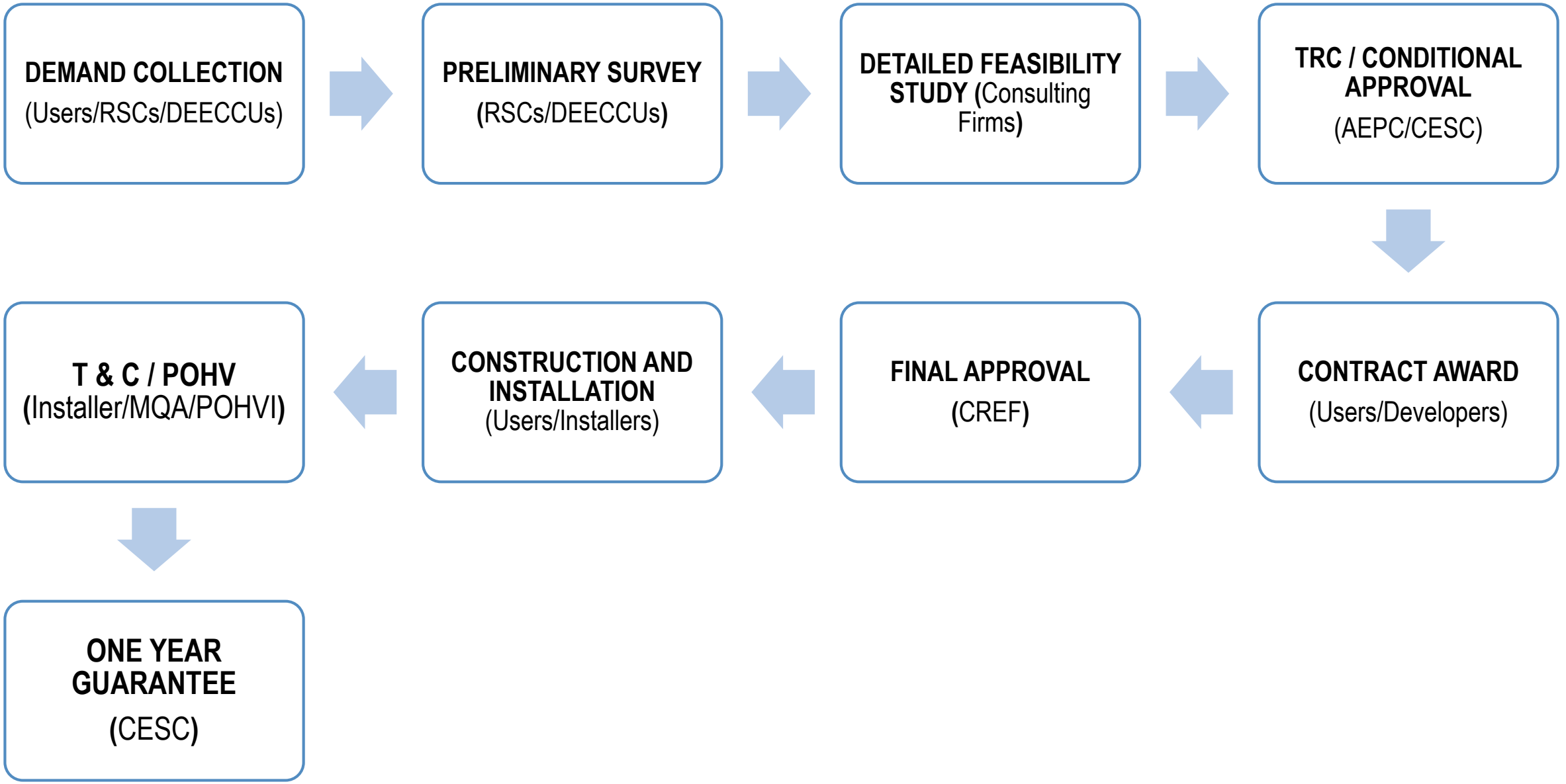
PROJECT DEVELOPMENT PROCESS FOR SMALL HYDRO

This slide outlines the general procedure for development of small, grid connected hydropower plants.



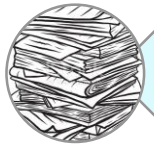
PROJECT DEVELOPMENT PROCESS FOR MICRO-HYDRO

This slide outlines the general procedure for development of small (micro/pico), off-grid hydropower plants.



SMALL HYDRO: SOME ISSUES

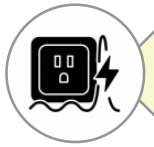
Small plants in large number cause difficulty in regulation and corporate governance



Small plants in large number means tediousness in contract management for off-taker

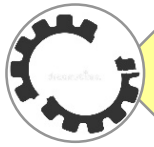
Small project means lesser socio-environmental mitigation budget and capacity

Energy declaration difficult because of fluctuating hydrology



High frequency of outages of plant owing to fault in low voltage lines, flood and landslides.

With allowance for small power plans, all water for hydropower, has become dominant

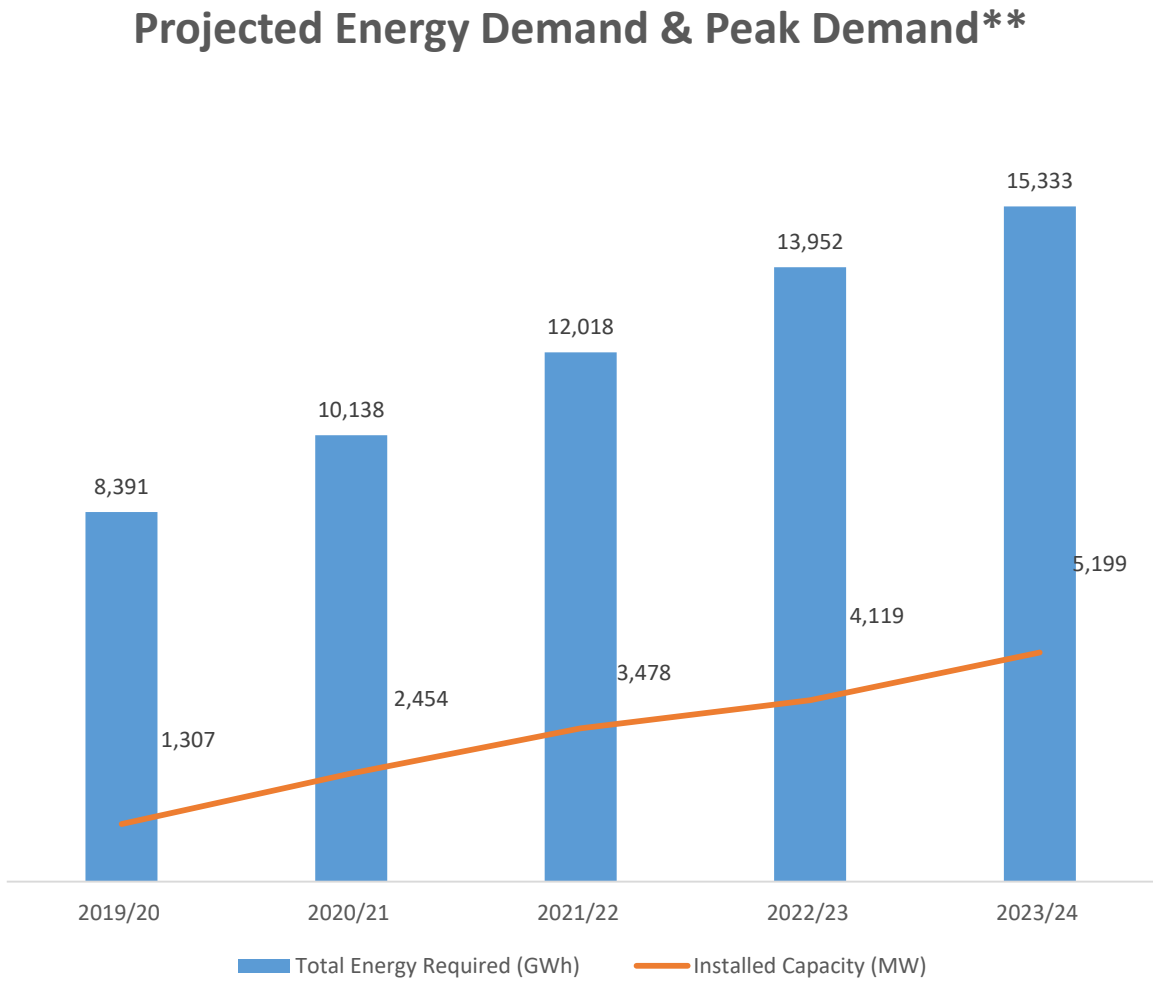


Small projects have propensity to become sick projects. Case study to be given below.

There may be other issues but these are the major shortcomings that Nepal has experienced.

GOVERNMENT'S COMMITMENT AND PRIORITY IN ELECTRICITY*

- **Generation mix to enhance energy security**
  - Estimated generation of 15,000 MW by 2028
    - 30-35% reservoir;
    - 25-30% Peaking-Run-of the-River (PROR);
    - 30-35% Run-of the-River (ROR);
    - Others 5-10% (non hydro renewables)
- Per capita consumption- 270 kWh/yr (Present)
- Change in the energy consumption pattern to reach per capita energy consumption
  - 700 kWh/year by 2023 and
  - 1,500 kWh/year by 2028
- Promote infrastructure
  - Electricity based transport
  - Electric cooking



**Based on NEA's CDP

* Based on Ministry of Energy, Water Resources and Irrigation's Whitepaper 2017/18

RELEVANT POLICIES

1. No separate hydropower related facilities for small projects connected to grid. However, some differences clearly exist for projects below 1 MW in pre-construction period. For example, **according to Environmental Protection Rules, 2020,** for projects above ***1 MW up to 50*** MWs, only Initial Environmental Examination is to suffice.

2. ***Procedures for subsidy to be provided to hydropower projects upon completion of construction, 2015*** provides that each hydropower project shall be qualified for NRs. 50 lakh/Megawatt refund upon completion of project.

3. **Concept Paper and Action Plan relating to National Energy Crisis Control and Electricity Development Decade, 2015** assures that the tax holiday will be prescribed till the duration of the energy crisis prevention decade. *(S. 5.1.6 (f))*

4. Relevant **Tax Act** provides for 100% VAT exemption and limiting the Custom Duty to 1% only during import of plants and equipment of hydropower projects and on construction equipment, machineries, instruments, or other related pieces, on recommendation of relevant government agencies (Office of Investment Board of Nepal, Department of Electricity Development, AEPC, etc.)

Even without any preferential treatment for small hydropower projects, small hydropower projects have continued to rise despite them having higher per megawatt costs of generation.

RELEVANT POLICIES

5. As per **Renewable Energy Subsidy Policy, 2016** issued by Government of Nepal, provides that any micro in off-grid area on the following basis:

   a) The entire off-grid section of Nepal has been divided into 4 parts based on their geographical remoteness;

   b) A mini/micro hydro, on basis of project is qualifiable for, a subsidy upto Rs. 382,000 per kW based on the degree of remoteness;

   c) Alternatively, it may opt for subsidy based on generation, in which, the promotor of the project receives subsidy for up to 55% percent of the actual generation based on the degree of remoteness.

6. As per Renewable Energy Subsidy Policy, 2016, an off-grid pico hydro is qualified for the following subsidy:

   a) The entire off-grid section of Nepal has been divided into 3 parts based on their geographical remoteness

   b) A pico hydro with capacity less than 5kW, on basis of project is qualifiable for, a subsidy upto Rs. 185,000/kW based on the degree of remoteness, whereas for projects with 5kW-10kW capacity, upper limit of subsidy is Rs. 210,000/kW

A CASE OF SICK HYDROPOWER PROJECTS IN NEPAL

Statement of Problem

- The developers of 35 hydropower stations from size **250 kW -13.6 MW**, commissioned between **2005-2019** were found to be facing problems related to insolvency.
- Regrettably, 34 out of such 35 stations were below 10 MW capacity. Some of them were regularly paying only interest on long term debt, while others were missing out on payment of both principal and interest. Few others were regular in their payment but were being kept by the lending banks on the watch list. This pointed out towards the dire reality of grid connected small hydropower projects operated.
- A report by an Investigation Committee led by Joint Secretary of the Ministry of Energy, Water Resource and Irrigation formed to investigate the conditions of financially vulnerable hydropower projects belonging to private sector pointed out the following causes for the lack of solvency and liquidity.

Major Causes of Problem

1. Evacuation through lower capacity transmission line
2. High interest rate (7% to 14% of interest rate was observed)
3. Inefficient project management (inexperienced developers) during construction leading to delay and increased cost
4. High per megawatt cost of construction
5. Some projects faced up to 40% penalty because of improper availability declaration
6. Outages and non-dispatch
7. Up to 53% reduction deviation on discharge of river compared to projected monthly discharge

Steps taken for Remedy

1. Decision of the Electricity Regulatory Commission to eliminate penalty imposed on the basis of availability declaration for plants up to 10 MW capacity seeing reduction on energy output because of hydrological reasons.
2. Refinancing facilities up to 1% to sick projects by the Central Bank of Nepal upon request of Ministry of Energy, Water Resources and Irrigation.

CONCLUSION AND WAY FORWARD

- Small hydropower projects have been crucial and have offered some degree of relief when Nepal was undergoing severe energy crisis.
- Nepal’s early experience with small hydropower, made the government owned entity, the PPPs and IPPs to proceed with projects of larger size.
- Issues like high per megawatt costs, improper project management, issues with transmission lines (off taker's as well as developers’), fluctuating hydrology, etc. has been leading off grid micro projects towards insolvency.
- Having large number of off grid micro hydro projects is not ideal from regulation and contact management point of view. Bringing them under regulatory purview also becomes difficult but the feasible projects should be brought under regulatory mechanism by connecting them to the grid.
- In areas which are still not connected to the grid, small (including mini, micro and pico) projects may still be very crucial. Regardless of their construction cost, one cannot deny the fact that they have led to numerous benefits.
- Small hydro projects should be designed based on optimum capacity considering proper hydrological and climatic risk and tariff should be designed accordingly.

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Thank you