ENERGY SUSTAINABILITY ASPECT WITH MICRO HYDROPOWER

TIKIR DAM PROJECT (Run-off River Type)

Presented By…,
U San Htut Thein

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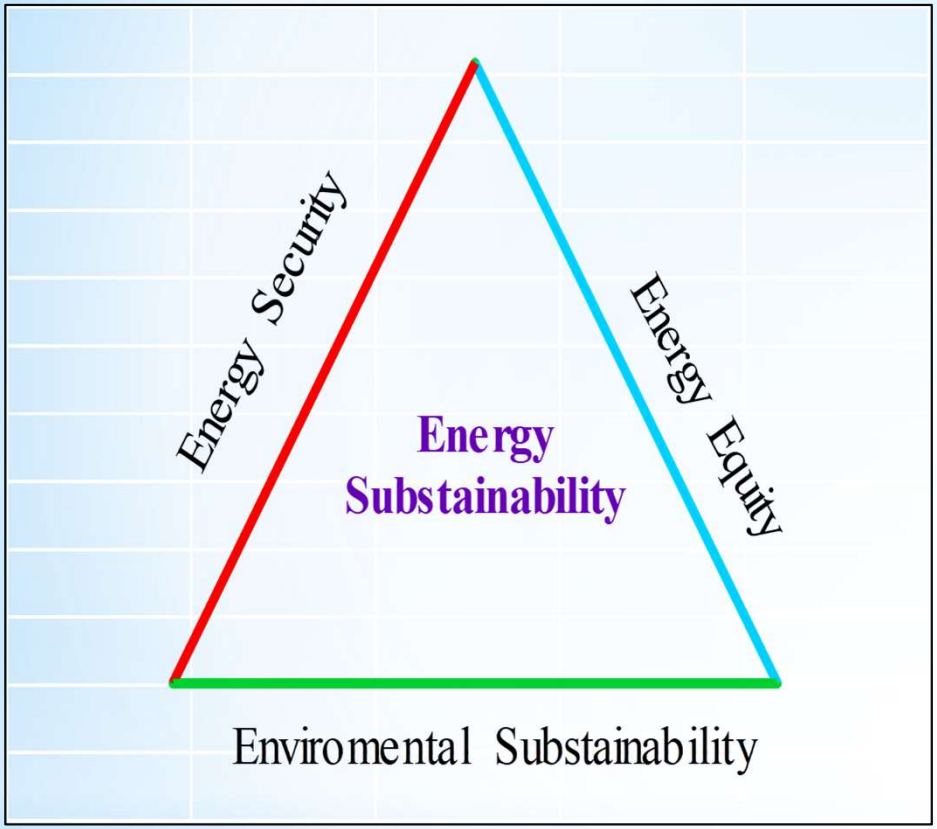
IWUMD , MOALI , MYANMAR

SUMMARY

- Energy Sustainability Index
- Sustainability Aspects For Micro- Hydro Power
- Presentation Of Tikir MHP Project
- Conclusion

❑ Energy Sustainability Index



- **Energy security;** can be defined as the effective management of primary energy supply from domestic and external sources, reliability of Energy infrastructure, and ability of energy provides to meet current and future demand.

- **Energy equity;** is interpreted as accessibility and afford ability of energy supply across the population .

- **Environmental sustainability;** is stated as encompasses achievement of supply-demand side energy efficiencies and development of energy supply from renewable and other low-carbon sources.

➢ Energy Sustainability Aspects

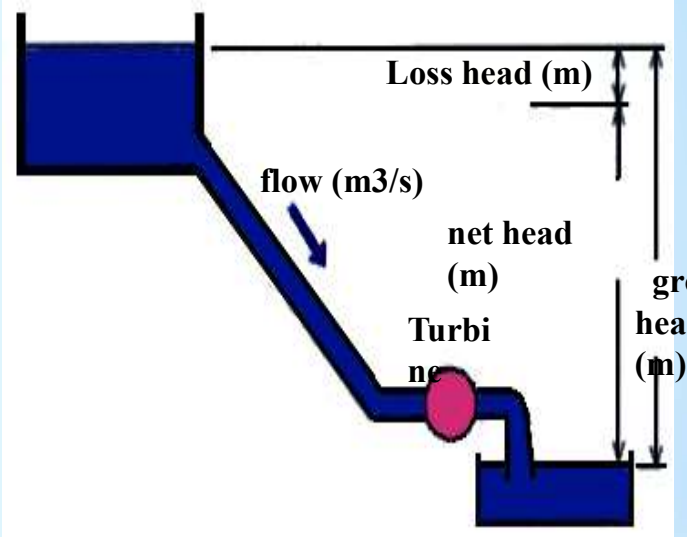
(i) **Type of Resource:** Renewable source of energy and is available at distributed locations/sites.

(ii) **Availability :** May be available 24 hours and for all the 365 days in a year.

(iii)Potential Assessment:

Main Potential for hydropower is Water Sources

Power (P) equation is simple ; $P\ (kW) = 9.81 \times Q \times H \times \eta$



Consists of two parameters ;

(a) Head - Can be measured easily and fixed in nature at most of the sites.

(b) Discharge - Can be measured with various techniques depending upon the site conditions.

-Variable in nature.

-Considered critical parameter and need to be estimated based on economic factors i.e. dependability.

P (kW)	= Power
H (m)	= Net Head
Q (m^3/s)	= Flow Rate
η	= Efficiency (0.6 ~ 0.8)

(iv)Technology:

- Mainly based on three engineering
  - -Civil
  - -Mechanical
  - -Electrical

- Should be need-based and possibly locally based.
- Local engineering skill development training centre
- Small scale local manufacturing facilities
- Trained manpower for operation and maintenance in the area
- Standardization of technology in order to reduce the manufacturing cost

(v)Management:

- Management of micro hydro power plants is very critical issue as plants are
  - •Individually owned plant
  - •Community based plant
  - •Government plant

(vi) Environmental issue:

- Not very important as development of MHP does not impact much the environment
- Possible to keep the environment as it is through plantation and water release and by following standards.

Major factors of the rural electrification development system with micro hydropower plant

a. Community involvement in all activities from start to finish-

-Such as planning, installation, maintenance, financial and environmental management of the micro hydropower schemes.

b. Community capability ;

i. Has technician in village that can maintain the system,

ii. Can understand and be able to do book keeping and manage the fund,

iii. Willing to pay monthly electricity bill, etc.

c. Electricity helps to increase household incomes such as from weaving, grinding, welding etc.

d. The users can reduce other energy costs such as kerosene, cooking gas, candle, etc.

- **Environmental Impact and Sustainability**
  - -The micro hydropower plants have little impact on the environment.
- **Socio-Economic Benefits of Micro Hydropower Systems**
  - - Especially for poverty reduction and enhancement of the rural peoples' livelihoods.
  - - To growth in rural areas in a sustainable manner.
- **The Institutional Capacity and Policy Framework**
  - - Development and management also depend on the institutional linkages put in place to achieve sustainability.
  - - In most of the cases, the community is not able to effectively manage the MHP systems without the support of the government, private sector, NGOs (PPP) and other institutions with interests in the energy sector .

Challenges in the Development and Management of the Micro hydro power systems ;

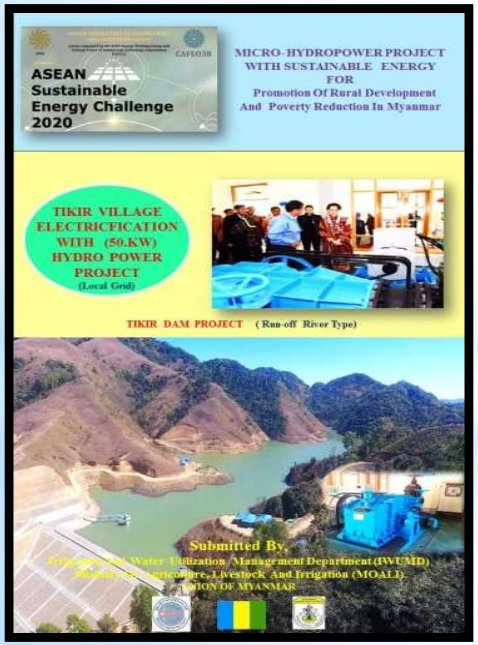
For the survey that the installation, operation and maintenance of micro hydro plants, the following are the key challenges;

- Lack of sufficient funds.
- Political interference from feuding local politicians over the control of the project .
- Lack of or very little government support in terms of community capacity building, expertise advice and unfavourable.
- Lack of locally available skilled manpower which could easily be locally fabricated. (For example turbines , generator, etc..,) .
- High cost of spare parts sometimes leads to long down time.

CHAMPION OF ASEAN SUSTAINABLE ENERGY CHAIIENGE (2021)
AWARD
FOR
50.KW MICRO- HYDROPOWER PROJECT WITH SUSTAINABLE ENERGY

Promotion Of Rural Development And Poverty Reduction In Myanmar

(Tikir Village Electrification Project)



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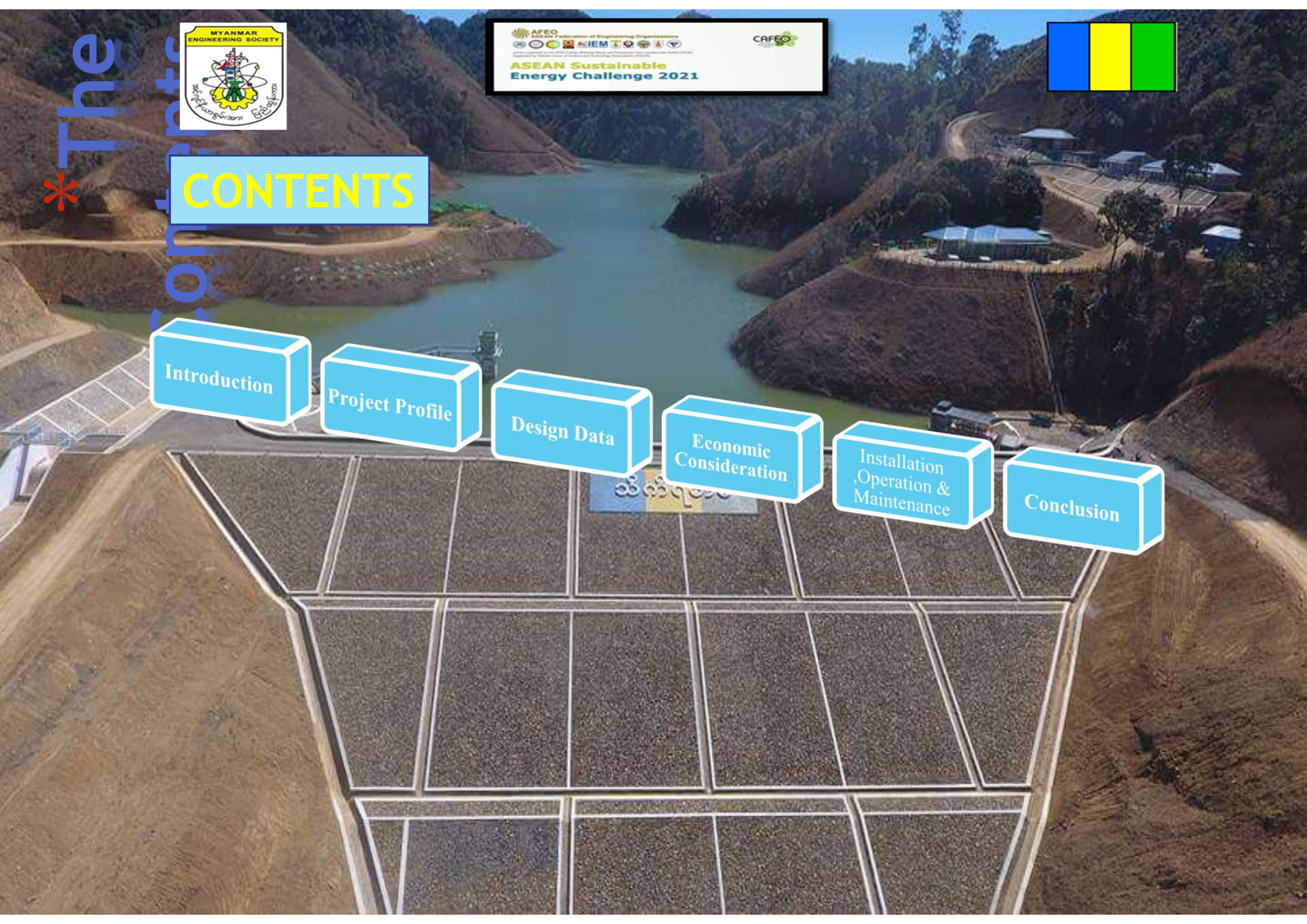
MYANMAR ENGINEERING SOCIETY
AFEO ASEAN Federation of Engineering Organizations
ASEAN Sustainable Energy Challenge 2021
CAFEO
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Installation ,Operation & Maintenance
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Introduction

❑ Project Approach

Mountainous Village ;Tikir

This project is approached and instructed by The Union Government Leader , Union Minister of MOALI and State Chief Minister when they made a site visit to Tikir village , Htantalan township since (2017) for regional development plan of chin state and to find water potential from the Tikir Dam near the village for producing electricity with hydropower , clean water supply and developing living standard with the assistant of the local technology and material available in the market and to implement the project as quick as possible.

Tikir Dam is the first micro-Hydropower project of its kind producing electricity utilized the constructed irrigation facilities for irrigation water under MOALI in mountainous chin state of Myanmar. It is completely designed , fabricated and constructed by IWUMD Department. It is zero impact to the environment and easy to make locally. With the encouragement and fully support by Director General of IWUMD, it makes IWUMD Department to hold the Sustainable Energy Awards for their innovation and creativities in ASEAN countries for this micro & Mini hydro power generation plants at dams including Tikir Dam Project .

The Objective was gained electricity for rural electrification promotion at rural and mountainous area in Myanmar .

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Project Profile

Project Profile

Project Location: Tikir Dam is located near a mountainous village , bordered by India to the west of myanmar called Tikir village in Htantalan Township, Chin State of Myanmar.

Tikir Dam Project

Project Datas

- Name of village - Tikir Village
- Project Name - Tikir Dam Project
- Township - Htantalan
- District - Hakha
- State - Chin
- Distance from National Grid - 65 Kilometers

Population List

Name of Village	Tikir
House Hold	350
Family	400
Population	1200
Livelihood	(1) Fishing. (2) Agriculture (3) Hunting.
No. of school	(2)

➢ Life of Project

- ➢ Operation Starting Date — June, 2017
- ➢ Opening Ceremony Date — January , 2019

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Design Data

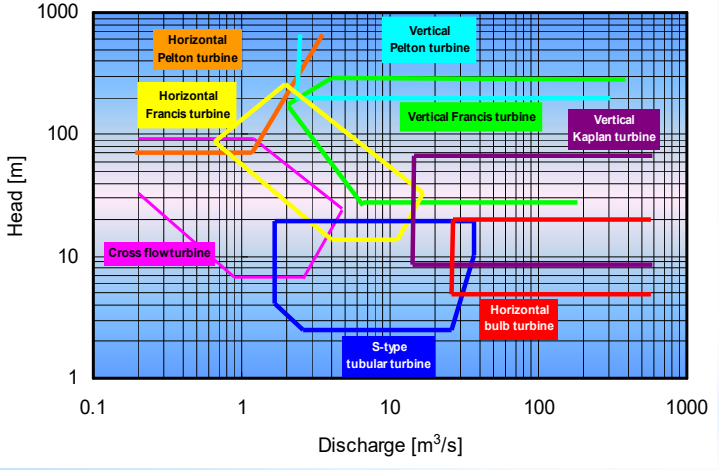
❑ Design Data

Generator Power Output (KW)	50
Generator Efficiency (%)	0.85
Mechanical Efficiency (%)	0.83
Design Head for Turbine (m)	20
Required Flow Rate (m3/s)	0.5
Velocity of Water (In Pipe) (m/s)	4
Specific Speed(Ns)	300
Turbine Speed (rpm)	300
Turbine Runner outer dia; (D) (mm)	600
Turbine Runner Length (mm)	1100
Number of Runner blade	28
Penstock Dia;(mm)	355
Rotational Speed of Generator (rpm)	1500
Speed Increaser Gear Ratio	1: 5.5

➢ Technical Design

From Design Data, water storage capacity between full tank water level and minimum operation water level is 1265Acre-ft ..Design discharge for hydro turbine operation is 0.5 m^3/s . Design water discharge from conduit is 10 m^3/s and quite sufficient for hydropower generating as the flow rate requirement for one unit- 50kW micro-hydro turbine

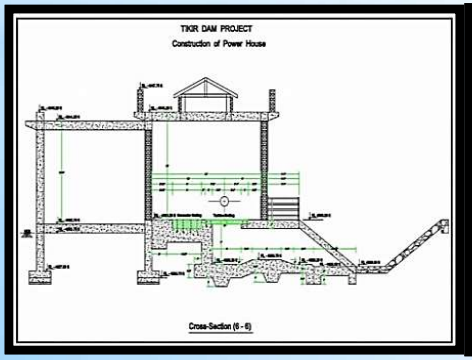
$$P = \eta\gamma QH$$

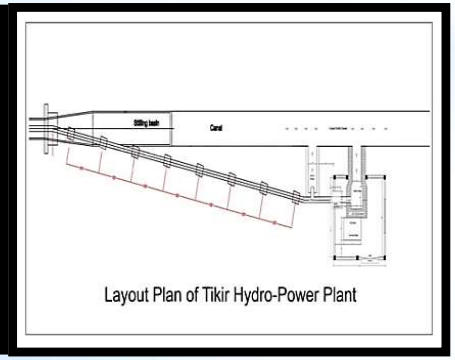


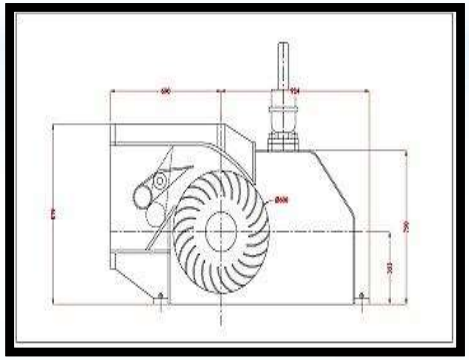
From the turbine selection table for low head of impulse turbine was chosen for this project . In the design consideration, Overall efficiency is assumed as 75 % . To obtain 50-KW for 4. pole generator, the turbine speed to drive the generator(4-poles) must be about 1500 RPM . We selected to design dia; of turbine rotation wheel 5.5-times generator's pulley wheel.

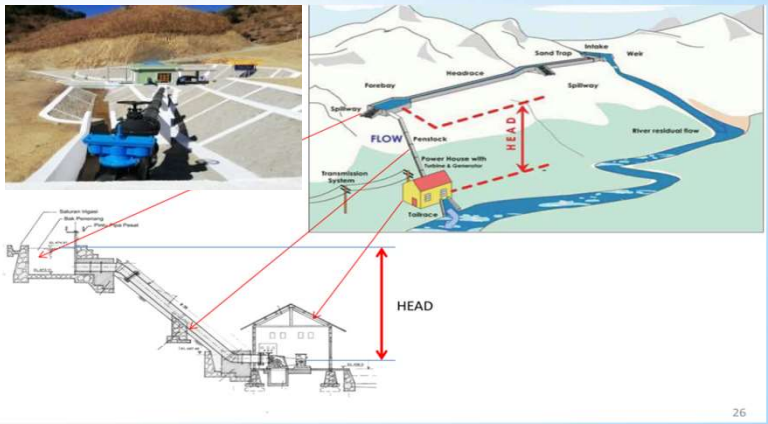
Where

P = Generated Power
η = Overall efficiency of the turbine
γ = Specific weight of water (KN/m^3)
Q= Flow rate of water (m^3/s)
H=Head of water (m)









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Economic Consideration

❑ ENVIRONMENT CONSIDERATION

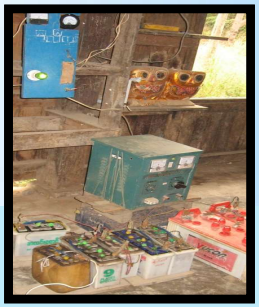
➢ 1-Amount of Emissions & Project Objective

❑ **The Amount of Emission Avoided (CO2)= 272MWhr/yr x 0.8tCO2/MWhr**
= 218 t CO2/yr

❑ If it is set up by economically, the project investment cost would be paid back within **7.5 Years.**

Total Investment Cost = US$ **207000**

The Rate of Investment = US$ **4140**/ KW



❑ Social Consideration

➢ 1- Benefit (User , Community , Country)

❑ Micro-hydropower plant able to partially fulfill the national electricity demand and it is effected to developed the rural village in local grid area of Country.
So it is one of the supporting and fulfilling sources to national energy policy.

❑ With it's new utility access, it is also easy to expect the regular income by creating small business such as from battery charging and other cottage industry .
The benefit for the user is not only by the economic point of view but also for the social livelihood development.

❑ The villagers can create new opportunities such as recreation and upgrading living standard by watching TV, better learning for students, introduce new job and business . The community get improve their living standard compare to the life without electricity

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Installation,Operation & Maintenance

❑ INSTALLATION

➢ By Design Data

- Turbine Type =Cross-Flow Turbine
- Penstock Dia; = 355 mm
- Penstock Length = 60 m
- Installed Capacity = 50-KW
- No. of Unit = 1 x 50 KW
- Net Head = 20 m
- Design Discharge = 0.5 m3/s
- No. of operators = 1 x 2 (shifts)
- Electrician = 2 Nos
- Electrification = 250 Households
- (Now 350 Households)
- Operation & Maintenance = By VEC Team
- having 12 Members from user villages
- including 20% women members after
- training by IWUMD.

Based on the water flow rate and the water head (different between head race and tail race water level) , in addition with the help of suitable micro- hydro turbine and generator accessories available in local market and easy to manufacture at mechanical workshop of IWUMD department are the real origin of this project started to be implemented.

As the first and pilot project for rural village electrification, the investment cost for major parts is borne by IWUMD Department and the local community participated in connection of transmission & power line, volunteer the laboring for carpentry work and earth work excavation.

The Villagers of VEC Team have to take responsibility to run the plant by themselves after completion of start up and test running. Some villagers have been trained for operation and maintenance of the plant successfully.






Operation And Maintenance

1- Operation Hours (day/month/year)

The operation hour of the hydropower plant could be obtained as following.

Daily operation hours for battery charging (Day time) = 4 hours
Daily operation hours for lighting (Night time) = 12 hours
Monthly operation hours (Assume 1 day off for maintenance) = 464 hours
Yearly operation hours (350 – 12 = 338days/year) = 5408 hours
(Assume 15-Days off For Major maintenance)

2- Maintenance Scheme (In house, contracted out service, Government, others)

The operator should follow the points as mentioned below

1. Check the water level at Forebay (Reservoir or Dam)
2. Check the function of Water Control gate and Control Valve operation
3. Check volt & frequency meter and control panel alert .
4. Check bearing and pulley belt & gear system
5. Check the Transmission line.
6. Listen to the sound of turbine and generator.

It is designated to do the maintenance service once a month. At that time, over haul repairing of turbine of generator (if necessary),

3- Other Maintenance Measures (Training, after-sales service)

The installation and operation of micro-hydropower plant by using irrigation water is easily managed by the local people after short training to share hydropower & electricity knowledge and experience by IWUMD and could be referred for the operation and maintenance of the scheme. According to these advantages, the villagers (Organized Committee) could operate and manage by themselves ,

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Conclusion

❑ CONCLUSION

- **The renewable energy also called sustainable Energy** is the term which is very simple and most popular terms in this early 21st century after the fossil fuel crisis, the treat of global warming and climate change by the effect of carbon emission. The hydro generated power is one of the best sources among the renewable energy and widely installed wherever possible in the world.
- Myanmar is doing it's best to comply with ASEAN expectation to utilize 10% of its energy requirement from Renew and Sustainable Energy sources .
- With this easy to do technology, almost free operation & maintenance scheme and zero CO2 emission with low investment, the high replicability of this project surely will be easily spread to all from the near by to the whole country elsewhere within a short period.






❖ **Hence, " The Rural Electrification (local grid)**

With 50KW Tikir Micro-Hydro Power Project " is

the best Champion of Sustainability Model for

' ASEAN SUSTAINABLE ENERGYCHALLENGE AWARD -2021' in Asean and forever.

➢Recorded Photos

Thank You For Your Kind Attention

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