

# Upper Arun Hydroelectric Project



April, 2014



**Project Development Department,  
Nepal Electricity Authority**



# **OUTLINE OF THE PRESENTATION**

- **Part 1: Integrated Nepal Power System (INPS)**
- **Part 2: Upper Arun Hydroelectric Project**
- **Part 3: Ikhuwa Khola Hydroelectric Project**
- **Part 4: Further Steps for the Project Implementation**

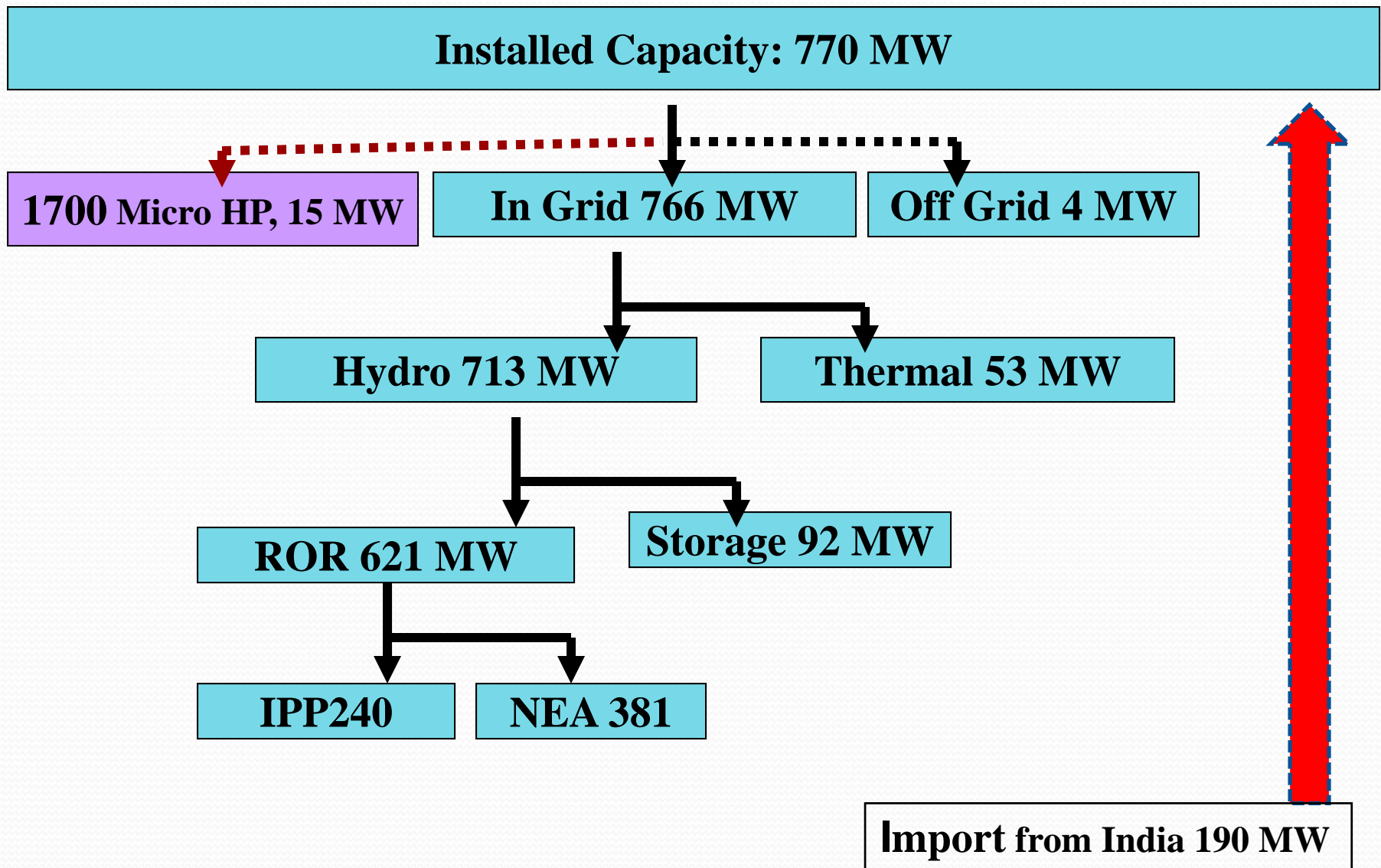




# **PART 1**

## **Integrated Nepal Power System (INPS)**

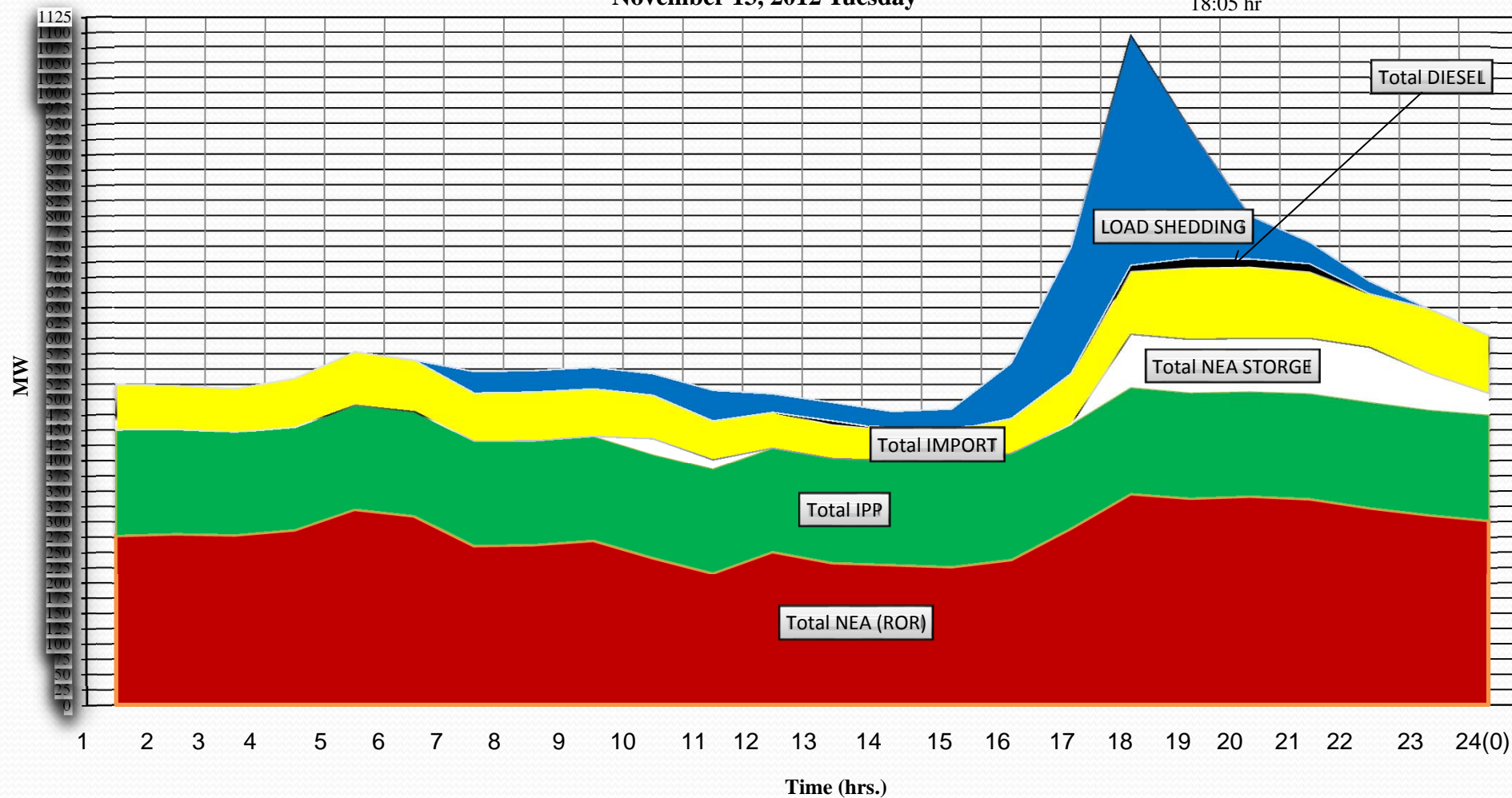
# Over All Power Scenario



# System Load Curve of Peak Load Day of FY 2012/13

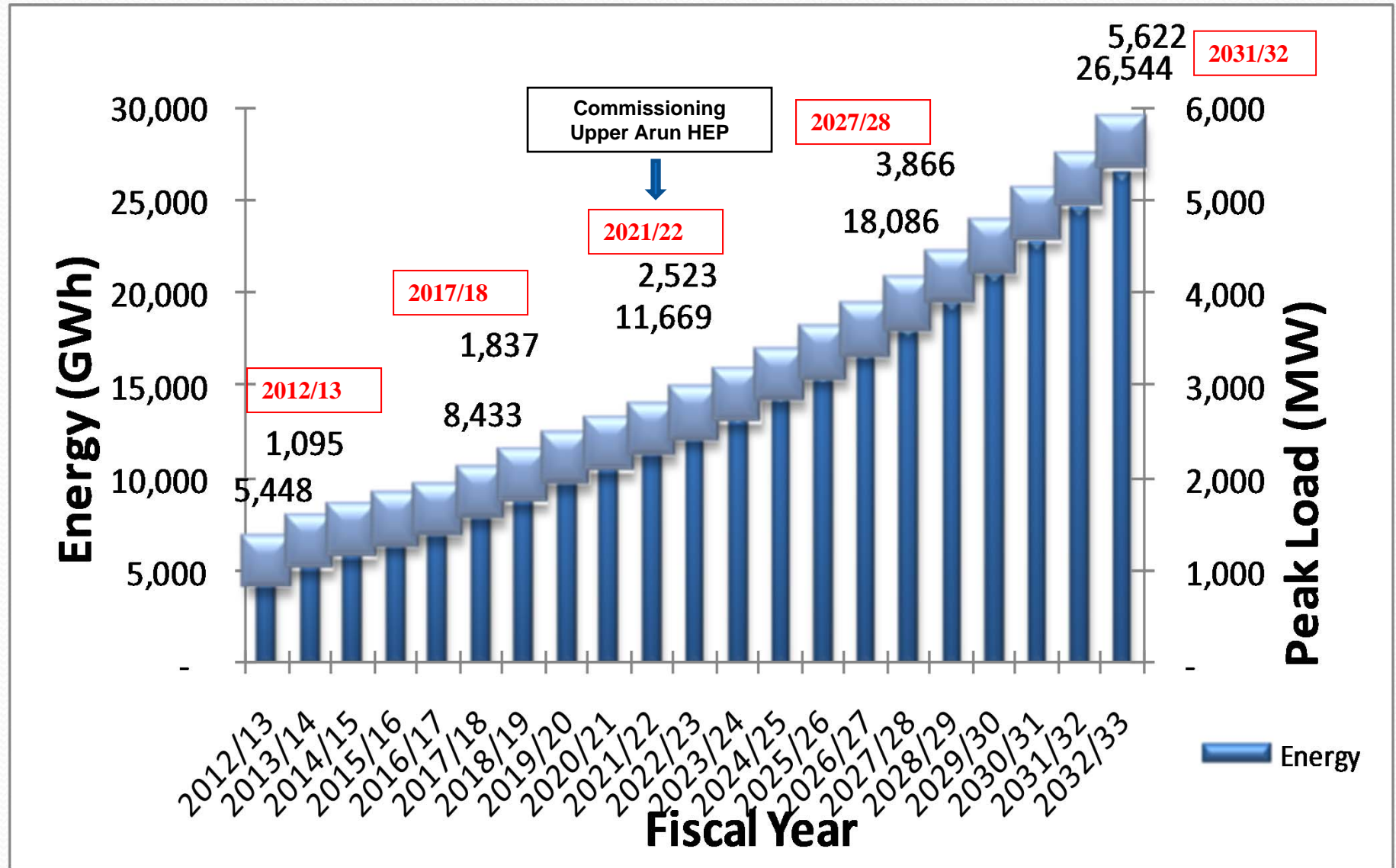
November 13, 2012 Tuesday

Peak Load 1094.62 MW at  
18:05 hr





# Load Forecast





# **PART 2**

## **Upper Arun Hydroelectric Project**

# Background of the Project

Particulars	Details	Remarks
Project Identification	Koshi Basin Master Plan in 1985	As PROR Project
Reconnaissance study	By NEA in 1986	NEA / GoN
Feasibility Study	In 1991 by JV of MKC, Lahmeyer, TEPCO and NEPECON	Grant Assistance from UNDP
Review Study	By NEA in 2011	NEA / GoN
License	Cabinet Decision : NEA to Construct the project under the Ownership of the Government	



# Project Location





# Over View of Arun Basin

## Major Hydropower Projects

Upper Arun (335 MW)

Arun – 3 (Licensed to IPP- 900 MW)

Lower Arun (Licensed to IPP-300 MW)

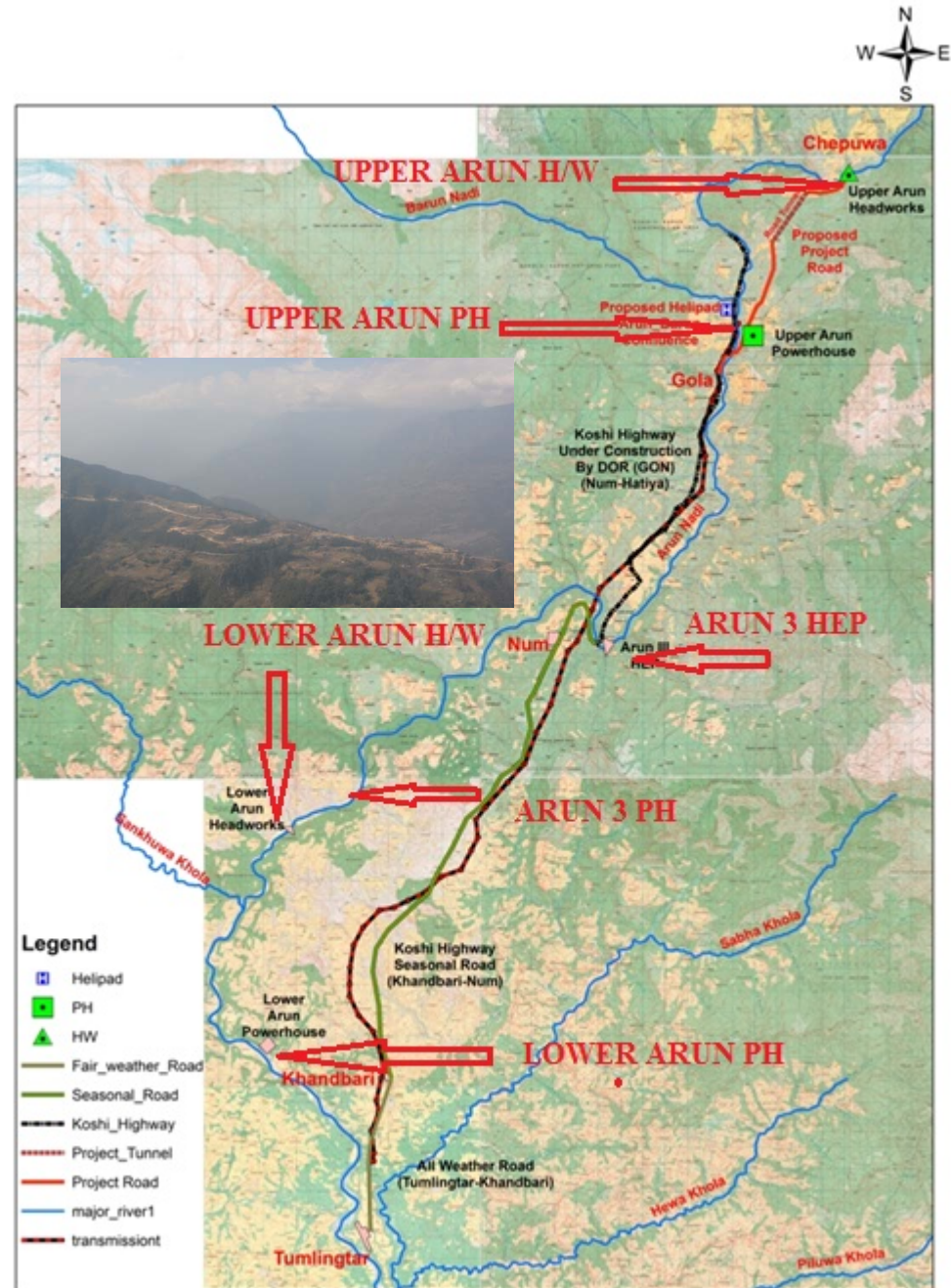
## Road Network (Tumlingtar to Kimathanka Highway)

Tumlingtar to Khadbari – All season Road (15 m)

Khadbari to Num – Fair Weather Road (39 Km)

Num to Barun Bazaar – Under Construction  
Fair Weather Road (37 km)

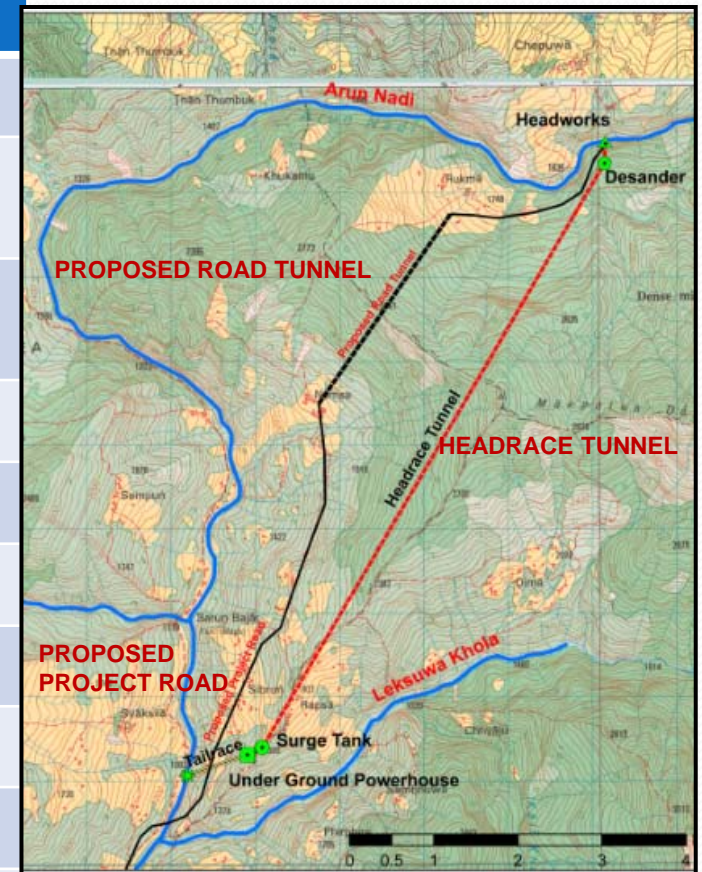
Powerhouse of Upper Arun HEP lies at about 25  
km road distance from Arun 3 HEP damsite  
which is close to NUM



# MAIN FEATURES OF THE PROJECT

## (Based on Feasibility Study -1991)

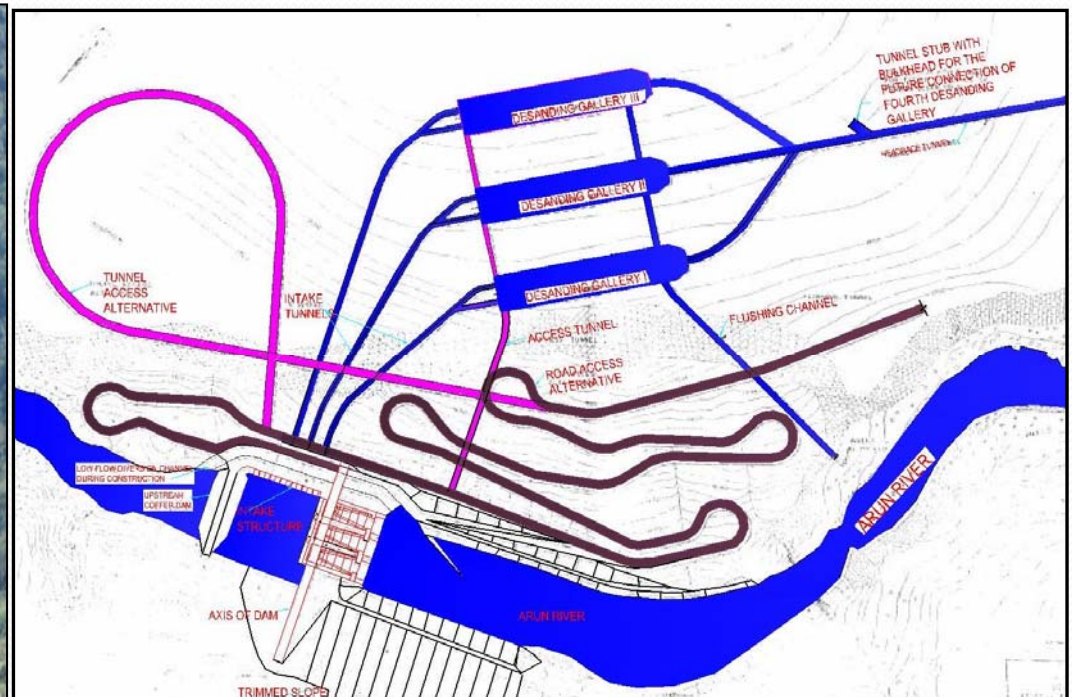
Particulars	Details
Catchment Area	25,700 sq.km. (98% in Tibet)
Firm Discharge	58.7 cumecs (Q95) – <b>Comparatively High</b>
Flood Discharge	4000 cumecs (PMF) <b>Comparatively Low</b>
Design Discharge	78.80 cumecs (about Q70)
Gross Head	492 m
Installed Capacity	335 MW
Total Annual Energy	2050 GWh
Storage for Peaking	2 hours
Geology	Sound
Project Cost	479.6 Milion USD ( <b>year 1991</b> )





# MAIN FEATURES : HEADWORKS

- Concrete Gravity Dam ( FSL 1598 MASL);  $L * H = 80 \text{ m} * 37 \text{ m}$
- Three Radial Gates;  $W * H = 12 \text{ m} * 22 \text{ m}$  (each)
- Three Under Ground Desander Caverns;  $L * W * H = 128 \text{ m} * 24 \text{ m} * 32 \text{ m}$





# MAIN FEATURES : WATER WAY

## Headrace Tunnel

### Horseshoe Type

Length - 7.84 km

Diameter - 5.5 m

## Surge Tank

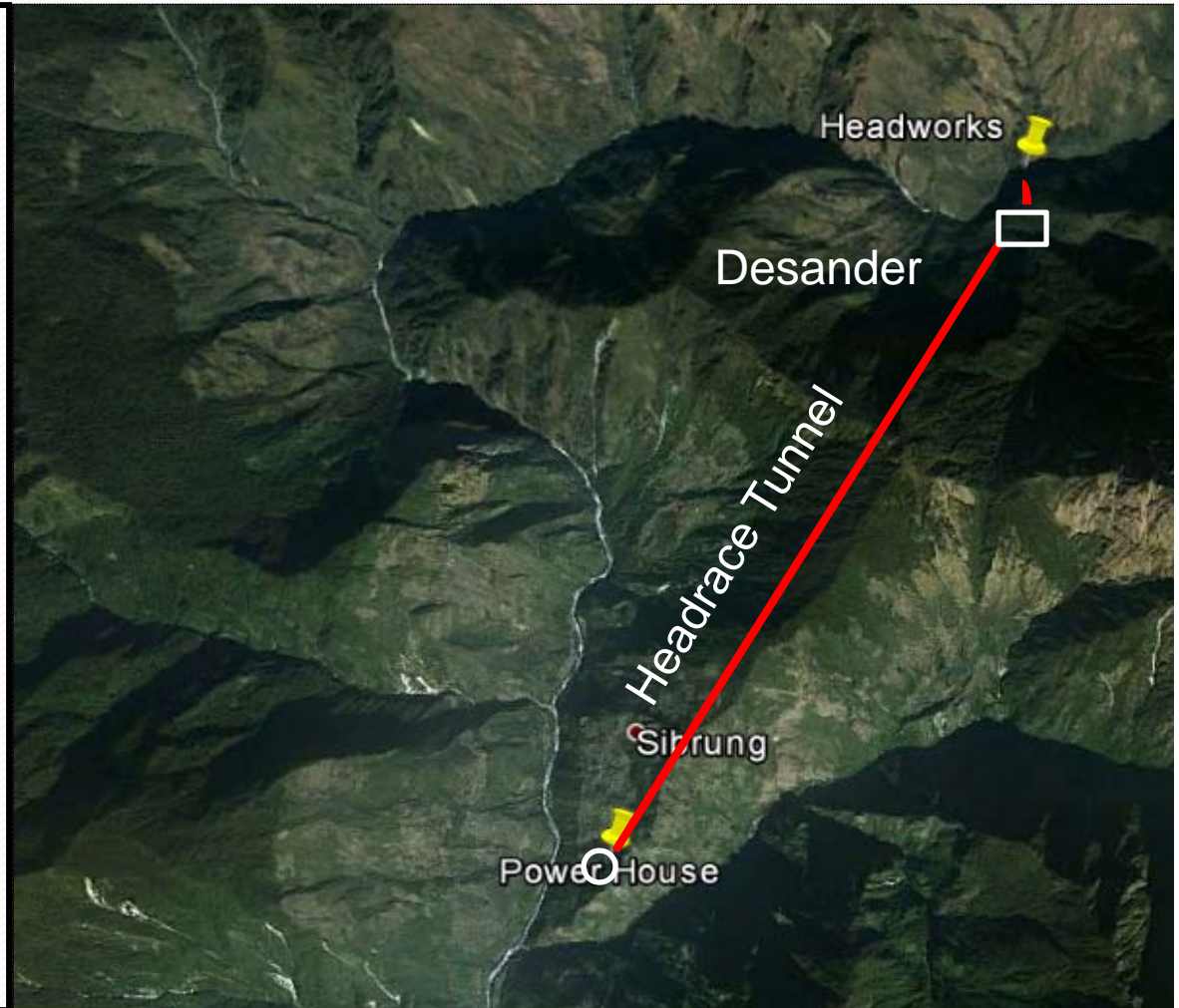
Height - 91 m

Diameter - 18 m

## Drop Shaft – 2 No.

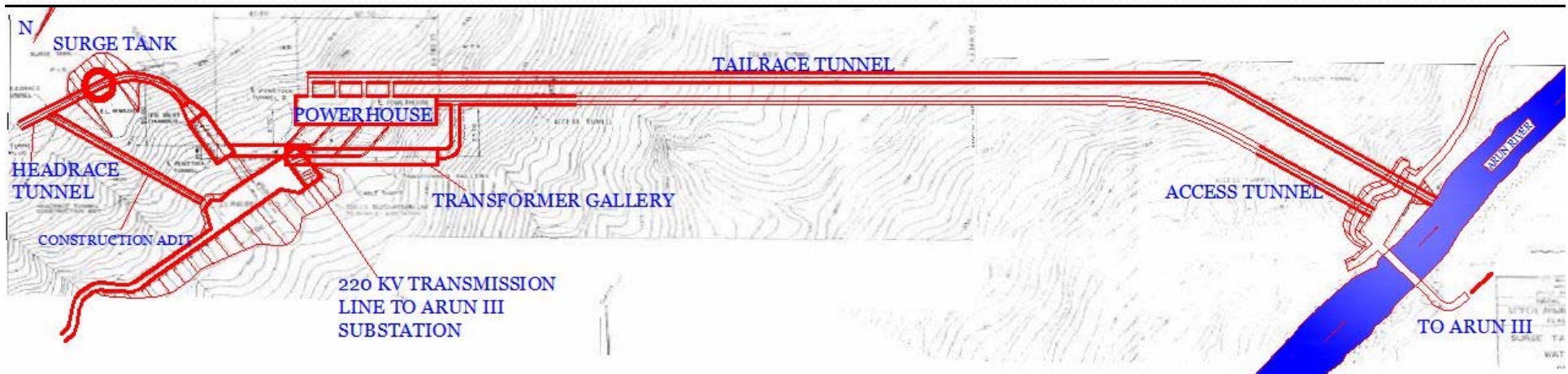
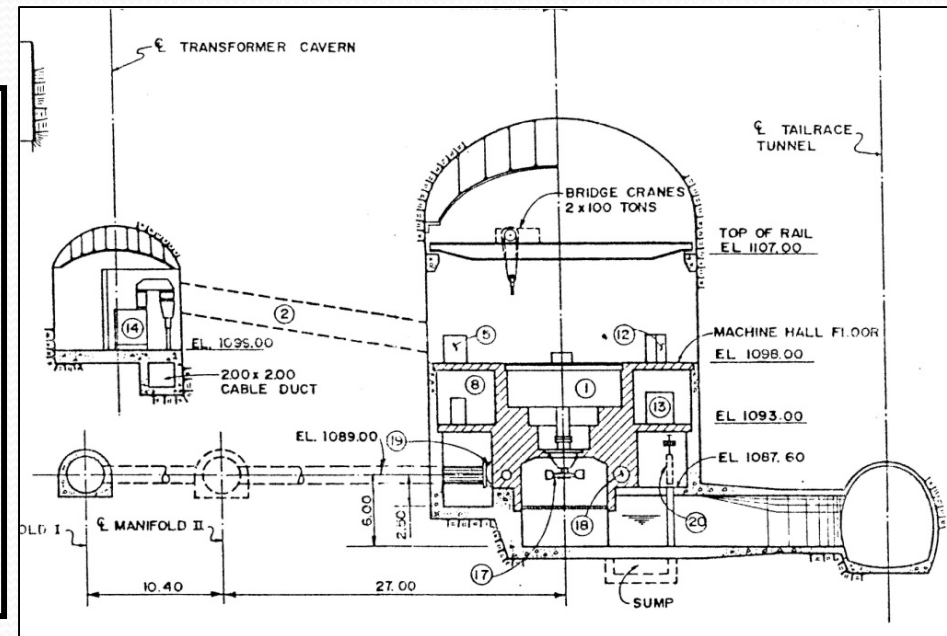
Diameter – 2.8 m

Height – 454 m



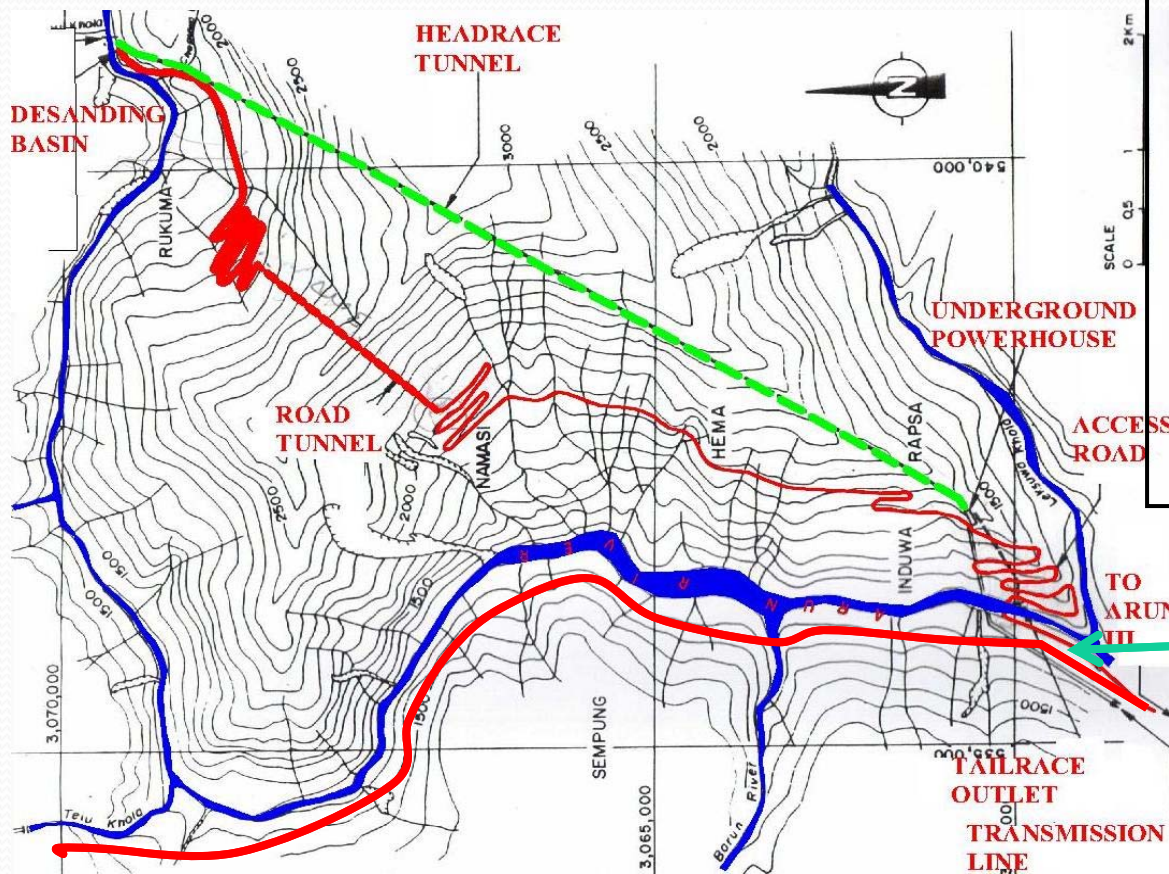
# MAIN FEATURES : POWER HOUSE

- **U/G Powerhouse Size:**  
 $L * W * H = 105 \text{ m} * 21 \text{ m} * 35 \text{ m}$
- **Turbines :**  
4 numbers of Pelton Turbines  
(CL at 1089 masl)
- **Tailrace : 850 m Long**





# Access Road to Powerhouse Site and Dam Site



- Total Length - 23.4 km
  - Road - 21.6 km
  - Road Tunnel - 1.8 km
  - One Bridge over Arun River
- Access road originates from the highway leading to Kimathanka

UNDER CONSTRUCTED ROAD  
FROM NUM TO KIMATHANKA

# **Review Study -2011**

## **Review Study-2011 Conducted to:**

- **Identify the Changes in facilities at Project Site**
- **Collect Information for Detailed Engineering Design**
- **Review Energy Generation.**
- **Update Power Evacuation**
- **Update Project Cost**
- **Review Project Evaluation**



## OBSERVATIONS OF REVIEW STUDY AND OTHER FEATURES

Particulars	Details	Remarks
Total Capacity	335 MW <b>at Q70</b>	
Annual Generation	2597.3 GWh 2050.0 GWh	As per Review Study As per Feasibility Study
Updated Project Cost	445.54 M US\$	2011 Price Level
Interconnection to Grid	Tumlingtar 220 k V S/S	
Project Commissioning Year	2021 / 22- Tentative	





# **PART 3**

## **Ikhuwa Khola Hydroelectric Project**

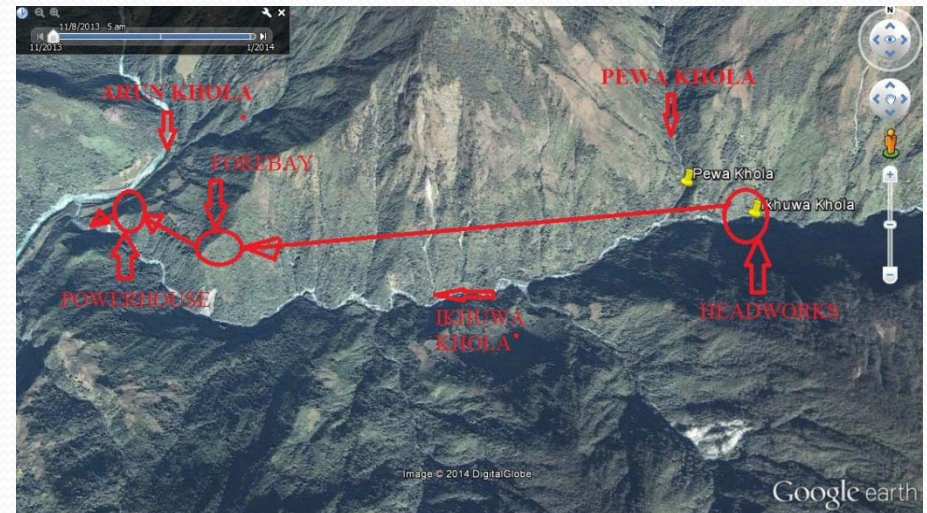
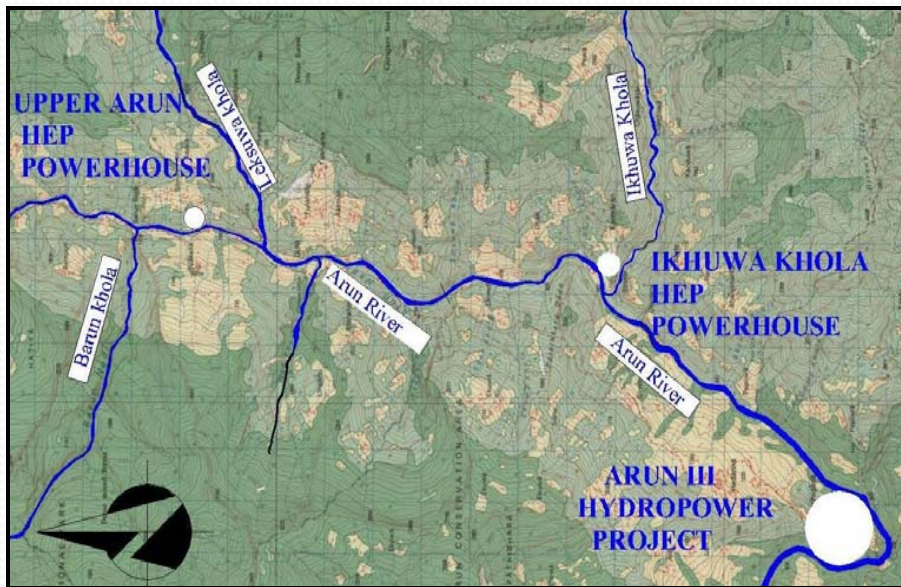
# **Ikhuwa Khola Hydroelectric Project**

- **In order to share benefits of UAHEP development with the local communities, NEA proposed to develop Ikhuwa Khola HEP through PPP mode by establishing a special purpose vehicle, where local communities would be shareholders of this project.**
- **Conceptualized to develop as an integrated part of Upper Arun HEP .**
- **Presently Ikhuwa Khola is being Studied by DoED through the JV of local consultants**
  - Inception Report has been submitted to DoED
  - This study is expected to be completed by the end of this fiscal year
- **NEA has requested GoN to sanction Ikhuwa Khola HEP's License for its integrated development with Upper Arun HEp**



# Ikhua Khola Hydroelectric Project- Features

- **Location**
  - 8 km Downstream of Upper Arun P/H Site
  - 5 km Upstream of Arun-3 Headworks
- **Power and Energy**
  - Net head = 601 m
  - Discharge Q40 = 6.02 m<sup>3</sup>/s
  - Installed Capacity = 30 MW
  - Average Annual Energy of = 181.74 GWh ( 40.72 GWh dry season and 141.02 GWh Wet season energy)





# IKHUWA KHOLA PROJECT LAYOUT



## Project's Economic Indicators:

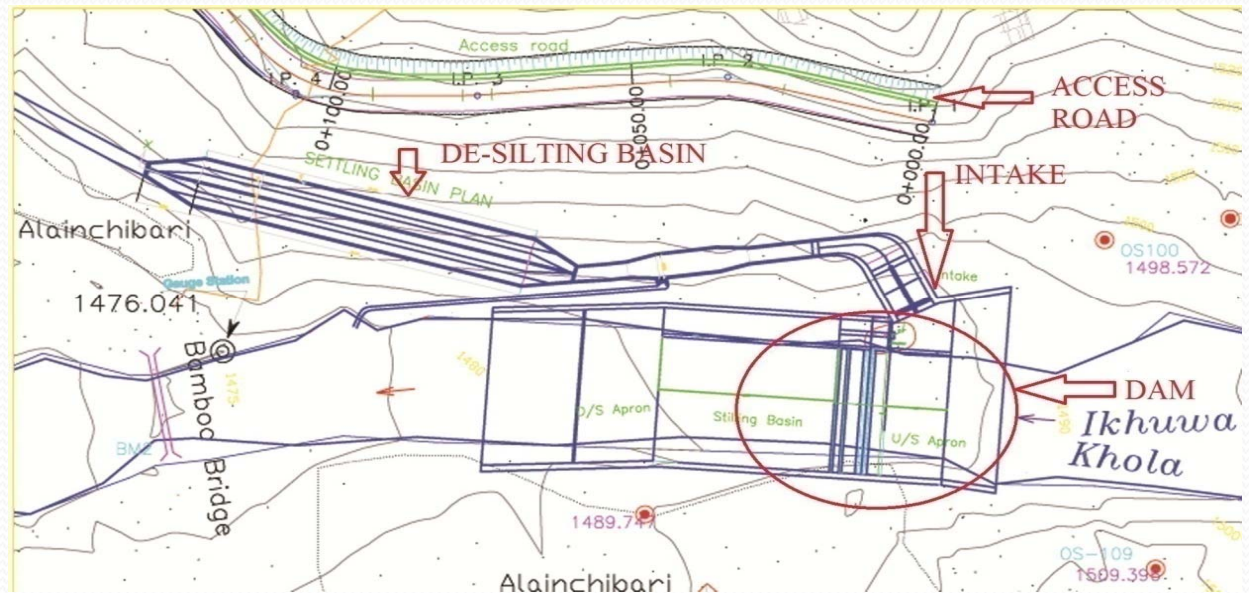
Estimated cost (excluding Taxes and Duties): Rs. 4.1 Billion

B/C	:	1.7
EIR	:	18.50



# MAIN FEATURES : HEADWORKS

- Concrete Gravity Dam ( FSL 1496.8 MASL);  $L * H = 30 \text{ m} * 3 \text{ m}$
- Intake: 2 Nos, 3 m x 1.7 m each.
- Headrace canal 1: covered, 40m long, 2.5m X2m in size.
- De-silting basin: Single chamber, Continuous, 83 m X 8m X 4m.
- Headrace canal 2 : covered, 2.2m X2m in size, 473m long





# MAIN FEATURES : WATER WAY

## Headrace Tunnel

**D- shaped**

Length - 3640 m

Size - 2.5 m X 2.5 m

## Forebay

Shape - Rectangular

Size - 56 m X 10 m X 4m

## Penstock

Diameter – 1.4 m

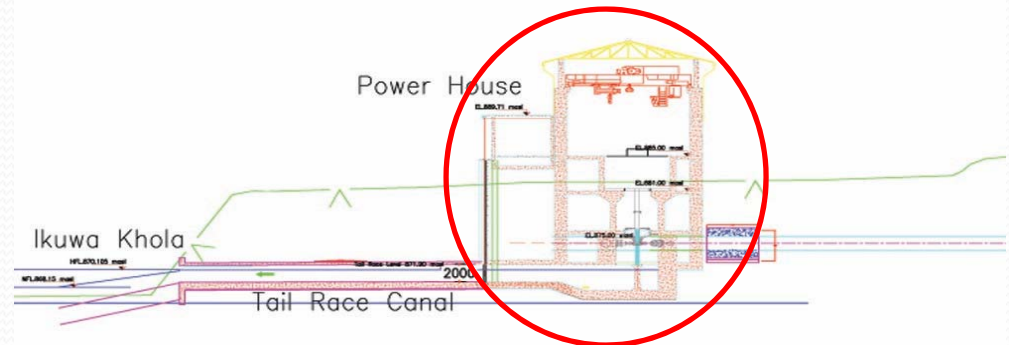
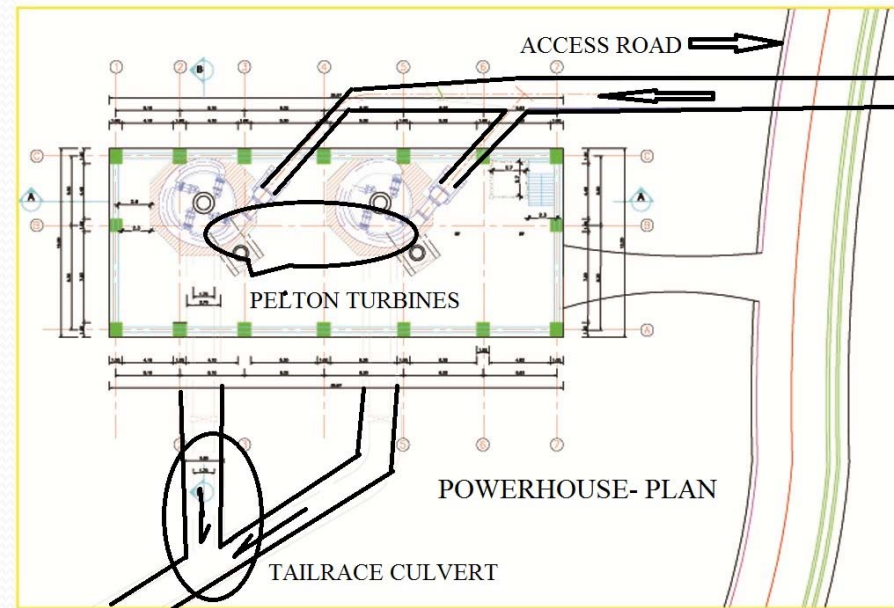
Length – 1560 m.





# MAIN FEATURES : POWER HOUSE

- **Surface Powerhouse:**  
 $L * W * H = 35 \text{ m} * 20 \text{ m} * 28 \text{ m}$
- **Turbines : 2 nos of Vertical shaft Pelton**
- **Tailrace : 40 m Long, Size: 2.2m X 2m**





## **PART 4**

# **Further Steps for the Project Implementation**



# STEPS FURTHER

Particulars	Tentative Target Dates
<b>Selection of Consultant for Detailed Design, Tender Document preparation and Construction Supervision for HEP and Environmental Study, and commence the studies.</b>	<b>This to be done for both Upper Arun HEP and Ikhuwa Khola HEP by mid of 2017</b>
<b>Access Road to Powerhouse and Dam Sites</b>	<b>IEE study to be completed by 2015. Local Consultant to be selected for Detail design and the construction of the Access road and Access road construction to be completed by end of 2017</b>
<b>Construction Camp</b>	<b>Design/Construction to be initiated and construction completed by mid of 2017</b>
<b>Start the Construction of both Projects</b>	<b>By the end of 2017</b>
<b>Commence the Construction of UAHEP and Ikhuwa Khola HEP, and the Transmission Line</b>	<b>Construction of the both projects to be completed by 2021/22</b>





# THANK YOU

**First Hydroelectric Project in Nepal**

**Pharping Powerhouse (500 kW) Constructed in 1911**