GROUP-3 PRESENTATION WEEK-1

# CASE STUDY ON ENERGY, HOUSING AND TRANSPORTATION IN ARUNACHAL PRADESH

## EXPLORING SUSTAINABLE SOLUTIONS

# INTRODUCTION

- **Purpose and Scope**: Interact, investigate, and identify problems and solutions in energy, housing, and transportation in rural Arunachal Pradesh.
- **Importance**: Address challenges unique to the demographic and terrain of rural areas in AP to enhance living standards and foster economic development
- **Key Questions**:
  - Evaluate existing systems in energy, housing, and transportation.
  - Explore alternatives for sustainable and affordable solutions in rural contexts.
  - Provide actionable insights and recommendations for policymakers and local communities.

# ENERGY LANDSCAPE

## OF ARUNACHAL PRADESH

# ENERGY LANDSCAPE

## OUR OBSERVATIONS

- Primary Commercial Energy Sources : Electricity, Diesel, Petrol, Kerosene
- Nearby Rural Areas :
  - Predominantly rely on fuelwood for energy needs, raising deforestation concerns.
  - Solar-lanterns and electric torches are also immensely popular.
  - Two Major Power Lines feeding to Jote from Itanagar and Balijan.
  - Instances of long disruptions in energy supply, particularly during landslides.
- Presence of numerous streams and rivers, serving as sources from which households extract water for their daily necessities. [SHP potential]

# ENERGY LANDSCAPE

## KEY STATISTICS

- A 2016 report indicates that about 75,000 households lack electricity access in Arunachal Pradesh.[1]
- Rough terrain and low population density (13 people per sq. km) present obstacles to widespread energy distribution.
- In urban areas, only 0.6% of households lack electricity access, while in rural areas, this figure is significantly higher at 6.1%, reflecting a tenfold disparity. [2].
- In urban areas, 89.2% of households rely on LPG/natural gas for cooking needs, contrasting with rural areas where 51.3% depend on firewood.[2]

The prevailing energy sources in rural areas nearby Jote.

## Untapped Hydropower Potential in Arunachal Pradesh

- Enormous Untapped Potential: According to a report by Central Electricity Authority, Government of India, Arunachal Pradesh holds significant untapped hydropower potential.
- Out of the total identified hydropower potential of 1,48,701 MW in the country, Arunachal Pradesh alone has a capacity to produce 50,328 MW, that is about one-third of the entire nation's potential.[3][4]
- But plans for large scale hydropower projects have raised concerns of Geographical Disturbance in Himalayan Region.[4]

## Sustainable Solutions: Small Hydro Power (SHP) in Arunachal Pradesh

### Hydroelectric power projects with a capacity of 25 MW or less

- The Ministry of New and Renewable Energy (MNRE) in India identified 5415 sites with a total capacity of 14,305.47 MW for small hydroelectric projects.[5]
- Among this, Arunachal Pradesh boasts the highest number of identified SHP sites, with a total capacity of 1633.04 MW.[5]
- Local Expert Insights: Insights from local experts reveal that in most households, water is sourced from nearby abundant streams.
- NIT Arunachal Pradesh also draws water from a nearby stream.
- SHPs benefits :
  - Ideal for rivers, small streams, dams, and canals, offering minimal apparent environmental effects.
  - Sustainable and community-focused.

# TRANSPORTATION LANDSCAPE

## Of Arunachal Pradesh

# TRANSPORTATION IN AP

## OUR OBSERVATIONS

- The community primarily relies on private vehicle ownership.
- Limited availability of public transportation, particularly in rural areas.
- During the monsoon season, loose soil contributes to landslides, posing challenges to mobility.
- We noticed that the nearby bridges were relatively narrow and in suboptimal condition, raising concerns.
- There is a limited transportation service connecting the neighboring Jote area to Itanagar, with just two buses currently serving this route. This scarcity of transportation options highlights the challenges faced by the local community in accessing vital urban centers such as medical facilities in case of emergencies.

# TRANSPORT NETWORK

## KEY STATISTICS

- Arunachal Pradesh's road network spans 22,672 km with a density of 38.2 km/1000 sq km (2022).
- The condition of bridges is a concern, with over 1,200 bridges, and approximately 20% classified as "poor" or "critical" (Source: Arunachal Pradesh Public Works Department).
- In 2022, Arunachal Pradesh recorded 1,542 road accidents, resulting in 254 fatalities and 1,288 injuries (Source: National Crime Records Bureau).

## Condition of some roads and bridges in nearby Jote area

# Opportunities and Recommendations

- Key Corridor Focus: Prioritizing the upgrade and expansion of roads linking major towns, agricultural hubs, and tourist destinations to enhance market access and resource connectivity.
- Bridging Infrastructure Gaps: Investments in all-weather bridges across rivers and gorges, reducing reliance on ferries and ensuring year-round connectivity.
- Promoting Public Transportation: Development of a reliable and affordable public bus network, particularly in rural areas, to reduce dependence on private vehicles.
- Multi-Modal Solutions: Exploring ropeways and monorails in challenging terrains for remote area connectivity, fostering investments in resource extraction and eco-tourism.
- Rural Feeder Roads Development: Enhancing access to villages and agricultural lands through well-maintained gravel roads, facilitating the efficient transportation of produce and agricultural inputs.

GROUP-3 PRESENTATION-2

# COMMUNITY IMMERSION

## Exploring Villages adopted under Unnat Bharat Abhiyan

# VILLAGE VISITS

- 5 villages (Poma, Kampo, Jote 1, Jote 2, SandguPotta) adopted by NIT Jote under Unnat Bharath Abhiyaan were visited.
- General Observations:
  - Low and scattered population across the visited villages.
  - We came to know about a general trend of migration to urban centers driven by aspirations for better education and livelihood opportunities.
  - Presence of small-scale industries, particularly bamboo handicrafts.
  - Roads to these villages were challenging resulting causing low connectivity.

## Bamboo Processing Centre
### Poma Village

- Employs approximately 10 people from the local community.
- Primarily focuses on the production of bamboo furniture, utensils, and traditional weaving products.
- Products are sold through the Government Exhibition Centre in Chandranagar, enhancing market reach.
- The center faces challenges due to energy disruptions affecting production.

## Bamboo Processing Centre, Poma Village

# School Visits

## Educational Landscape of Arunachal Pradesh

- Arunachal Pradesh ranks among the three bottom states in India concerning literacy rates. Access to higher and technical education in the state is notably limited.
- Marginalisation of Education: Marginalization of education in Arunachal Pradesh is evident from significant gender disparities and variations across different tribes as well.
- Male literacy stands at 58.8%, while female literacy is notably lower at 40.6%. Certain tribes, such as Abor, Adi, Apatani, and Adi Padam, show a literacy rate above 5%, while Wancho, Aka, Bangni, Miji, and Nocte are lagging behind, with less than 1% achieving higher education.[7]

# Education Marginalization in Arunachal Pradesh

## Major Causes

- Wastage and stagnation: Wastage is the non-completion of educational levels and premature withdrawal of students from school and is particularly prevalent at the upper primary stage in Arunachal Pradesh. Stagnation involves the prolonged retention of a child in lower classes, exacerbating the likelihood of subsequent wastage.

- Poor Articulation and Infrastructure : Inadequate facilities at schools fail to attract and retain students, with poor infrastructure and insufficient teachers accelerating dropouts.

- Economic Disparities: Wealthier families often send their children to private schools, providing extra tuition and better results, while economically disadvantaged students face barriers due to high school fees and a lack of study materials.

# School 1

## Govt. Secondary School Jote

- School 1 accommodates around 80 students with a permanent staff of four.
- Faces significant infrastructure limitations affecting the overall learning environment.
- Reports very low attendance rates among students due to lack of means of transport and other reasons.
- We were informed that the locality also displays limited cooperation with the school with preference for livelihood activities over prioritizing education.

# School 2

## Sangdupotta Village

- The second school was a sharp contrast and had surplus infrastructure that were unused due to a lack of specialized staff.
- Lack of specialized staff in core sciences is a pervasive challenge in Arunachal Pradesh, often necessitating recruitment from outside states.
- A trend of migration to Itanagar for studies was observed, where students, however, face challenges in adapting to the urban living conditions.

# Addressing Low Attendance

## Exploring Solutions

- Low attendance is primarily attributed to a preference for engaging in livelihood activities, particularly during harvest seasons, coupled with the challenges of difficult travel.
- Potential Solutions :
  - Hostel Facilities: Establishing hostels to provide accommodations for students, particularly those facing challenges in commuting from remote areas.
  - Community Engagement Programs: Initiating community-driven programs to raise awareness about the importance of education, fostering a supportive environment.
  - Improved Transportation: Enhancing transportation infrastructure, including government-sponsored school buses, to facilitate easier access to schools and address travel challenges faced by students.

# Interaction with Youth Welfare Society

## Poma Village

- We interacted with the Poma Panchayath Youth Welfare Society(PPYWS) who were tirelessly working to host their 25th-anniversary celebrations, constructing bamboo house structures. This highlights the collective spirit of Arunachal Pradesh societies, where activities like house building are a community endeavour.
- The society consistently organizes sports tournaments and various events, and for the 25th-anniversary celebration, they were planning a grand event with both traditional activities such as arrow shooting and handcraft making, alongside popular sports like football and volleyball.
- Insights Shared: Provided insights into challenges faced by youth of Arunachal Pradesh, including the lack of network connectivity and transportation issues.
- Rising Drug Problem: They also highlighted the increasing drug problem in the region as a significant concern, with several young individuals in the village recently admitted to rehabilitation facilities.

In Arunachal Pradesh, constructing bamboo houses is often a communal effort, mirroring the shared collaborative spirit of the community.

## Sports Enthusiasm and Opportunities

- We observed a vibrant sports passion within the community, where football and volleyball stood out as prominent activities.
- Previously many gifted football players have come from northeastern India, but there is a lack of training resources, impacting aspiring individuals with immense sporting talent.
- Promotion of sports, especially football and volleyball, could be a viable strategy to combat the growing issue of drug abuse in the region.

# Housing Landscape

## Other Prospective Initiatives

# HOUSING CONDITIONS

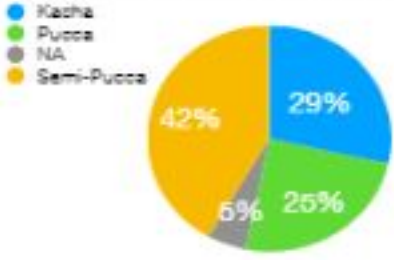
## In Arunachal Pradesh

A Nocte house in rural Jote.

# Housing Situation in Arunachal Pradesh

**Derived From - NFHS-5 (2019-21)[2]**

- House Ownership Distribution: 55% of households(sample population) in Arunachal Pradesh own a house with this figure being 57% in rural households and 45% Urban households.
- 2% of households lack sanitation facilities, using open spaces or field
- Type of Housing Structures (Percentage Distribution): Notably, pucca houses form 25% of the houses, with a majority of them being made from bamboo.



# TRADITIONAL HOUSING
## IN ARUNACHAL PRADESH

- The houses of the tribes of Arunachal Pradesh have a traditional style of construction from diverse construction elements and show a thoughtful use of locally sourced materials.
- The size of the houses depends on the family patterns of the tribes.
- Stilted kaccha houses, locally known as 'chang' are prevalent in Arunachal Pradesh and Assam, primarily constructed using bamboo or wood with thatched roofs.
- Weaved bamboo sheets are commonly employed for walling infill, while thatch serves as a traditional roofing material.

## HYBRID TRADITIONAL HOUSES
### OUR OBSERVATIONS

- We observed a hybrid traditional house under construction, featuring concrete pillars and stilts instead of bamboo in Poma Village.
- The design incorporates a central fireplace, with the middle of the house functioning as both the kitchen and a gathering space for family members.
- To enhance ventilation of smoke, only two layers of thatched bamboo sheets are used for the walls.
- The space between the floor and the ground serves for housing domestic animals like cows and pigs, as well as storage for firewood and tools.

# TRADITIONAL BAMBOO HOUSING

## Our Observations and Proposed Solution

- Despite technological advancements, the traditional construction method remains the preference among locals in the region. The high transportation costs associated with obtaining modern building materials for concrete structures serve as a significant deterrent.
- Traditional houses, requiring maintenance only every 2-3 years, offer a sustainable and cost-effective alternative, aligning with the economic considerations of the community.
- But such houses are associated with problems such as leakage, mosquitos, bugs and susceptibility to harsh weather.
- Introduce modern bamboo housing as a viable solution, drawing inspiration from successful implementations in other regions, such as Ecuador.

# ECUADOR BAMBOO HOUSING PROJECT

**Project of the International Network for Bamboo and Rattan (INBAR), financed by the World Bank**

- Innovative Housing Design: Houses elevated above the ground for flood resistance.
- Utilization of Ecuadorean bamboo for stable temperatures, low humidity, and eco-friendly construction. The innovative design allows for good ventilation during hot months, with high ceilings protecting against sun and rain.
- Prefabrication Technique:Walls and structure are pre-fabricated off-site, enabling the completion of houses in just two weeks.
- Bamboo Quantity: Approximately 1,000 to 1,200 six-meter bamboo posts or stalks required for each house.

Drawing parallels between traditional architecture in Arunachal Pradesh and the bamboo project in Ecuador and considering the abundance of bamboo, it becomes evident that there are promising opportunities for implementation in the region.

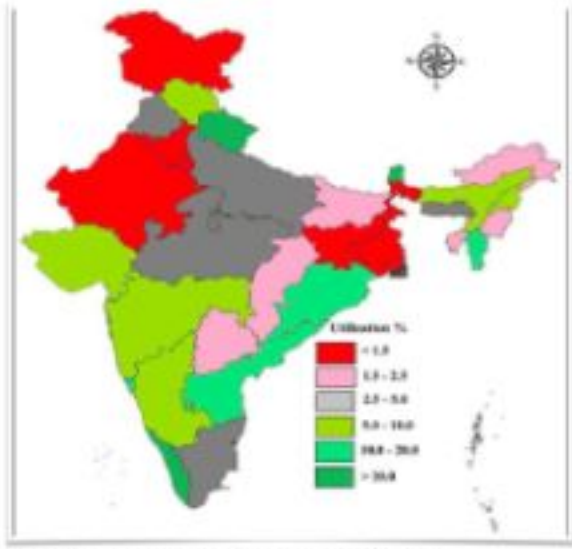
# OTHER PROSPECTIVE INITIATIVES

BIOGAS PLANTS

GRAVITY ROPEWAYS

## Potential for Biogas Implementation in Arunachal Pradesh Rural Areas

- We observed lush greenery and an ample population of cattle, including mithun and cows, in nearby rural areas of Arunachal Pradesh.
- A recent assessment on state-wise biogas potential and its utilization in India [8] showed a biogas production potential of less than 250 million m3 annually in Arunachal Pradesh, which is below the national average.
- Despite the low potential, there is still a severe underutilization of these resources, with the utilized percentage of the estimated biogas potential being less than 2.5%.




State-wise utilized percentage of estimated biogas potential

# AD based biogas Plants

## Benefits and Implementation

- Anaerobic digestion-based biogas production in rural areas, utilizing locally available resources like agricultural residues and livestock manure, is not only highly sustainable but also economically viable.
- This approach would reduce reliance on firewood and contributes to mitigating power disruptions caused by landslides.
- The study estimated the Net Present Value (NPV) of biogas plants used for cooking fuel, electricity, and vehicle fuel to be 0.18, 478.89, and 168.05, respectively, indicating economic viability.
- The government could consider subsidizing installation costs, enhancing the feasibility of widespread biogas plant adoption.
- Initiatives for creating awareness among the local population could be promoted, including collaboration with academic institutions such as NIT Jote for research and implementation support.

# Gravity Ropeways

## In Hilly areas of Arunachal Pradesh

- Arunachal Pradesh features rough hilly terrain, complicating the transportation of agricultural and other goods in such places.
- It typically takes 2-3 hours to manually carry approximately 40 kg loads over 1.3 km on steep mountain paths during the demanding journey to the market.
- Gravity ropeway, based on Newton's law, offer a sustainable solution to the challenges posed by agricultural transportation in rough terrains.
- Implementing gravity ropeways is cost-effective in both construction and maintenance and has been widely utilized in regions of Nepal and Himachal Pradesh.

# BIBLIOGRAPHY


1. AP State Electricity Regulatory Commission. Deloitte (2016). Power for All - Arunachal Pradesh. Retrieved from https://apserc.nic.in/pdf/Power_for_all.pdf

2. International Institute for Population Sciences (IIPS) and ICF. 2021. National Family Health Survey (NFHS-5), India, 2019-21: Arunachal Pradesh. Mumbai: IIPS.

3. Ministry of Power, Government of India. "National Hydroelectric Power Policy." https://powermin.gov.in/sites/default/files/uploads/new_hydro_policy.pdf

4. Opangmeren Jamir, February 4, 2022. Opinion: Decision-makers in Arunachal Pradesh need to take EIAs seriously. The Third Pole. https://www.thethirdpole.net/

5. Himanshu Nautiyal, S.K. Singal, Varun, Aashish Sharma, Small hydropower for sustainable energy development in India,Renewable and Sustainable Energy Reviews,Volume 15, Issue 4,2011,Pages 2021-2027,ISSN 1364-0321, https://doi.org/10.1016/j.rser.2011.01.006.

6. World Bank. (Year). Ecuador Innovates with Bamboo Houses for the Low-Income Population. worldbank.org

7. Padh, S. R. (2018). Overcoming Exclusion and Marginalization in Education through Inclusive Approaches: Challenges and Vision of Arunachal Pradesh in India. International Journal of Social Science and Humanity, 8(4)

8. Singh, R, Kalamdhad, A. A comprehensive assessment of state-wise biogas potential and its utilization in India. Biomass Conv. Bioref. 13, 12567–12579 (2023). https://doi.org/10.1007/s13399-021-02001-y