**Final Project - ENV 617 - Hydro Team**

**Title:** Comparative Analysis of Hydropower Projects: U.S., India, and Global Perspectives  
**Authors:** Hydro Team (April 2025)

**Research Questions (based on final analysis)**

**1. Comparative Analysis of Hydropower Designs**

* **Question:** How do the key physical parameters (dam height, crest elevation, reservoir capacity) differ between the U.S., India, and globally?
* **Justification:**  
  The U.S. dataset provides dam structural dimensions like *crest elevation*, *structural height*, and *crest length*;  
  India’s dataset provides *max/min water head*, *reservoir capacity*, and *dam height*;  
  The Global dataset mainly offers *electrical capacity* and basic location attributes.
* **Goal:** Compare structural designs across regions to understand geographic, engineering, and climatic influences.

**2. Correlation Between Physical Design and Energy Generation**

* **Question:** Is there a relationship between hydropower design features (e.g., dam height, reservoir size) and the electrical generation capacity?
* **Justification:**  
  Both U.S. and India datasets (and partially the global dataset) include relevant variables (*reservoir capacity*, *dam height*, *electrical capacity*).
* **Goal:** Examine whether bigger dams and reservoirs directly translate into higher power output.

**3. Temporal and Operational Trends**

* **Question:** How have hydropower project designs evolved over time?
* **Justification:**  
  All datasets include a *year built* or *commissioning year* field.
* **Goal:** Investigate changes in construction patterns over decades: Are dams getting taller? Are capacities increasing?

**4. Influence of Administrative and Organizational Factors**

* **Question:** Does project ownership (Public vs. Private vs. Semi-public) influence operational characteristics such as age, capacity, or count?
* **Justification:**
  + U.S.: Ownership parsed from *organization* field
  + India: Ownership parsed from *owner* field
  + Global: Ownership parsed from *owner* field
* **Goal:** See if government-led or private projects differ systematically across regions.

**5. Geospatial Mapping of Installed Capacity**

* **Question:** Where are the major hydropower assets located geographically across U.S., India, and globally?
* **Justification:**  
  Latitude and longitude available in all datasets.
* **Goal:** Visualize clustering or dispersion of projects. Spot regional patterns.

**Updated General Objectives**

* **Establish Baseline Comparisons:**  
  Develop a thorough understanding of the physical, operational, and locational parameters of hydropower projects across datasets.
* **Explore Relationships Within the Data:**  
  Identify statistically significant correlations between size, reservoir capacity, and power generation.
* **Assess Technological and Regional Trends:**  
  Understand how project designs have evolved over decades (e.g., comparing 1950s vs. 2000s).
* **Evaluate Ownership and Policy Impacts:**  
  Determine whether public, private, or semi-public projects differ materially in characteristics.
* **Present Geospatial Perspectives:**  
  Map spatial distribution of hydropower infrastructure to support strategic energy planning.
* **Inform Future Policy and Engineering Decisions:**  
  Generate actionable insights for engineers, policy-makers, and planners based on cross-country hydropower analysis.