Hydropower Vision

Senior Design Group 15-08

Project Plan Version 1.1

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Problem Statement

With the rising demand for electricity, there is an ever increasing need to reduce greenhouse gas emissions and improve the overall quality of our electric grid. Many of the resources that we are currently using are either non-renewable (e.g. fossil fuels) or cannot consistently guarantee generation (e.g. wind and solar). However, hydropower is renewable, consistent, and allows for greater manipulation of output compared to other renewable generation sources. Hydroelectric power has not seen many major developments in North America in the past few decades, leading to a large untapped potential.

Objective

Our objective is to coordinate with the US Department of Energy and the National Renewable Energy Laboratory to help develop a long-term “Hydropower Vision”. The goal of this vision is to establish an analytical basis for responsible growth in domestic hydropower, and become a major source in the renewable energy market.

Systems Description

The project will give a detailed recommendation to the DOE Hydropower Vision. The recommendation will consist of many parts, the first being finding a prime location for Hydropower generation. This will then lead us to several other steps such as developing a power flow model and designing a new transmission line expansion.

A better explanation for our process can be seen by Figure 1, followed by a brief summary of each individual step.

Systems Block Diagram

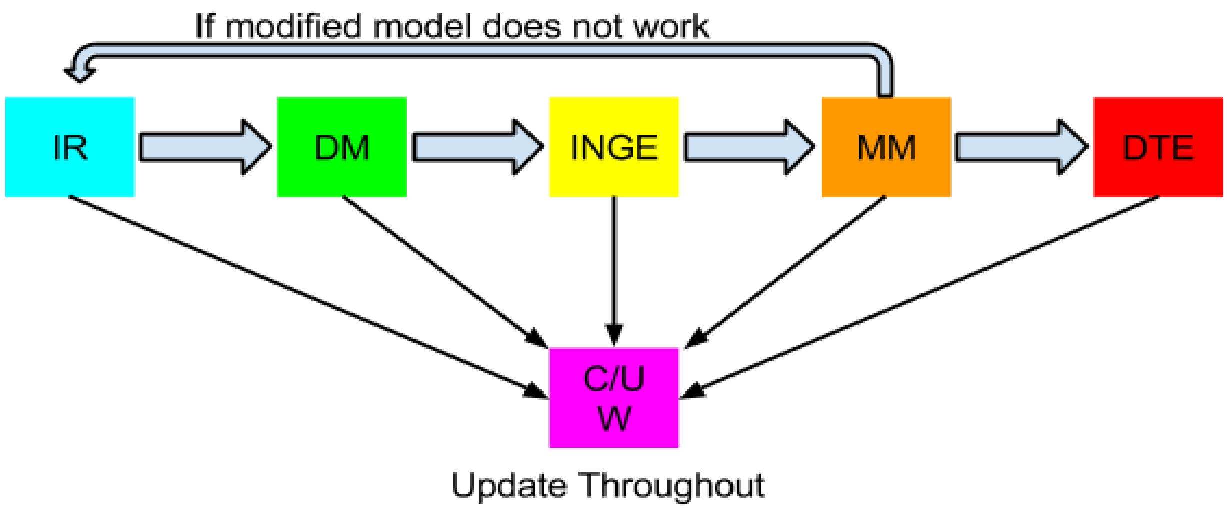


Figure 1: *Hydropower Vision System Block Diagram*

Identify Region (IR)

- Do this by looking at population, transmission availability, hydropower potential, economics, environmental concerns, etc.

Develop Model (DM)

- This will be a power flow model of the existing system in the identified Region, and be done using PLEXOS.

Identify Non-hydro Generation Expansion (INGE)

- Look for other generators that are likely to be put in place in the identified region.

Modify Model (MM)

- Add both the new hydro and non-hydro generators to the previously developed power flow model.

Design Transmission Expansion (DTE)

- Design transmission line expansion to connect new generation sources to the existing system.

Create/Update Website (C/U W)

- Use website to document all progress on the project.

Operating Environment

Our general working conditions are as follows:

Meetings:

- General group meetings take place in the TLA or empty labs around Coover Hall.
- Advisor meetings in the office of Professor James D. McCalley.

Researching:

- Takes place wherever there is a usable computer with an internet connection.

Modeling:

- Takes place where PLEXOS is available. PLEXOS is a type of simulation software which is very useful for modeling power flows and systems.

Functional Requirements

In order for our project to be considered functional it must meet the following criteria:

- It must be implemented by the DOE and NREL as a useful tool to develop a new long-term hydropower vision.
- The report/power flow must be developed in a functional and easy-to-use fashion.

Non-functional Requirements

Although our project isn't directly being used by consumers, there are a couple of non-functional requirements that it should meet:

- It should represent Iowa State students and faculty in a positive manner by being written and developed in a professional manner.

Deliverables

Our project has 5 main deliverables that we need to successfully complete in order for our system to be successful. These include:

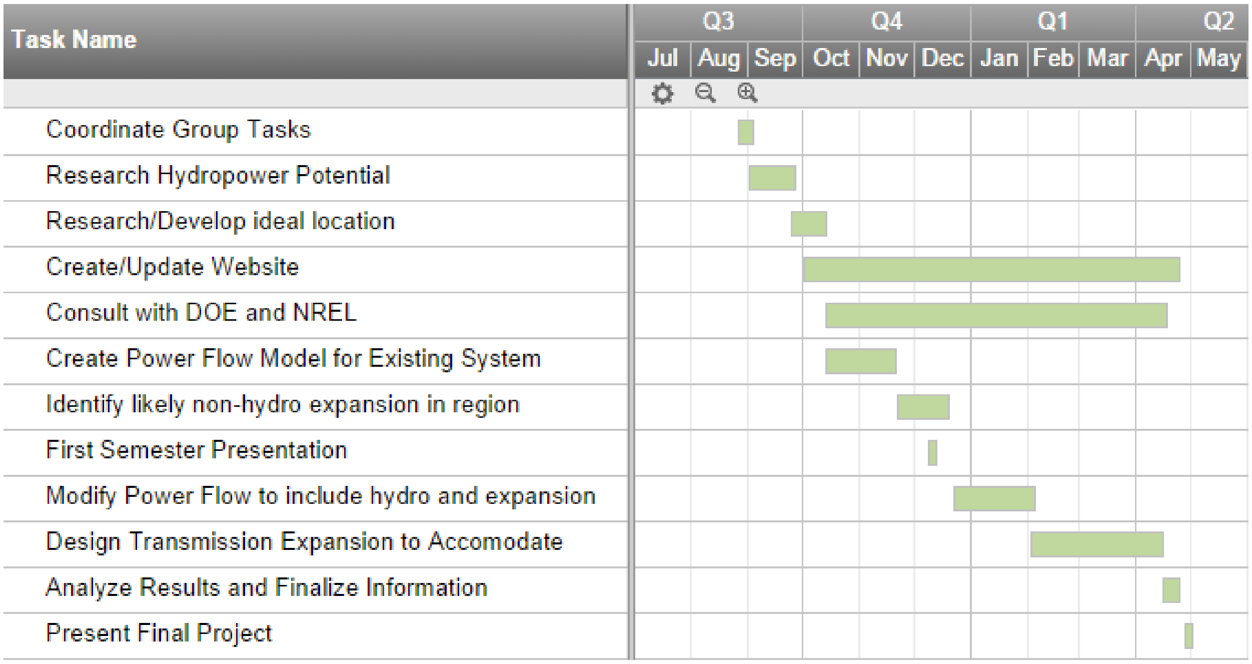
- Identify a region in the U.S. or Canada that would be best for new hydropower resources.
- Obtain or develop a power flow model of the existing electric system.
- Identify likely non-hydro expansion in the system.
- Modify model to include our suggested hydro region and other non-hydro expansions.
- Design a transmission expansion to accommodate hydropower in our chosen region.

Risk Management

Although our project does not have much for physical risks, such as arthritis from typing and researching, there are some possible risks to the completion of the project itself. Unfortunately, these risks lie mainly within the time management and research category.

Since our project consists of many parts that build on each other, it is important to successfully implement each deliverable in a timely and constructive manner. Meaning, the research has to be thorough, so that the project doesn't advance to the point of modifying the model and finding that it does not work. Thus forcing us to start over. We minimize this risk by looking into and ranking many different potential sites, so that we are not scrambling to find a new starting point for our project.

Project Schedule



Work-Breakdown Structure

Our group for this project consists of 6 team members. Every team member was designed a specific role based on our strengths and weaknesses in order to maximize our overall productivity. We decided to implement the roles as follows:

Aldhaheri, Mohammed:	Lead Researcher
Jones, Nicholas:	Communication Leader
Kraus, Kyle:	Webmaster
Martinson, Josh:	Key Concept/Webmonkey
Tillema, Alex:	Team Leader
Ward, Jared:	Key Concept Leader