**MODELING ENERGY SYSTEM INVESTMENT PLANNING INFRASTRUCTURE FOR THE STATE OF IOWA**

**PROJECT OVERVIEW**
The energy and transportation infrastructure in Iowa needs to be analyzed to provide the best investment strategy for the next forty years. These two systems are highly interdependent and must be analyzed together. The analysis will be completed using NETPLAN. A public website will be created to allow the user to alter the current systems and develop an alternative investment strategy.

**NETPLAN**
NETPLAN is multi-objective optimization software being developed at Iowa State University. This software analyzes current electric and transportation infrastructures and determines optimal investment strategies over a given time period. The current infrastructure is described in a data set, in which parameters can be altered to forecast alternative investment scenarios. Alternative scenarios could be mandatory emission reductions, increased fuel prices, demand increases, etc.

NETPLAN will solve for GW investments, arc flows, emissions, resiliency (given events), cost, un-served demand, and reserve margin.

**DATA SET**
The data set consists of 32 files describing each aspect of the current energy and transportation infrastructures. The data set is broken down into a system of nodes and arcs. The nodes represent generation and demands. The arcs represent flows between nodes, such as electricity or commodity transportation.

Our data set is divided into 1,281 nodes and 4,129 arcs. We have modeled all generation sites greater than 20 MW, transmission lines 115kV and up, and all major highways.

**SYSTEM DIAGRAM**
- **Data:**
  - Energy Infrastructure
  - Transportation Infrastructure
- **NETPLAN:**
  - Investment planning analysis
  - Resiliency analysis
  - Emissions analysis
- **Data Storage:**
  - NETPLAN base case results
  - Scenario results
- **Java Code:**
  - Retrieves results from data storage
  - Sends charted results to senior design website
- **Senior Design Website:**
  - Displays NETPLAN results in the form of tables and charts
  - Displays layout of current infrastructure using Google Earth
  - Contains base case data set for future analysis
  - Contains all necessary documentation regarding each step of our design

**GOOGLE EARTH**
The GoogleEarth map will be used to display the existing infrastructure of Iowa. The user will be able to select various infrastructure components and view their location and current generation, transmission, or transportation statistics.

**RESULTS**
Our data set was analyzed using several different scenarios. We first ran a base case consisting of current conditions with no extreme events over forty years. We then modified the data to account for alternative, yet possible, events during the time period.

During all of our simulations we found the optimal strategies involve high wind and high natural gas generation investments. With the potential increase in cheaper generation we found an increased investment potential in hybrid vehicles.

**SUMMARY**
Our team developed and tested a data representing the current infrastructure of Iowa and provided possible investment strategies for forty years. The website will allow the user to load pre-selected scenarios and view their simulation results. The team also developed a NETPLAN users manual which will allow the user to develop their own scenarios or data set.

**SCHEDULE AND TASK BREAKDOWN**

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**Team Members**
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- Michael Healy (EE)
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**Website**
http://seniori.ece.iastate.edu/dec1106/index.html

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**Team**
DEC11_06

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