IPRO 311— Integration of Plug-in Hybrid Electric Vehicles and Renewable Energy Systems

Project plan fall 2010

Faculty Advisors: Alireza Khaligh

Project Assistant: Seshadri Srinivasa Raghavan

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Team Information:

Team Roster

Robert Veitch, rveitch@iit.edu
Major: Computer Science
Description: Robert has an experience working as a programmer. He enjoys teamwork. He's interested in interactivity between several types of power generation systems i.e. phev technologies. Robert expects to be able to find one or several optimal combinations of phev usage based on site and power system conditions, and to effectively report these results.

Byron Enriquez, benrique@iit.edu
Major: Mechanical, Materials and Aerospace Engineering
Description: Byron has an experience working with software such as Auto-cad, ProEngineer, Illustrator. He expects to acquire knowledge of renew-able energies and how to get the best advantage out of it. Byron wants to understand and find a system for the integration of plug-in hybrid electric vehicles that has better performance and efficiency than the actual ones. He wants a better understanding of what it is like to work in a group and develop organizational skills.

Peter Ryszkiewicz, pryszkie@iit.edu
Major: Electrical and Computer Engineering
Description: Peter is a good researcher, and a fast learner who focuses on his professional goals. He looks forward to learn presentation skills, learn ethical issues, gain knowledge about the introduction of PHEVs to the market. Peter expects to contribute to an important endeavor, teach others about the importance of PHEV and wind energy integration, set a framework for future contributions.

Team Information:

Team Roster

Joseph Krause, jkrause2@iit.edu
Major: Electrical and Computer Engineering
Description: Joseph has a Significant undergraduate team leading experience. He has extraordinary working knowledge of hybrid electric vehicles and plug-in hybrid electric vehicles. He is Familiar with wind energy advantages and disadvantages. Joseph expects develop integration of plug-in hybrid vehicles with wind energy power.

Malik Ajose, majose@iit.edu
Major: Architecture
Description: Malik is proficient at using software such as AutoCad, 3D Max, Rhino, Illustrator, Photoshop, InDesign, and Microsoft suite. He aspires to develop a better project presentation skill set. Malik expects to acquire a basic knowledge of Plug-in Hybrid Electric Vehicle, and its effect on the global economy.

Ghita Pop, gpop@iit.edu
Major: Architecture
Description: Ghita has a strong managing skills. He wants to learn more about alternative energy sources. He wants to be able to develop a working idea for a plug-in hybrid.

Team Information:

Team Roster

James Lee, jlee192@iit.edu
Major: Electrical and Computer Engineering
Description: James is currently taking Power Engineering Courses and interested in renewable energy and the control system. He expects to be able to transform renewable energy, especially wind energy, to an electrical energy so that we can generate the power for HEVs. Hence, the air pollution would be decreased. Besides this IPRO experience would build the team work skill and how to interact with people in the other field.

Joseph Charles, jcharle1@iit.edu
Major: Mechanical, Materials and Aerospace Engineering
Description: Joseph has moderate experience with mechanical engineering and am hard working and resourceful. He also has experience working in group settings and with IPRO. Joseph will continue to develop my professional and group skills and will learn about the power industry, which I may end up working in. He expects the semester to be an enjoyable learning experience and hope to expand my professional as well as personal network.

Team Information:

Team Identity

Name: Plug-in Hybrid Electric Vehicle

Motto: Plug into Sustainability

Logo:

Team Purpose and Objectives:

Team Vision

To achieve synergy through the integration of wind energy and plug-in hybrid electric vehicles (PHEVs) in order to reduce the amount of coal/ gas energy generating sector.

Team Goals

The goal of this IPRO is to examine the driving patterns of PHEVs user in conjunction to the supply and demand of electricity. By doing this, it will be easy to identify when it's best for PHEVs users to recharge or discharge their battery packs.

Team Objectives

- Evaluate the driving habits of plug-in hybrid electric vehicle owners in conjunction to the electric energy sector.
- Research and analyse what effects arise from periodically charging and discharging PHEV battery.
- Establish the pros and cons of a PHEV system in comparison to gas-operated vehicles, and plug-in hybrid vehicles.
- Evaluate the operational renewable wind energy generating capacity in order to prognose its impact on existing conventional energy infrastructure.
- Collaborate as a team in order to realize probable solutions for the project.

Background Information

User Problems

- The United States contribute to approximately 20 percent of the world's carbon dioxide emission.
- The net import of fuels to meet domestic energy consumption is expected to fall down to 20% in 2035 (23.68qbtu) from being 26% (30.85qbtu) in 2005.
- Based on EIA data, the transportation and electric power industries together make up to 92% of the carbon dioxide emmision increase in the next couple of decades.
- A conventional car emits 8.8kg of carbon dioxide per gallon of gasoline

Addressing Problems

- The collection of data on driving patterns. The Chevy Volt will be evaluated in our field operational test (FOT).
- The collection of data on battery characteristics in order to evaluate its cost efficiency compared to a conventional gas-powered vehicle.
- The collection of data on wind energy, and the impact it can possibly have in reducing the carbon footprint of United States current energy demand.
- The collection of data on how to effectively mitigate both the wind energy plant and the PHEVs in order to achieve synergy.
- The collection of data on cosumer preferences and power system considerations in order to determine the most economical time to discharge/ recharge battery packs.

Background Information

Ethical Issues

- U.S. will potentially cut down on global oil usage which will help decrease green house effect.
- It will support roughly 500,000 jobs in the U.S., with an annual average of more than150,000 workers directly employed by the wind industry.
- Using more domestic wind power will diversify the nation's enery portfolio - adding wind-generated electricity at stable prices not subject to market volatility.

Societal Cost

- PHEVs doesn't present an opportunity to drive for a long period of time, which in turn doesn't allow for family trip.
- PHEVs help promote efficient driving habits.

Proposed Implementation

- W. Short and P. Denholm, "A Preliminary Assessment of Plug-in Hybrid Electric Vehicles on Wind Energy Market in *Technical Report, National Renewable Energy Laboratory,* Apr. 2006.

Team Values Statement

Ethics and Conflict Resolution

The IPRO 311 Project has set certain team values that define ethically tolerated behaviors with the Team. These guidelines set the standard by which all Team members can abide, thereby encouraging success of the Project. The Team states these guidelines for all Team members to follow:

Responsibility:

- Participate in team discussions and work;
- Arrive on time to scheduled classroom meetings as well as supplemental team meetings;
- Follow through with commitments in a timely manner;

Teamwork:

- Recognize role of team leaders;
- Be a team member that others can depend on to complete tasks;
- Share team responsibility;

Respect:

- Recognize other team member's strengths and weaknesses;
- Acknowledge other's contributions to the project;
- Be receptive to other's ideas and thoughts;

Communication:

- Utilize all methods of communication;
- Ensure other members and group leaders are aware of your intent and ac tions; post all work on iGroups website.

Work Breakdown Structure

Problem Solving Process

The IPRO 311 Project has set certain team values that define ethically tolerated behaviors with the Team. These guidelines set the standard by which all Team members can abide, thereby encouraging success of the Project. The Team states these guidelines for all Team members to follow:

Process:

Step 1: Problem Definition
Step 2: Brainstorm solutions
Step 3: Delegate the tasks
Step 4: Implement solutions, compare the solution to the problem

Major Tasks:

Pick a site in Chicago, IL
Pick PHEV
Research driving habits, vehicle fleet sizes, projections
Research weather / wind conditions for the chosen site
Research power plant types, efficiencies, costs, etc (coal, nuclear, wind, etc)
Pick a candidate power grid (or create a fictional one consisting of several power plant types)
Research / compare various combinations of phev and wind plant deploy ments

Solution Test:

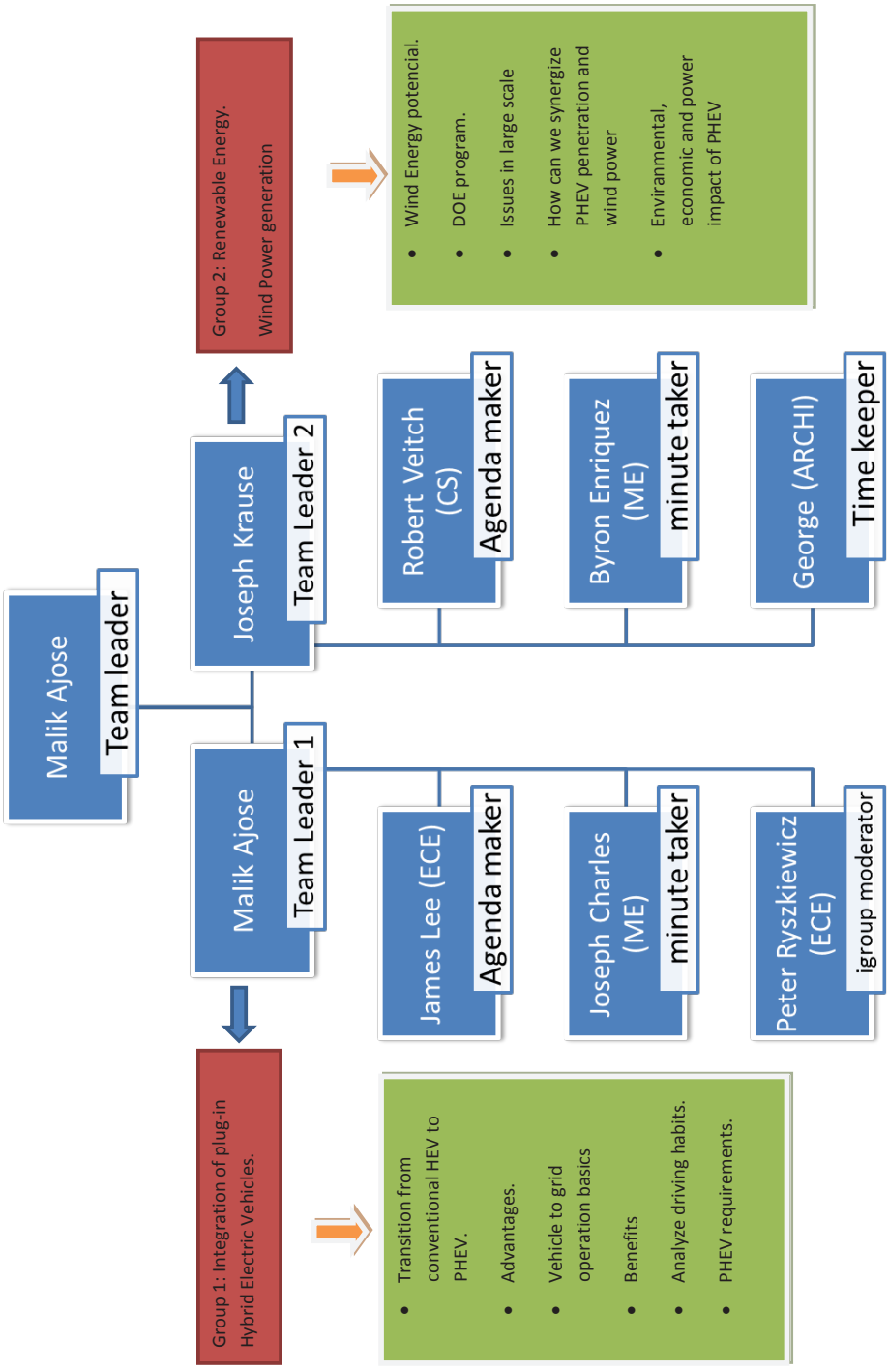
Analyze the potential savings acrued by implementing the given strategy of phev charging / wind power deployment

Reasonability of Tasks:

Given an appropriate distribution of tasks, it is reasonable to assume a set of recommendations can be generated by the end of the semester as a result of the research which will be performed

Work Breakdown Structure

Team Structure



Expected Results

Expected Activities

- Customer could be also a provider of electricity.
- The demand for the electricity would be flatten by smart grid.
- We could create many jobs that are related with PHEVs.

Expected Data

- We could find out the usual habit of driving (When people usually drive, park and how they drive).
- We could find out how many power plant could be cut off during the night.
- We could estimate the right battery size for the average driver.

Expected Results

Potential Outputs

By determining the factors that affect both wind energy and PHEVs, we will achieve a clear understanding of how the two function. We will know how wind energy affects the power grid and details such as when peak hours are and how much power will be available for our site. We will also know PHEV charge requirements, how often consumers charge them and their driving patterns.

Once the factors are determined, we will research what sort of problems or obstacles are present in the two subjects. Will PHEVs charging during peak demand periods overload the grid? How will the grid handle extra power from wind energy?
When individual factors and problems are well developed, we can begin brainstorming solutions to bring about wind energy and PHEV synergy.

Proposed Solution

We will be creating consumer survey feedback for PHEV driving patterns as well as charging patterns. We will also be creating a basic model of wind profile for our site and of a basic power grid to see how the two will affect each other. Once these are created and enough research and data is collected we will see how the two subjects fit together.

Expected Results

Project Challenge

One challenge is the restriction of information that will be obtained because of security or private reasons. This may affect the numbers in our calculations for energy demands or prices. The economics of the market is also constantly changing such that there may be unforeseen events affecting global energy demand and supply. On the opposite side, there may be technological breakthroughs which may solve indirectly the problem addressed by this IPRO such as cheap, plentiful power supply, energy storage, and power transmission: this is the best case scenario. One assumption that is made is that people will be accepting of PHEVs and embrace the technology as a practical mode of transportation with liberal adoption rates.

Probable Solution

Our proposal will contribute to the solution process by gathering momentum for the PHEV and renewable resource movement. The best case is the government quickening legislation for the adoption of PHEVs and renewables, mostly wind energy production. The results will also motivate individuals to think about using cleaner energy and support the green revolution.

Designation of Roles

Team Leader: Joseph Krause, Malik Ajose

Minute Taker: Joseph Charles , Byron Enriquez

Agenda Maker: James Lee, Robert Veitch

Time Keeper: Ghita Pop

iGroup Moderator: Peter Ryszkiewicz