# *Mission Profile – 12402 and 12401*

## General Mission

The mission of the Sustainable Energy Systems for Education (SESE) family of projects is to design, develop, build, test, and deliver interchangeable sustainable energy technological solutions for use by future senior design teams and undergraduate engineering class projects in the KGCOE, beginning fall semester 2013.

The SESE projects should demonstrate the core functions of sustainable systems. All work produced should be in an open source / open architecture format, encouraging use of the technologies by others.

## Project Statement

The Wind Energy Collection to Energy Bank (WECEB) system focuses on Collection of the wind, Conversion of the mechanical energy to electrical, and then Storage of that electrical energy. Transmission by wiring is used to transmit the electrical energy to the Storage unit. Control also comes into play with several aspects of the system.

The mission of the Charging Dock & Power Control (CDPC) project is to design, build, test and deliver a charging station that controls the charging of the portable power source. The portable power supply can be a battery pack or battery packs that ultimately powers the Land Vehicle for Education (LVE, R12005). The circuit board will be integrated with the portable power supply, and be required to interface both mechanically and electrically with the charging dock as well as the LVE. The charging dock will receive power from other sustainable energy sources such as the Wind Energy Collection to Energy Bank (WECEB) project, and/or a standard AC outlet.

### Turbine Assembly and Wind Energy Collection

The WECEB system will be designed to harvest wind energy in various wind conditions present in the Rochester environment. The stand is designed to be setup by two people with a Turbine Clamp Allen Wrench the only additional tooling required. The two setup people will retrieve the stand from the storage location designated by Dr. Hensel. The users will load the materials onto a transport cart and transport the materials to the setup location as determined by Dr. Hensel. Upon arrival at the desired location, the users will refer to the Turbine Assembly directions located in the user manual. Upon setup of the turbine stand, the wind turbine will begin harvesting wind energy. This energy will be stored in a flooded lead acid battery for later use by the CDPC team.

| Duty Cycle | Ideal Value | Marginal Value |
|---|---|---|
| Setup Time | 15 minutes | 30 minutes |
| Minimum Operating Wind Speed | 3 m/s | 5 m/s |
| Maximum Operating Wind Speed | 50 m/s | 45 m/s |
| Maximum Rotor Diameter | .9144m | 1.5m |
| Operating Temperature | -2 to 35 C | 7 to 32 C |

## Energy Transmission

The energy that is stored by the WECEB team will be transferred via power line, with minimal to no line loss.

## Dock Setup

Students will have to carry out the CDPC and its corresponding weatherproof enclosure to the windmill location, depending on where it is on that given day. Students will also need to bring the charge-depleted LVE batteries so that way they may be charged and used in the land vehicle for education.

Users will, according to the instruction manual, affix the CDPC dock into the expanded position, which will expose eight battery terminals and locations to place the batteries and the way in which to plug the battery wires into the dock.

The user will then plug the wire from the windmill into the charging dock and flip the switch from the off to on position to start the charging operation.

The user will be educated on the current status of batteries and charging levels according the LED displays (for clarification on the different lights, they may refer to the user manual, although it is pretty self-explanatory).

## Energy Regulation

The charging dock and power control team (CDPC) will be either converting or regulating the received power depending upon which energy source is the current provider.

## Battery Charging

The CDPC will be home to a range of four to eight LVE batteries. They will be charged either indoors or outdoors, again, determined by the input power method.

## Table 1 - Efficiencies

### Efficiencies Spreadsheet

Manual Input Fields

| WECEB (Project 12401) | | | |
|---|---|---|---|
| **Step** | **Power** | **Efficiency** | **Cost** |
| Windmill | 159.8 | 35 | $ 329.99 |
| Generator | 96.9 | 35 | $ - |
| Controls | 92.3 | 95 | $ - |
| Storage | 76.9 | 80 | $ 183.49 |

| CDPC (Project 12402) | | | |
|---|---|---|---|
| **Step** | **Power** | **Efficiency** | **Cost** |
| Line loss | 76.1 | 99 | |
| Controls | 75.4 | 98.5 | $ 18.00 |
| Regulator | 74.3 | 89.5 | $ 23.30 |
| Watts | 67.2 | 100 | |

| Descriptive Statistics | | |
|---|---|---|
| **Voltage** | 12 | Volts |
| **Amperes** | 0.7 | Amps |
| **Wattage** | 8.4 | Watts |
| **Battery Count** | 8 | Count |
| **Total Power** | 67.2 | Watts |
| **Time Constant** | 6 | Hours |
| **Watt-hours** | 403.2 | Wh |

**Select 12401 Technology Below**

| | |
|---|---|
| Select Tech. (1,2): | 1 |

**Select 12402 Technology Below**

| | |
|---|---|
| Select Tech. (1,2,3): | 3 |

| | | |
|---|---|---|
| **Total Power Required:** | **159.8** | Watts |
| **Total Cost:** | **$ 554.78** | |

**Note:** Charging Time for a battery is approx. 5.5 hours

| | | |
|---|---|---|
| Watt-hours (total) = | 959.06 | watt-hr |
| Watt-hours (storage) = | 461.31 | watt-hr |
| Watts/hr. from storage = | 19.22 | watts/hr. |

The above table depicts the total watts needed, as well as watts per hour from the storage unit to charge eight LVE batteries over a worst-case scenario.