INTRODUCTION:

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. The solutions will be developed for use by future senior design teams and undergraduate engineering class projects in the KGCOE, beginning fall semester 2013. The SESE should represent an integration of the six core technologies that make up a sustainable system: Capture/Collection, Conversion, Storage, Transmission, Management/Control, and Consumption. The objective is to provide opportunity for various technological solutions within the core functions to allow the execution and integration of numerous modular SESE systems and elements. All work produced should be in an open source/open architecture format, encouraging use of the technologies by others.

The project outlined in this Project Readiness Package is the Charging Dock and Power Control (CDPC) project. The mission of the 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) and the Wireless Open Source/Open Architecture Command and Control System for Education (WOCCSE) (R12003) systems. 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 and WOCCSE units. 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.

ADMINISTRATIVE INFORMATION:

- Project Name (tentative): Charging Dock and Power Control (CDPC)
- Project Number, if known: P12402
- Preferred Start/End Quarter in Senior Design:
  ☒ Fall/Winter ☐ Fall/Spring ☐ Winter/Spring
- Faculty Champion: *(technical mentor: supports proposal development, anticipated technical mentor during project execution; may also be Sponsor)*

Name	Dept.	Email	Phone
Dr. Hensel	ME		

For assistance identifying a Champion: B. Debartolo (ME), G. Slack (EE), J. Kaemmerlen (ISE), R. Melton (CE)

- Other Support, if known: *(faculty or others willing to provide expertise in areas outside the domain of the Faculty Champion)*

Name	Dept.	Email	Phone

- Project "Guide" if known: Leo Farnand, lfarnan1@rochester.rr.com 585-377-2498 *(project mentor: guides team through Senior Design process and grades students; may also be Faculty Champion)*

- Primary Customer, if known (name, phone, email): ME Dept (Dr. Hensel, Dr. DeBartolo, Mario Gomes, John Wellin)

- Sponsor(s): ME Department *(provider(s) of financial support)*

PROJECT OVERVIEW:

The SESE is a modular project aimed at developing a power source for the Land Vehicle for Education (R12005) and Wireless Open Source/Open Architecture Command and Control System for Education (R12003) systems.

From the SESE roadmap, the functions of Capture/Collection, Conversion and Storage represent the front-end processes in a sustainable energy system and are the basis for this project. A sustainable energy system starts with harvesting renewable and low impact energy in an efficient way. Next, the energy needs to be converted, in an equally efficient way to prepare the energy to be directed to the storage location. Storage is necessary because it is difficult to consume the energy as it is created, and the location and time of when it is desirable to consume the energy will not always coincide with the collection.

This project will require collaboration between various teams within the SESE family to determine and pass along Engineering Specification Values. This team should focus on the design and packaging of the circuits necessary to take the output from the WECEB project and convert this energy into portable power modules that would be used to power the previously referenced LVE. The Charging Dock must also have an alternate input that would allow charging the portable power modules to be charged from a conventional AC source. Additionally, a Graphical User Interface (GUI) must be designed to assess the the status of the Charging Dock and portable power modules.

As mentioned in the summary, this project should use the Charging Dock and Power Control EDGE site as a starting point (http://edge.rit.edu/content/P11402/public/Home).
Also for more information on the larger project into which this system will be integrated, please visit http://edge.rit.edu/content/R12006/public/Home

DETAILED PROJECT DESCRIPTION:
See attached.

- Customer Needs and Objectives: *See attached.*

- Functional Decomposition: *See attached.*

- Potential Concepts*: TBD by project team.*

- Specifications (or Engineering/Functional Requirements): *TBD by team*

- Constraints:

Regulatory Constraints
- The design shall comply with all applicable federal, state, and local laws and regulations. The team's design project report should include references to, and compliance with all applicable federal, state, and local laws and regulations.

- The design shall comply with all applicable RIT Policies and Procedures. The team's design project report should include references to, and compliance with all applicable RIT Policies and Procedures.

Economic Constraints

- Each team will be required to keep track of all expenses incurred with their project.
- Purchases for this roadmap will be run through the Mechanical Engineering Office. Each team must complete a standard MSD purchase requisition and have it approved by their guide. After guide approval, the purchasing agent for the team can work with Ms. Venessa Mitchell in the ME office to execute the purchase and obtain the materials and supplies.

Environmental Constraints

- Adverse environmental impacts of the project, such as the release of toxic materials or disruption of the natural wildlife, are to be minimized.
- Particular focus should be placed on resource sustainability (described further in Sustainability Constraints).
- Material Safety Data Sheets (MSDS) are required for all materials.

Social Constraints

- Each team in this roadmap is expected to demonstrate the value and outcome of their project at the annual Imagine RIT festival in the spring.

Ethical Constraints

- Every member of every team is expected to comply with Institute Policies, including the Policy on Academic Honesty, and the Policy on Academic Accommodations.

Health and Safety Constraints

- Wherever practical, the design should follow industry standard codes and standards (e.g. Restriction of Hazardous Substances (RoHS), FCC regulations, IEEE standards, and relevant safety standards as prescribed by IEC, including IEC60601). The team's design project report should include references to, and compliance with industry codes or standards.

Manufacturing Constraints

- Commercially available, Off-The-Shelf (COTS) components available from more than one vendor are preferred.
- It is preferable to manufacture and assemble components in-house from raw materials where feasible.
- Students should articulate the reasoning and logic behind tolerances and specifications on manufacturing dimensions and purchasing specifications.

Intellectual Property Constraints

- All work to be completed by students in this track is expected to be released to the public domain. Students, Faculty, Staff, and other participants in the project will be expected to release rights to their designs, documents, drawings, etc., to the public domain, so that others may freely build upon the results and findings without constraint.
- Students, Faculty, and Staff associated with the project are encouraged to publish findings, data, and results openly.
- Students, Faculty, and Staff associated with the project are expected to respect the intellectual property of others, including copyright and patent rights.

Sustainability Constraints

- All raw materials and purchased materials, supplies, and components used in the roadmap must have a clearly defined Re-Use, Re-Manufacturing, or Recycling plan.
- This is intended to be a "Zero Landfill" project. This includes documents as well as project materials.
- Each team in the project family is limited to no more than 150 pages of **printed** documentation during MSD1 and MSD2 (not including the MSD2 poster and MSD2 technical paper). Teams may use an unlimited amount of **electronic** documentation, unless disk space becomes limited on the server.
- Each team must prepare an MSD2 poster and technical paper which is exempt from the paper constraint above.

- Project Deliverables: *Expected output, what will be "delivered" – be as specific and thorough as possible.*

The primary deliverable of the project is to demonstrate the capability of charging battery modules to power the Land Vehicle for Education (R12005) and Wireless Open Source/Open Architecture Command and Control System for Education (R12003) systems using a sustainable energy source. The delivered technological solution must do so under the proposed engineering specifications and constraints listed above.

- Budget Estimate: *Major cost items anticipated.*
  $500 for prototype components, materials, parts, shipping, etc.

- Intellectual Property (IP) considerations: *Describe any IP concerns or limitations associated with the project. Is there patent potential? Will confidentiality of any data or information be required?*

- Other Information: *Describe potential benefits and liabilities, known project risks, etc.*

- Continuation Project Information, if appropriate: *Include prior project(s) information, and how prior project(s) relate to the proposed project.*

For more information on the larger project into which this system will be integrated, please visit http://edge.rit.edu/content/R12006/public/Home

STUDENT STAFFING:

- Skills Checklist: *Complete the "PRP_Checklist" document and include with your submission.*

- Anticipated Staffing Levels by Discipline:

See descriptions on DPM project readiness packages from the family roadmap for more detail.

Discipline	How Many?	Anticipated Skills Needed (*concise descriptions*)
EE	3	Project planning, Analog circuit design, circuit modeling, PSPICE analysis, PCB design and layout, embedded software design, implementation & debug
ME	3	Project planning, Stress analysis, mechanical modeling, 3D CAD, FEA,
CE	1	Open architecture microcontroller modeling and programming, Interfacing transducers and actuators to microcontrollers, GUI design, real time control, system software testing and debugging
ISE	1	System Project planning and management, FAST diagramming, FMEA, DFA, Cost management (DMC & UMC), Production System design, strong interpersonal skills, DFM, DFE
Other		

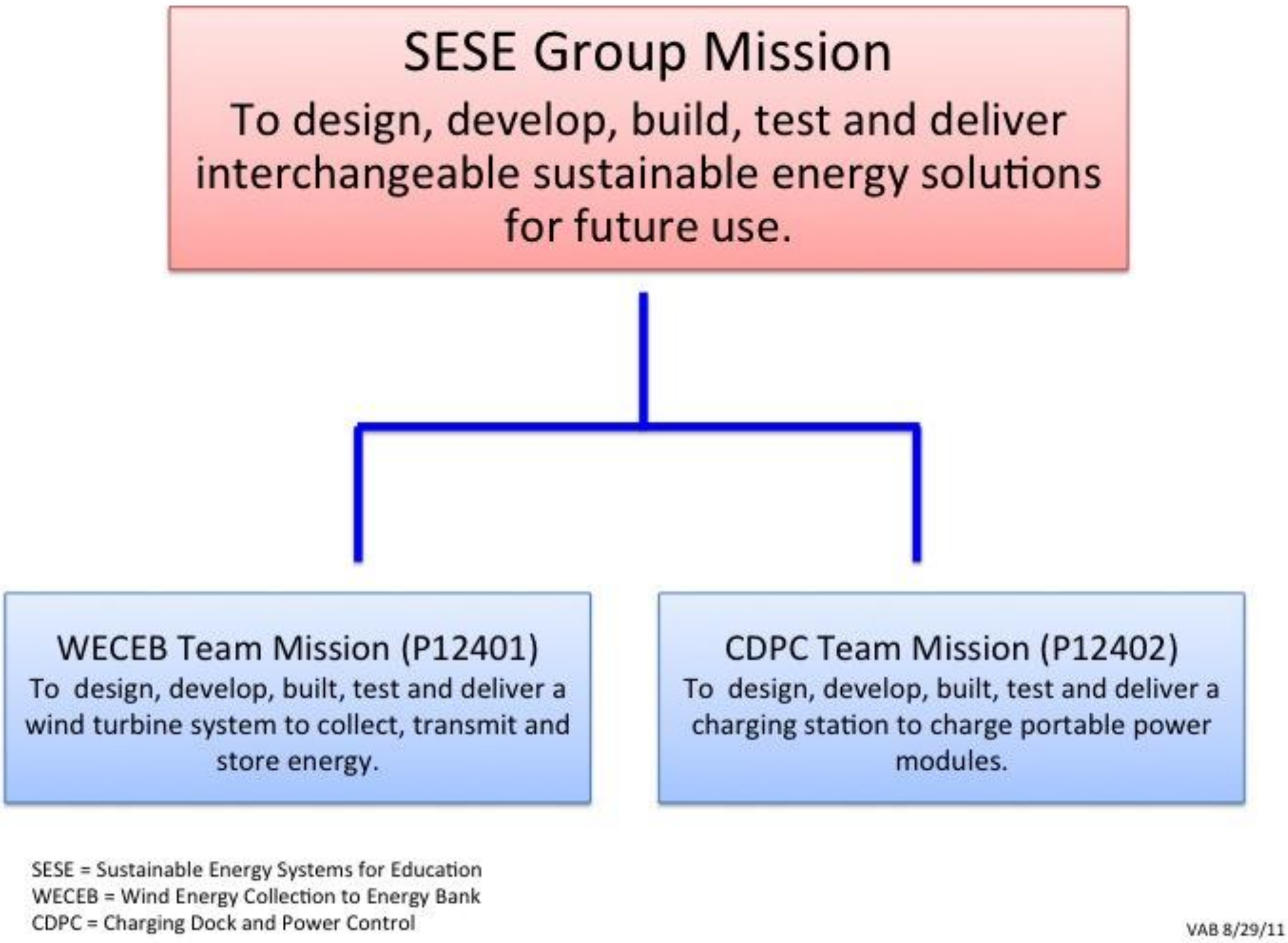
OTHER RESOURCES ANTICIPATED:

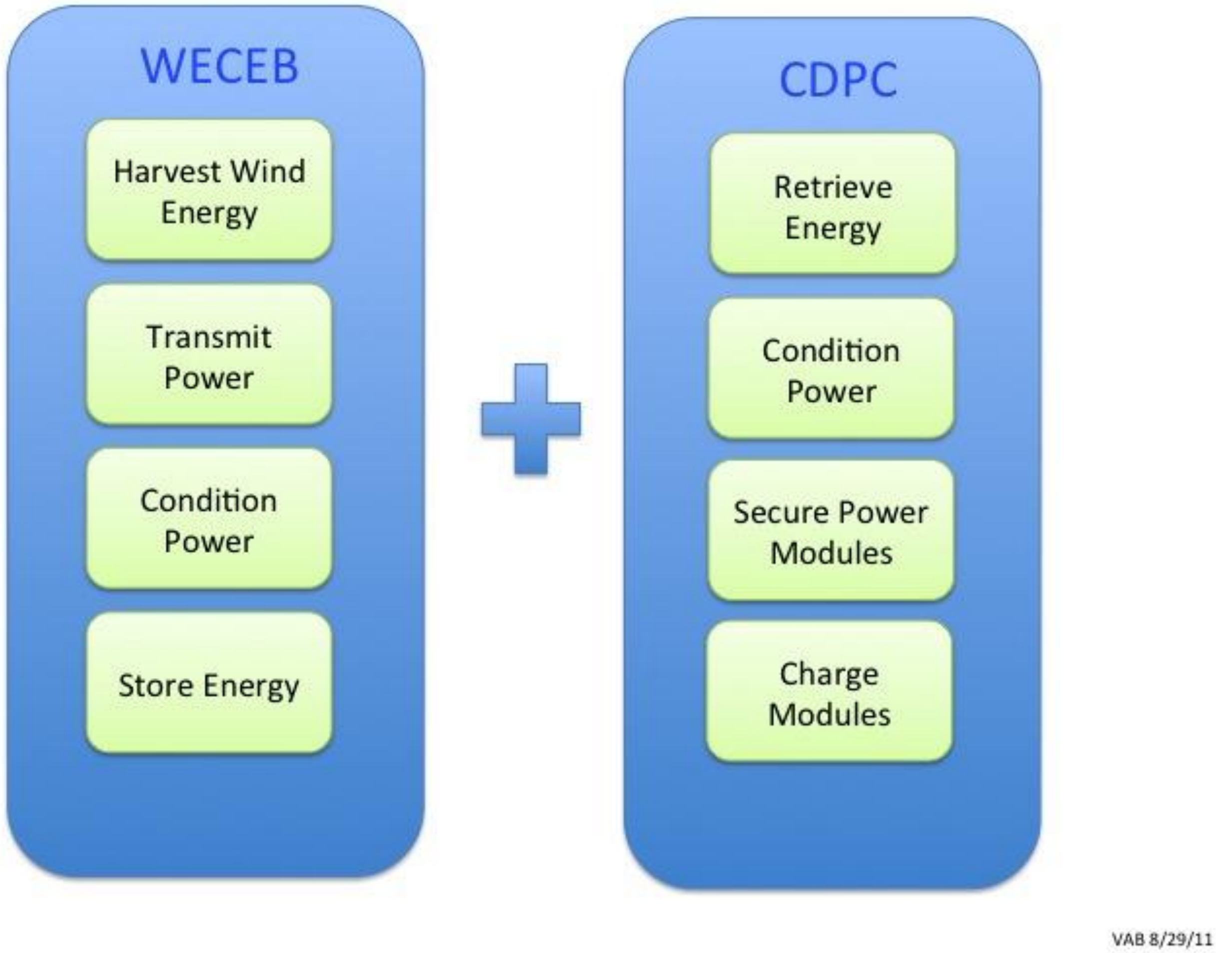
Describe resources needed to support successful development, implementation, and utilization of the project. This could include specific faculty expertise, laboratory space and equipment, outside services, customer facilities, etc. Indicate if resources are available, to your knowledge.

Category	**Description**	**Resource Available?**
Faculty		☐
RIT EE/ME Departments	Faculty expertise from each department for consulting. Expertise in power conversion (EE), metal fabrication (ME), fluids, solid modeling software, and sustainability is preferable.	☐**X**
Environment		☐
RIT, Lab or MSD Floor	A dedicated space to work, safely store large project materials, and test equipment. An open area/field for operations and testing.	☐**X**
Equipment		☐
RIT EE/ME Departments	Labs containing modeling software and hardware for designing, building and testing the system's components. Fabrication equipment (ME machine shop).	☐**X**

Materials		☐
Online and Local Suppliers	Sheet Metal, Metal Stock, Electrical Components, Wires, Connectors, Batteries, PCB, PCB Components,	☐**X**

Prepared by: Leo Farnand Date: 9/1/11


SESE Group Mission
To design, develop, build, test and deliver interchangeable sustainable energy solutions for future use.
WECEB Team Mission (P12401)
To design, develop, built, test and deliver a wind turbine system to collect, transmit and store energy.
CDPC Team Mission (P12402)
To design, develop, built, test and deliver a charging station to charge portable power modules.
SESE = Sustainable Energy Systems for Education
WECEB = Wind Energy Collection to Energy Bank
CDPC = Charging Dock and Power Control
VAB 8/29/11


WECEB
Harvest Wind Energy
Transmit Power
Condition Power
Store Energy
CDPC
Retrieve Energy
Condition Power
Secure Power Modules
Charge Modules
VAB 8/29/11

Some Customer Needs

- Able to power WOCCSE and LVE modules.
- Operate in typical Rochester ambient, wind, temperature and humidity conditions.
- Easy to setup and operate by students.
- Robust against accidental damage.
- Non hazardous to users and other students/passers by.
- Environmentally friendly.
- Long life energy storage/battery modules.
- Quick recharge times.
- Open source, open architecture solution.
- Available for use beginning in the fall semester 2013.
- Easy to service.
- Maximize use of commercial off-the-shelf (COTS) components.
- Use commercial AC power as a backup energy source.
- System Unit Manufacturing Cost (UMC) target of $200 in qty's of 30.

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Project Task Sampler
Organize/Staff Team(s)
Plan Project Activity
Execute Tasks
Monitor Activity
Solve Problems
Document Work
Communicate
VAB 8/29/11

Some Project Constraints

- Use of preferred suppliers and CAD/CAM/CAE development tools.
- Make/Buy strategy.
- Project budget to design/build = $1,000
- Documentation uploaded to EDGE
- Compliance with all applicable regulatory agency requirements.
- Adherence to all RIT institute policies and procedures.

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