



Mobile Elemental Power Plant MEPP

SUSTECH 2013

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MEPP

- Integrate alternative energy methods into the curriculum
- Applied programs
 - Require active learning
 - Hands-on approach
 - Real world applications
- Creative solution to engage students
- Campus restrictions



MEPP

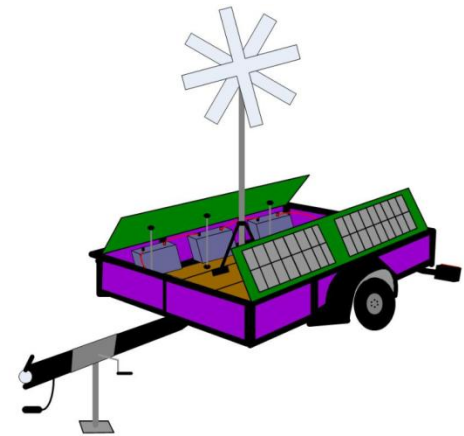
– Initial Research Project

- Determine feasibility of developing a portable renewable power station to replace a typical gas generator
 - Hybrid Power
 - Cost effective
 - Purposeful



MEPP

- Initial Research Team
- 3 EET Students
 - Concept Drawing
 - Determine Major System Components
 - Research
 - Specifications
 - Price
 - Availability
 - Size and weight
 - Results
 - Mobile Elemental Power Plant (MEPP)
 - Project plan with concept drawing
 - Component list with vendor selections
 - Budget
 - Research grants for project funding





MEPP

- Mobile Elemental Power Plant (MEPP)
 - Multidisciplinary Capstone Research Project
 - 4 Engineering Technology Faculty
 - 24 Engineering Technology Students
 - » DET (2)
 - » EET (8)
 - » MET (7)
 - » MfET (7)



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- Grants and funding \$11,720
- Donations from our Industry Partners
- Additional \$3500 Office of Undergraduate and Research Grant - students
- \$1480 faculty Research Scholarship and Promotion Grant (RSPG)



MEPP

– Design Specifications

- Quick setup and tear down
 - Less than 30 minutes
 - 2 person
- Light weight, towable
- Small envelope
- Sustainable, hybrid power
 - Solar
 - Wind



MEPP

- Multidiscipline Teams
 - Trailer
 - Mast/Turbine
 - Solar
 - Electrical
 - Battery Bank
- Team budgets
- Design, Analysis, Prototype, Fabrication, Assembly, System Integration and Test

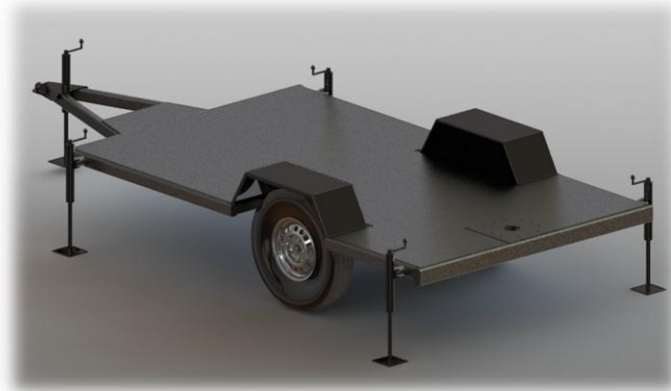
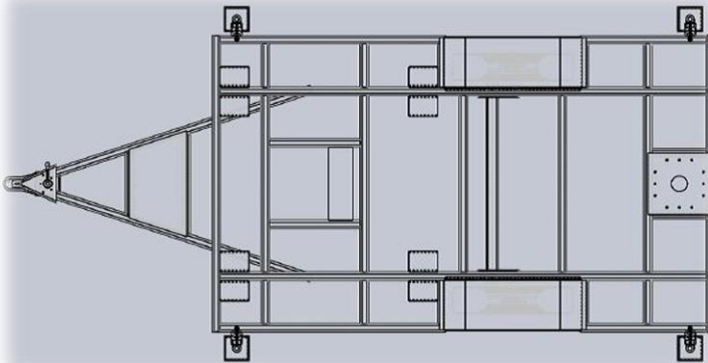


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– Trailer

- 6 foot by 10 foot single axle trailer custom design
 - Steel decking with steel mounting plates
 - Stabilizer jacks
 - 3500 lb capacity





MEPP

– Mast

- Total Mast Solutions (England)
- \$3800
- 30 foot Aluminum telescoping pneumatic mast
- 4.5 inch diameter
- 5 sections, 4 extendable



– Wind Turbine

- Sunforce 600 Watt turbine
- 4.3 feet diameter
- Fiberglass blades
- Excess wind speeds >100 mph
- Generation above 4 mph

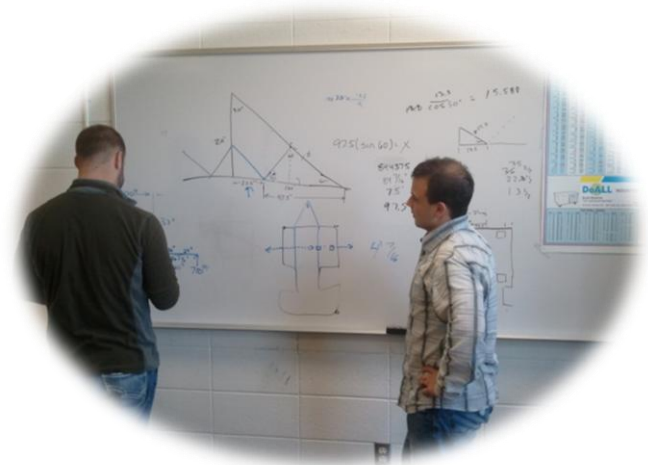


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MEPP

– Outrigger System

- Quad Pod System
- Stabilization of Mast
 - Guy wire
- Removable for storage



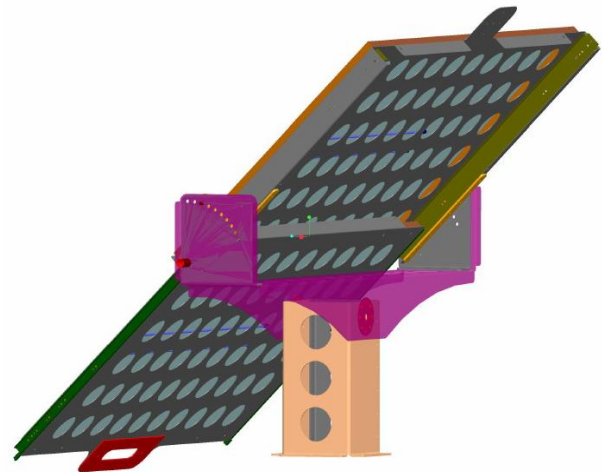


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– Solar Panel System

- Sunmodule (2 each)
 - 240 Watt
 - monocrystalline silicon
 - 60 cells/module
- 10 degree angle selection
- Sliding rack system



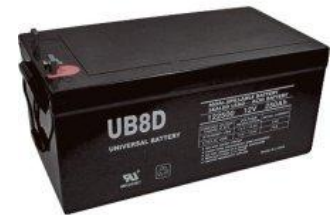


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– Battery Bank

- Universal Battery
 - Four each 12V
 - 250 Amp-Hour
 - Deep Cycle
 - Sealed Lead Acid (SLA)
 - Absorbed Glass Mat (AGM)
 - 161 pounds each
 - 1250 cycles (30% discharge or less)





MEPP

- Xantrex Solar Charge Controller
 - Maximum Power Point Tracking (MPPT)

- Samlex America Inverter
 - 3000 Watt
 - 24VDC – 120VAC pure sine wave inverter

- Coleman Air Diversion Load
 - 35 Amp, 1000 Watt, 24V

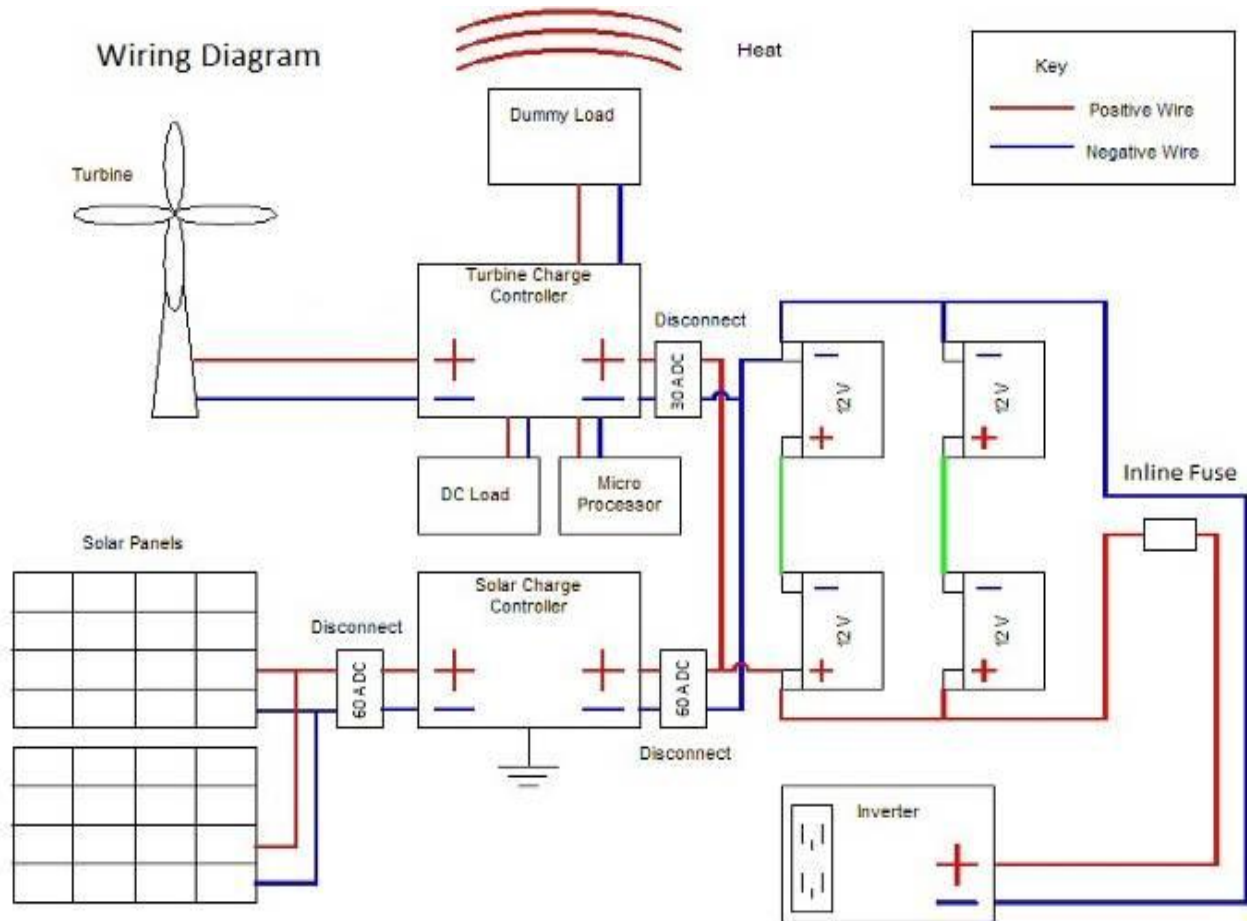
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MEPP

– MEPP Applications

- Remote medical services
- Disaster relief situations FEMA
- Military operations
- Recreational
- Remote governmental applications
- Commercial sites
- Educational
 - Lab experimentation
 - Extended research projects



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– Advantages

- Sustainable
- Portable
- Clean and quiet





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MEPP

M_{obile}E_{lemental}P_{ower}P_{lant}

Team Members

Faculty	Derek Lytle
Julie McCulley	Michael Davis
Meg Leatherbury	Austin Garrett
Dustin Birch	Toni Hanhdung Dinh
Kelly Harward	Justin Clarson
	Shawn Hoesel
	Brent Taft
Students	Collin Lewis
Brian Denkers	Miles Huntington
Ian Jenkins	Mathew Warr
Mery Suberville	Mike Ramstetter
Chris Evans	Kirk Brown
Spencer Mark	Joe Stewart
Brian Gray	Matthew Wilson
Ryan Rich	
Nick Pantuso	
Matthew Palmer	

Project Purpose

With an ever decreasing supply and increasing cost of fossil fuels, there is a growing need and demand for alternative energy solutions. Billions are spent every year on research and development of alternative energy. The Engineering Technology Department at Weber State University understands the importance of educating students about alternative energy. The Mobile Energy Power Plant, or MEPP, incorporates combined renewable energy sources on a mobile platform. The four programs participating in the MEPP project include Mechanical Engineering Technology, Manufacturing Engineering Technology, Electronics Engineering Technology, and Design Graphics Engineering Technology. The MEPP concept can be used in many situations including restricted remote locations, disaster relief conditions, search and rescue teams, or simply environmentally conscientious consumers. This project provides students with an overall engineering experience realistic to industry. Students not only learn about the challenges of designing and implementing their team focus, but also working with all teams to overcome the complexities of uniting complex subassemblies.

Sponsors



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MEPP

- Functionality Test Phase Mechanical/Electrical
 - Three locations
 - WSU
 - West Haven, Utah
 - Tusher Mountains, Southern Utah





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- Road Testing
 - City, Interstate, and remote area travel
- Variety of Weather Conditions





MEPP

- Functional Electrical Testing
 - Local
 - Remote
- Local
 - < 1800 Watt loads short durations
 - > 500 Watt loads for longer durations (over 4 hours)
 - Monitor Solar vs. Wind generation





MEPP

– Electrical Testing

- National Instruments NI 9171 USB Chassis
- NI 9219 4 channel Analog Input Module
- ACT200-10-S AC current transducer
- DCT200-10B-24S DC current transducer



MEPP

– Electrical Testing

- AC current transducer
 - Monitor inverter output
- DC current transducers
 - Solar charge controller
 - Turbine charge controller
 - Inverter input
 - Battery bank



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– Electrical Testing

- Turbine
 - Manual test: 480 Watts at 500 RPM approx. 25mph
 - 9 mph to start generating < 100 Watts





MEPP

– Electrical Testing

- Solar

- Uses Maximum Power Point Tracking (MPPT) technology
- 350 Watts
- Average of 200 Watt/hr throughout the day





MEPP

– Outcomes

- Multidisciplinary research project with cross-functional teams
- Real-world application in alternative energy and sustainability
- Instructional applications
 - Coursework and lab activities
 - Student involved projects
- Hands-on experience with various forms of alternative energy
- Outreach activities



MEPP

– Future of MEPP

- Investigate possibility of integrating hydroelectric power
- Mini-MEPP
- WSU Office of Sponsored Projects (OSP)
 - Marketability
 - Industry Partners



MEPP

– Thank you!