



## Precise Energy Separation

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### **Precise Energy Separation(PES) Power Storage/Pulse Generator Switching Circuit**

Capstone 2014/2015 Senior Project

#### **About PES**

Precise Energy Separation (PES) is a patented process that produces a molecular level reaction cleaving the bonds between atoms through use of specific, focused light (photon) energies providing a unique and efficient method of water and air purification. This completely new technology is a quantum leap forward over existing environmental treatment and sustainable alternative energy technologies. Industries where PES can be applied are aquatic and air invasive species remediation, hospital/nursing home facility sterilization, sterilization & pasteurization, water and Ammonia-splitting (for Hydrogen Gas formation for use in a fuel cell), water and wastewater treatment, PCB remediation, and medical drug delivery, to mention only a few of the many commercial uses of PES.

#### **Project Description**

The ultimate goal of Fahs Stagemyer's PES technology is to develop a portable, scalable, and tunable pulse energy system. A PES system will consist of an Energy Source (Standard AC current to alternative energy sources such as Solar, Wind and Hydro), a AC/DC or DC/DC energy converter/amplifier, an Energy storage system, a solid state or similar switching system with a triggering/DC current distribution network, a software control (monitor and response) system, an energy pulse distribution source (Flash lamp, laser to Magnetic field), and a site-specific environmentally friendly casing. The 2014/2015 Capstone PES project will consist of the building and testing of a PES bench top power storage and switching circuit system and the integration of the pulsed-power to the light source interface which will meet the requirements of portability, scalability, and tunability. A computer software system will modify the pulsed power and frequency based on a given data input. An example of this would be a higher peak pulse power and frequency requirement when trying to kill a target concentration of invasive species in a liquid sample, with a changing Percent UltraViolet Transmittance(%UVT), that is more turbid than typical.

Note: A theoretical power storage and switching circuit has been designed by URI grad students (summer of 2014) which will be used as a basis for the build phase of this system.

#### **Objectives/Deliverables**

- Identification and qualification of vendors who will supply electrical parts for the Converters, Chargers/amplifiers, Ultra-Capacitors (Energy Storage), Switching circuit with original power supply from a typical 110V/60Hz electrical outlet and/or a DC energy source (Solar, Wind or Hydro).
- Qualification and performance validation of all system components for scalability from a tested bench-top model.
- Corroborate with Lamp vendor to ensure power requirements of lamps are met by the switching circuit.
- Design, build and test a bench-top power source, switching circuit, %UVT sensor, and computer software interface validating the PES technology.

## System Requirements

- Lamp:
  - Discharge dissipate time:  $< 20 \mu\text{s}$
  - Average impedance during discharge:  $< 70 \Omega$
  - Current endurance:  $> 50\text{A}$
  - Frequency: 40 – 50 Hz
  - Physical size: 12-16 inches in length/ Bore: TBD
  - Xenon pressure:  $\sim 450$  Torre
- Capacitor for the lamp:  $\sim 60 \text{ nF}/7.5\text{kV}$
- Trigger circuit: Running at the lamp frequency. Trigger voltage depends on the lamp property ( $\sim 20\text{kV}$ )
- Power supply for the lamp: Charger – AC-DC and/or DC-DC amplifier
- %UVT sensor with Computer interface

### *Overall system requirement:*

To provide a constant pulse emission of UV light which can penetrate through a doped quartz sleeve and challenge water at a minimum power intensity of  $2 \text{ watts}/\text{cm}^2$  at the wavelength range of 230nm-350nm.

## Team Requirements

Electrical Engineers (2-3) - source, assemble, and test all electrical components of the final Test Unit--Includes lamp, circuitry, and sensors, etc.

Computer Engineer – source or write the software program to set the tunability of the peak power pulses with the %UVT sensor.

## Contact Information

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