



## RedWave Energy, Inc.

### *High Speed Diode and Rectenna for Waste Heat to Electricity Harvesting*

**Program:** OPEN 2015

**ARPA-E Award:** \$3,565,018

**Location:** Wheaton, IL

**Project Term:** 05/26/2016 to 05/25/2019

**Project Status:** ACTIVE

**Website:** [redwaveenergy.com](http://redwaveenergy.com)

**Technical Categories:** Distributed Generation

#### **Critical Need:**

Most power plants operate on the same general principles: energy-dense fuel is burned to release heat, which boils water to make steam; this steam is used to spin a turbine that generates electricity. In 2013, centralized thermoelectric U.S. power plants converted 33% of the energy in the fuel is converted into electricity. In other words, the power plants had an average electricity generation efficiency of only 33%, wasting two-thirds of primary energy as heat. Innovative technologies to use this waste heat to generate more electricity could improve the overall efficiency of thermoelectric power production.

#### **Project Innovation + Advantages:**

The team led by RedWave Energy, Inc. will develop a waste heat harvesting system, called a rectenna, that converts low-temperature waste heat into electricity. Rectennas are nanoantennas that convert radiant energy to direct current (DC) electricity. The rectennas are fabricated onto sheets of flexible material in tightly packed arrays and placed near key heat sources such as the turbine's condenser, heat exchanger, and flue gas cooling stack. Heat radiates onto the nanoantennas and energizes electrons on the antennas' surface. These electrons are rectified by the system, resulting in DC power. This technology will target the waste heat in industrial processes and thermoelectric power generation.

#### **Potential Impact:**

If successful, innovations from RedWave Energy's project will allow widespread utilization of waste heat produced by power plants and industry. Capturing this heat and converting it to electricity will dramatically improve the overall energy efficiency of U.S. power plants.

#### **Security:**

Improving the energy output of U.S. power plants will increase the resiliency of electricity production.

#### **Environment:**

The increased electricity captured from waste-heat is generated without the greenhouse gas emissions associated with traditional electricity production from fossil fuels.

#### **Economy:**

Power plants implementing this technology could yield up to a 30% increase in efficiency, helping to reduce costs for utilities and consumers.

#### Contacts

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#### Partners

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