

Semi-Year Progress Report:

Project Number and Title: *URI Project 1.11 Energy Harvesting and Advanced Technologies for Enhanced Life*

Research Area: *Development of Improved Road and Bridge Monitoring and Assessment Tools*

PI: *K. Wayne Lee, University of Rhode Island (URI), Civil and Environmental Engineering*

Co-PI(s): *Michael L. Greenfield, URI, Chemical Engineering and Sze Yang, URI, Chemistry*

Reporting Period: *April – September 2019*

Date: *9/30/2019*

Overview:

Provide overview and summary of activities performed during previous six months...

Literature review utilizing the Seebeck/Peltier Effect (thermoelectric effect) was further researched and reviewed. The parts for the energy harvester were ordered online and delivered to the new engineering building. Currently, the solar apparatus is being further designed and built based on European and Texas studies.

Provide context as to how these activities are helping achieve the overarching goal of the project...

The project goal is to extract energy from a pavement that experiences heating due to incoming solar radiation. Warm water and small thermoelectric voltages are two possible ways to extract this experimentally. The first two activities relate to testing this extraction experimentally. The third activity relates to evaluating the feasibility and success of these steps by using parameterized physics- and chemistry-based models. The solar harvester was heavily analyzed and reviewed prior to the ordering of the materials.

Describe any accomplishments achieved under the project goals...

Data testing on the pavement core model with an embedded water pipe was an accomplishment for the project. (See Figure 1).

Describe any opportunities for training/professional development that have been provided...

The graduate students working on the project are both in the non-thesis Civil Engineering master's program. They are receiving training that is not usually available to non-thesis students regarding conducting research and actively participating in the research process.

Describe any activities involving the dissemination of research results (be sure to include workshops, seminars, and conferences attended/held for dissemination of information regarding this project) ...

Research team submitted a 4-page paper that will be published in Scopus/WoS. The paper is titled *Infrastructure Assessments Through Solar Energy Harvesting*.

K. Wayne Lee, David Schumacher, Austin Decotis and Michael Greenfield submitted a paper, entitled "Transportation Infrastructure Assessment through Solar Energy Harvesting" to the Transportation Research Record (TRR) of Transportation Research Board (TRB) on 8/1/19.

Prof. Lee presented a technical paper which Austin and David prepared at UKC2019 in Chicago on 8/14/19.

The 32nd Rhode Island Transportation Forum will be held October 25th, 2019. The theme is “Durable Infrastructure for Sustainable and Resilient Transportation System for Eternal Peace and Prosperity,” and research team plans to present the progress.

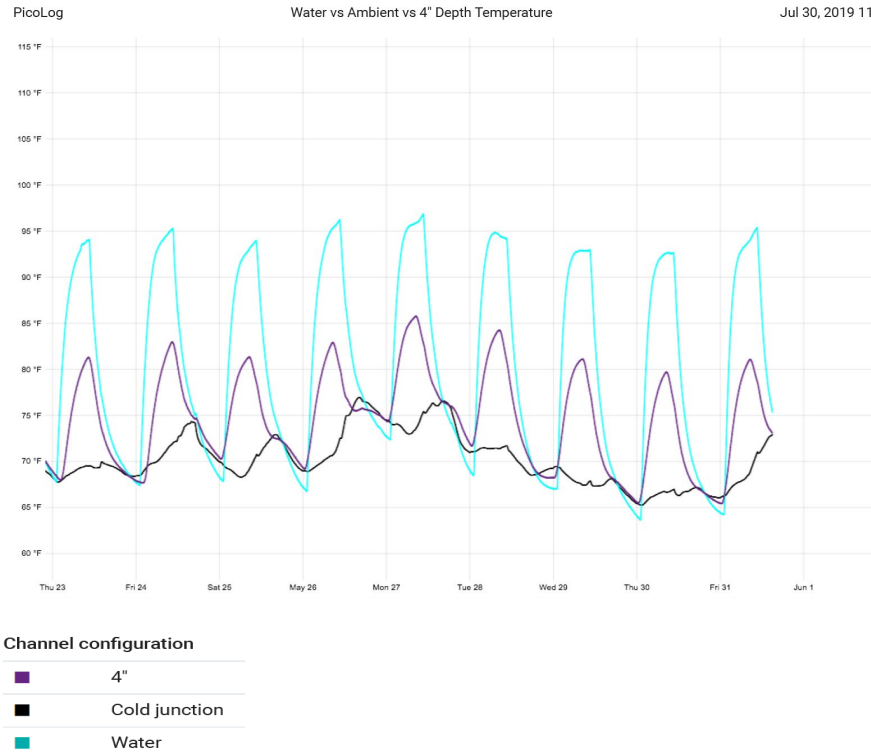


Figure 1: *Four-inch Depth vs Ambient Temperature vs Water Temperature*

Participants and Collaborators:

What organizations have been involved as partners on this project?

University of Rhode Island, Dept of Civil Engineering, Dept. of Chemical Engineering and Department of Chemistry.

Have other collaborators or contacts been involved? If so, who and how?

Name of Technical Champion: Steven Cascione
Title: Programming Services Officer
Organization: RIDOT
Phone number: 401-734-4803
Email: Steven.Cascione@dot.ri.gov

What students have participated in the project? (Include class standing, major, role in the research)

David Schumaker, CVE non-thesis MS student, setting up experiments on heat extraction using water

Austin DeCotis, CVE non-thesis MS student, begun design of the experimental setup on Seebeck effect

Changes:

None.

Discuss and changes in approach and the reasons for the change...

Planned Activities:

Description of future activities over next quarter (10/1 – 12/31/19).

Experiments on Seebeck effect between a hot pavement and a cold sink in the ground will be conducted in the Kirk Lab.

The solar harvester will be fully built and tested. i.e. electricity generation, temperature differential'