Request for Research Funding for FY 2023-2024			
SPR Subpart B Project: (Research Center use only) SMO-24-05			
Requesting Office	SMO	**Priority**	5 of 12
Proposed Title	Durability and Effectiveness Analysis of Solar and Wind-Powered Cathodic Protection Systems		
Justification	Corrosion in marine environments is well understood and pervasive. Systems to prevent corrosion are expensive and require significant maintenance. Significant improvements to renewable power, battery, and wireless technology has made deployable systems possible; however, the use of Solar- and Wind-Powered cathodic protection (CP) systems are limited in both the literature and practice. Previous research by this project team indicated that the as-installed solar-powered system between Piers 115 and 116 of the Sunshine Skyway Bridge did not provide equal cathodic protection as the typical rectified-powered Impressed Current Cathodic Protection (ICCP) systems. It was also noted that the output voltages of the solar panels were reduced overnight, presumably due to a lack of sunlight exposure to the solar panels, reducing current output. The effects of partial cathodic protection from ICCP systems on the structure are unclear. The conversion of Galvanic Cathodic protection Systems to Impressed Current using Solar has only been accomplished at one location in the state of Fl, Niles Channel in the FL, Keys. One additional bridge is scheduled to be converted from Galvanic to ICCP in April of 2023, the Apalachicola bridge in D3. This bridge has jackets installed in 2002 that are no longer meeting the Association for Materials Protection and Performance guidelines for effective CP. Currently, the initiative comprises several trials as listed below. Such trials can generate valuable data for analysis within the scope of this proposed research project. 1. Cedar Key Channel 3 D2 Cedar Key 2. Cedar Key Channel 4 D2 Cedar Key 3. SR404 West Relief D5 Melbourne 4. Buckman Bridge D2 Jacksonville 5. San Pablo Bridge D2 Jacksonville 6. Bents 13 and 19 at US192 D5 Melbourne 7. Tomoka Bridges D5 Ormond Beach 8. Sunshine Skyway D7 Tampa 9. Niles Channel D6 Keys To bridge the knowledge gap, the design and installation of Solar- and Wind-Powered ICCP systems will be observed, developed, and refined. At five bridges (from the list above), a field assessment will be conducted to collect manual measurements including current (on/off) and depolarized potentials a minimum of 48 hours after extinguishing power from the ICCP System per current FDOT protocol. Manual measurements can be used to calibrate data from Remote Monitoring Units (RMU), which provides continuous monitoring of the ICCP power supply. RMU data will be reviewed monthly, and a summary letter will be provided each month. After 3-6 months modifications, improvements will be made to the units such as adding more powerful solar panels, wind turbines, batteries, or other equipment. After 12 months, a final report will summarize the performance and recommendations associated with the trial Solar- and Wind-Powered ICCP systems. Based on our study, a preliminary specification language will be provided.		
Impact	The following impacts will be realized: • Rapidly deployable ICCP systems powered by renewable energy sources (solar and wind) • The need for routing alternating current (AC) power to the bridge substructure will be removed • The Solar- and Wind-Powered ICCP systems can be used in new construction or deployed on the existing inventory • These systems have the potential for significant cost savings and can be built and repaired using a variety of components • FDOT will have specification language to use for the implementation of these systems • These systems will be fully and rapidly implementable by the state to address deteriorating infrastructure • Ultimately, these systems can provide more pervasive protection to FDOT's bridges		
Affected Offices	Statewide		
Existing Work	WJE recently carried out a small study as part of to BE-725 regarding the implementation of new solar-powered systems by SMO.		

Keywords Used In Existing Work Search **(Cannot leave blank)**	Solar-Power, Wind-Power, Renewable Energy, Deployable Systems, Cathodic Protection; ICCP System; Impressed Current System; Galvanic System.		
Related Contracts (Give contract numbers)	DOT-RFP-19-9059-GH		
Funding Request	$200,000	**Anticipated Duration**	24 months (24 months in field, with periodic reports)
Project Manager	Shannon Deese	**Contracting Method**	RFP
Equipment			
Urgency	1	Trial Solar-Powered ICCP systems have been installed in several bridges throughout the state.	
Implementability	1	The results are fully implementable within one year.	

Project Benefits

The potential financial benefits of implementing the research results are reducing maintenance costs of bridges by eliminating the need for routing of AC power to the junction boxes.

Project Benefits **(Select all that apply and explain)**	**Quantifiable Benefits (units, dollars, etc…if applicable)**	**Methodology or Data Sources Used to Determine Quantifiable Benefits. If not applicable, please give justification of project benefits**
○ Materials Enhancement	NA	
○ Materials Savings	NA	
○ Time Savings	NA	
○ Lives Saved/Injuries Prevented	NA	
○ Other (Explain)	AC Electrical Power	Solar panels eliminate the need for routing of AC power to the junction boxes.

*Comments should explain and support urgency, financial benefit, and implementability scores