Water Power Technologies Office 2019 Peer Review



Energy Efficiency & Renewable Energy



A cost-disruptive, low impact, modular form factor low-head hydropower system EE0007243

Hydropower Program

October 2019

David Duquette

Littoral Power Systems, Inc. New Bedford MA

Project Overview

ENERGY Energy E Renewa

Project Summary	Project Information
LPS conceived way to build hydro plants using a kit of standard, pre-fabricated	Project Principal Investigators
modular parts based on the form factor of intermodal shipping containers. This project developed designs, analyzed the most critical dam safety functions, tested for leakage and analyzed costs to prove the feasibility of the system.	 David Duquette (LPS) – Commercialization Chad Cox, P.E. (GZA) – Technical
	WPTO Lead
The project exceeded the original goals. The first commercial installation is under way.	 Rajesh Dham, PE Corey Vezina Tim Welch
Project Objective	
 <u>Objectives</u> develop designs for the main modules prove out dam safety cptimize assembly process ICC target: 30% less than traditional rapid time-to-commissioning simple maintenance very low downtime 	Project Partners/Subs
	 GZA GeoEnvironmental Alden Research Laboratory University of Massachusetts – Dartmouth NREL AECOM
	Project Duration
 easy, low-impact decommissioning @ end of SL look for offramps to improve design/ manufacturability (e.g., AM) 	Feb. 1, 2016 throughMarch 31, 2019

Project Impact



credible path to LCOE \leq 0.11/kWh opens up 3GW of ORNL-identified NSD sites



U.S. hydroelectric power project pipeline as of the end of 2018. Figure taken from U.S. Hydropower Market Research Report 2018 Update (April 2019).

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Chad Carpenter

Technology R&D for Low-Impact Hydropower Growth

"Enable the design and development of new Standard Modular Hydropower (SMH) technologies for both existing water infrastructure and new stream-reach development. This new approach to systems design for hydropower projects incorporates ecological and social objectives for river systems earlier in design processes"

Tundra

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Total Project Budget – Award Information		
DOE	Cost-share	Total
\$1,421K	\$371K	\$1,792K

Status: completed

Management and Technical Approach

U.S. DEPARTMENT OF













Technical Accomplishments

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Upstream pool Ice loading Anchor force Upstream water pressure ownstream po Concrete Base Pad Uplift pressure

Global stability analysis

- sliding overturning flotation
- Post-tensioned structure follows
- PTI and FERC guidelines

Seepage analysis w/varying riverbed

compositions

• meets USACE (Cedergren) guides

Leakage worst case per AWWA C563

• 0.07% of flow rate through turbine

Structural integrity

- per AISC and USACE
- a per USACE ETL 1110-2-584
- ISO 1496-1:1990 containers

LCOE analysis

- >50% reduction in civil works cost
- 13.4¢/kWh

Statistical tool - LCOE vs. site

Turbine selection - 20+ considered

Spillway – pneumatic modular

large debris passage

Technical Accomplishments (cont.)







- Estimated time-to-commissioning of 5MW facility is 30 weeks.
- LPS believes this can be cut in half with experience.

Cost Sensitivity





End-User Engagement and Dissemination Strategy



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HYDROELECTRIC PROJECT FERC PROJECT NO. 14425



Application for Federal Energy Regulatory Commission License

December 8, 2017

Progress Since Project Summary Submittal

LITTORAL Power Systems

WHOOSHH

AVISTA

ΑΞϹΟΜ

Rickly

KOOTZNOOWOO

Luminaire Technologies



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LPS/ Whoosh Zero-Ascend OmniSpecies[™] fish passage system



LPS work with Cadens LLC on additive manufacturing

Current work

DE-EE0008778:Control No. 1836-1531Prefabricated standard modular installations for low-cost small hydropower sites

SMH facility with an innovative modular foundation.



Replicated across three greenfield sites that $cost \leq $3,500/kW$ and enhances local ecology and community. © 2019 Littoral Power Systems, Inc.

WPTO work

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Thank you



