

Washington State Ferries – Hybrid-Electric Propulsion Conversion Project

2018 Supplemental Budget Proviso (ESSB 6106, Section 309 (7))

\$600,000 of the Puget Sound capital construction account— state appropriation is provided solely for development of a request for proposal to convert the three ferry vessels in the Jumbo Mark II class to hybrid electric propulsion and make associated necessary modifications to the Seattle, Bainbridge, Edmonds, and Kingston terminals. The department is directed to explore capital project financing options to include, but not be limited to, federal funding opportunities, private or local contributions, and application for Volkswagen settlement funds, and energy-savings performance contracting to be repaid in whole or in part by fuel-cost savings. The department will report total capital cost estimates, optimal construction schedule, annual capital and operating savings or costs, and a recommended funding option to the governor and to the transportation committees of the legislature by June 30, 2019.

Background

Washington State Ferries (WSF) has been exploring the feasibility of converting vessels to hybrid-electric propulsion system since 2012. Over the last few years, hybrid technology has developed rapidly, with ferry systems reducing their emissions by building hybrid and all-electric vessels. Prompted by the need to update the obsolete and unsupportable propulsion controls on its three Jumbo Mark II vessels, WSF revisited the idea in 2017. Rapid advancement in energy storage and charging technologies suggested that considerable cost savings could be realized through a conversion of these vessels. WSF conducted two hybrid conversion studies¹ and concluded a conversion of three Jumbo Mark II vessels would be fiscally, environmentally, and operationally advantageous. Subsequently, in 2018, the Legislature included \$600,000 for WSF to develop a request for proposal (RFP) to convert these vessels to hybrid-electric propulsion.

Procurement Strategy

The initial request for funding assumed a design-build approach in which funds would be used to develop a single contract for the design and construction of three vessels and four terminals. Further considerations of contracting strategies resulted in an alternate design-bid-build approach, for the following reasons:

- The vessel propulsion system original equipment manufacturer (OEM) retains proprietary system information that is unavailable to WSF or other potential propulsion system integrators.
- A single-source RFP with the OEM pursuant to RCW 47.56.030(2) effectively limits the scope of the conversion while reducing technical risk. The scope of this contract is for the preliminary engineering, system integration, and procurement of OEM-proprietary equipment.
- Separate contracts for vessel construction and terminal modifications will provide for competition and reduced cost. The services of the OEM system integrator in support of these subsequent contracts reduces technical risk.

The RFP was issued in August 2018 and included Part A, design work to replace obsolete equipment and Part B, design work for hybrid conversion. Part A was awarded in March 2019. Part B is pending award subject to the availability of funding.

Proviso Expenditures

The above contracting approach required substantially less funding than anticipated. The funding supported contract development, proposal evaluation, a cost risk assessment, meetings with industry and utility

¹ [WSF Medium Voltage Shore Power Feasibility Study \(2018\)](#); [Jumbo Mark II Class Hybrid System Integration Study \(2018\)](#)

representatives, grant funding research and application development, and financing discussions. A cost Breakdown is as follows:

Direct Labor Support	\$ 6,826	WSF fleet engineer hourly wages
Contractor Support	\$322,339	Consultant support
Indirect Support	\$ 43,523	WSF staff efforts
Total:	\$ 372,688	

Financing Options

WSF has worked with WSDOT finance staff, the Office of Financial Management, the Department of Commerce, and the Department of Ecology to explore capital project financing options. These efforts continue, but a summary of findings to date are as follows:

Federal Funding: This project is eligible for Federal Highway Administration funds, but not Federal Transit Administration funds due to FTA’s more stringent “Buy America” requirements. WSF has already succeeded in winning \$6M in [FHWA Congestion Mitigation and Air Quality Improvement Program](#) funds for equipment purchases for the first two vessels. Other federal funding sources include the [Environmental Protection Agency Clean Diesel Program](#) funding. To be competitive, design work must be completed prior to application, but the project would compete very favorable for up to 6 elements of our JMII hybrid program. The 2019 Region 10 cap is \$900,000, so the opportunity could be up to \$5.4M.

Volkswagen Settlement Funds: Washington State has been allocated \$112,745,650 in VW Mitigation Funds. Marine vessel projects are eligible for up to 45% of this, or \$50.7M. Working with the Department of Ecology, WSF has a pending application for \$35M to fund the conversion of one vessel. Additional funding requests may be submitted for additional elements of the project.

Energy Savings Performance Contracting: WSF met with Siemens Government Services, Inc., a certified Energy Services Company (ESCO) to evaluate options for Energy Savings Performance Contracting (ESPC). The WSF team considers this approach infeasible for this project for several reasons. Primarily, financing at a reasonable rate relies on certainty of fuel savings. The scope of this project does not provide this certainty to the financier. A second reason is that such a financing scheme would transfer a large portion of the cost savings to the financier, rather than the state.

Private or Local Contributions: WSF is working with the [Department of Commerce](#) and [Maritime Blue](#) to identify opportunities for public-private partnerships, private contributions and private financing. There is growing support for carbon-reduction initiatives, and Maritime Blue has developed a strategy for Washington’s maritime sector to become a global leader in innovation and sustainability. The Jumbo MKII Conversion is a Maritime Blue demonstration project that could potentially attract such support from the private sector.

Capital Cost Estimate

In June 2018 WSF conducted a Preliminary Cost Risk Assessment. The preliminary cost and schedule estimates were developed based on pre-design studies. Unlike these studies, however, these efforts focused on the preliminary route to be affected, Seattle-Bainbridge. This was for practical reasons, as the base data was very preliminary and evaluating all four terminals would have made the risk assessment process overly-complicated. This approach was consistent with WSF’s budget request and grant applications. A preliminary cost of \$132 million for two vessels and two terminals is aged as follows:

	FY20	FY21	19/21	FY22	FY23	21/23	Total
Vessels Conversions							
Vessel No. 1							
PE	\$8,000,000	\$1,000,000	\$9,000,000			\$0	\$9,000,000
CN	\$12,000,000	\$23,000,000	\$35,000,000			\$0	\$35,000,000
Total	\$20,000,000	\$24,000,000	\$44,000,000	\$0	\$0	\$0	\$44,000,000
Vessel No. 2							
PE			\$0	\$2,310,000		\$2,310,000	\$2,310,000
CN			\$0	\$10,690,000	\$20,000,000	\$30,690,000	\$30,690,000
Total	\$0	\$0	\$0	\$13,000,000	\$20,000,000	\$33,000,000	\$33,000,000
Terminal Electrification							
Seattle							
PE	\$1,500,000	\$1,500,000	\$3,000,000	\$500,000		\$500,000	\$3,500,000
CN		\$2,615,000	\$2,615,000	\$8,385,000	\$16,000,000	\$24,385,000	\$27,000,000
Total	\$1,500,000	\$4,115,000	\$5,615,000	\$8,885,000	\$16,000,000	\$24,885,000	\$30,500,000
Bainbridge							
PE	\$1,300,000	\$1,300,000	\$2,600,000	\$400,000		\$400,000	\$3,000,000
CN		\$1,000,000	\$1,000,000	\$7,500,000	\$13,000,000	\$20,500,000	\$21,500,000
Total	\$1,300,000	\$2,300,000	\$3,600,000	\$7,900,000	\$13,000,000	\$20,900,000	\$24,500,000
Total Project	\$22,800,000	\$30,415,000	\$53,215,000	\$29,785,000	\$49,000,000	\$78,785,000	\$132,000,000

Since the 2018 Cost Risk Assessment workshop, WSF has worked to manage the major cost and schedule risks identified. One promising idea is the placement of the more complex elements of the rapid charging system on the vessel, rather than the terminal. This change would avoid costly over-water construction, minimize the impact on tribal agreements, and locate the high voltage connection off of the vessel, away from passengers. Initial estimates suggest this would reduce the above costs by approximately \$14M total (a cost increase for the two vessels would be about \$17M; a cost reduction for the two terminals would be about \$31M). WSF will update the Cost Risk Assessment and associated cost and schedule estimates once the hybrid design is complete.

Optimal Construction Schedule

The optimal schedule would support completion of the hybrid conversion with the scheduled preservation work on all three vessels. The following schedule was established during the Cost Risk Assessment workshop.

Major Activity	Dates
<i>Vessel Design</i>	<i>Jun-Dec 2019</i>
<i>Vessel No. 1 Construction</i>	<i>Jun-Nov 2021</i>
<i>Vessel No. 2 Construction – pending funding</i>	<i>Jul-Nov 2022</i>
<i>Seattle Utility Improvements</i>	<i>TBD</i>
<i>Bainbridge Island Utility Improvements – pending funding</i>	<i>TBD</i>
<i>Terminal Design – pending funding</i>	<i>July 2019-Jan 2021</i>
<i>Terminal Construction (Seattle and Bainbridge) – pending funding</i>	<i>Apr 2022-Apr 2023</i>
<i>Terminal/Vessel Testing – pending funding</i>	<i>Apr-Jul 2023</i>
<i>Seattle Bainbridge Route Electrification Complete</i>	<i>Jul-2023</i>

Unfortunately, this schedule is likely unachievable due to delays in funding.

Capital and Operating Cost Savings

The following is a summary of cumulative cost savings for the scope of two vessels and two terminals, Seattle and Bainbridge Island. Costs and savings reflect the above schedule, US Energy Information Agency fuel costs projections, and the following additional assumptions: 25% Fuel Savings with zero terminal improvements, 50% savings with 1 terminal improvement, and 95% savings with both terminal Improvements. The estimated payback period for a cost of \$132M is 25 years, or the year 2044. The JMII vessels have approximately 40 years of service life remaining.

Operating Cost Impacts (2 Vessels)	Cummulative Cost Savings			
	2020-2029	2020-2039	2020-2049	2020-2059
Electricity Cost	\$ (13,329,660)	\$ (36,516,002)	\$ 60,915,162	\$ 86,527,130
Battery Replacement Cost	\$ (10,380,000)	\$ (23,520,000)	\$ 34,140,000	\$ 44,640,000
Fuel Savings	\$ 59,717,770	\$ 153,517,770	\$ 247,317,770	\$ 341,117,770
Diesel Engine Maintenance Avoidance	\$ 2,000,000	\$ 6,000,000	\$ 9,000,000	\$ 12,000,000
Cumulative Savings	\$ 38,008,110	\$ 99,481,768	\$ 161,262,608	\$ 221,950,640

Recommended Funding Options

The Volkswagen Settlement funds and FHWA CMAQ funds, totaling \$41M, will provide a substantial jumpstart to this program, but additional funding will be needed. WSF and WSDOT finance staff will continue to pursue all of the opportunities mentioned above. In addition, the Office of Financial Management is pursuing Certificate of Participation bond financing.