Port of Juneau

City & Borough of Juneau • Docks & Harbors
155 S. Seward Street • Juneau, AK 99801
(907) 586-0292 Phone • (907) 586-0295 Fax

July 11th, 2021

The Honorable Pete Buttigieg
Secretary of the U.S. Department of Transportation
Office of the Secretary of Transportation
1200 New Jersey Ave, SE
Washington, DC 20590

RE: 2021 RAISE Transportation Discretionary Grant | Port of Juneau Dock Electrification Grant

Dear Secretary Buttigieg:

The City and Borough of Juneau – Docks & Harbors Department is seeking Rebuilding American Infrastructure with Sustainability and Equity (RAISE) Transportation Discretionary Grant funding to provide the shoreside power connection which will allow large cruise ships to shift to clean hydropower-generated electricity when in port. Once constructed, this project will reduce greenhouse gases and provide a cleaner local environment ensuring Juneau remains a highly desirable port-of-call for the Alaskan cruise ship itineraries.

Docks & Harbor is committed to seeing this project through and providing necessary infrastructure to support the local community and the cruise ship industry. Tourism is now the largest private economic industry in Southeast Alaska and in 2019 Juneau welcomed 1.3M passengers. We are optimistic our grant application fully meets the Administration's vision outlined in the NOFO to address climate change. In May, my Port Engineer and I were privileged to have the opportunity to brief Ms. Lucinda Lessely, the Acting MARAD Administrator, on the infrastructure concerns challenging the 49th State, including the Juneau needs contained in this application.

As Alaska's capital city, Juneau is known primarily as a government town. Unfortunately, over the past decades this has led to a neglected waterfront and economic opportunities afforded to well-managed, diversified ports and harbors have largely gone unfulfilled. The aphorism that *a rising tide floats all boats* cannot be truer in Juneau. Since 2012, Docks & Harbors has invested nearly $136 million in infrastructure improvements, recapitalizing half-century old port and harbor facilities.

Though much has been accomplished, the vision to create and leverage economic diversity through smart, sustainable and expanded marine infrastructure requires funding sources outside what Juneau, with its 32,000 residents, can provide.

Of the $136 million recapitalization efforts, less than 8 percent has been from federal grants or federal partnerships. This includes $10 million from the USACE to conduct statutory maintenance dredging in Douglas Harbor, Harris Harbor and Aurora Harbor; $3 million through a Sport Fish grant for the recently opened $12 million Statter Harbor Launch Ramp; and $175,000 for cruise ship security improvements under two FEMA Port Security Grants.

In addition, in testament to the investment and pride Docks & Harbors takes in our facilities, we have received numerous awards since 2012. This includes:

- Five Juneau Branch American Society of Civil Engineers (ASCE) Project-of-the-Year Awards
- Two Juneau Branch ASCE Engineer-of-the-Year Awards
- Pile Driving Contractors Association (PDCA) National Project-of-the-Year Award
- Precast Concrete Institute (PCI) Award
- Anchorage (AK) Engineers Week Project of the Year Award
- Two Engineering News-Record (ENR) Project-of-the-Year Regional Awards
- ENR Innovation Award for the new cruise ship berths project
- States Organization for Boating Access (SOBA) National Project-of-the-Year Award for the Statter Harbor Launch Ramp

To ensure local support of our initiatives, Docks & Harbors conducts comprehensive community involvement to engage the public throughout our visionary efforts. In 2017, we completed the expansion of the downtown cruise ship docks which was identified in the 2004 Long Range Waterfront Plan. In 2018, Docks & Harbors completed a plan linking the new cruise ship berths to the downtown shopping areas. This $15M uplands development plan was fulfilled with a ribbon cutting ceremony this May. Cruise ship dock electrification studies have been completed in 2016 and 2021 which follows the Assembly adopted *Juneau Climate Action & Implementation Plan* from 2011. The Juneau community is in full support of advancing the infrastructure to provide access for visiting cruise ships to use locally generated, clean energy for their dockside use.

The City and Borough of Juneau Docks & Harbors respectfully requests consideration of our application to expand our marine services facilities at our cruise ship docks to provide electrical shore tie. We have a proven track record, a plan to expand economic opportunity and the ambition to make our port and harbors a world-class destination.

Sincerely,

Carl J Uchytil

Carl Uchytil, P.E.
Port Director

2021 RAISE Transportation Discretionary Grant Application:
Juneau Cruise Ship Dock Electrification Project

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I. Project Description

Juneau Alaska is a premier cruise ship destination. The Juneau Cruise Ship Dock Electrification Project will enable cruise ships visiting the community to plug into renewable shore power, thereby allowing the ships to operate without onboard fuel-fired generators and reduce carbon gas emissions in Juneau's port. The dock electrification project includes two new power connection floats, cable positioning devices, submarine cables, a shared electrical substation, and upgrades to existing electrical systems. Juneau's two city-owned cruise ship berths sit in the heart of downtown Juneau. Completed in 2017, the berths provide moorage for neopanamax cruise ships. The project will connect cruise ships moored at these docks with electricity generated by the utility's hydroelectric power plants, providing a critically important reduction of vessel emissions in downtown Juneau and provide an alternative to vessel power generation while in port.

Project Need

The primary purpose of the Juneau Cruise Ship Dock Electrification Project is to replace diesel used for cruise ship hoteling — when docked ships provide power, heat, air conditioning, and hot water for guests and staff, like a floating hotel — with shore-based hydroelectric power while visiting the community. Over a 20-year period, the installation of shore power at the two City and Borough of Juneau (CBJ) docks would eliminate cruise ship emissions of 46,314 metric tons of CO_2, 1,681 metric tons of NO_x, 1,337 metric tons of SO_x, and 130 metric tons of $PM_{2.5}$. that now occur when cruise ships run auxiliary engines for hoteling while in port at those berths. This will allow the community to realize the benefits of a successful, sustainable visitor industry while remediating environmental impacts associated with visiting cruise ships.

Project Goals

The Juneau Cruise Ship Dock Electrification Project will:

1. Displace 4.6 million gallons of diesel with hydroelectric shore power over a 20-year period.
2. Reduce air emissions in Juneau by nearly 50,000 metric tons of combined CO_2, NO_x, SO_x, $PM_{2.5}$ over a 20-year period.
3. Support 3,390 jobs, $100 million in wages, and $300 million in tourism spending, annually.
4. Provide a monetary benefit of $76 million, more than 3 times higher than the requested investment costs.

Transportation Challenges Addressed

The predominant benefit of the Juneau Cruise Ship Dock Electrification Project is the reduction of vessel greenhouse gas emissions by providing shore tie power from clean hydroelectricity.

Emission Reduction

Cruise ships are "floating communities" which generate their own electrical and propulsion power, and heat using combustion equipment installed on-board the vessels. While docked in Juneau the ships operate in hotel mode and are a source of air pollution. Juneau hosts a significant number of cruise ships; 644

large cruise ship voyages are expected in 2022, so the emissions created during hoteling status add up.

Electrification of the two cruise ship berths would displace the following emissions over the next 20 years: 46,314 metric tons of CO_2, 1,681 metric tons of NO_x, 1,337 metric tons of SO_x, and 130 metric tons of $PM_{2.5}$. The value of this emission reduction, based on damage costs provided by the US Department of Transportation, is projected to be $78 million. The reduction of these pollutants would also be part of a greater effort to address and reduce climate change.

Remote Community Transportation Services

Juneau is surrounded by water, mountains, ice fields, and glaciers. Access into Juneau is only by water or air, as there are no roads extending beyond the immediate area.

Unlike most of the country, the electrical grid supporting the community is not connected to an outside grid or intertie. All electrical energy is generated by resources within the Juneau region. The effect is a “soft grid” that requires sensitive power plant control to respond to load changes. Cruise ships demand a large amount of power when connected. This requires additional control features to ensure smooth power transfers.

Environmental Justice Discussion

According to the Environmental Protection Agency EJSCREEN, Juneau has a relatively low environmental justice (EJ) index. However, dock electrification will decrease environmental impacts on the entire downtown business district and nearby residential neighborhoods, with the reductions in air emissions and reduced negative health impacts further benefiting Juneau's efforts to provide environmental justice to the elderly, minorities and children residing in the downtown Juneau port area. The Juneau population is 19% Alaska Native, and Juneau’s youth population is 25% Alaska Native.

Project History

In 2001, the world’s first cruise ship shore power facility was installed in Juneau, and has been an incredible success story. It was installed as a collaborative project by Princess Cruise Lines and Alaska Electric Light and Power (AEL&P), the local utility. This facility has been in operation since then, providing electricity to the cruise ships moored at the Franklin Dock from Juneau’s renewable resource, hydroelectric generating plants. The result has been a reduction of consumption of fossil fuels powering the onboard generators, and thereby a reduction of carbon gas emissions.

Hydroelectric power generation supports 100 percent of the firm electrical needs of the Juneau community, except in the rare case of electrical outages. With the hydro facilities, excess energy is delivered to “non-firm” loads which have alternative generation resources. The cruise ships that use the Franklin Dock have been afforded this opportunity for 20 years. The Juneau Cruise Ship Dock Electrification Project will build on the community’s success in offering renewable hydropower as a value to additional ships.

Hydroelectric Generation in Juneau

The Juneau mining industry pioneered world-class development of hydropower in the early 1900’s. Originally hydropower was developed to provide energy to support mining and mills to

extract gold from low-grade ore bearing rock. The early hydroelectric facilities, Annex Creek, Salmon Creek, and Gold Creek Power Plants, are continuously maintained and upgraded so that more than 100 years later they continue to provide Juneau with renewable energy. Hydropower development has continued since the days of hardrock gold mining in Juneau with construction of the Snettisham Plant including taps into Long and Crater Lakes and the construction of the first phase of the Dorothy Lake project. These two plants presently provide the bulk of the electrical energy consumed by Juneau customers.

Technical Engineering: Project Components

The primary hydroelectric power plants are connected to Juneau with two 69KV transmission lines routed into the town through the uplands above the new CBJ docks. Electricity will be fed from one of these transmission lines to the water-side facility and will include several components. These are defined in sequence leading from the transmission line to the power connectors for the ships.

New AEL&P Substation

A new substation will be located on the hillside above the new docks. This site is located adjacent to the two existing 69KV transmission lines. The substation will consist of 69KV switchgear and protective relays, transformer(s), and secondary circuit breakers and protective relays. The substation will be adequately sized to power two cruise ships with two separate transformers. The transformer(s) will be rated for the ships, 10 to 15 MVA each, producing output voltage of 11.2KV and 6.6KV.

15KV feeder to South Franklin Street

For each ship electrical deployment facility, this portion of the system will include four 6-inch diameter conduit (8 total) and one 2-inch diameter conduit (2 total) installed above ground on structural stands, or potentially installed below ground where possible. The conduits will include 15KV rated cables for power and fiberoptic cables for instrumentation and control. The conduits will terminate into a new vault at South Franklin Street on the uphill side.

15KV Feeder from South Franklin Street to Shore

Twelve 6-inch diameter conduits are presently installed below grade from the location of the proposed new vault on the uphill side of South Franklin Street to an existing vault near the shore adjacent to the Juneau Tram. Twelve more conduits extend from this vault beneath the shore and open under water at approximately -5 feet Mean Low-Low Water. This system of conduits and vaults provide allowance to install cables to power two ships. The 15KV cables identified earlier will extend to the existing vault at the shore where they will be terminated to a junction inside the vault. The fiber optic cable(s) will extend to this same vault and onto the shore power deployment float.

15KV Submarine Cable to the Power Floats

Submarine cables specifically designed for underwater application will be routed from the vault on shore underwater to shore power deployment floating docks. They will be connected to the shore cables on 15KV terminals inside the vault. These cables will be suspended to the float and supported on a structure specifically

designed to support their weight. The cables will terminate in a 15KV switch located on the floating dock.

Switchgear

The switchgear on the floats will be enclosed in a cabinet mounted to the float near the cable deployment equipment. The cabinet and enclosed equipment will be suitable for the corrosive marine environment. The switchgear will include a disconnect switch and ground switch, combined to isolate and ground the cables to the ship when they are being handled. The switch will be collaboratively controlled by the ship crew and AEL&P operators.

15KV Feeder to the Ship

Durable cables rated for mining and marine applications will be routed from the switchgear to the ship via a cable deployment device. The cables are quite flexible and include connectors on the ship's end. The cables will be installed in covered cable trays from the switchgear or junction to the deployment device. The cable deployment device will support and move the cables to and from the ship as required to connect and disconnect shore power. This type of system mounted to a floating dock will ease cable hand-off and reduce the need for cable attendance typical with tidal changes.

Floating Docks

The shore power system will be supported by floating dock structures that will be accessed from aluminum gangways mounted to the nearby catwalks and approach dock. The floating dock will be fabricated with concrete pontoons or steel pipe construction and will be anchored in place with steel pipe piles and pile frames. The floating docks will offer cruise vessels a consistent level relative to the ships' electrical connection portals providing for improved handoff and retrieval of the shore power cables. The cable positioning/deployment devices will move along the face of the floating docks and they will have extendable booms capable of providing an extensive range of reach and ability to accommodate vessels with varying portal configurations.

Figure 1. Aerial view of the two cruise ship berths that will be connected to hydroelectric shore power.

Low voltage power will be provided from the shore electrical facilities for the cable positioning device and power float lighting. This will involve a separate 480-volt feeder with user voltage panels on the floating docks.

Existing AEL&P Franklin Dock Substation

With the addition of a substation to support the CBJ docks, the existing transformer serving the Franklin Dock will have to be replaced. In order to synchronize the cruise ships to the system, voltage produced by the substation transformer must match the voltage generated onboard the cruise ship. With a single cruise ship connected to the system, AEL&P has been able to adjust the system voltage enough to make the connection. However, with additional ships connected to the system, it will be difficult if not impossible. The solution is to replace the existing transformer with one that includes a load tap changing (LTC) feature, thus adjusting voltage to the ship with reduced impact to the utility system.

Broader Infrastructure Investment Context

Through public and private collaborations and partnerships, significant investments have been made into Juneau's port and hydroelectric generation.

AEL&P has been instrumental in initiating programs to utilize as much of their available renewable resources as possible, thereby minimizing the community's carbon footprint. Juneau is one of the greenest cities in the world when it comes to electricity. The electrical utility provides "100% hydropower 99% of the time." Few places in the world have such environmentally-sound, cost-effective, and reliable electricity sources.

The community has also invested heavily into the port of Juneau. The project would build upon benefits from the first electrified cruise ship dock in the world, just a few hundred yards south, at the South Franklin dock that went into operation 20 years ago. Since 2012, the City has invested nearly $120 million (92% local, 8% federal) into its harbor and port infrastructure to modernize operations, facilitate economic diversity, and establish better management practices.

A more environmentally-sustainable cruise ship industry will also attract more private economic development, helping make Juneau and the region more economically competitive. According to the Southeast Alaska Business Climate Survey 2020, more than $74 million in private dollars was invested into the regional tourism sector in 2019, with significant increases in private investment expected in future years.

Benefits to Communities in Rural Areas

Juneau is a remote, rural community with access to important maritime resources. Since the community is not connected by the road system to the rest of the state, marine infrastructure is critical to the economy and to support and expand tourism in the community. The Juneau Cruise Ship Dock Electrification project is a key factor in accomplishing this and preserving and expanding jobs in the tourism industry.

Statement of Work

The Juneau Cruise Ship Dock Electrification Project is a straightforward dock electrical infrastructure project primarily oriented toward reducing harmful hydrocarbon emissions in the

community, while continuing to support the local economy. It will provide added utility to the existing docks constructed in 2016 and 2017.

II. Project Location

The project is situated at the CBJ North and South Berths adjacent to historic downtown Juneau. The cruise ship onshore electrical deployment system will include a connection to the existing electrical transmission lines into downtown with a substation and feeders as narrated in the project description above.

Downtown Juneau is located near the head end of Gastineau Channel. The town sits in the fjord on a delta formed by Gold Creek at the base of Mount Juneau and Mount Roberts. A deep water harbor at the port affords access for large ships. The North and South Berths are located along the shore at the base of Mount Roberts.

The 69KV transmission lines are routed near the project site at approximately 130 feet above sea level at the base of Mount Roberts. Each line is situated parallel to shore and mounted on separate support structures. The new substation will be positioned on a land bench adjacent to the lower transmission line. The feeders routed down to the onshore deployment floats will be 900-feet long to the South Berth and 1,350 feet to the North Berth.

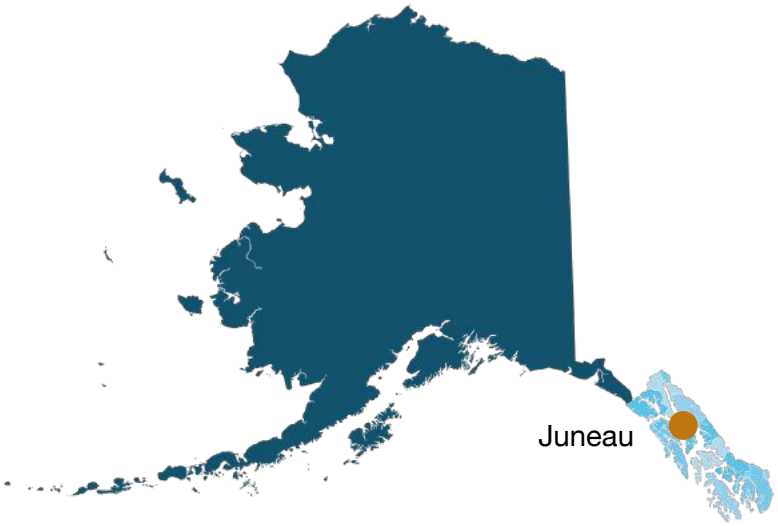
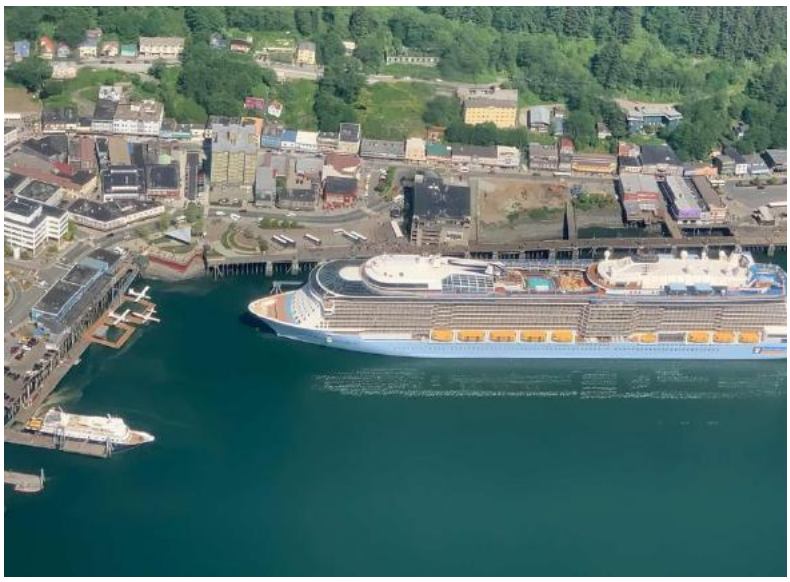


Figure 2 Project Location Map: Juneau is surrounded by mountains, some covered with ice fields and glaciers, forming numerous lakes. The port is situated at the base of Mount Roberts.



Connection to Existing Infrastructure

The electrical system supporting Juneau and its surrounding area is composed of a network of power plants, transmission lines, substations, and distribution lines. The project map (Figure 3) illustrates the locations of the components involved in the electrical deployment system to both CBJ cruise ship berths.

The primary source of electrical energy is generated by AEL&P's hydroelectric power plants. The existing plants are detailed in Table 1:

Table 1 Juneau Hydroelectric Capacity

Hydroelectric Plant	Peak Capacity (MW)	Typical Annual Energy Production (MWH)
Snettisham (Crater & Long Lakes)	78.2	295,000
Lake Dorothy, Phase I	14.3	75,000
Salmon Creek	5	31,000
Annex Creek	3.6	24,000
Gold Creek	1.6	5,000
Totals	**102.7**	**430,000**

AEL&P maintains fuel-fired standby generators to support Juneau when there is a loss of electrical connection to the larger power sources. The largest source is considered to be the combination of the Snettisham and Lake Dorothy power plants. They are connected to Juneau via a single transmission line. The standby power plants include those at Lemon Creek, Gold Creek, Industrial Boulevard, and Auke Bay. Their total capacity is 107 MW.

The Snettisham and Lake Dorothy power plants are connected by transmission line to the Thane Substation. This transmission line operates at 138 Kilovolts (KV) with much of it configured with aerial lines supported on towers. A segment of the line is routed along the bottom of the Taku River with oil-cooled submarine cables. Annex Creek is also connected to the Thane Substation with a 23KV transmission line routed from the Annex Creek Power Plant over Powerline Ridge to the Sheep Creek Valley and subsequently the Thane Substation. The Thane Substation converts the voltages

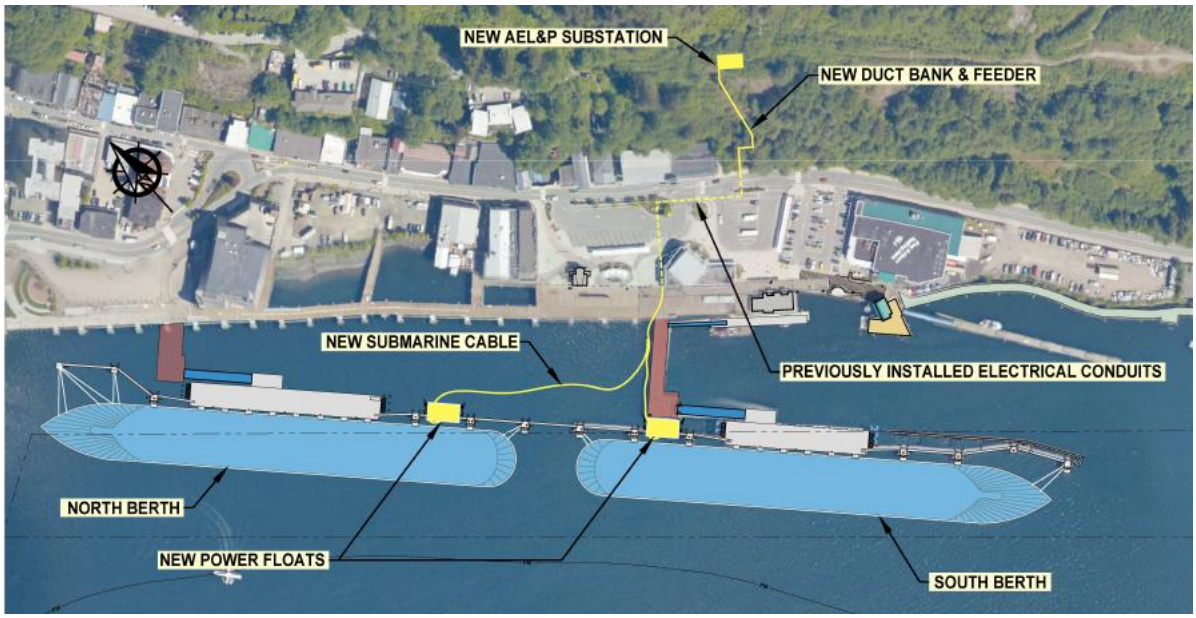


Figure 3 Project Map: The location of the substation designated for this project is identified. This illustrates the locations of the components involved in the electrical deployment system to both CBJ cruise ship berths.

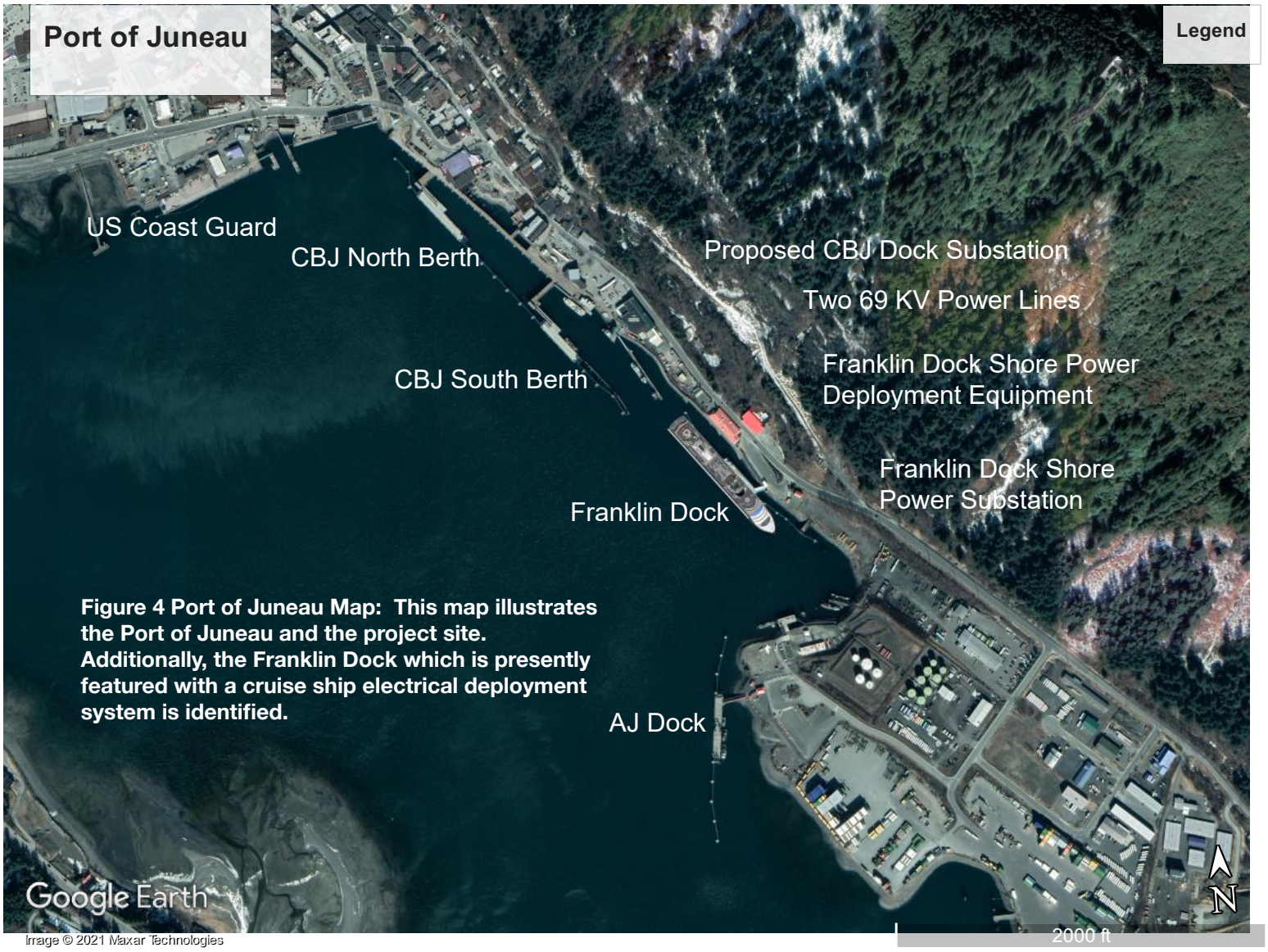


Figure 4 Port of Juneau Map: This map illustrates the Port of Juneau and the project site. Additionally, the Franklin Dock which is presently featured with a cruise ship electrical deployment system is identified.

from these power plants to 69KV with two transmission lines routed from there into Juneau proper.

69KV Line No. 1 is routed to feed power to the Second Street Substation on Gastineau Avenue, the Capital Avenue Substation, and the Lower Salmon Creek Substation. This power line is configured with aerial lines supported by wooden structures. It has a short segment of underground cable routed across the avalanche zone on Thane Road.

69KV Line No. 2 is routed parallel to Line No. 1 from the Thane Substation to the Lower Salmon Creek Substation with some exceptions in Juneau proper. This line feeds the Franklin Dock Substation and continues to the Lower Salmon Creek Substation.

The substations on either of the 69KV transmission lines can be switched to the alternate line when required to deenergize one line or to balance their loads. The entire line is configured with aerial conductors supported by wooden structures.

From the Lower Salmon Creek Substation, a single 69KV transmission line is routed to serve power to the standby power plant and substation at Lemon Creek, the Airport Substation, the Mendenhall Loop Substation, the Lena Loop Substation, standby power plant and

substation at Industrial Boulevard, and the power plant and substation at Auke Bay.

Area of Persistent Poverty

Juneau is not considered to be in persistent poverty. Persistent poverty is defined as a borough in which 20 percent or more of its population has lived in poverty over the past 30 years.

Designated Urbanized Area

With a 2020 population of 31,773, Juneau is not considered an Urbanized Area, as it does not have at least 50,000 residents. It is designated as an Urban Cluster (2,500 to 49,999 residents.)

Figure 5. Ships that would receive shore power berth in the heart of downtown Juneau.

III. Grant Funds, Sources, and Uses of All Project Funding

Project Cost

$24,951,856

Funding Sources and Amounts

If awarded, RAISE grant funds will make up 80.3% of the funding for the project components.

Non-Federal Funding Commitments

The City has approved $4.9 in funding for this project because of the importance to the community to begin this project. The City has in the past funded many cruise-related infrastructure projects with fees related to dockage and passenger arrivals. It has funded utility conduits crossing roadways and parking lots for this electrification project.

Non-Federal Funds

Juneau is a rural area under the RAISE grant definition and the Juneau Cruise Ship Electrification project is eligible for greater than 80% RAISE grant funding. The CBJ requests that the US DOT increase its share of the grant funding for this project. The 20% matching portion equals $4.99 million of the total project cost estimate. CBJ is very aware of the competitive nature of the RAISE program and the importance of local match, if available. The City has approved $4.9 in match even though the city has suffered severe losses to its cruise-related revenues from the COVID-19 pandemic that halted all cruise ship travel for more than a year.

How Each Funding Source Will be Spent

The tables below outline the total allocation of funds by project component and show detailed cost estimates for each component. The cost estimates are based on similar, recent pubic project experience in Southeast Alaska. If awarded, RAISE grant funds and local matching funds would be the sources of funding for all project components, as identified in the grant award agreement.

Total Project Budget

Table 2 Total Project Budget

Juneau Cruise Berth Electrification Project Budget		
Use of Funds	**Eligible Project Costs**	**Percentage of Total Funds**
North Berth Power Connection	**$9,877,200**	**39.6%**
Contingency (15%)	$1,481,580	5.9%
Environmental Permitting	$200,000	0.8%
Final Design and Contract Documents (10%)	$1,135,878	4.6%
Construction Administration and Inspection (10%)	$1,135,878	4.6%
South Berth Power Connection	**$7,914,000**	**31.7%**
Contingency (15%)	$1,187,100	4.8%
Environmental Permitting	$200,000	0.8%
Final Design and Contract Documents (10%)	$910,110	3.6%
Construction Administration and Inspection (10%)	$910,110	3.6%
Total Project Costs	**$24,951,856**	**100%**

North Berth Electrification Costs

Table 3 North Berth Project Budget

Port of Juneau Cruise Ship Electrification Shore Power Connection Study Budget Level Estimate - North Berth					
Item	**Item Description**	**Units**	**Quantity**	**Unit Cost**	**Amount**
1505.1	Mobilization	LS	All Req'd	20%	$1,646,200
2702.1	Construction Surveying	LS	All Req'd	$75,000	$75,000
2894.1	100-ft Aluminum Gangway with Pontoon Mounting Assemblies	LS	All Req'd	$400,000	$400,000
2895.1	Floating Dock, 36' x 66'	SF	2,376	$500	$1,188,000
2896.1	Furnish 36-Inch dia. Steel Pipe Pile	LF	1,200	$350	$420,000
2896.2	Install 36 -Inch dia. Steel Pipe Vertical Pile	EA	4	$30,000	$120,000
2896.3	Install 36 -Inch dia. Steel Pipe Batter Pile	EA	2	$40,000	$80,000
2896.4	Furnish and Install Pile Frames	LS	All Req'd	$250,000	$250,000
2897.1	Transition Plates	LS	All Req'd	$75,000	$75,000
2899.1	Supply and Install Pile Anodes	LS	All Req'd	$75,000	$75,000
5120.1	Electrical Support Assemblies	LS	All Req'd	$50,000	$50,000
11000.1	Cable Positioning Device	LS	All Req'd	$1,000,000	$1,000,000
16000.1	Electrical Substation	LS	All Req'd	$3,193,000	$3,193,000
16000.2	Feeder to Shore	LS	All Req'd	$500,000	$500,000
16000.3	Submarine Cable & Support Structure	LS	All Req'd	$660,000	$660,000
16000.4	Power on Float	LS	All Req'd	$145,000	$145,000
	Estimated Construction Bid Price				**$9,877,200**
	Contingency (15%)				$1,481,580
	Environmental Permitting				$200,000
	Final Design and Contract Documents (10%)				$1,135,878
	Construction Administration and Inspection (10%)				$1,135,878
	Total Recommended Project Budget				**$13,830,536**

South Berth Electrification Costs

Table 4 South Berth Project Budget

Port of Juneau Cruise Ship Electrification Shore Power Connection Study Budget Level Estimate - South Berth					
Item	**Item Description**	**Units**	**Quantity**	**Unit Cost**	**Amount**
1505.1	Mobilization	LS	All Req'd	20%	$1,319,000
2702.1	Construction Surveying	LS	All Req'd	$75,000	$75,000
2894.1	50-ft Aluminum Gangway	LS	All Req'd	$100,000	$100,000
2895.1	Floating Dock, 36'x66'	SF	2,376	$500	$1,188,000
2896.1	Furnish 36-Inch dia. Steel Pipe Pile	LF	1,200	$350	$420,000
2896.2	Install 36 -Inch dia. Steel Pipe Vertical Pile	EA	4	$30,000	$120,000
2896.3	Install 36 -Inch dia. Steel Pipe Batter Pile	EA	2	$40,000	$80,000
2896.4	Furnish and Install Pile Frames	LS	All Req'd	$250,000	$250,000
2897.1	Transition Plates	LS	All Req'd	$75,000	$75,000
2898.1	Approach Dock Addition with Gangway Mounting Assemblies	LS	All Req'd	$350,000	$350,000
2899.1	Supply and Install Pile Anodes	LS	All Req'd	$75,000	$75,000
5120.1	Electrical Support Assemblies	LS	All Req'd	$50,000	$50,000
11000.1	Cable Positioning Device	LS	All Req'd	$1,000,000	$1,000,000
16000.1	Electrical Substation	LS	All Req'd	$1,855,000	$1,855,000
16000.2	Feeder to Shore	LS	All Req'd	$482,000	$482,000
16000.3	Submarine Cable & Support Structure	LS	All Req'd	$310,000	$310,000
16000.4	Power on Float	LS	All Req'd	$165,000	$165,000
	Estimated Construction Bid Price				**$7,914,000**
	Contingency (15%)				$1,187,100
	Environmental Permitting				$200,000
	Final Design and Contract Documents (10%)				$910,110
	Construction Administration and Inspection (10%)				$910,110
	Total Recommended Project Budget				**$11,121,320**

IV. Selection Criteria

The Juneau Cruise Ship Dock Electrification project will provide necessary infrastructure for cruise ships to connect to renewable hydroelectric shore power while at the CBJ cruise ship berths, significantly reducing the level of air pollution, and helping make the Juneau tourism sector more sustainable to support the overall economy. Due to emissions reductions, this project has an incredibly strong benefit cost ratio of 3.75 when discounted at 7%. Project benefits are detailed in the attached BCA, located in Appendix A.

Primary Merit Criteria

Safety

Safety comprises a significant benefit to the project. Cruise ships contribute to Alaska's mobile-source emission inventories. In aggregate, reductions of emissions of nitrogen oxides (NOx), sulfur oxides (SOx), and fine particulate matter (PM2.5) prevent premature deaths and relieve respiratory symptoms. Monetized health-related benefits related to emissions reductions are estimated in the BCA (Attachment A).

Environmental Sustainability

In Juneau, environmental sustainability translates into economic sustainability. The City and Borough of Juneau (CBJ) has identified dock electrification as contributing to Juneau's sustainability, climate action, and renewable energy goals in several planning efforts and documents over the past decade. Significant sustainability benefits are achieved and optimized by displacing onboard fossil fuel electrical generation with clean, zero-emission, hydropower-generated shore power for cruise ships berthed at Juneau's publicly-owned docks.

Dock electrification eliminates greenhouse gas (GHG) emissions, particulates and pollution while cruise ships are in port, reducing the cruise industry's carbon footprint while improving Juneau's air and water quality. These benefits ameliorate the impacts of cruise ship tourism in the community and contribute to Juneau's efforts to be a global leader in cruise port sustainability. The related electrical infrastructure upgrades required for dock electrification additionally support cruise ship-related tourism.

Incorporation of electrification infrastructure: Dock electrification provides the infrastructure needed to enable cruise ships' use of safe, cleaner shore power.

Avoidance of adverse environmental impacts: Dock electrification improves the air quality of Juneau for residents and visitors alike, providing an inviting downtown area. Dock electrification eliminates adverse environmental impacts to air quality and climate by reducing Clean Air Act criteria pollutants, including NOX, SO2, PM, and VOC, as well as CO2 and other greenhouse gases. These benefits are described in more detail and quantified in the BCA, Appendix A.

Noise reduction from replacing the use of auxiliary engines with quiet renewable electricity will benefit the quality of life of downtown residents, businesses, and workers, as well as the quality of the cruise ship visitor experience.

Finally, dock electrification will reduce threats to public health in downtown Juneau by reducing emissions while cruise ships are in port. Much of Juneau's core downtown area is located within several

hundred yards of the CBJ's cruise ship port, and is bounded by mountains that result in a confined settlement area next to the port. Downtown Juneau and the port area are periodically subject to air inversions that trap emissions in the area as well as to light winds that can bring cruise ship emissions up Gastineau Channel and concentrate them against the mountains.

Long-Term Community and Regional Planning

The role of dock electrification for economic and environmental reasons has been the focus of several recent significant planning efforts with robust public input.

Southeast Alaska 2025 Economic Plan: The recently completed regional economic Comprehensive Economic Development Strategy prioritizes beneficial electrification as the #4 economic priority for the region, specifically including dock electrification.[1]

Blueprint Downtown: The City and Borough of Juneau's 2021 planning effort known as "Blueprint Downtown" focused on dock electrification as part of its final report, as well as the plan's vision statement: "Juneau has the opportunity to showcase best sustainable practices, focusing on a transition from fossil fuels to renewable hydroelectricity for heating and transportation. Mitigating cruise industry impacts, with steps such as increased shore-side power, is a key element of this shared focus on enhancing renewable energy."[2]

Visitor Industry Task Force: The 2020 Juneau Mayor's Visitor Industry Task Force final report mentions dock electrification specifically, and electrification of transportation generally, in eight places and recommends maximizing use of shore power by all cruise lines by requiring assignment of shore power configured ships to electrified docks.[3]

Juneau Renewable Energy Strategy: The CBJ adopted the Juneau Renewable Energy Strategy (JRES) in 2018. It establishes a goal to have renewable energy provide 80% of Juneau's energy by 2045. Dock electrification is identified as an action contributing to the goals.[4]

Juneau's Climate Action Plan: Dock electrification directly supports the goals and recommendations of the City and Borough of Juneau's climate action plan. The CBJ adopted the Juneau Climate Action & Implementation Plan (JCAIP) in 2011. The JCAIP provides an energy and GHG emission inventory and sets a goal of reducing GHG emissions by 25% by 2032. Juneau dock electrification is specifically identified in the plan as significantly assisting Juneau in meeting this goal.[5]

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[1] Southeast Alaska 2025 Economic Plan https://www.seconference.org/publication/southeast-alaska-2025-economic-plan/

[2] Blueprint Downtown https://chstm2y9cx63tv84u2p8shc3-wpengine.netdna-ssl.com/wp-content/uploads/2019/07/Final-Blueprint-Downtown-Report-w-Appendix-6.18.19-1.pdf

[3] Visitor Industry Task Force Report https://juneau.org/assembly/visitor-industry-task-force

[4] Juneau Renewable Energy Strategy https://renewablejuneau.org/policies-for-renewables/cbj-renewable-energy-strategy/

[5] Juneau's Climate Action Plan https://juneau.org/index.php?gf-download=2019%2F03%2F2011-Climate-Action-Plan.pdf&form-id=22&field-id=11&hash=32c8805f269ce4bd156cb5cd0bdfd2917fbac831e531c75d02d84a2e17e4405c

Figure 6. Image shows a cruise ship docking in Juneau in 2019.

Juneau dock electrification also supports and encourages cruise industry climate goals. The Cruise Line Industry Association (CLIA) has committed to a fleet-wide reduction in carbon emissions by 40% by 2030 compared to 2008 levels and notes the use of shore power as an implementation strategy. Dock electrification appears to be one of the more cost-effective near-term strategies for meeting industry carbon reduction goals.

Quality of Life

Electrification of the City and Borough of Juneau's two docks will make a significant contribution to the quality of life of Juneau residents and visitors. As the number and size of cruise ships visiting Juneau have increased, public concerns about the impacts of the visitor industry have grown concurrently. Quality of life benefits of dock electrification include reduced noise in the downtown Juneau waterfront and business district when auxiliary engine operations are replaced by quiet shore power, and improved air quality in Juneau.

Emissions Reduction

The air quality enjoyed by residents in the community is at times degraded by cruise ship stack emissions. The most visible emissions from ships are when they are approaching Juneau in its mountainous, fjord-like setting, while entering and departing the Juneau harbor, and during the hours docked in port. On occasion, there is a haze of emissions from cruise ships in the downtown and harbor areas.

Reduced Noise

Elimination of ship noise at Juneau waterfront and business district when ship use "quiet" hydropower instead of auxiliary engines.

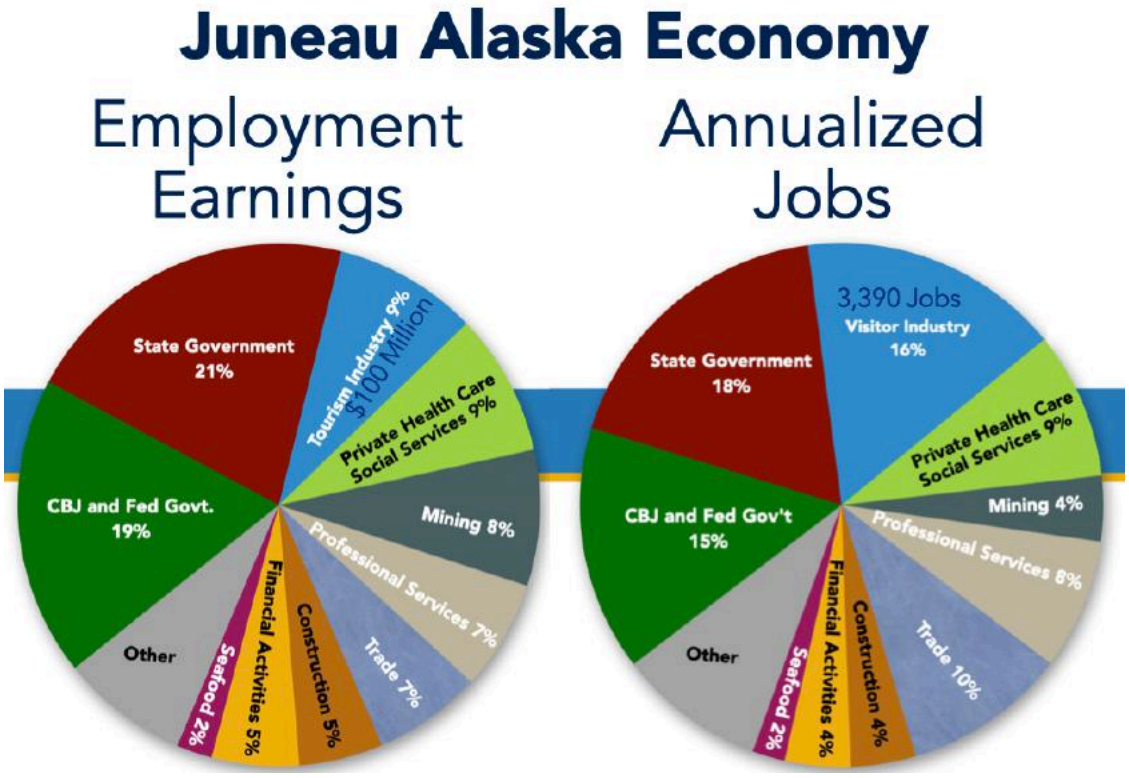


Figure 7 The Juneau Economy

Economic Competitiveness

An environmentally sustainable cruise ship sector is not only good for the environment, it is also important for the economy. In recent years, the Juneau economy has been devastated by a pair of economic losses. Jobs in state government, historically the cornerstone of the local economic base, fell 20% over the past eight years. On top of this, Juneau was particularly impacted by the pandemic crisis, losing 19% of all jobs in the first six months of COVID-19.

As state government jobs are cut, the community is increasingly turning to tourism to help support the local economy. Most visitors, 94% of all Juneau tourists, come to the community by cruise ship. In 2019, the Juneau cruise ship focused tourism sector directly supported 3,390 year-round equivalent jobs and $100 million in associated wages, making it the largest private sector industry in the community, both in terms of jobs and wages. In 2022, Juneau tourists are expected to spend $305 million in the community. Approximately one-fifth of all local sales tax dollars are spent by tourists.

Figure 8: Juneau Tourist by Arrival Mode, 2022 Projection

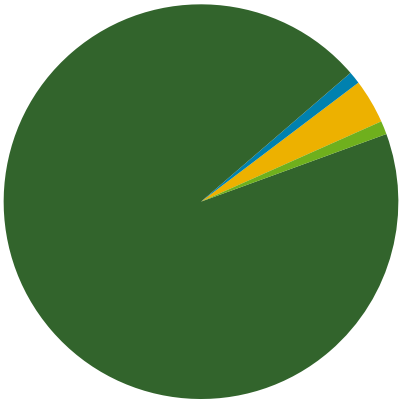


Figure 9 Annual Juneau Cruise Ship Passenger Arrivals

The number of cruise passengers to Juneau has been increasing – from just under a million in 2013, to 1.33 million in 2019, to a projected 1.58 million in 2022. In 2022, 664 large cruise ship voyages are planned for Juneau.

State of Good Repair

The two city-owned berths called the Alaska Steamship Wharf (north berth) and the Cruise Ship Terminal (south berth) are in excellent structural condition and are among the newest facilities in the world, having been constructed in 2016 and 2017. An in-depth planning and design process lead to the decision to install concrete floating berths, galvanized steel structures with sacrificial zinc pile anodes to construct a facility with a minimum service life of 50 years. The City is committed to ensuring the shore tie power systems are kept in a state of good repair, in line with its demonstrated history of maintaining its assets.

Secondary Selection Criteria

Partnership

CBJ Docks & Harbors is the project proponent and owner. It operates and manages multiple waterfront facilities and properties throughout Juneau. These include the two CBJ-owned cruise ship docks, several small boat harbors and small boat floats, six launch ramps, two commercial loading facilities, two boat yards, and several hundred acres of tidelands and waterfront properties under lease.

There are multiple longstanding partnerships focused on the Cruise Ship Dock Electrification Project. First is with Alaska Electric Light & Power (AEL&P), the electrical utility providing all of

Juneau's clean hydro power for more than 125 years. AEL&P is committed to meeting Juneau's current and future power needs at some of the lowest rates in the state of Alaska. AEL&P has also partnered with the owners of the Franklin Dock to build the first electrified cruise dock in the world.

Cruise Line Agencies of Alaska is another partner. It represents the major cruise operators and organizes the yearly berthing schedule for Juneau. Their technical expertise in orchestrating the yearly ballet of transiting huge ships through narrow fjords and their support of environmental regulations provide the understanding to schedule ships to fully utilize available shore tie power

The Franklin Dock is a direct partner as they would receive some important infrastructure upgrades to provide AEL&P improved grid controls to alleviate system wide fluctuations.

Alaska Department of Environmental Conservation are partners as they are required to monitor and report emissions violations and provide monitoring.

CBJ has nearly three dozen letters of support for this project, including from several Alaska Native Regional Corporations and Alaska Native Brotherhood, the oldest known indigenous persons' civil rights organization in the world. The full list of letters of support can be found in Attachment D.

Innovation

Innovative Technologies

The sections above describe the configuration of the system to deploy electrical energy to the cruise ships. Much of the system will be engineered using conventional technology used in utilities and a corrosive marine environment. However, some components will be unique to this system.

Substation Transformers: There will be a single transformer designated to each deployment system. Some of the ships utilize power plants with 6.6KV generation and main distribution while others use 11.2KV generation. To facilitate ships with differing voltages at each berth, separate transformers are necessary. The secondary windings in the transformers will be configured to provide both 6.6 and 11.2KV power. They will utilize interlocked circuit breakers to provide the desired voltage, but they can only provide one or the other. The transformers will include "Load Tap Changing" windings and control to accomplish refined voltage matching between the ship and the utility during power transfers to and from the utility. This feature will aid in minimizing voltage and power fluctuations to the overall grid.

Submarine Cables: The North and South Berths are located offshore with approach docks and ramps connecting them to shore. The deployment floating docks will also be positioned offshore so that they are adjacent to the ship when it is moored. They will not be close to the main floating docks. This situation promotes use of submarine cables routed from the vaults on shore to the deployment float. The cables will be suspended from the deployment float and laid on the sea floor in a circular manner to allow their movement with tide changes. This is unique to onshore power deployment systems in that the ships are moored to floating docks positioned slightly offshore.

Deployment System: The first onshore power deployment system for cruise ships

was installed in Juneau in 2001. It involved a festooning system mounted to a structure located at the end of the Franklin Dock, a fixed dock constructed close to shore. Although the system has provided good service since its installation, it requires constant management during onshore power connections due to tidal changes. More recent deployment systems at other ports involve fixed cranes with extendable booms supporting the connecting cables. Recent installations now include movable cranes with extendable booms to support the cables. These allow for a much greater range of service allowing connection to a larger variety of ships. The deployment systems for the North and South Berths will involve a movable device with extendable boom crane. Its design will be unique to these berths. They will be mounted to a floating versus fixed docks. They will include reels mounted to the equipment to store or deploy cables. The reels will lay cables on the deployment float as it travels away from the switch located on the float and gather cables as it travels back toward the switch.

Innovative Project Delivery

CBJ has a robust understanding of Design, Bid, Build project delivery methods, but it also has a charter amendment to allow for alternative procurement processes. This flexibility gives CBJ the latitude to maintain federal procurement requirements while capitalizing on possible proprietary technologies which would strengthen infrastructure resiliency, efficiency and reliability.

Innovative Financing

Maritime infrastructure projects do not have the same funding avenues as other transportation modes such as highways and rail. Financing for this project would be through more traditional methods.

Demonstrated Project Readiness

The project will involve three primary components: construction of the substation, construction of the upland feeders to the deployment docks, and construction of the deployment dock. Alaska Electric Light & Power (AEL&P) will be responsible for the substation and contractors will be used to construct the feeders and deployment dock. Engineers and contractors with a strong background of installations of this type are locally available, and they are supported with additional resources from other locations in Alaska as needed to meet project schedules.

Technical Capacity

Juneau Alaska was the first place in the world to create the technology to allow cruise ships to plug into shore power and is ready to expand on that capacity.

Juneau has local engineers and contractors with experience throughout Alaska with strong backgrounds with marine structural and medium voltage electrical systems as required for this project. All are well versed with local climatic conditions, technical application, and resource acquisition. Local engineers and contractors worked alongside AEL&P to construct the world's first cruise ship onshore power deployment system here in Juneau.

Financial Capacity

While CBJ Docks & Harbors has a reserve account, all of that funding, and much more, is needed to provide the capital cost of this important infrastructure project. State passenger fees were levied for the new berth construction and those fees continue to pay off the financing

package.The principal source of funds for the Docks enterprise account within CBJ Docks & Harbors is the cruise ship berthing charges and a $3 per visitor fee for Port Development. The COVID-19 pandemic completely devastated the 2020 and 2021 cruise seasons and revenue to the Docks enterprise has fallen to zero. A reasonably-sized fund balance has allowed regular maintenance and security staff to remain intact, but this fund is shrinking as CBJ awaits the restart of Alaska cruises. The Juneau Cruise Dock Electrification Project cannot proceed absent the requested RAISE grant funding.

V. Environmental Risk

As this project has been a part of the original port development plan, there is minimal environmental risk associated with completing the dock electrification.

Table 5 Environmental Permits and Reviews

ENVIRONMENTAL PERMITS AND REVIEWS	
NEPA Status	No NEPA has been conducted for this project. It will be developed as part of the required environmental reviews during the design process.
Reviews, Approvals and Permits by Other Agencies	Non-local agencies with permitting responsibilities include the U.S. Army Corps of Engineers (USACE). A USACE permit will be required for all work below the high tide line. An individual Section 10/404 permit will be necessary from the USACE and includes a purpose and need statement, detailed project description, mitigation statement, practicable alternatives analysis, essential fish habitat assessment, biological assessment for formal endangered species act consultation. While these permitting steps can be tedious, we expect little difficulty in achieving the permit. CBJ Docks & Harbors has a long and effective history of permitting significant in-water and tidelands projects and past experience tells us that this project will easily clear permitting requirements. The immediate area has already been highly developed with very similar infrastructure, and there are no known habitat issues like eel grass beds or salmon spawning streams in the project area.
Environmental Studies or Other Documents	From the National Marine Fisheries Service, an Incidental Harassment Authorization (IHA) along with a Marine Mammal Monitoring Plan are anticipated to be necessary to complete this project. The CBJ has had extensive past experience and success in acquiring and monitoring for these authorizations.
DOT&PF Coordination	Right of way and utility permit coordination has not yet been conducted with the local DOT, but the City has a close working relationship with them. We have worked with them on numerous transportation projects and do not anticipate any issues with obtaining local DOT reviews or approvals.
Public involvement	Over the last decade, this project has been through a comprehensive public involvement process which has included extensive coordination with the Cruise Line Agencies of Alaska and the input of Juneau stakeholders and residents during community workshops, open house events, harbor board presentations, integrated design charrettes and stakeholder meetings.
STATE AND LOCAL APPROVALS	
The Juneau Cruise Ship Berth Electrification project has become a demonstrated community value supported by CBJ Assembly (CBJ Resolution 2958) as well as in both the CBJ Juneau Climate Action Plan (CBJ Resolution 2593) and the CBJ Juneau Renewable Energy Strategy (CBJ Resolution 2808).	
FEDERAL TRANSPORTATION REQUIREMENTS AFFECTING STATE & LOCAL PLANNING	
As stated above, this project has become a demonstrated community value supported by CBJ Assembly (CBJ Resolution 2958) as well as in both the CBJ Juneau Climate Action Plan (CBJ Resolution 2593) and the CBJ Juneau Renewable Energy Strategy (CBJ Resolution 2808).	

During the first phase of uplands work, conduits and vaults were installed for future power conductors. During the installation of the floating berths there were no issues. The City has received multiple environmental permits and approvals for recent projects in the vicinity. The immediate area has already been highly developed and there are no habitat issues such as eel grass beds, salmon spawning streams or marine mammal haul outs in the project area.

Required Approvals

Due to the extensive planning and public involvement process that has already been performed, we expect the final permitting and approval process to be straight forward and relatively brief. The CBJ has extensive experience in acquiring environmental permits and local approvals for projects of a similar nature and will draw upon that experience to navigate through and acquire all required approvals and permits in a timely manner as needed to meet the milestones described in the project schedule. The table below further discusses the specific reviews and approvals required for this project.

Project Schedule

The anticipated schedule for this project spans a 36-month timeframe, with time intervals measured from the date of RAISE Grant awards. This schedule will easily accommodate the June 30, 2024 U.S. DOT fund obligation deadline, and includes contingency to account for any unexpected delays so that funds are not at risk of expiring prior to being obligated. Project completion will be achieved well in advance of the September 30, 2029 deadline for funding expenditure.

Project Schedule

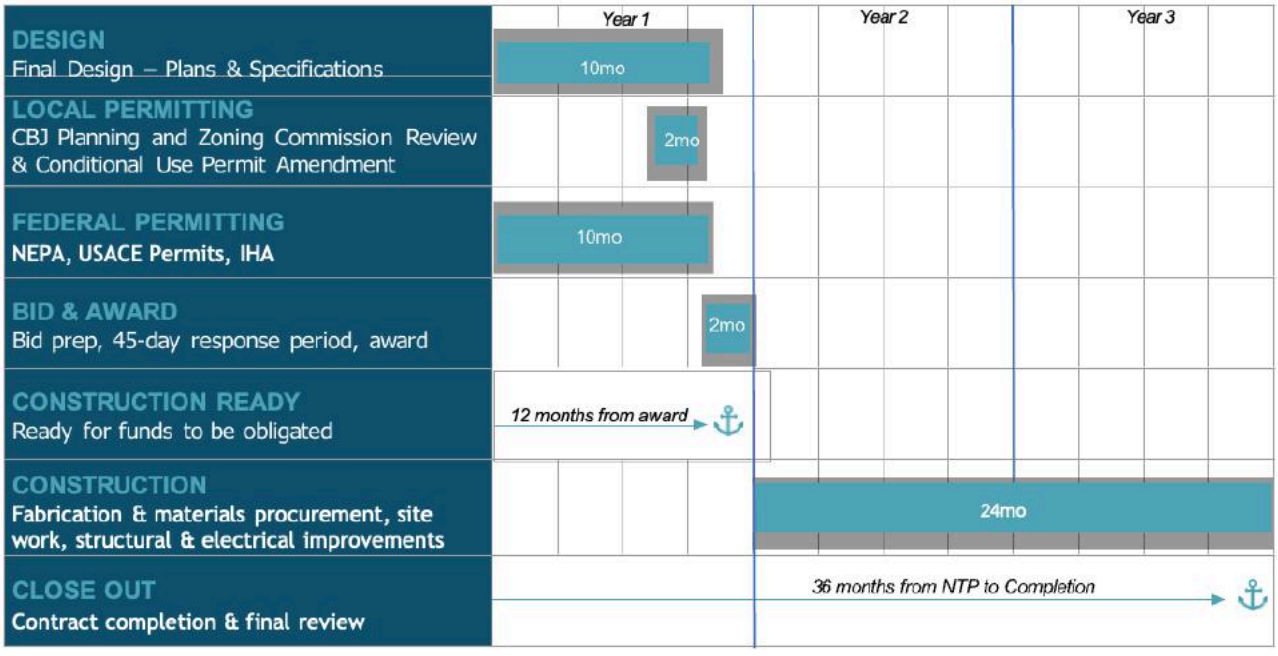


Figure 10 Project Schedule

Assessment of Project Risks and Mitigation Strategies

Risk

The largest project risk is associated with the total availability of hydropower on Juneau's island grid. Juneau is situated in a rainforest with significant precipitation to provide excess power. Critical to the assumptions behind this grant application is the reasonable assertion that additional hydropower will be available to power the docks by 2038.

Most of the materials and supplies can be sourced domestically but several cable handling systems are produced by non-domestic companies. The City and Borough may pursue a waver for relevant domestic preference laws, if a suitable cable handling system cannot be produced domestically. CBJ has taken steps to identify several cable handling device manufacturers to locate domestically sourced options.

Another risk is a catastrophic event that precipitates a substantial downturn in the cruise market, which was the temporary case with COVID-19.

Mitigation Strategy

Juneau has three potential hydroelectric projects that are in the planning stages and may be constructed to provide additional energy. These include Sheep Creek (Chas'heeni), Lake Dorothy Phase II, and Sweetheart Lake.

To mediate risks to the cruise industry, Juneau continues to collaborate with the industry, state and federal regulators and other partners in the environmental protection and security sectors to provide improved protocols to protect the passengers, crew and communities visited by over 1.5 million passengers each year.

Figure 11. View of berths from the water.

V. Benefit Cost Analysis

The Benefit-Cost ratio fore this project is incredibly strong at 3.75, meaning that in 20 years the project will provide nearly four times the value of the original investment. The BCA was conducted under the guidelines of the U.S. DOT for a Discretionary Grant Application to identify, estimate and quantify the expected benefits of the Juneau Cruise Ship Electrification Project compared to the baseline condition.

The largest calculated benefit of the Juneau Cruise Ship Dock Electrification Project is the monetized value of emission reductions. A growing number of cruise ships are traveling to Juneau, Alaska. Ships primarily use diesel to power all onboard cruise ship operations while visiting the Juneau port. Electrification of two municipally-owned cruise ship berths will allow two additional ships to plug into hydroelectrical power when they are docked in Juneau, thus eliminating a significant level of carbon-based emissions associated with cruise ship hoteling.

Electrification of the two cruise ship berths would displace the following emissions over the next 20 years: 46,314 metric tons of CO_2, 1,681 metric tons of NO_x, 1,504 metric tons of SO_x, and 149 metric tons of $PM_{2.5}$. The associated value of this emission reduction, based on damage costs provided by the US Department of Transportation, would be $78 million.

The impact summary table is on the following page, and the complete BCA can be found in Appendix A.

Project Benefits
by the Numbers

4.6 million gallons of diesel displaced

50,000 metric tons of CO_2, NO_x, SO_x, $PM_{2.5}$ [3] air emissions reduced

$76 million in project benefits

3.75 benefit/cost ratio

Annual support for

3,390 jobs

$100 million in wages

$300 million in local tourism spending

Table 6 Impact Summary

Impact Summary						
CURRENT STATUS/BASELINE & PROBLEM TO BE ADDRESSED	CHANGE TO BASELINE	TYPE OF IMPACTS	POPULATION AFFECTED BY IMPACTS	ECONOMIC BENEFIT	SUMMARY OF RESULTS	PAGE REFERENCE IN BSA
An increasing number of cruise ships are visiting Juneau, Alaska, with 664 large cruise visits planned for 2022. However, high levels of ship-generated emissions are also increasing. By electrifying two municipally-owned docks, cruise ships can plug into green hydroelectric shore power while visiting Juneau, reducing the level of air pollutants.	Installation of shore power at two cruise ship berths would eliminate cruise ship emissions, including nearly 50,000 metric tons of CO2, NOx, SOx, and PM2.5 that occur when cruise ships run auxiliary engines for hoteling while in port.	**Emissions Reduction Benefits**	**City and Borough of Juneau (CBJ) residents and visitors.** The Juneau 2020 population was 31,773. Juneau's Alaska Native population is 19%. 1.68 million tourists are expect in Juneau in 2022.	The value of this emission reduction is projected to be $78 million.	Electrification of the two cruise ship berths would displace the following emissions over the next 20 years: 46,314 metric tons of CO_2, 1,681 metric tons of NO_x, 1,337 metric tons of SO_x, and 130 metric tons of $PM_{2.5}$.	Page 7-14 BCA Tabs 1,2,5-8
		Other Impacts: **Jobs and Wage Income**		Growth of the tourism sector contingent upon the economic benefits of cruise ship tourism outweighing environmental costs.	94% of Juneau's tourists arrive on cruise ships. The tourism sector directly supports 3,390 year-round equivalent jobs and $100 million in associated wages, annually. Tourists are expect to spend $304 million in Juneau in 2022.	Pages 15-16
		Other Impacts: **Local Tax Revenue**		CBJ will collect sales tax dollars from cruise ships on electricity.	$434,000 over 20 years	Pages 16-17
		Other Impacts: **Safety Benefits**		Health safety will improve due to reduced emissions.	Included in emissions reductions estimates above.	Page 17

July 11th, 2021

Benefit-Cost Analysis of the Juneau Cruise Ship Dock Electrification Project

Rain Coast Data was hired by Haight & Associates, on behalf of City and Borough Docks and Harbors, to develop a Benefit-Cost Analysis for a RAISE Discretionary Grant application. The Rain Coast Data team included PhD economist Brian Vander Naald and Meilani Schijvens, M.S.

Benefit-Cost Project Summary

The largest calculated benefit of the Juneau Cruise Ship Dock Electrification Project is the monetized value of emission reductions. The ratio of discounted benefits to costs (B/C ratio) is 3.75.

A growing number of cruise ships are traveling to Juneau, Alaska. While Juneau has one cruise ship berth that enables ships to connect to shore power – the first to be developed globally – the community has four cruise ship berths. Ships without access to shore-based electricity use diesel to power onboard cruise ship operations while visiting the Juneau port. Electrification of two municipally-owned cruise ship berths will allow two additional ships to plug into hydroelectrical power when they are docked in Juneau, thus eliminating carbon-based emissions associated with cruise ship hoteling.

Following the development of the baseline and project scenarios, the following impacts were considered and monetized for the Benefit-Cost Analysis (BCA):

Emission Reduction Benefits: Electrification of the two cruise ship berths would displace the following emissions over the next 20 years: 40,362 metric tons of carbon dioxide (CO_2), 1,472 metric tons of nitrogen oxide (NO_x), 1,337 metric tons of sulfur dioxide (SO_x), and 130 metric tons of fine particulate matter ($PM_{2.5}$). The associated value of estimated emissions reductions, based on damage costs provided by the US Department of Transportation, is $73 million discounted over a 20-year period.

Table 1 summarizes the findings of the benefit-cost analysis for the development of Juneau Cruise Ship Dock Electrification.

Table 1. Benefit-Cost Analysis Summary Results

Measure	Discounted at 7%
Emissions Reduction Benefits	$73,170,730
Residual Value	$2,758,415
Total Benefits	**$75,929,146**
Capital Costs in 2019 dollars	$19,064,709
Maintenance Costs	$1,208,542
Total Costs	**$20,273,251**
Benefit-Cost Ratio	**3.75**

In addition, we qualitatively discussed the following benefits that are not included directly in the benefit-cost ratio calculations:

- Jobs and wage income supported
- Local tax income
- Safety benefits

Project Description

The cruise industry is a significant and growing contributor to the Juneau economy. Growth in this sector has led to increasing concerns regarding cruise ship environmental impacts, including air emissions produced while in port. In 2022, 664 large cruise ships voyages are scheduled to visit in Juneau between April and October. CBJ owns and manages two of the four cruise ship berths in Juneau. The two privately owned berths provide similar moorage and utility connections as the city's, with the Franklin Dock providing the only shore tie power connection in Juneau. That system was the first of its kind in the world, constructed in 2001.

The Juneau Cruise Ship Dock Electrification Project would install two onshore power deployment facilities at the City & Borough of Juneau's (CBJ) two cruise ship docks. Completed in June of 2017, the berths provide moorage for neopanamax cruise ships up to 1,100 feet. The berths provide deep water moorage with access to potable water, sewer discharge and visitor amenities in the upland transportation staging areas. A deployment system will be developed to connect cruise ships moored at these docks to electricity generated by the utility's hydroelectric power plants. This system will enable connected ships to operate in hoteling mode without onboard fuel fired generators, reducing greenhouse gas emissions in Juneau's port.

Impacts of Transportation Infrastructure Improvements

The primary goal of the Juneau Cruise Ship Dock Electrification Project is to continue building a successful visitor industry economic sector while remediating environmental impacts associated with large cruise ships visiting the community. Juneau's cruise ship docks are located in downtown Juneau. The community has a population of 32,000 and is 19% Alaska Native. The installation of shore power at the two CBJ docks would eliminate nearly 50,000 metric tons of cruise ship emissions, including the CO_2, NO_x, SO_x, and $PM_{2.5}$ that is emitted when cruise ships run auxiliary engines for hoteling while in port at those berths.

Baseline Scenario

In 2020, 43 cruise ships had been scheduled to make 606 port visits to Juneau. In 2022, 664 voyages are currently planned.[1] Cruise ships are "floating communities" which generate their own electricity and propulsion power, and heat using combustion equipment installed on board the vessels. While docked in Juneau, the ships operate in hotel mode, meaning they continue to provide power, heat, air conditioning, and hot water for guests and staff, like a floating hotel, and as a source of air pollution. The cruise ship season in Juneau begins in late April and continues through October.

If electrical power is not provided at the CBJ docks, the vessels' electrical needs will continue to be met by generation from the large on-board diesel-fired engines or gas turbines, which are a source of GHG emissions. This would mean nearly 50,000 metric tons of CO_2, NO_x, SO_x, and $PM_{2.5}$ would be generated over the next 20 years in downtown Juneau, all of which could be avoided through development of this project.

[1] Data provided by Cruise Lines International Association.

Analysis Approach

The BCA for this project was prepared according to Benefit-Cost Analysis Guidance for Discretionary Grant Programs, published by US Department of Transportation, February 2021, and with reference to OMB Circulars A-4 and A-94 concerning benefit-cost analysis. This BCA considers all reasonable project costs and monetizable benefits over a 20-year horizon (2023–2043), and describes analysis period and discounting. The following sections summarize the results and outlines the project costs, benefits, and assumptions used in this analysis.

View of Juneau cruise ship docks that will be electrified.

The Project Summary matrix (Table 2) provides a summary of the population impacted, the benefits of the project, and a reference to where each impact is discussed in this report.

Table 2. Project Summary Matrix

Current Status/Baseline & Problem to be addressed	Change to Baseline	Type of Impacts	Population Affected by Impacts	Economic Benefit	Summary of Results	Page Reference in BSA
An increasing number of cruise ships are visiting Juneau, Alaska, with 664 large cruise visits planned for 2022. However, high levels of ship-generated emissions are also increasing. By electrifying two municipally-owned docks, cruise ships can plug into renewable hydroelectric shore power while visiting Juneau, reducing the level of air pollutants and greenhouse gas emissions.	Installation of shore power at two cruise ship berths would eliminate cruise ship emissions, including nearly 50,000 metric tons of CO2, NOx, SOx, and PM2.5 that occur when cruise ships run auxiliary engines for hoteling while in port.	**Emissions Reduction Benefits**	31,773 Juneau residents (Juneau's population is 19% Alaska Native), and 1.6 million tourists.	The value of this emission reduction, based on damage costs provided by the US Department of Transportation, is projected to be $73 million.	Electrification of the two cruise ship berths would displace the following emissions over the next 20 years: 46,314 metric tons of CO_2, 1,681 metric tons of NO_x, 1,337 metric tons of SO_x, and 130 metric tons of $PM_{2.5}$.	Page 7-14 BCA Tabs 1,2,5-8
		Other Impacts: **Jobs and Wage Income**		The struggling Juneau economy is transitioning to a visitor industry economy. Long-term success of tourism is contingent upon the economic benefits of cruise ship tourism outweighing environmental costs.	Nearly all – 94% – of Juneau's tourists arrive on cruise ship. The Juneau tourism sector directly supports 3,390 year-round equivalent jobs and $100 million in associated wages annually. Tourists spend $305 million annually. This project will support and grow those jobs, earnings, and spending.	Page 15-16
		Other Impacts: **Local Tax Revenue**		The municipality will collect sales tax dollars from cruise ships on electricity received during the time they are plugged into shore power, helping offset operating costs.	$434,000 over 20 years	Page 16-17
		Other Impacts: **Safety Benefits**		Health safety will improve due to reduced CO_2, NO_x, SO_x, and $PM_{2.5}$ emissions.	The monetized health-related benefits are included in the emissions reductions estimates above.	Page 17

Results of Benefit-Cost Analysis

This BCA was prepared under the guidelines of the U.S. Department of Transportation for a Discretionary Grant Application.

The proposed development of the Juneau Cruise Ship Dock Electrification Project will result in a variety of monetizable benefits, the sum of which significantly exceed the project costs considered in this analysis.

Table 3 summarizes the findings of the BCA. The ratio of discounted monetized benefits to costs (B/C ratio) is 3.75 at the 7% discount rate. The following sections describe the costs and benefits used to calculate the values displayed in the table below.

Table 3. Benefit-Cost Analysis Summary Results

Measure	Discounted at 7%
Total Benefits	$75,929,146
Total Costs	$20,273,251
Benefit-Cost Ratio	**3.75**

The results of the BCA are presented using the cash flows that occur over the analysis period (2025–2044). The discount rates of 7% follow the guidance of OMB Circular A-4. The discount rate is used to discount future cash flows to the present. The discount rate takes into account the time value of money and the uncertainty associated with future cash flows (put simply, the principle of discounting works on the assumption that a dollar today is worth more than a dollar a year or more in the future). (Note that due to the use of the discount rate and because the dollars a required to be in 2019 dollars by the BCA guidelines, the total costs dollar amount is not identical to the total grant request.)

Additional non-quantifiable social benefits would also result from this project that were not considered as part of the benefit-cost calculations.

Benefits

The total benefit of this project is $76 million. The largest monetizable benefit of providing electrical connectivity to the CBJ cruise ship berths is air emissions savings.

Value of Emissions Reduction Benefits

Reduction of CO2, NOx, SOx, and PM2.5 Emissions

The total benefit of avoided emissions is expected to be more than $73.2 million over the 20-year scope of this analysis. Air pollution from cruise ships is generated by diesel engines that burn high sulfur content fuel, producing sulfur dioxide (SO_x), nitrogen oxide (NO_x), fine particulate matter ($PM_{2.5}$), and carbon dioxide (CO_2). Cruise ship emissions exert more significant impacts in specific coastal areas that are visited repeatedly, such as Juneau.

Table 4. Value of Emissions Savings

Foregone Emissions Value	Discounted at 3% or 7%
Foregone CO2 emissions (discounted at 3%)	$1,929,408
Foregone NOx emissions (discounted at 7%)	$8,308,116
Foregone SOx emissions (discounted at 7%)	$23,095,002
Foregone PM2.5 emissions (discounted at 7%)	$39,838,204
Total annual 20-year savings of emissions value in 2019 Dollars	**$73,170,730**

Electrification of the two cruise ship berths would displace the following emissions over the next 20 years: 46,314 metric tons of CO_2, 1,681 metric tons of NO_x, 1,337 metric tons of SO_x, and 130 metric tons of $PM_{2.5}$.

Table 5. Value of Emissions Savings

Foregone Emissions Over 20 Years	Metric Tons
Probable Metric tons CO2 avoided	46,314
Probable Metric tons NOx avoided	1,681
Probable Metric tons SOx avoided	1,524
Probable Metric tons PM2.5 avoided	149

The team used “probable estimates” in place of “maximum estimates” to provide a conservative estimate (see tab “Fuel Consumption Avoidance”) of emissions reductions. It is possible that emissions reductions will be even greater.

Infrastructure enabling the connection of cruise ships to shore power will reduce the cruise industry’s impact on the environment by lowering the level of air pollutants created by the combustion of fuel while in port. The economic damage caused by air pollution represent externalities because these impacts are borne by everyone in the community, rather than by the cruise ship operators whose activities generate those emissions. Local air pollutants are generated by cruise ships while they are in hoteling

status (docked in Juneau, but continuing to provide power, climate control, and hot water for its guests and staff, like a floating hotel). The monetized value, per metric ton, of the damage caused by these emissions is provided by the US Department of Transportation. Using Appendix A, Table A-6 of the Benefit-Cost Analysis Guidance for Discretionary Grant Programs $73 million in future savings will be realized if this project is developed, over the first 20 years of the project.

Ship-specific information on emissions levels are not available for the Alaska cruise ship fleet. In order to calculate the levels of CO_2, NO_x, SO_x, and $PM_{2.5}$ emissions that are generated when a cruise ship is in hoteling status, the study team used the emission levels measured and presented in "Evaluating Air Emission Inventories and Indicators from Cruise Vessels at Ports," by German De Melo Rodríguez, Enrique Martin-Alcalde, J.C. Murcia-González, and Sergi Saurí, published by the World Maritime University in 2017. This paper provides estimates of air emissions of the various pollutants (CO_2, NO_x, SO_x, and PM) released by cruise vessels at the port level. The methodology was especially valuable as it specifically measured emissions generated during hoteling. Additional insight was derived from another study "Air Pollution Emission Inventory For 2008 Tourism Season Klondike Gold Rush National Heritage Park Skagway, Alaska," prepared by Richard Graw, US Forest Service, and Albert Faure, Alaska Department of Environmental Conservation Division of Water Cruise Ship Program.

In order to measure potential emission reductions from the Juneau Cruise Ship Dock Electrification Project, several assumptions were developed by the BCA project team:

> **Total Cruise Ship Time in Port and Connection Time Assumptions:** Critical to measuring probable emissions avoided is understanding the total time that ships would be connected to shore power in the future. Cruise hours in port were developed by reviewing the schedules Cruise Line Agencies of Alaska Cruise Ship Calendar for 2022.[2] It is assumed that the average time in port by cruise ships visiting the community will remain relatively similar in future years, since the 2022 schedule effectively maximizes berth usage. Connection time is a subset of total time in port. The existing electrified cruise ship berth in Juneau requires approximately 90 minutes to tie up a ship, follow safety protocols – which includes a visual inspection and lockout of a switch on the dock by a member of the ship's crew to ensures the cables are working safely – and coordinating between the ship and the electric utility's system operator to perform the switching and transfer of load. The reverse action prior to departure takes a similar amount of time.[3] Haight & Associates projects that the upgraded substation transformer will better synchronize the ship with the grid and the deployment system will be slightly more efficient, so that the connection-disconnection time can be reduced to 60 minutes on each end, rather than 90 minutes. Therefore, to arrive at the total time connected per visit, the arrival time was subtracted from the departure time, with an additional two hours subtracted for electricity connection/disconnection time.

[2] https://secureservercdn.net/198.71.233.51/2xl.54d.myftpupload.com/wp-content/uploads/2021/06/Juneau-2022.pdf
[3] Interviews with Alec Mesdag, Director of Energy Services Alaska Electric Light & Power Co. June 16, 2021.

Total Electricity Available:
Understanding the total amount of excess hydroelectricity currently available to power two cruise ship berths in Juneau is fundamental to developing projected emission displacement calculations. The ability to provide energy with existing hydro resources is limited based on the water available at any given time, depending on annual precipitation rates. According to Alaska Electric Light and Power (AEL&P), the electrical utility for Juneau, hydrologic data collected over the years indicates that enough additional energy is available to serve two additional docks around 25% of the time (one in every four years).[4]

Aerial view of the two cruise ship berths that will be connected to hydroelectric shore power.

The project team made a further assumption that within the next 15 years, additional electric capacity would become available, based on two assumptions:

1) There is a high likelihood that new electric generation capacity is likely to be constructed – three hydroelectric sources could be developed to provide Juneau with additional energy capacity, Lake Dorothy Phase II, Sheep Creek (Chas'heeni), and Sweetheart Lake;

2) One of AEL&P's interruptible customers might no longer require electricity.

Therefore, for the first 15 years of the project, the project team assumes that 25% of ship power needed to electrify the cruise ship berths would be available, and that for the last five years of this 20-year analysis, 100% of cruise ship shore power electricity needs would be available.

Avoided Fuel Consumption: Avoided fuel consumption is estimated at 297,598 gallons per year, for years in which sufficient hydroelectricity is available – one in every four years for the first 15 years of the project analysis period. Avoided fuel consumption is based on time in port, estimated fuel consumption avoided for an

[4] Interviews with Alec Mesdag, Director of Energy Services Alaska Electric Light & Power Co. June 16, 2021.

existing electrified cruise ship dock in Juneau, and the number of vessels that currently have the technical capability to plug into shore power.

At year 15 is it assumed that all vessels using the CBJ cruise ship berths would have the ability to connect to shore power: Based on Cruise Lines International Association 2019 Environmental Technologies and Practices Report, 88% of new cruise ships are expected to be constructed with the ability to plug into shore power.[5] Because ships with shore-side electricity systems would likely be given docking priority at the berths with electrical capacity, by year 15 this analysis assumes that the probable time cruise ships in Juneau will be connected to shore power will increase from 494 hours at the North Berth and 353 hours at the South Berth to 1,663 total hours of connection time for both berths, thus also increasing the gallons of avoided fuel consumption during the final five years of the analysis period to 584,648 gallons annually. (See tab "Fuel Consumption Avoidance" of the BCA tables). Shore power usage is a primary means whereby the cruise industry work on its pledge to lower its carbon footprint.

[5] CLIA 2019 Environmental Technologies and Practices Report. https://cruising.org/-/media/research-updates/2019-clia-infographic_environmental-technologies-practices-report---cruise-industry-report.ashx

Value of CO2 Savings

An estimated 46,314 metric tons of CO_2 air emissions is expected to be avoided through implementation of this project. The discounted present value of CO_2 avoided is expected to be $37,684 in the initial year it is realized, and $1.93 million over the 20-year scope of this analysis. See Table 6 below:

Table 6. Monetary Value of Avoided CO2

Year	Probable Metric tons CO2 avoided	2019 Value of CO2 value per metric ton	Nominal value of CO2 avoided	Discounted present value of CO2 avoided
2025	757.39	$56	$42,414	$37,684
2026	757.39	$57	$43,171	$37,240
2027	757.39	$58	$43,928	$36,789
2028	757.39	$59	$44,686	$36,334
2029	757.39	$60	$45,443	$35,873
2030	757.39	$61	$46,201	$35,409
2031	757.39	$62	$46,958	$34,941
2032	757.39	$63	$47,715	$34,471
2033	757.39	$64	$48,473	$33,998
2034	757.39	$66	$49,988	$34,039
2035	757.39	$67	$50,745	$33,548
2036	757.39	$68	$51,502	$33,057
2037	757.39	$69	$52,260	$32,567
2038	757.39	$70	$53,017	$32,076
2039	5,951.72	$71	$422,572	$248,216
2040	5,951.72	$72	$428,524	$244,381
2041	5,951.72	$73	$434,475	$240,558
2042	5,951.72	$75	$446,379	$239,951
2043	5,951.72	$76	$452,330	$236,068
2044	5,951.72	$77	$458,282	$232,208
Total Savings over 20-year period, discounted at 3%				**$1,929,408**

Notes: CO_2 emissions are based on gallons of fuel consumed while "hoteling" in port. Probable gallons avoided came from adding the values from the north and south berth "probable" boxes from the "Fuel consumption Avoidance" tab. For the first 15 years of the project, probable metric tons of CO_2 avoided take the metric tons per gallon contained in the EPA guidance (https://www.epa.gov/energy/greenhouse-gases-equivalencies-calculator-calculations-and-references) times the 25% of the time that AELP will be able to supply hydro power for the plug in. Implicitly, we are assuming that the other 75% of the time there are equivalent amounts of CO_2 coming from burning diesel on board versus AELP providing shore power using diesel. For that 75% of the time, there are no emissions savings from plugging into shore power. From years 16-20, analysis assumes that there will be a renewable source of electricity for 100% of the ships' plug in time. The 2019 value per metric ton came from Table A-6 of the 2021 BCA guidance document. Pages 40-41 of the 2021 BCA guidance document indicates that CO_2 emissions should be discounted at 3%.

Value of NOx Savings

An estimated 1,681 metric tons of NOx air emissions is expected to be avoided through implementation of this project. The discounted present value of NOx avoided is expected to be $340,667 in the initial year it is realized, and $8.3 million over the 20-year scope of this analysis. See Table 7 below:

Table 7. Monetary Value of Avoided NOx

Year	Probable Time connected	Probable Metric tons NOx avoided	2019 NOx value per metric ton	Nominal value NOx avoided	Discounted present value of NOx avoided
2025	968	30.43	$16,800	$511,249	$340,667
2026	968	30.43	$17,000	$517,336	$322,171
2027	968	30.43	$17,300	$526,465	$306,407
2028	968	30.43	$17,500	$532,551	$289,673
2029	968	30.43	$17,700	$538,638	$273,816
2030	968	30.43	$18,000	$547,767	$260,240
2031	968	30.43	$18,000	$547,767	$243,215
2032	968	30.43	$18,000	$547,767	$227,304
2033	968	30.43	$18,000	$547,767	$212,433
2034	968	30.43	$18,000	$547,767	$198,536
2035	968	30.43	$18,000	$547,767	$185,548
2036	968	30.43	$18,000	$547,767	$173,409
2037	968	30.43	$18,000	$547,767	$162,064
2038	968	30.43	$18,000	$547,767	$151,462
2039	1663	209.12	$18,000	$3,764,201	$972,741
2040	1663	209.12	$18,000	$3,764,201	$909,104
2041	1663	209.12	$18,000	$3,764,201	$849,630
2042	1663	209.12	$18,000	$3,764,201	$794,046
2043	1663	209.12	$18,000	$3,764,201	$742,099
2044	1663	209.12	$18,000	$3,764,201	$693,551
Total Savings over 20-year period, discounted at 7%					**$8,308,116**

Notes: NOx emissions are based on "hoteling" time in port. Probable time plugged in to shore power came from adding the Probable time connected to north and south berths from the "Probable CBJ Docks" box in the "Fuel consumption Avoidance" tab. The value of emissions per hour (125.75 kg/hr), which appears in the upper left-hand corner of the "Avoided NOx" tab in the BCA spreadsheet, comes from the average value in Table 3 of Melo Rodriguez et al. (2017). The 2019 value per metric ton came from Table A-6 of the 2021 BCA guidance document. Page 40 of the 2021 BCA guidance document indicates this gas should be discounted at 7%.

Value of SOx Savings

An estimated 1,524 metric tons of SOx air emissions is expected to be avoided through implementation of this project. The discounted present value of SOx avoided is expected to be $932,979 in the initial year it is realized, and $23.1 million over the 20-year scope of this analysis. See Table 8 below:

Table 8. Monetary Value of Avoided SOx

Year	Probable Hours connected	Probable Metric tons SOx avoided	2019 value of SOx value per metric ton	Nominal value of SOx avoided	Discounted present value of SOx avoided
2025	968	27.24	$44,900	$1,222,946	$932,979
2026	968	27.24	$45,500	$1,239,288	$883,595
2027	968	27.24	$46,200	$1,258,354	$838,494
2028	968	27.24	$46,900	$1,277,420	$795,513
2029	968	27.24	$47,600	$1,296,486	$754,567
2030	968	27.24	$48,200	$1,312,828	$714,092
2031	968	27.24	$48,200	$1,312,828	$667,375
2032	968	27.24	$48,200	$1,312,828	$623,715
2033	968	27.24	$48,200	$1,312,828	$582,911
2034	968	27.24	$48,200	$1,312,828	$544,777
2035	968	27.24	$48,200	$1,312,828	$509,137
2036	968	27.24	$48,200	$1,312,828	$475,829
2037	968	27.24	$48,200	$1,312,828	$444,700
2038	1663	46.79	$48,200	$2,255,406	$714,004
2039	1663	187.17	$48,200	$9,021,625	$2,669,173
2040	1663	187.17	$48,200	$9,021,625	$2,494,555
2041	1663	187.17	$48,200	$9,021,625	$2,331,359
2042	1663	187.17	$48,200	$9,021,625	$2,178,841
2043	1663	187.17	$48,200	$9,021,625	$2,036,300
2044	1663	187.17	$48,200	$9,021,625	$1,903,084
Total Savings over 20-year period, discounted at 7%					$23,095,002

Notes: SOx emissions are based on "hoteling" time in port. Probable time plugged in to shore power came from adding the Probable time connected to north and south berths from the "Probable CBJ Docks" box in the "Fuel consumption Avoidance" tab. The value of emissions per hour (112.55 kg/hr), which appears in the upper left-hand corner of the "Avoided SOx" tab in the BCA spreadsheet, comes from the average value in Table 3 of Melo Rodriguez et al. (2017). The 2019 value per metric ton came from Table A-6 of the 2021 BCA guidance document. Page 40 of the 2021 BCA guidance document indicates this gas should be discounted at 7%.

Value of PM2.5 Savings

An estimated 148.6 metric tons of PM2.5 in air emissions is expected to be avoided through implementation of this project. The discounted present value of PM2.5 avoided is expected to be $1.6 million in the initial year it is realized, and $40 million over the 20-year scope of this analysis. See Table 9 below:

Table 9. Monetary Value of Avoided PM2.5

Year	Probable Hours connected	Probable Metric tons PM2.5 avoided	2019 value of PM2.5 per metric ton	Nominal value of PM2.5 avoided	Discounted value of PM2.5 avoided
2025	968	2.690	$796,600	$2,142,719	$1,634,670
2026	968	2.690	$807,500	$2,172,038	$1,548,633
2027	968	2.690	$818,600	$2,201,895	$1,467,216
2028	968	2.690	$829,800	$2,232,021	$1,389,990
2029	968	2.690	$841,200	$2,262,685	$1,316,903
2030	968	2.690	$852,700	$2,293,618	$1,247,576
2031	968	2.690	$852,700	$2,293,618	$1,165,959
2032	968	2.690	$852,700	$2,293,618	$1,089,681
2033	968	2.690	$852,700	$2,293,618	$1,018,394
2034	968	2.690	$852,700	$2,293,618	$951,770
2035	968	2.690	$852,700	$2,293,618	$889,505
2036	968	2.690	$852,700	$2,293,618	$831,313
2037	968	2.690	$852,700	$2,293,618	$776,928
2038	968	2.690	$852,700	$2,293,618	$726,101
2039	1663	18.484	$852,700	$15,761,516	$4,663,264
2040	1663	18.484	$852,700	$15,761,516	$4,358,190
2041	1663	18.484	$852,700	$15,761,516	$4,073,075
2042	1663	18.484	$852,700	$15,761,516	$3,806,612
2043	1663	18.484	$852,700	$15,761,516	$3,557,582
2044	1663	18.484	$852,700	$15,761,516	$3,324,843
Total Savings over 20-year period, discounted at 7%					**$ 39,838,204**

Notes: PM2.5 emissions are based on "hoteling" time in port. Probable time plugged in to shore power came from adding the probable time connected to north and south berths from the "Probable CBJ Docks" box in the "Fuel consumption Avoidance" tab. The value of emissions per hour (11.7 kg/hr), which appears in the upper left-hand corner of the "Avoided PM2.5" tab in the BCA spreadsheet, comes from the average value in Table 3 of Melo Rodriguez et al. (2017). Moreover, "95% of the ship-generated PM is of an aerodynamic diameter of less than 2.5 µm (PM2.5)" (Melo Rodriguez et al. 2017, p.2), so we assume that 95% of the PM is PM2.5. The 2019 value per metric ton came from Table A-6 of the 2021 BCA guidance document. Page 40 of the 2021 BCA guidance document indicates this gas should be discounted at 7%.

Residual Value and Remaining Life of Service

The project fully depreciates in 2044, which is 20-years after the expected first year of operation in 2025. Given that the assumed lifespan of the capital investment is 50 years, residual values were calculated as 60% of the original capital value. While residual value is technically a negative cost, we have classified the residual value as a benefit so it will be added to the numerator in the benefit-cost ratio according to the Benefit-Cost Analysis guidance document.

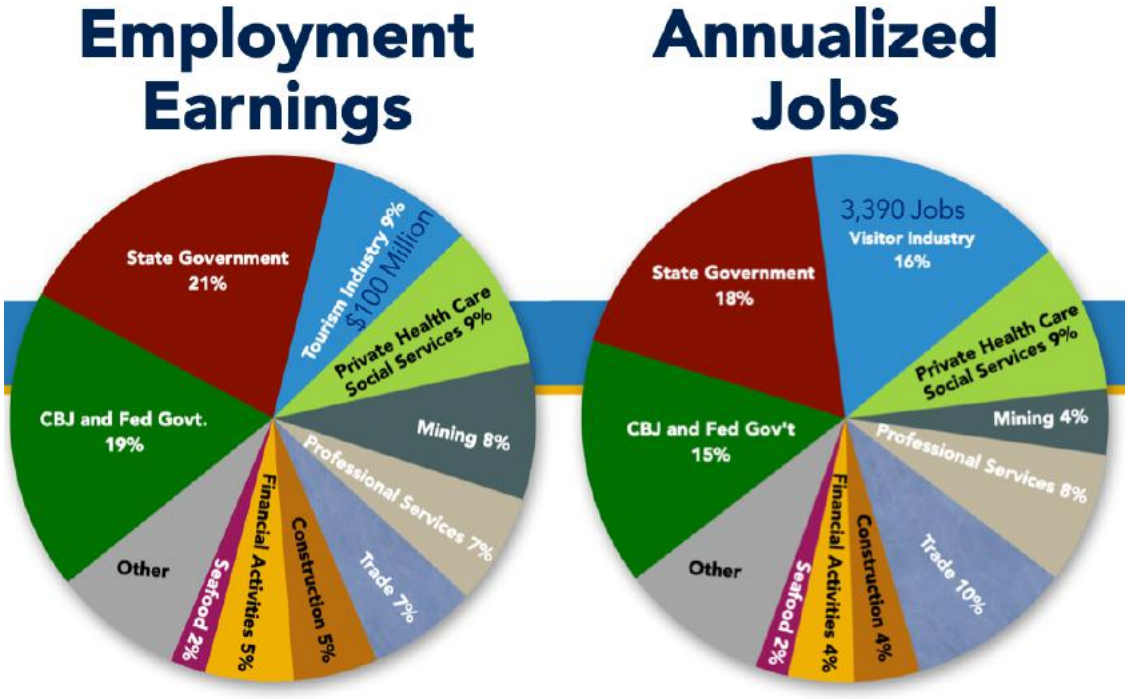
Other Benefits

Supporting the Local Economy

In recent years, the Juneau economy has been devastated by a pair of economic losses. Jobs in state government, historically the cornerstone of the local economic base, fell 20% over the past eight years. On top of this, Juneau was particularly impacted by the pandemic crisis, losing 19% of all jobs in the first six months of COVID-19.

As state government jobs are cut, the community is increasingly turning to tourism to help support the local economy. In 2019, the Juneau tourism sector directly supported 3,390 year-round equivalent jobs and $100 million in associated wages, making it the largest private sector industry in the community, both in terms of jobs and wages. In 2022, Juneau tourists are expected to spend $305 million in the community. Approximately one-fifth of all local sales tax dollars are spent by tourists.

City and Borough of Juneau by Industry, 2019



Most visitors, 94% of all Juneau tourists, come to the community by cruise ship. The number of cruise passengers to Juneau has been increasing – from just under a million in 2013, to 1.33 million in 2019, to a projected 1.58 million in 2022. In 2022, 664 large cruise ship voyages are planned for Juneau.

However, local support for a growing cruise ship tourism sector is contingent upon the economic benefits of this important sector outweighing environmental costs. The ability of the community to sustain and support this key economic sector depends on the community's ability to remediate and address local environmental concerns. The development of the Juneau Cruise Ship Dock Electrification Project would be an important step in that process.

Municipal Tax Benefits

One benefit of the Juneau Cruise Ship Dock Electrification Project is that it would allow the municipality to collect sales tax dollars from cruise ships on electricity received during the time they are plugged into shore power. The current sales tax in the City and Borough of Juneau is 5%. Since each cruise ship company that would use shore power would make electricity purchases in excess of the "single item or service tax cap" local tax exemptions – currently $12,400 per month – sales tax on this would be capped at $620 monthly. There are seven cruise ship lines which could potentially connect to shore

power. Assuming only May through September usages (there will be some usage in April and October) and that each line uses electricity in excess of $12,400 then these 7 cruise lines would pay a combined total of $4,340 in municipal sales tax for electricity on a monthly basis, and $21,700 on an annual basis. If unchanged, this would provide $434,000 in municipal tax revenue over the course of 20 years. However, the sales tax code provides for an adjustment to the level of the cap every two years, based on the most recent Anchorage CPI data.

Safety Benefits

Cruise ships contribute to Alaska's mobile-source emission inventories. In aggregate, reductions of emissions of nitrogen oxides (NOx), sulfur oxides (SOx), and fine particulate matter (PM2.5) prevent premature deaths and relieve respiratory symptoms. The monetized health-related benefits estimated have already been included in the emissions reductions estimates.

Noise Pollution Reduction

Reduced noise in the downtown Juneau waterfront and business district when auxiliary engine operations are replaced by quiet shore power, and improved air quality in Downtown Juneau, West Juneau & Douglas.

Costs

Capital Expenditures

Design, permitting, and construction of the Juneau Cruise Ship Dock Electrification Project are scheduled to occur over a three-year period from 2022–2024. The estimated construction cost for all elements of the electrification project (North and South berth connections) is $24.9 million. To account for inflation, capital costs and maintenance costs were first adjusted from 2021 nominal dollars to the baseline 2019 real dollars using GDP deflators from the Bureau of Economic Analysis. Future costs were then further discounted using a 7% discount rate to the baseline 2019 dollars. For the sake of this analysis, capital costs have been spread evenly over the duration of the construction period.

Table 10. Total Costs

Assume completion in 2024	Discounted at 7%
Capital Costs	$19,064,709
Maintenance Costs	$1,208,542
Total Costs	**$20,273,251**

Operations and Maintenance Expenditures

Equipment and float maintenance will be approximately $50,000 per berth annually. Discounted at 7% over a 20-year period, maintenance is expected to be $1.2 million

Operations costs are assumed to be on par with the current South Franklin Dock during cruise season. According to a March 8th memo from AEL&P to the Juneau Assembly, "AEL&P staff now spends about 500 man-hours per year supporting the South Franklin Dock during the cruise ship season…Additional linemen and engineering support will be required during the summer season." Because these are private utility costs, rather than municipally-borne costs, it is assumed that the fees for ship-to-shore power would include these increased costs, and thus they are not included in the BCA calculations.

State of Good Repair

The residual value of the project assets is characterized as a state of good repair benefit. The two city-owned berths called the Alaska Steamship Wharf (north berth) and the Cruise Ship Terminal (south berth) are in excellent structural condition and are among the newest facilities in the world, having been constructed in 2016 and 2017. An in-depth planning and design process lead to the decision to install concrete floating berths, galvanized steel structures with sacrificial zinc pile anodes to construct a facility with a minimum service life of 50 years. The City is committed to ensuring the shore tie power systems are kept in a state of good repair, in line with its demonstrated history of maintaining assets.

Table 1. Benefit-Cost Analysis Summary Results

Measure	Discounted at 7%
Emissions Reduction Benefits	$73,170,730
Residual Value	$2,758,415
Total Benefits	**$75,929,146**
Capital Costs in 2019 dollars	$19,064,709
Maintenance Costs	$1,208,542
Total Costs	**$20,273,251**
Benefit-Cost Ratio	**3.75**

Table 3. Benefit-Cost Analysis Summary Results

Measure	Discounted at 7%
Total Benefits	$75,929,146
Total Costs	$20,273,251
Benefit-Cost Ratio	**3.75**

Table 4. Value of Emissions Savings

Foregone Emissions Value	Discounted at 3% or 7%
Foregone CO2 emissions (discounted at 3%)	$ 1,929,408
Foregone NOx emissions (discounted at 7%)	$ 8,308,116
Foregone SOx emissions (discounted at 7%)	$ 23,095,002
Foregone PM2.5 emissions (discounted at 7%)	$ 39,838,204
Total annual 20 year savings of emissions value in 2019 Dollars	**$ 73,170,730**

Table 5. Metric Tons of Emissions Savings

Foregone Emissions Over 20 Years	Metric Tons
Probable Metric tons CO2 avoided	46,314
Probable Metric tons NOx avoided	1,681
Probable Metric tons SOx avoided	1,524
Probable Metric tons PM2.5 avoided	149

Table x. Total Costs

Assume completion in 2024	Discounted at 7%
Capital Costs in 2019 dollars	$19,064,709
Maintenance Costs	$1,208,542
Total Costs	**$20,273,251**

Presented by: The Manager
Presented: 06/14/2021
Drafted by: R. Palmer III

RESOLUTION OF THE CITY AND BOROUGH OF JUNEAU, ALASKA

Serial No. 2958

A Resolution of the City and Borough of Juneau in Support of the U.S. Department of Transportation and the Rebuilding American Infrastructure with Sustainably and Equity (RAISE) Grant Program.

WHEREAS, the U.S. Department of Transportation administers the Rebuilding American Infrastructure with Sustainably and Equity (RAISE) Grant Program under the Consolidated Appropriations Act 2021 by reviewing, scoring, and ranking applicants seeking limited federal funds; and

WHEREAS, Juneau led the world with the first electrified cruise ship berth in 2001 providing renewable hydroelectricity that utilized excess power reserves to reduce ship emissions and to lower the local residents power rates; and

WHEREAS, Juneau continues to wisely use new technologies to see power consumption reductions that have allowed the existing generation system to absorb new loads from electrical cars and electrical buses without new generation infrastructure; and

WHEREAS, the CBJ Climate Action Plan recommends mandating new commercial docks to provide electric plug-ins for cruise ships and other commercial vessels, and require that ships use electric shore power whenever it is available; and

WHEREAS, CBJ consistently receives public comment concerning emissions caused by cruise ships, and hydropower provides energy while limiting greenhouse gas emissions; and

WHEREAS, the Visitor Industry Task Force recommended that CBJ prioritize electrification of all cruise ship docks; and

WHEREAS, CBJ lost marine passenger fee funds that typically are used for public infrastructure projects as a result of tax revenue loss due to the Covid-19 pandemic; and

WHEREAS, the cruise ship fleets continue to retrofit or build shore tie power connection systems to reduce emissions and reduce operating costs; and

WHEREAS, CBJ Docks and Harbors is committed to designing, constructing, and maintaining infrastructure under its charge in a sustainable and efficient manner commensurate with available resources; and

WHEREAS, due to fiscal limitations with new capital projects for the municipally owned cruise ship berths were not initially equipped with shore tie power infrastructure; and

WHEREAS, the addition of shore power connections to the municipally owned cruise ship berths will drastically reduce vessel emissions and visible particulates in Juneau; and

WHEREAS, CBJ Docks and Harbors intends to submit an application under the Rebuilding American Infrastructure with Sustainably and Equity (RAISE) Grant Program to design, purchase, install, and maintain shore tie power connections to both municipally owned cruise ship berths.

NOW, THEREFORE, BE IT RESOLVED BY THE ASSEMBLY OF THE CITY AND BOROUGH OF JUNEAU, ALASKA:

Section 1. Cruise Ship Dock Electrification. The Assembly of the City and Borough of Juneau strongly supports the design, purchase, install, and maintenance of shore tie power connections to both municipally owned cruise ship berths, and requests the U.S. Department of Transportation provide full funding for this project.

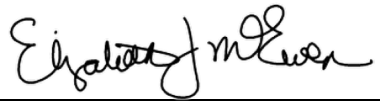
Section 2. Local Match. The Assembly of the City and Borough of Juneau supports providing a local match as required by the grant agency.

Section 3. Effective Date. This resolution shall be effective immediately after its adoption.

Adopted this 14th day of June, 2021.

Beth A. Weldon, Mayor

Attest:



Elizabeth J. McEwen, Municipal Clerk

Presented by: The Manager
Presented: 06/14/2021
Drafted by: R. Palmer III

RESOLUTION OF THE CITY AND BOROUGH OF JUNEAU, ALASKA

Serial No. 2958(b)

A Resolution of the City and Borough of Juneau in Support of the U.S. Department of Transportation and the Rebuilding American Infrastructure with Sustainably and Equity (RAISE) Grant Program.

WHEREAS, the U.S. Department of Transportation administers the Rebuilding American Infrastructure with Sustainably and Equity (RAISE) Grant Program under the Consolidated Appropriations Act 2021 by reviewing, scoring, and ranking applicants seeking limited federal funds; and

WHEREAS, Juneau led the world with the first electrified cruise ship berth in 2001 providing renewable hydroelectricity that utilized excess power reserves to reduce ship emissions and to lower the local residents power rates; and

WHEREAS, Juneau continues to wisely use new technologies to see power consumption reductions that have allowed the existing generation system to absorb new loads from electrical cars and electrical buses without new generation infrastructure; and

WHEREAS, the CBJ Climate Action Plan recommends mandating new commercial docks to provide electric plug-ins for cruise ships and other commercial vessels, and require that ships use electric shore power whenever it is available; and

WHEREAS, CBJ consistently receives public comment concerning emissions caused by cruise ships, and hydropower provides energy while limiting greenhouse gas emissions; and

WHEREAS, the Visitor Industry Task Force recommended that CBJ prioritize electrification of all cruise ship docks; and

WHEREAS, CBJ lost marine passenger fee funds that typically are used for public infrastructure projects as a result of tax revenue loss due to the Covid-19 pandemic; and

WHEREAS, the cruise ship fleets continue to retrofit or build shore tie power connection systems to reduce emissions and reduce operating costs; and

WHEREAS, CBJ Docks and Harbors is committed to designing, constructing, and maintaining infrastructure under its charge in a sustainable and efficient manner commensurate with available resources; and

WHEREAS, due to fiscal limitations with new capital projects for the municipally owned cruise ship berths were not initially equipped with shore tie power infrastructure; and

WHEREAS, the addition of shore power connections to the municipally owned cruise ship berths will drastically reduce vessel emissions and visible particulates in Juneau; and

WHEREAS, CBJ Docks and Harbors intends to submit an application under the Rebuilding American Infrastructure with Sustainably and Equity (RAISE) Grant Program to design, purchase, install, and maintain shore tie power connections to both municipally owned cruise ship berths; and

WHEREAS, on June 14, 2021, the Assembly adopted Resolution 2958, and this version has been amended to include a match funding amount, which would require passage of an appropriation ordinance in the future and this resolution does not bind a future Assembly.

NOW, THEREFORE, BE IT RESOLVED BY THE ASSEMBLY OF THE CITY AND BOROUGH OF JUNEAU, ALASKA:

Section 1. Cruise Ship Dock Electrification. The Assembly of the City and Borough of Juneau strongly supports the design, purchase, install, and maintenance of shore tie power connections to both municipally owned cruise ship berths, and requests the U.S. Department of Transportation provide full funding for this project.

Section 2. Local Match. The Assembly of the City and Borough of Juneau supports providing a local match up to $ 4,900,000 or as required by the grant agency.

Section 3. Effective Date. This resolution shall be effective immediately after its adoption.

Adopted this 12 day of July, 2021.

Beth A. Weldon, Mayor

Attest:

Elizabeth J. McEwen, Municipal Clerk

FY 2021 RAISE Project Information Form - All Fields Required
****DO NOT CHANGE FILE NAME, COPY/PASTE, OR PDF THIS DOCUMENT WHEN SUBMITTING TO AVOID PROCESSING ERRORS****

Field Name	Response	Instructions
Project Name	Juneau Cruise Ship Berth Electrification	Enter a **concise,** descriptive **title** for the project. This should be the same title used in the Grants.gov SF-424 submission and the application narrative.
Project Description	The Juneau Cruise Ship Berth Electrification Project will enable cruise ships that are visiting the community to plug into renewable shore power, thereby allowing the ships to operate without onboard fuel fired generators. Juneau's two city-owned cruise ship berths sit in the heart of downtown Juneau. Completed in 2017, the berths provide moorage for neopanamax cruise ships. The RAISE Grant will fund two new power connection floats, cable positioning devices	Describe the project in plain English terms, using **no more than 100 words**. For example, "The project will replace the existing bridge over the W river on Interstate-X between the cities of Y and Z" or "the RAISE Grant will fund construction activities for streetcar service from location X to location Y." Please **do not** describe the project's benefits, background, or alignment with the selection criteria in this description field.
Urban/Rural	Rural	Identify whether the project is **located in a rural or urban area**, using the drop-down menu. For RAISE 2021, a project is designated as urban if it is located within (or on the boundary of) a Census-designated urbanized area that had a population greater than 200,000 in the 2010 Census. If a project is located outside a Census-designated urbanized area with a population greater than 200,000, it is designated as a rural project.
Urbanized Area	Not located in an Urbanized Area	If you have identified the project as "urban," please select the **associated 2010 Census-designated urbanized area (UA)** from the drop-down. If you identified the project as "rural" but it is located in an UA with a population under 200,000, please select the UA from the drop-down. If you have identified the project as "rural" and it is located outside an urbanized area, please select "Not located in an urbanized area" from the drop-down.
Capital or Planning	capital	Identify the project as **capital** or **planning**. The "**capital**" designation is for projects that requesting funding for the construction of surface transportation capital infastructure. The "**planning**" designation is for projects that are requesting funding primarily for planning, preparation, or design of eligible surface transportation capital projects.
Amount Requested	$20,051,856	Enter the **total amount of RAISE funds requested** for this project in this application. [*For **capital** projects, the minimum urban entry is $5,000,000 and the minimum rural entry is $1,000,000. For **planning** projects, the minimum entry is $1. The maximum entry for both types is $25,000,000*].
Project Location County	AK - Juneau Borough	**Identify the county** where the project is located in using the drop-down. If the project is located in more than one county, please identify the county in which the majority of the project is located.
Additional Project Counties		**Identify additional counities seperated by a comma**. For instance, if the project additionaly runs through Middlesex County and Suffolk County, please enter 'Middlesex County, Suffolk County' in the cell.

FY 2021 RAISE Project Information Form - All Fields Required
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Field Name	Response	Instructions
Project Location Census Tract	5	Identify the census tract number of the project. Please visit USDOT's RAISE webpage to review a full list of census tracts by state and county or refer to the Census Bureau's TIGER Web map to identifiy. For example, if the most central tract is Census Tract 93.30, please enter '93.30' into the cell. Do not be concerned if the last zero is missing from your response (e.g., 93.30 may display as 93.3). If the project is located in more than one census tract please identify the census tract in which the majority of the project is located.
Other Project Census Tracts		**Identify other census tracts in which the project is located, seperated by a comma**. For example, if the project is located in Census Tract 93.31, Census Tract 93.32, and Census Tract 94.03, please enter '93.31, 93.32, 94.03' into the cell.
Project Located in an Area of Persistent Poverty?	No - it is not located in area of persistent poverty	Identify if the project is located in an area of persistent poverty based on the critieria outlined in the NOFO. The list of counties and census tracts that meet this definition can be found on USDOT's RAISE webpage.
Project Location Zip Code	99801	**Identify the 5-digit zip code of the project location.** If the project is located in more than one zip codes, please identify the zip code in which the majority of the project is located.
Project Type	Maritime - New Capacity	Identify the **Primary** and **Secondary project type** combination that **most closely aligns with your project** from the choices in the drop-down menu. See the "Project Types" tab in this file for further information and project type definitions.
Prior BUILD/TIGER Funds Awarded to Project?	No	Identify **whether the project has previously received BUILD/TIGER funding**, and if so, whether that funding was through a planning or capital grant, using the drop-down menu.
Prior BUILD/TIGER Application?	No	Identifiy **whether this project has previously been submitted for BUILD/TIGER funding** and, if it is has, please identifiy the **most recent competition** it was submitted to for consideration.
USDOT FY21 Discretionary Application?	No	**Please identifiy if this project has been submitted to other USDOT FY21 discretionary grant programs** in addition to RAISE. If it has been submitted to multiple programs (in addition to RAISE), please select 'Multiple' from the drop-down.
Total Project Cost	$24,951,856	Enter the **total cost of the project**. This should equal the sum of Total Federal Funding and Total Non-Federal Funding. *This value may not be less than the amount requested.*

FY 2021 RAISE Project Information Form - All Fields Required
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Field Name	Response	Instructions
Total Federal Funding	$20,051,856	Enter the **amount of funds committed to the project from ALL Federal sources including the proposed RAISE amount**. *This value may not be less than the amount requested.* For **RAISE projects designated as urban**, Federal funding cannot exceed 80% of total project cost unless the project is a planning project located in an area of persistent poverty as defined in the RAISE NOFO.
Total Non-Federal Funding	$4,900,000	Enter the **amount of funds committed to the project from non-Federal sources**. For **RAISE projects designated as urban**, the total non-Federal funding amount must be greater than or equal to 20% of the project cost unless the project is a planning project located in an area of persistent poverty as defined in the RAISE NOFO.
Tribal Government?	No	Select "Yes" from the drop-down menu if the applicant is a **Federally recognized tribal government**.
Tribal Benefits?	N/A	**If the applicant is not a Federally recognized tribal government**, is the project located on tribal land? And if not, does it have direct tribal benefits? Answer using the drop-down menu.
Private Corporation Involvement	Yes - directly involves or benefits a private corporation	Does this project **involve (a) private entity(ies) that will receive a direct and predictable financial benefit** if the project is selected for award? This includes, but it not limited to, private owners of infrastructure facilities being improved and private freight shippers or carriers directly benefitting from completion of the proposed project.
Private Corporation Name(s)	Alaska Electric Light and Power Company	**If this project directly involves or benefits a specific private corporation**, please list the corporation(s) separated by a comma.
TIFIA/RRIF?	No	Is the project currently, or does this project anticipate applying for Transportation Infrastructure Finance and Innovation Act **(TIFIA)** or Railroad Rehabilitation & Improvement Financing **(RRIF) loans**?
Department Financing Program?	No	If your application is unsuccessful, would you like to be contacted about the **Department's financing program**?