Zero Emission Fleet Study Update

WETA Board of Directors
May 19, 2022

WETA

ARUP

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Study Goals

"Develop a plan to transition ferry operations on San Francisco Bay to zero-emission vessels"

How much power do we need?

Where will it come from?

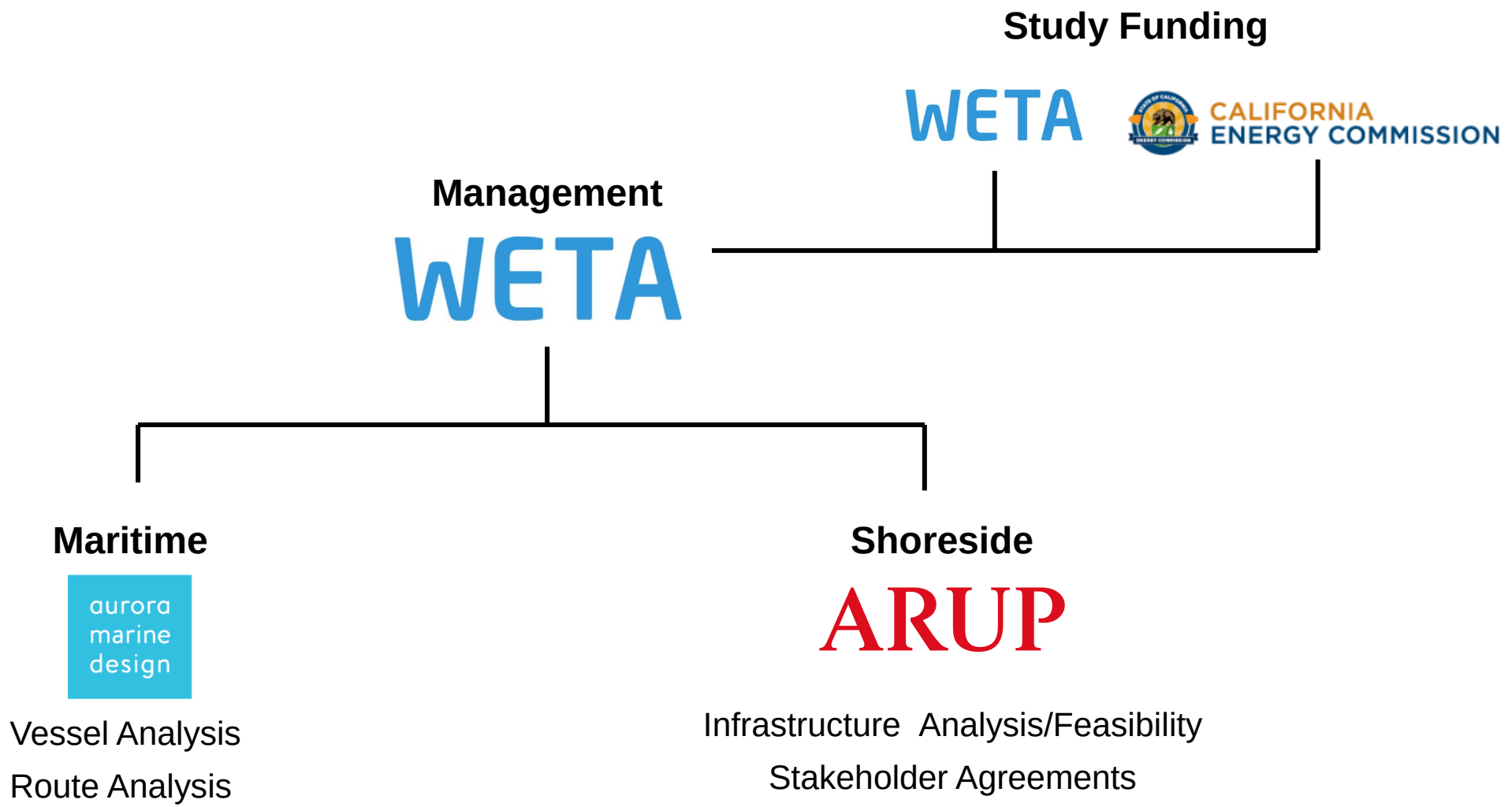
When do we need it?

How much will it cost?

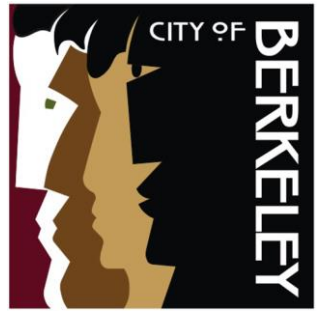
How do we pay for it?

Emphasis on the use of electric propulsion systems and resolving the technical and regulatory barriers for the shore side infrastructure

Study Responsibilities



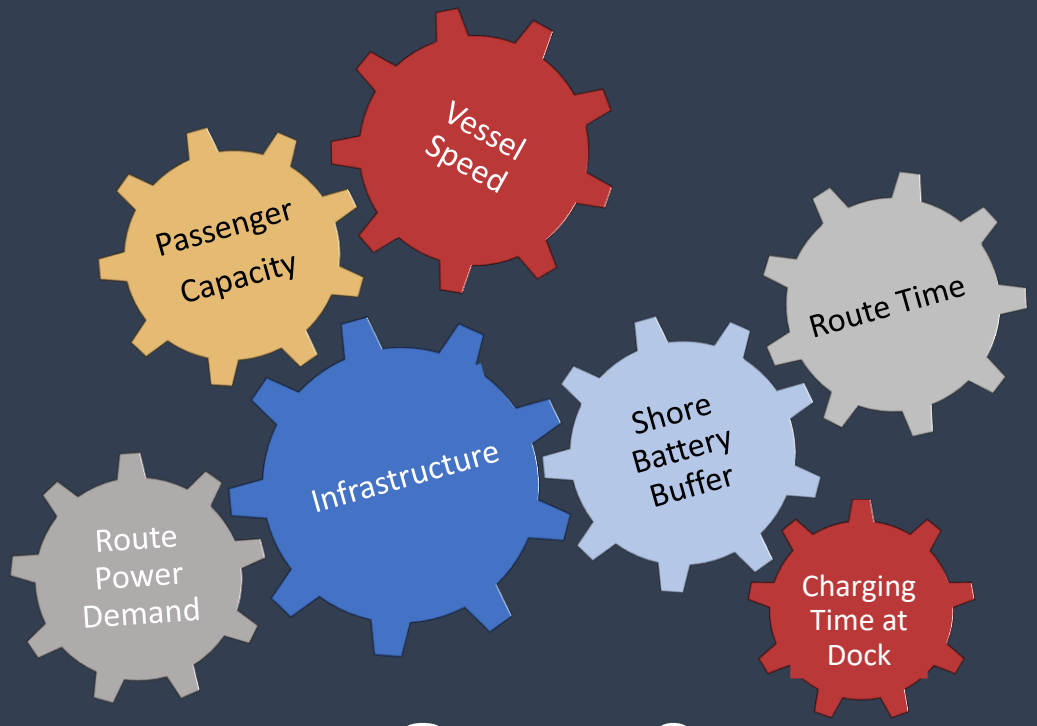
Stakeholders Engaged



Workflow

Stage 1
Baselining

Collect and process data on operations, vessels and terminals to define their constraints and opportunities



Stage 2
Optioneering

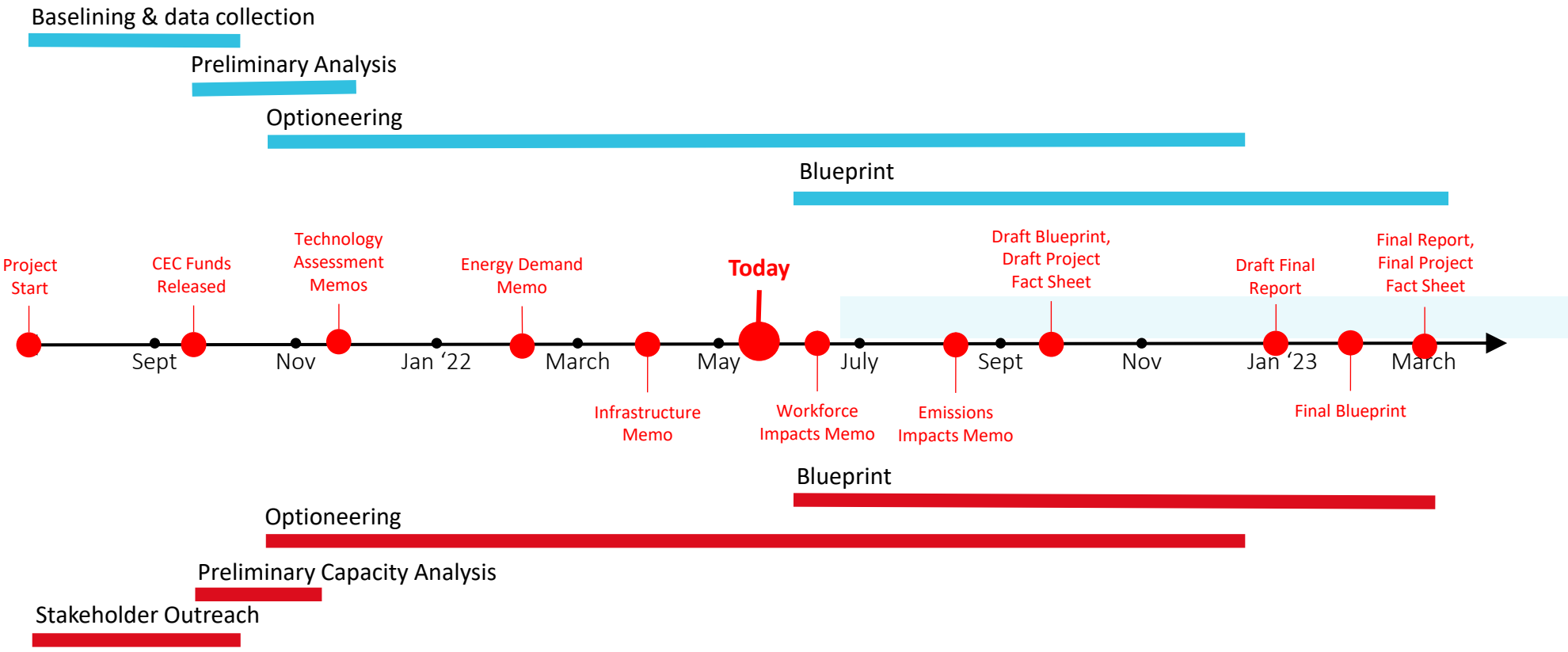
Develop solutions and assess their attributes and drawbacks to select optimal direction

Stage 3
Blueprint & Strategy

Lay out an actionable path to progress to procurement, design and delivery of electrified ferry service

Study Schedule

Vessel Side



Shoreside

Aurora – Vessel Analysis

Study Schedule

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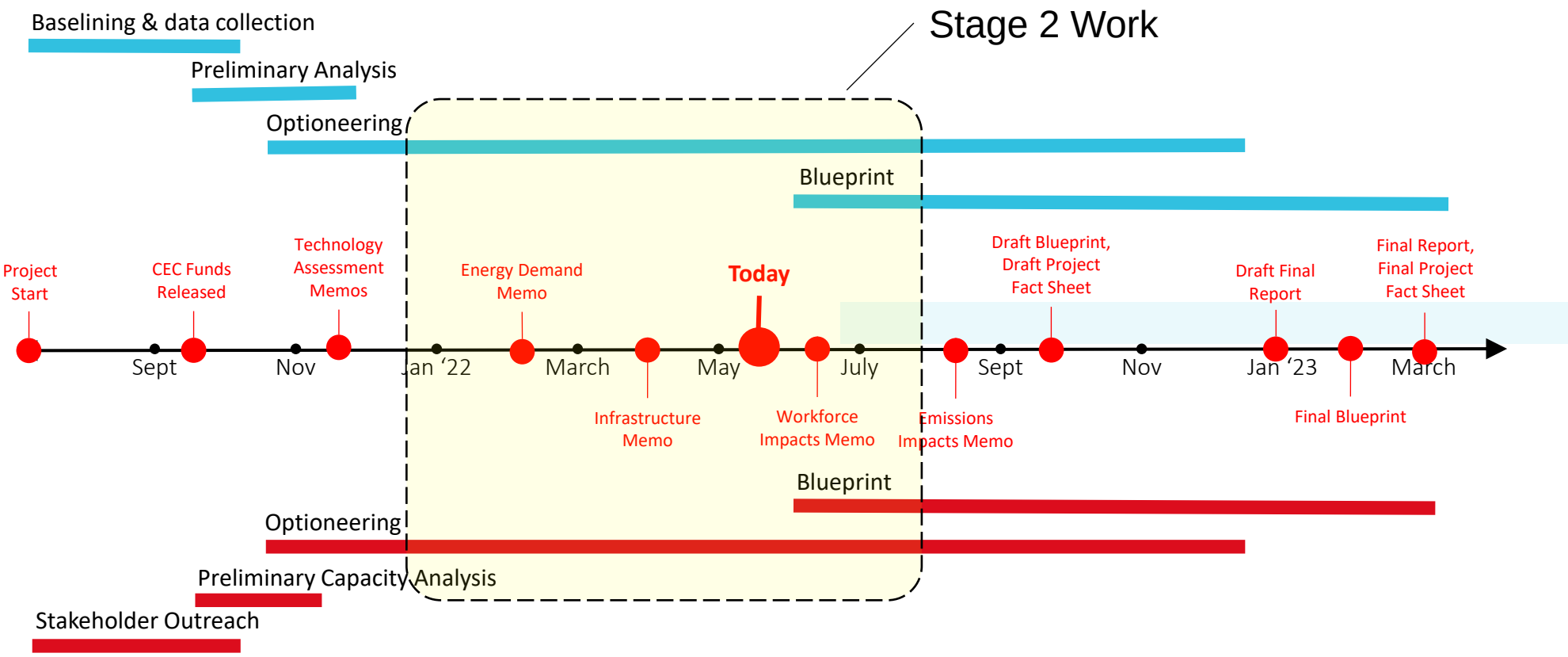
Vessel Side



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Shoreside

Fleet Electrification Schedule

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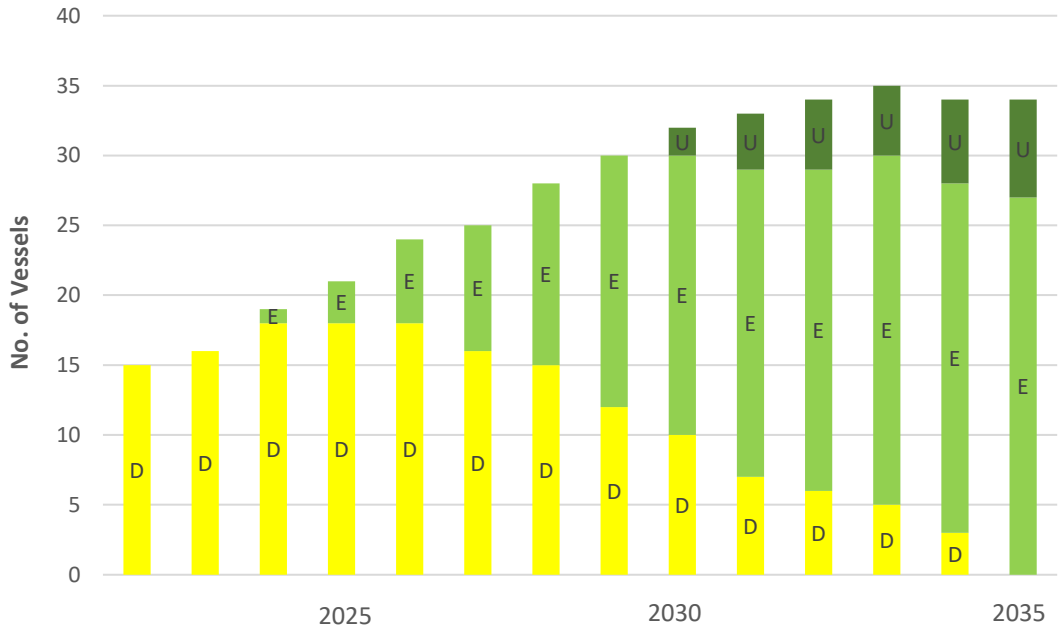
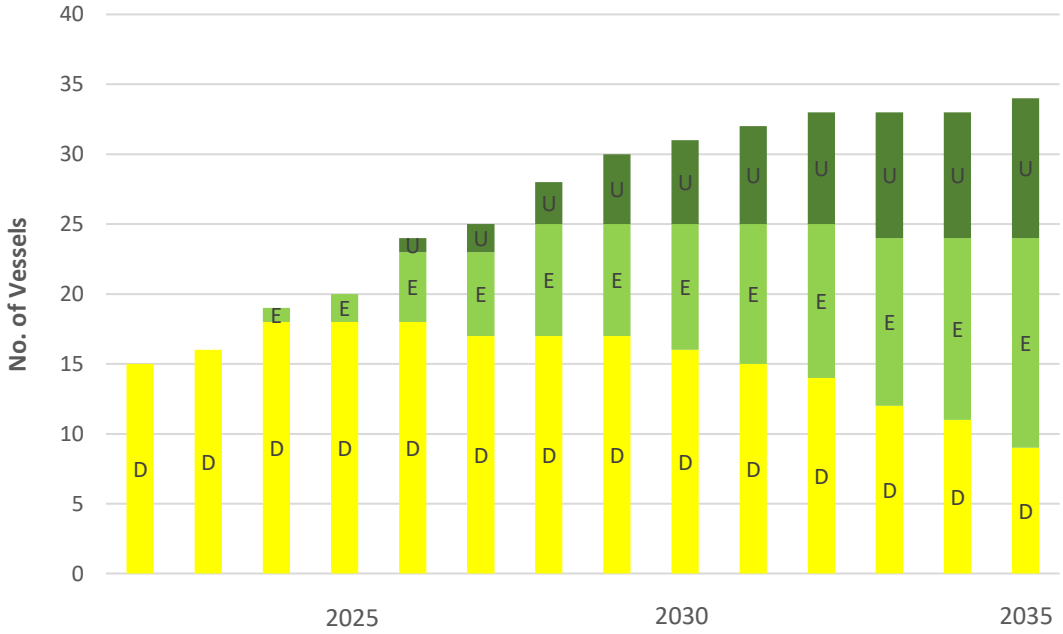
Optimal Implementation



Conservative Implementation



Diesel Vessel

Battery Electric Vessel

TBD (Future Technology, Alternative Fuel, Hydrogen)

Fleet Electrification Schedule

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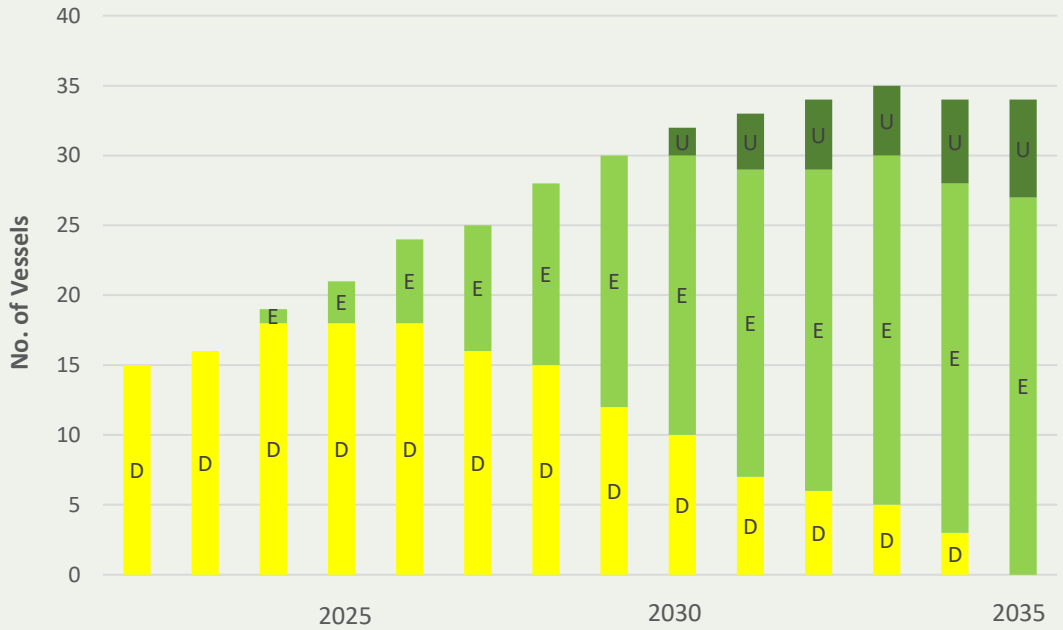
Optimal Implementation



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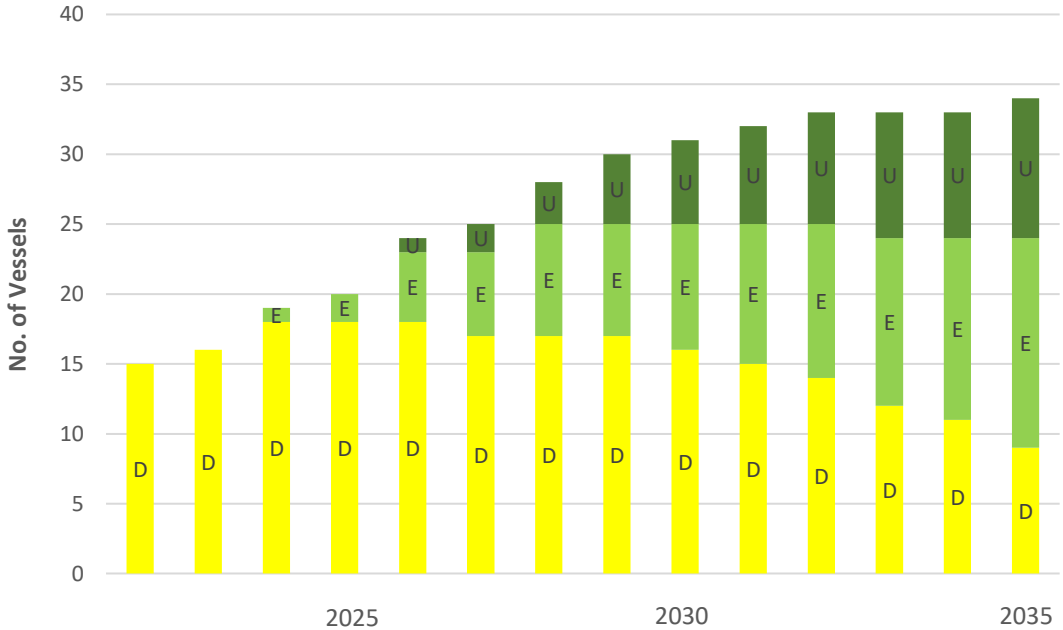

Diesel Vessel

Battery Electric Vessel

TBD (Future Technology, Alternative Fuel, Hydrogen)

OPTIMAL TIMELINE IS THE BASIS FOR OUR ANALYSIS

Stage 2 - Key Factors

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Constraints (established in Stage 1)

- Ridership demand is based on existing data and growth projections
- Attempt to mimic current service profiles to the extent possible
- **Peak hourly (i.e. commute times) ridership demand drives the vessel sizing and power requirements**
- SFFB is the common hub for most routes and will require the most attention

Charging Assumptions

- Two Charge Levels - Small Vessel (~1-1.5 MW) and Large Vessel (~4-5 MW)
- Charging occurs at all locations possible during onloading/offloading

Stage 2 -Optioneering Workflow

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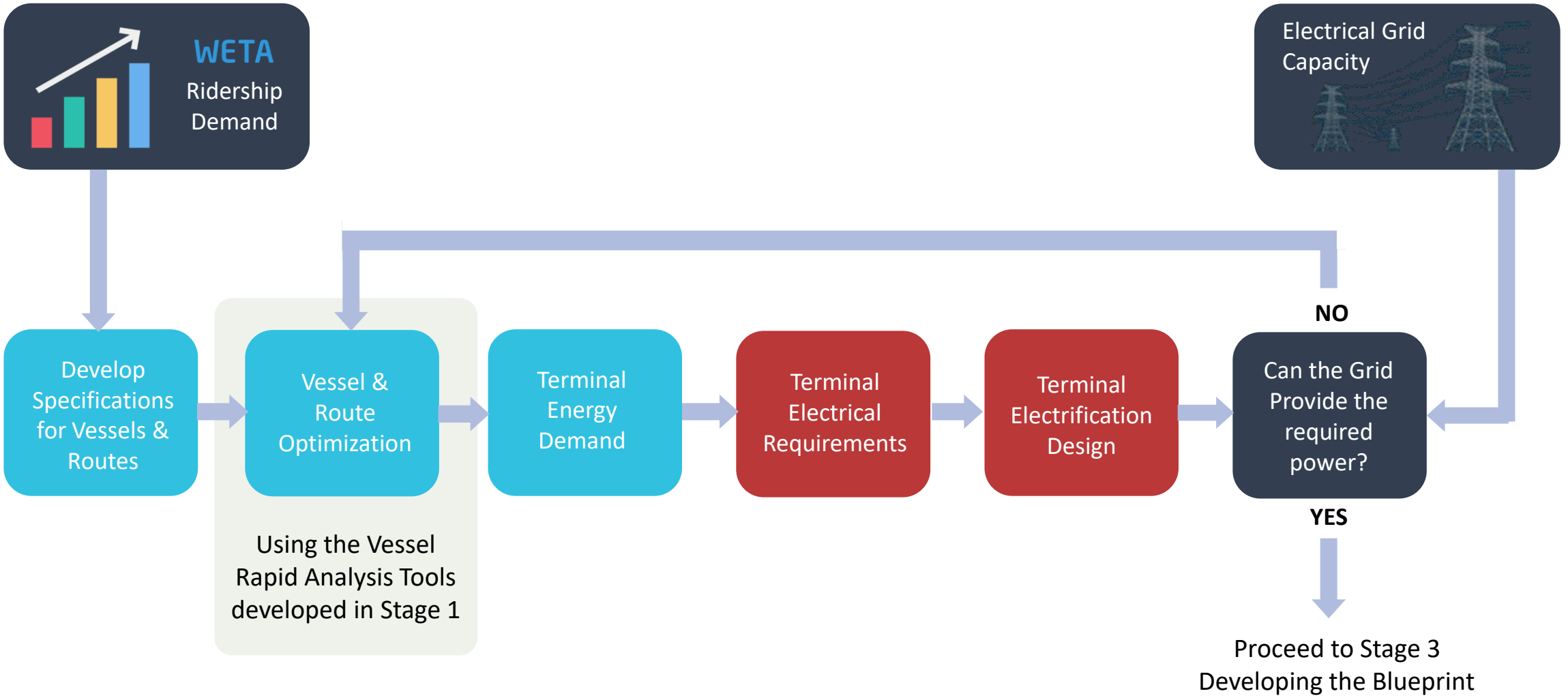

Stage 2 -Optioneering Workflow

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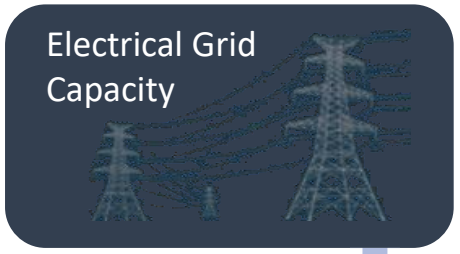
CONVERTING THE FLEET TO ZERO EMISSIONS IS A MULTI-YEAR PROJECT

VESSEL AND TERMINAL POWER DEMAND MUST BE BALANCED EACH YEAR THROUGHOUT THE TRANSITION



Develop Specifications for Vessels & Routes

Vessel & Route Optimization

Terminal Energy Demand

Terminal Electrical Requirements

Terminal Electrification Design

Can the Grid Provide the required power?

NO

YES

Proceed to Stage 3
Developing the Blueprint

Vessel Feasibility

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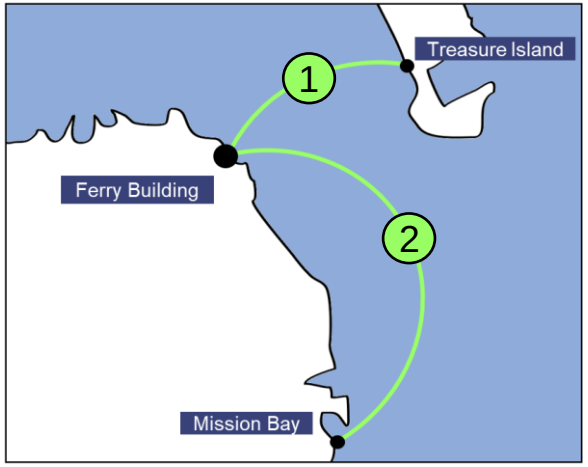
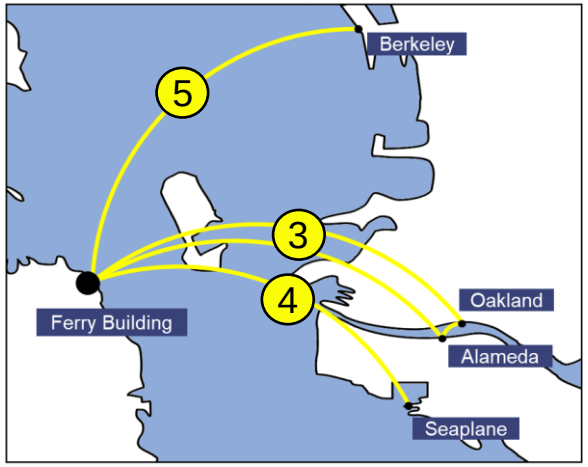
Phase 1 - Inner Central Bay



1 Treasure Island

2 Mission Bay

Phase 2 – Central Bay

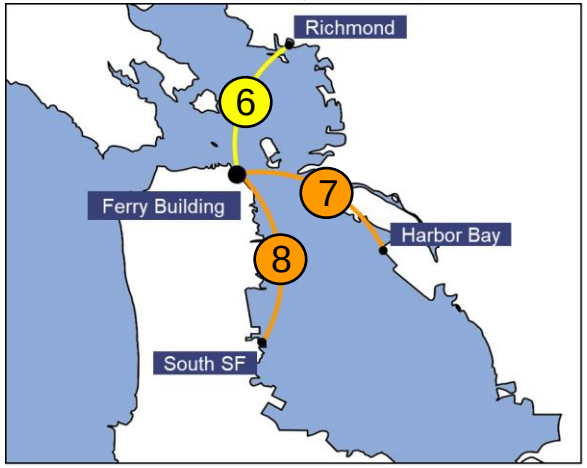


3 Oakland/Alameda

4 Seaplane

5 Berkeley

Phase 3 – Long Run Central Bay

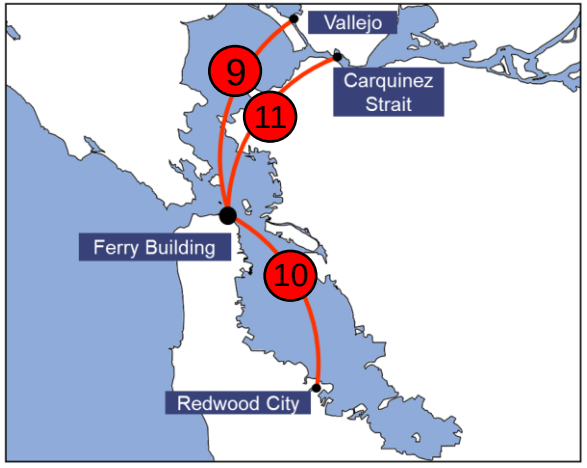


6 Richmond

7 Harbor Bay

8 South SF

Phase 4 – Long Runs



9 Vallejo

10 Redwood City

11 Carquinez

Feasible with Current Vessel Technology

Feasible with Current Vessel Technology - Operational Changes Required

Feasible with Current Vessel Technology - Significant Operational Changes Required

Not Currently Feasible – TBD Future Technology Required

Energy Demand Projections

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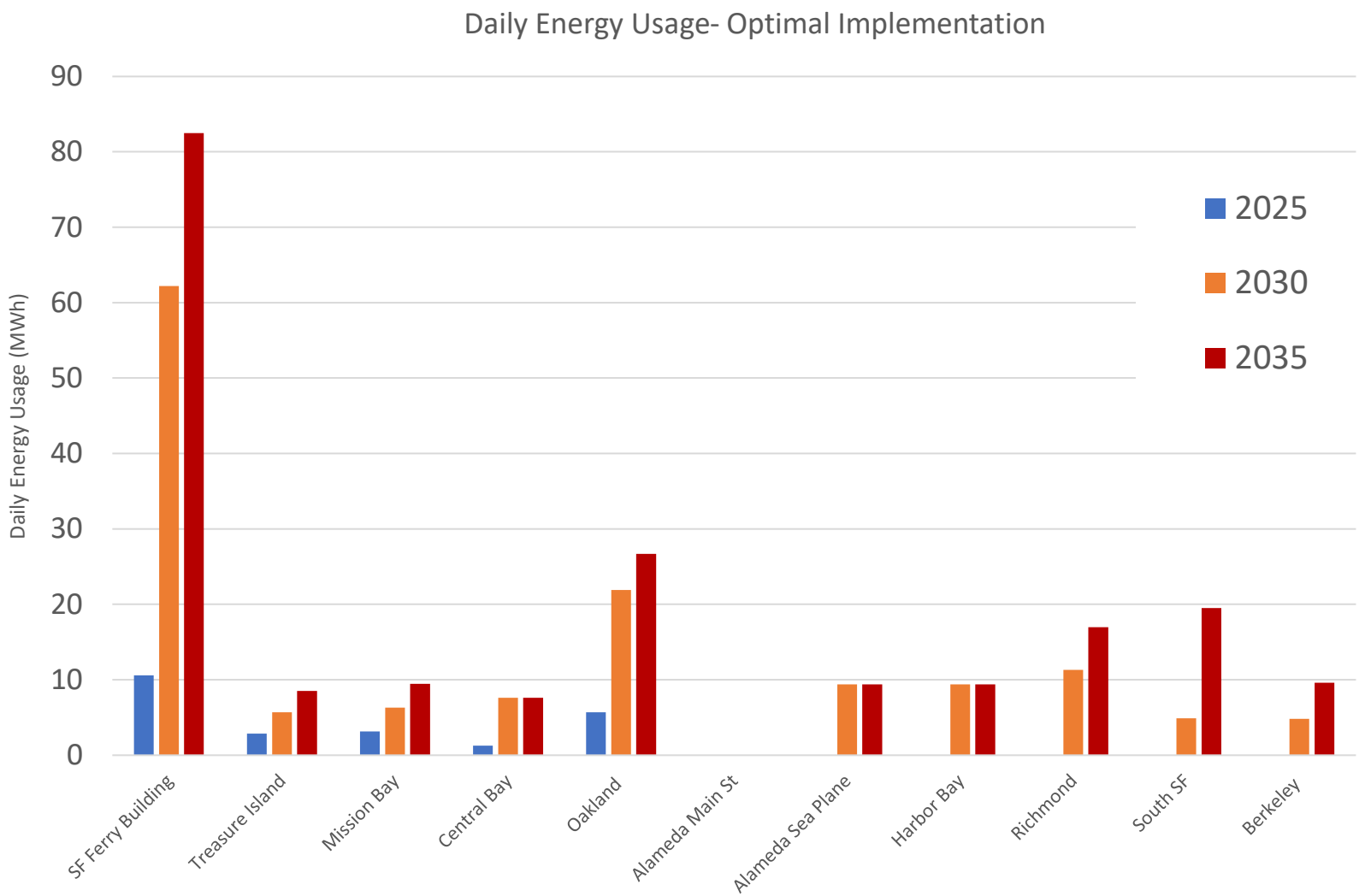
SF General Hospital **374 MWh/day**

SF Central Library **22 MWh/day**

Typical House **0.03 MWh/day**



Current Analysis Work

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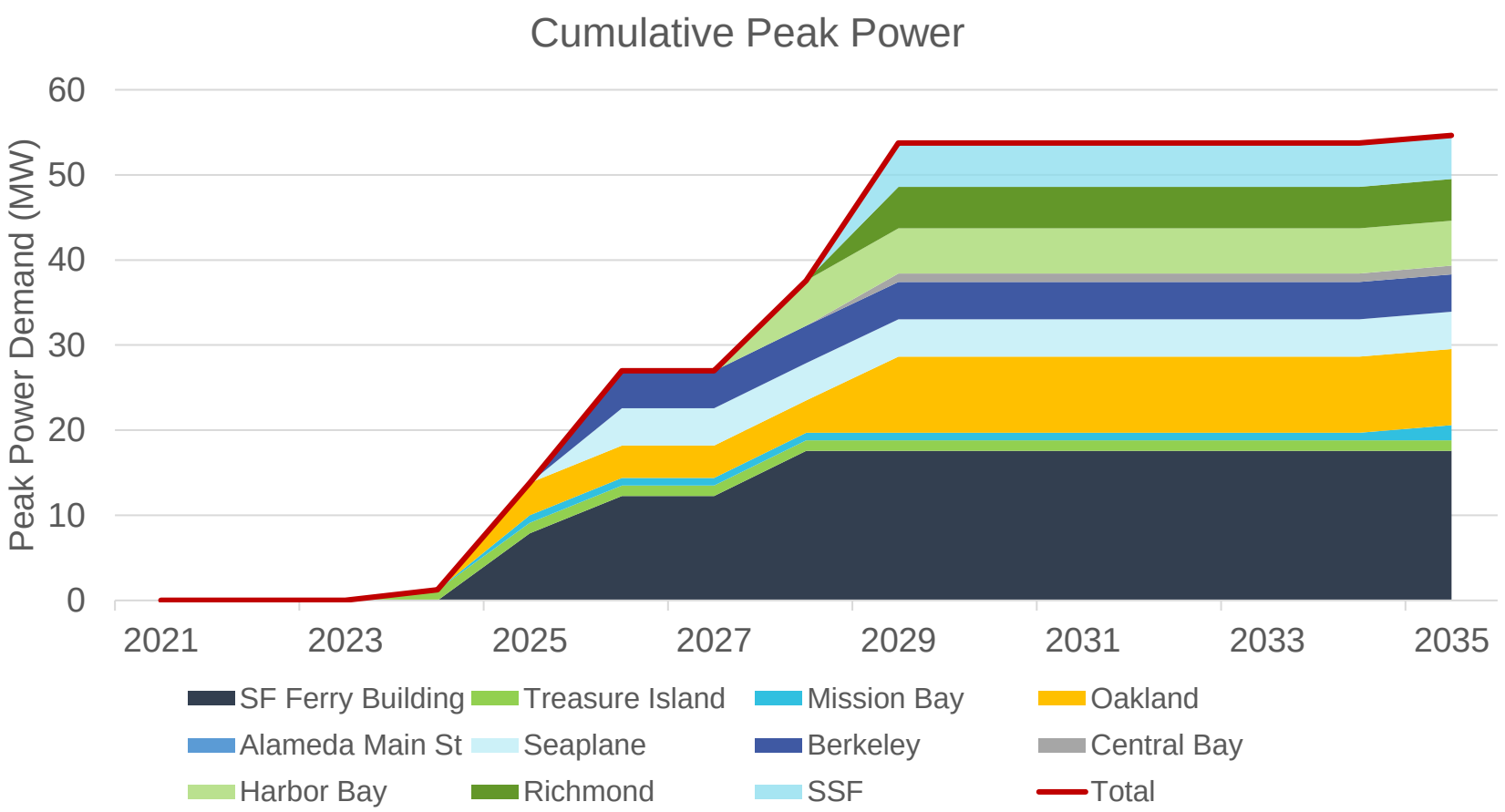
- **Charging**
- **Mooring and Docking**
- **Float Modifications**
- **Vessel Configurations**

Arup – Shoreside Analysis

Shoreside Analysis

Part 1: Baselining phase

- Analyzed the local grid context using publicly available data
- Identified potential constraints



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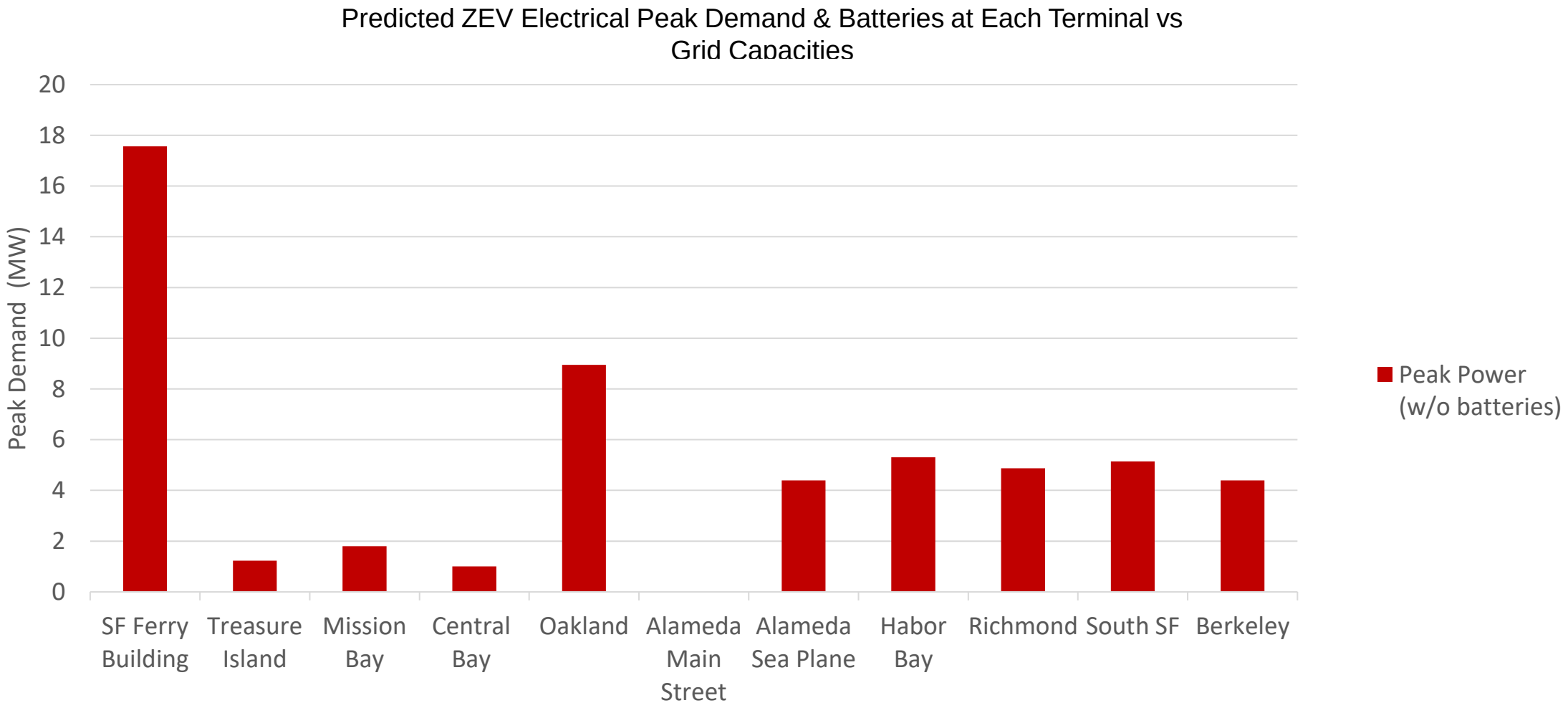
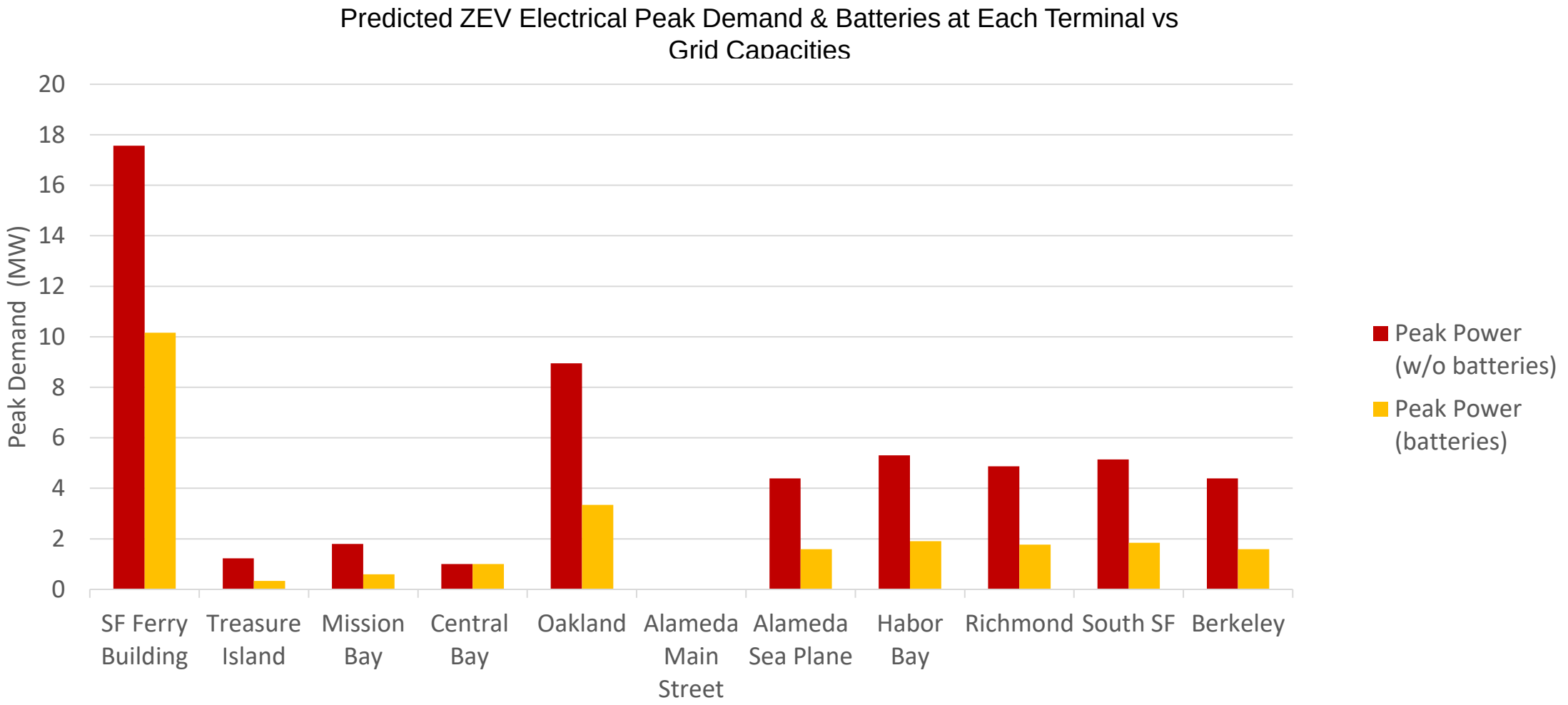
Part 1: Baselining Phase



**Alameda Main Street does not have predicted peak demands because there is no anticipated charging at this terminal*

ARUP

Part 1: Baselining Phase



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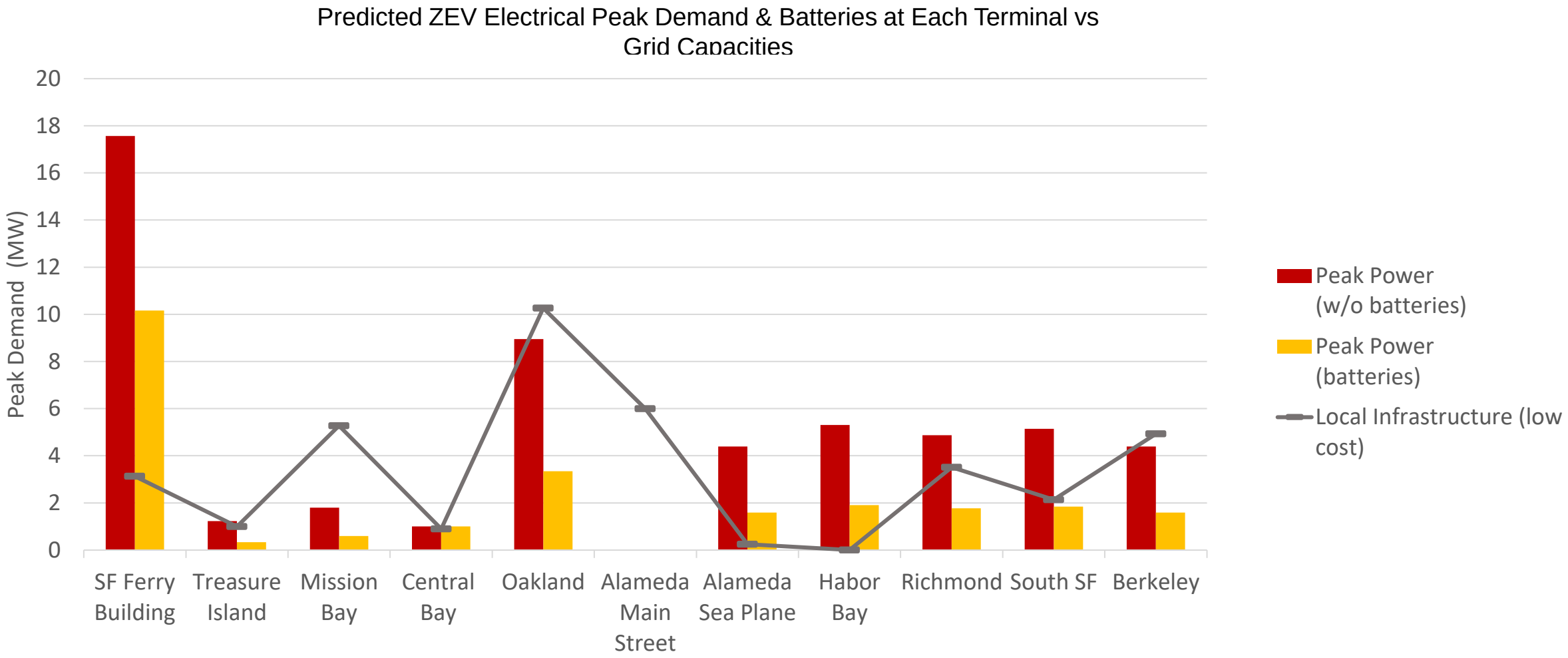

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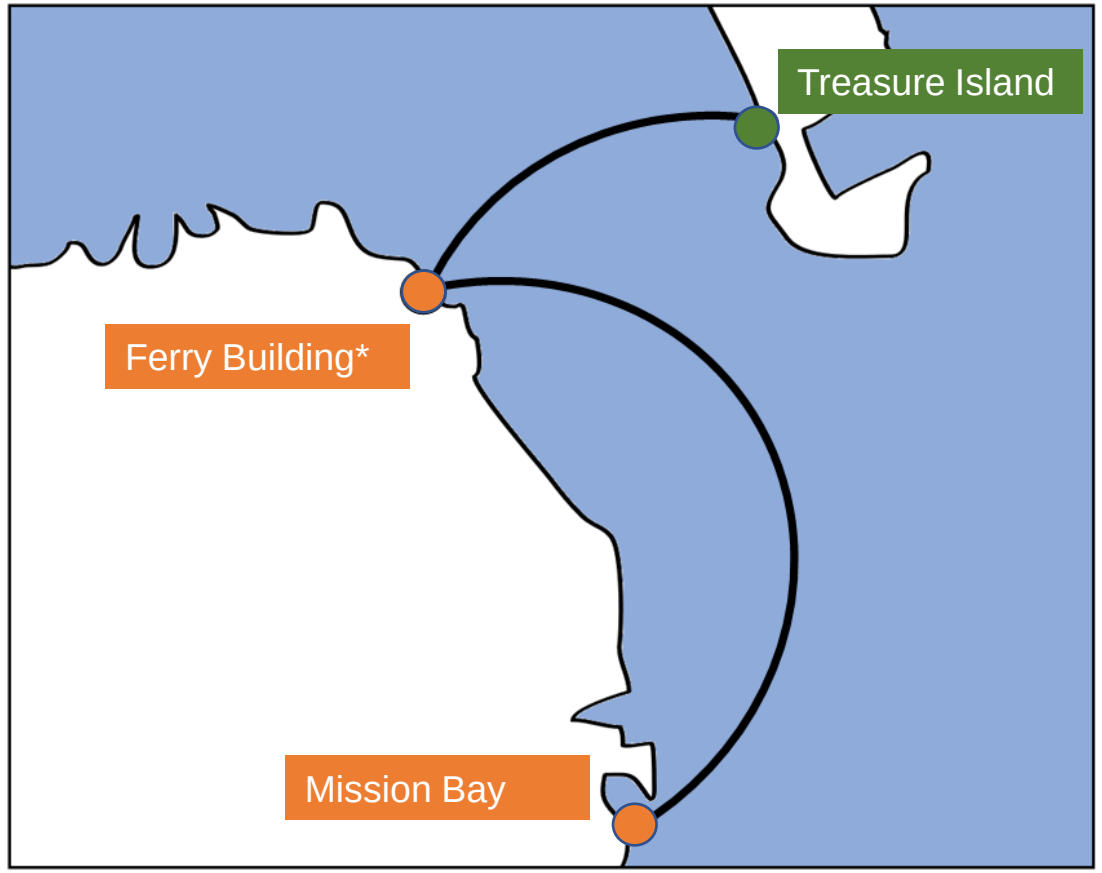
Phase 1 Shoreside Feasibility



Planned Grid Upgrades	Planned or existing grid capacity that is sufficient for electric ferries
Requires Upgrades	Local feeders found to have sufficient grid capacity on PG&E ICA mapping tool
Requires Significant Upgrades	New feeders or substation upgrade required with major cost and timeline implications

*Ferry building – minimal upgrades suffice in this first phase while only the highlighted routes are electrified

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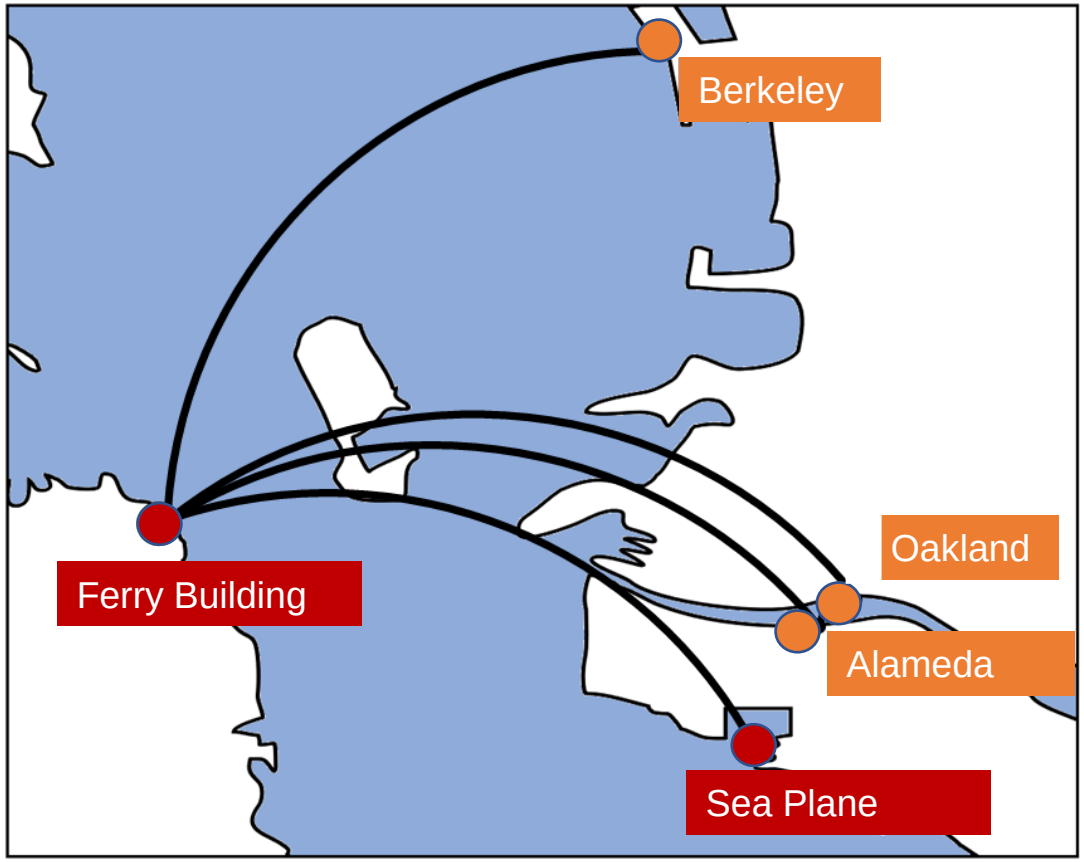
Phase 2 Shoreside Feasibility



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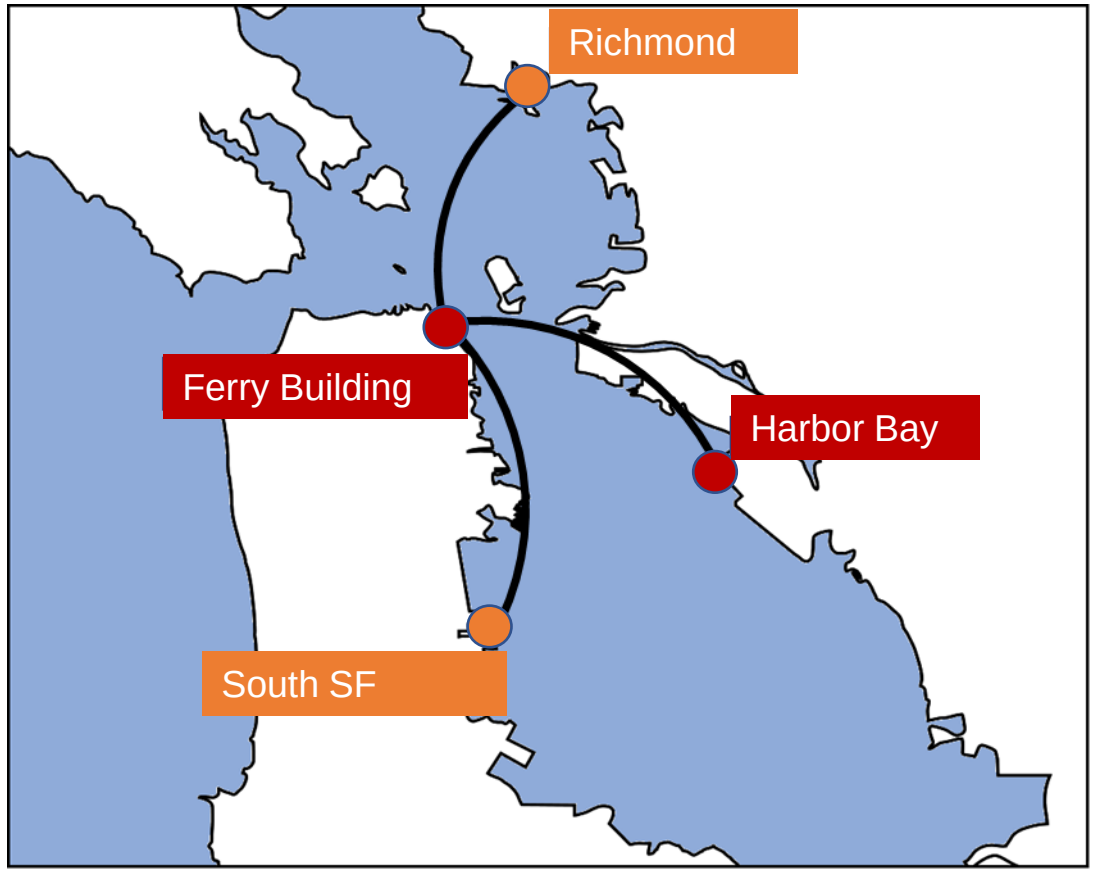
Phase 3 Shoreside Feasibility



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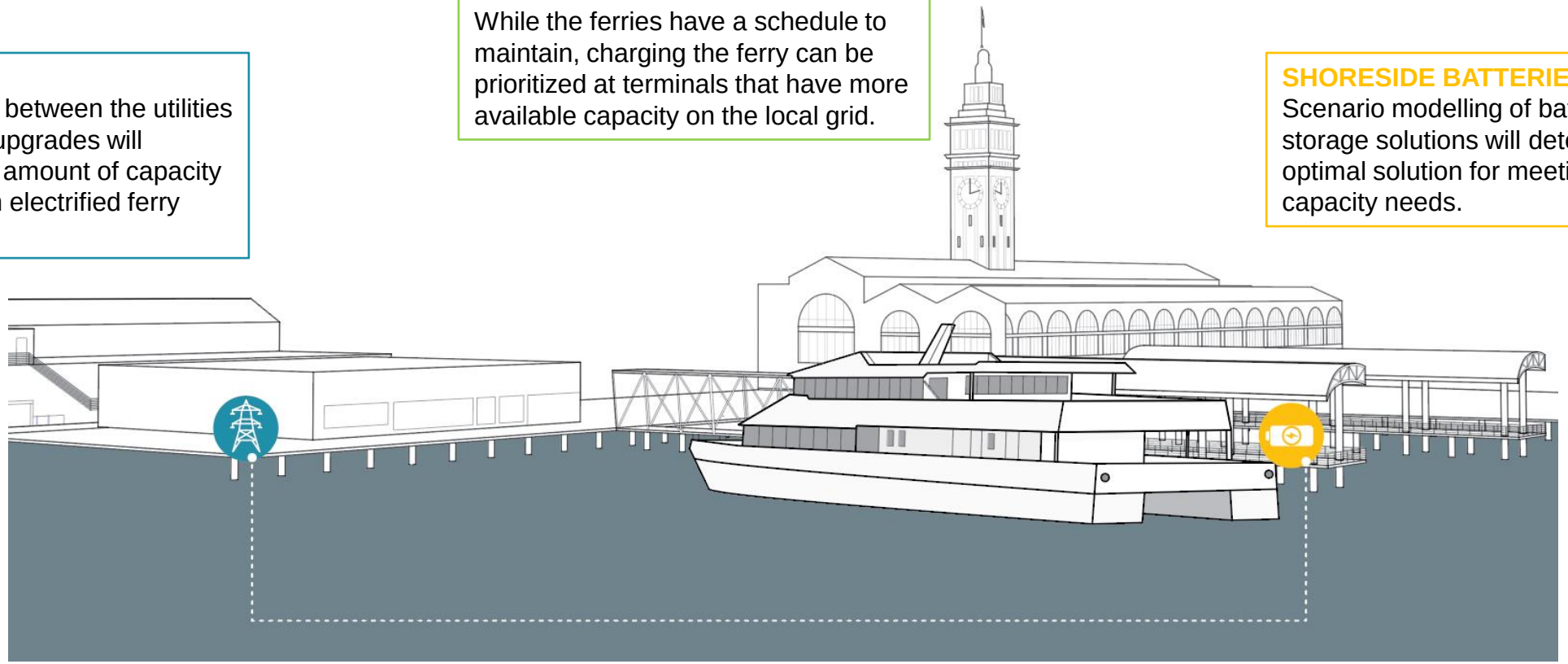
Part 2: Optioneering Phase

Grid Upgrades
With close coordination between the utilities and stakeholders, grid upgrades will provide the appropriate amount of capacity to meet the needs of an electrified ferry fleet.

LOAD MANAGEMENT
While the ferries have a schedule to maintain, charging the ferry can be prioritized at terminals that have more available capacity on the local grid.

SHORESIDE BATTERIES
Scenario modelling of battery energy storage solutions will determine the optimal solution for meeting the grid capacity needs.



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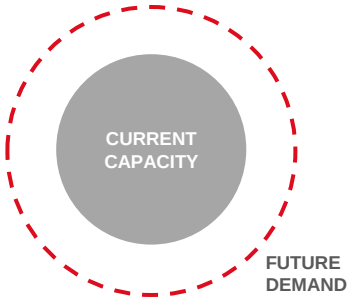
Part 2: Optioneering Phase

Current blocker:

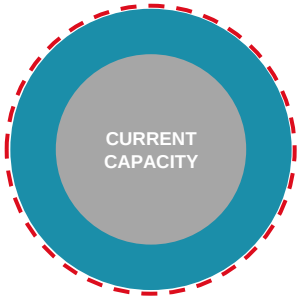
Grid Capacity uncertainty and optimized, balanced solution

Team Solution (Options):

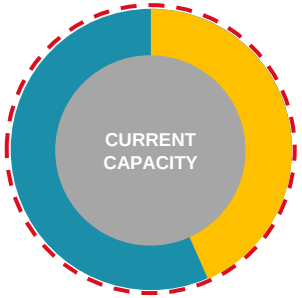
1. Upgrade grid to meet capacity needs
2. Interconnect battery energy storage
3. Provide load management



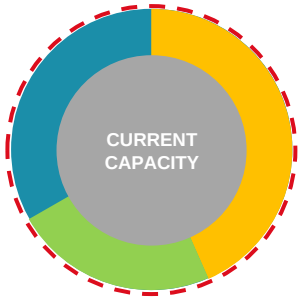
DEMAND COMPARISON:
CURRENT CAPACITY v. FUTURE ELECTRICAL DEMAND



SCENARIO 1:
GRID UPGRADES



SCENARIO 2:
GRID + BATTERIES



SCENARIO 3:
GRID + BATTERIES + LOAD MGMT

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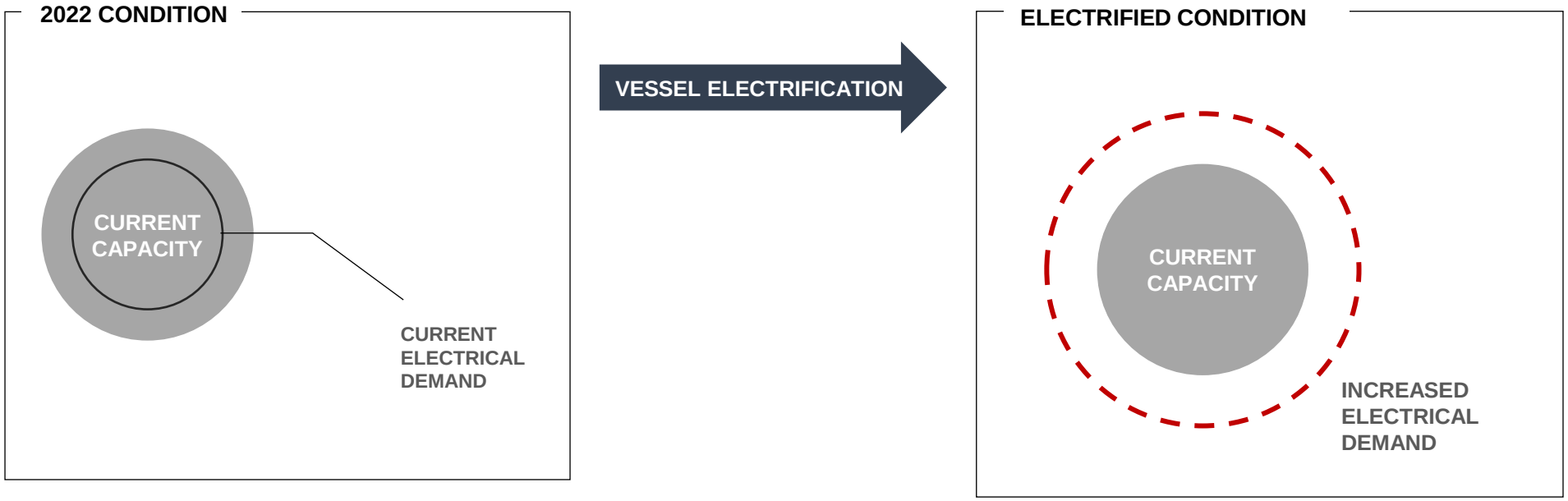
Optioneering in Action



Grid capacity meets electrical demand.

Grid capacity does not meet increased electrical demand in most terminal locations.

Optioneering phase: Arup is developing and evaluating solutions to meet increased electrical demand.

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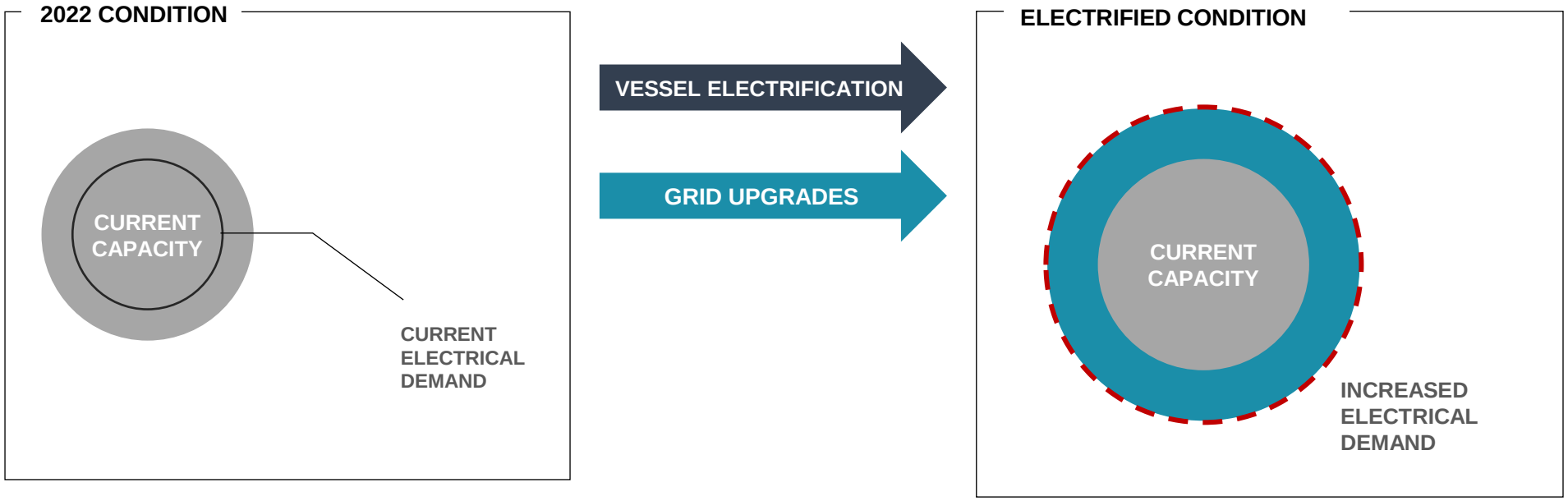
Optioneering in Action



Grid capacity meets electrical demand.

Grid capacity does not meet increased electrical demand in most terminal locations.

Scenario 1: Meet increased demand entirely through grid upgrades in collaboration with utilities.

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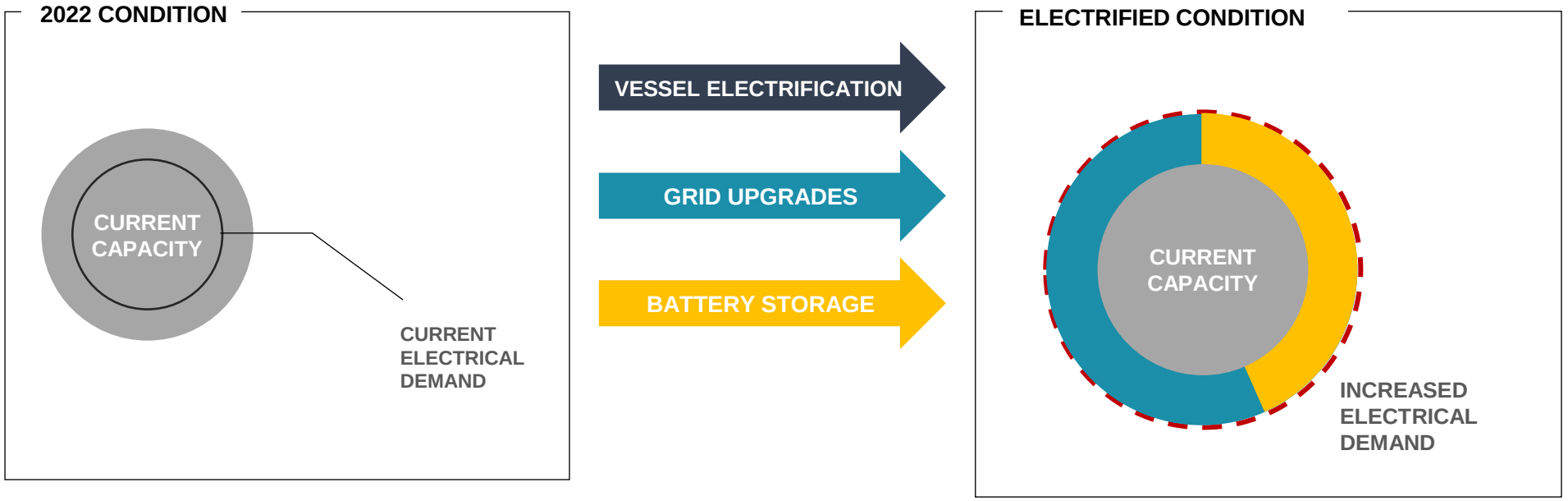
Optioneering in Action



Grid capacity meets electrical demand.

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Scenario 2: Meet increased demand through grid upgrades and battery storage.

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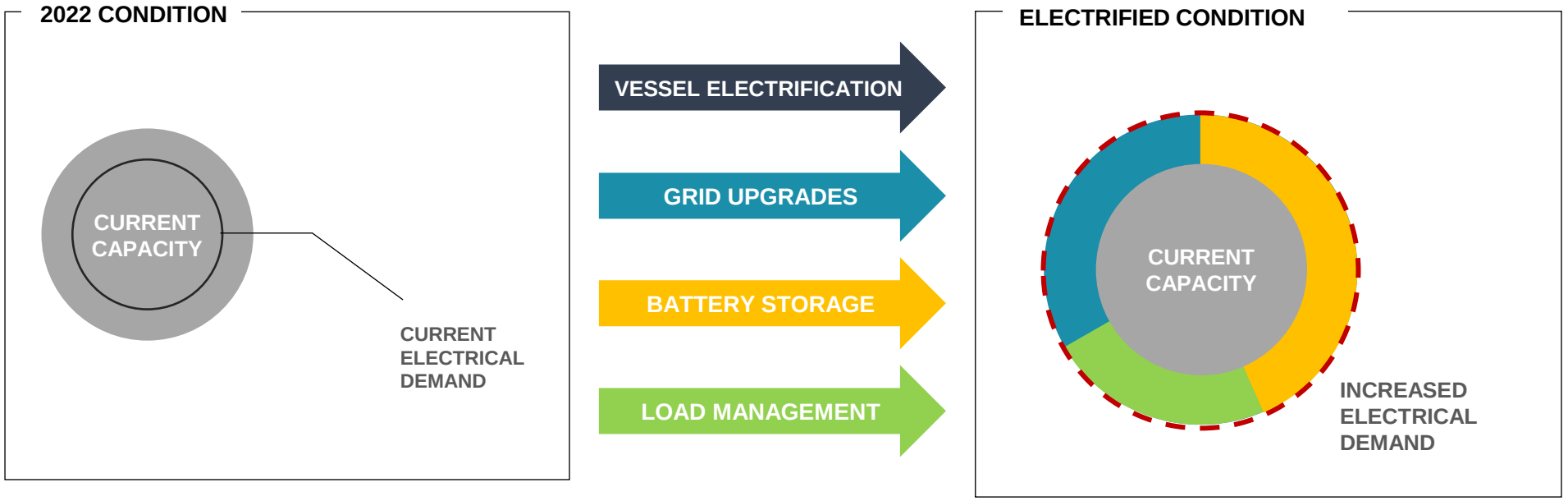
Optioneering in Action



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Scenario 2: Meet increased demand through grid upgrades and battery storage.

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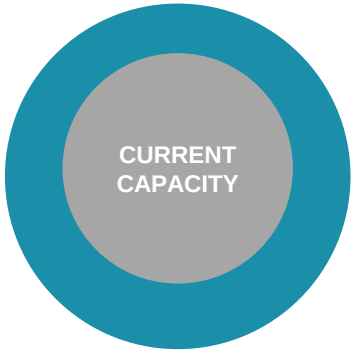
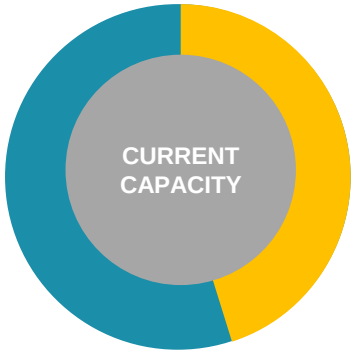
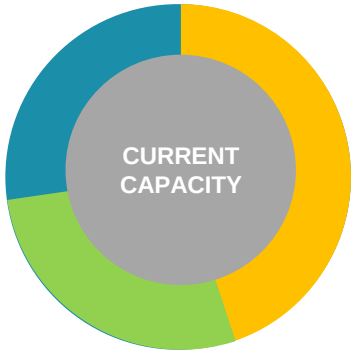
Optioneering in Action

SCENARIOS

METRICS	SCENARIO 1: GRID UPGRADES	SCENARIO 2: GRID + BATTERIES	SCENARIO 3: GRID + BATTERIES + LOAD MGMT
			
Cost	$$$$	$$$	$$
Timeline	Pending ongoing discussions with utilities		

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WETA – Progress Update

WETA Implementation Progress

- 2020 WETA was awarded a grant through TIRCP (Transit and Intercity Rail Capital Program) to build (1) 99-149 passenger all electric vessel and infrastructure
- 2022 WETA applied for an additional grant through TIRCP to build (1) 99-149 passenger all electric vessel and related infrastructure
- 2022 WETA applied for FTA funds to build (1) 99-149 passenger all electric vessel
- If awarded, this would provide WETA with (3) 99-149 passenger vessels to serve phase 1 of implementation.
- There is also discussion of finding funding for a possible 4th vessel

WETA Implementation Progress

- Engaged with SFPUC and the Port of San Francisco to analyze grid upgrades to serve the Downtown San Francisco Terminal and other charging opportunities along the waterfront
    - Includes examination of potential near term (temporary) upgrades while more complex solutions develop

- Engaged with San Francisco County Transportation Authority (SFCTA) for implementation of zero emission Treasure Island Ferry Service
    - Defining roles and responsibilities
    - Service planning and fare analysis
    - Coordination with SFPUC for electrification of Treasure Island Terminal

- Coordinating with Alameda Municipal Power to develop preliminary plans and cost estimates to electrify Alameda ferry facilities
    - Includes pre-engineering studies
    - Including Central Bay Operations and Maintenance Facility Expansion - preliminary work in FY23 capital budget

Questions