



Jacobs

Challenging today.
Reinventing tomorrow.

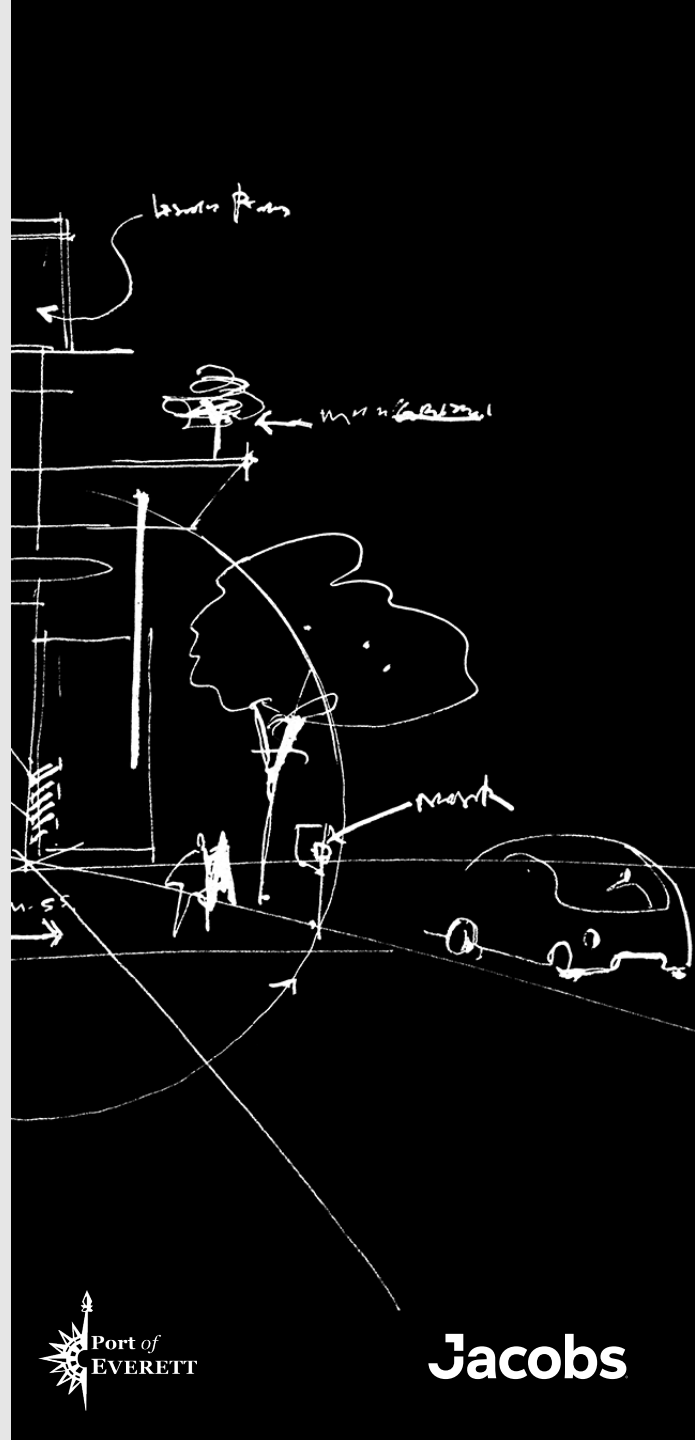
Utilizing Technology in Environmental Work

Enhancing Port Decarbonization Models with Real Time Asset Data

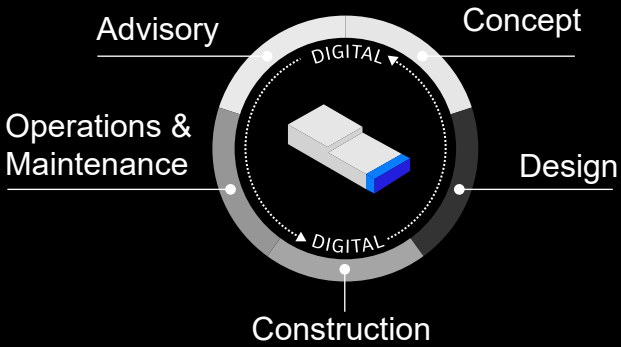
September 25th 2025

Agenda

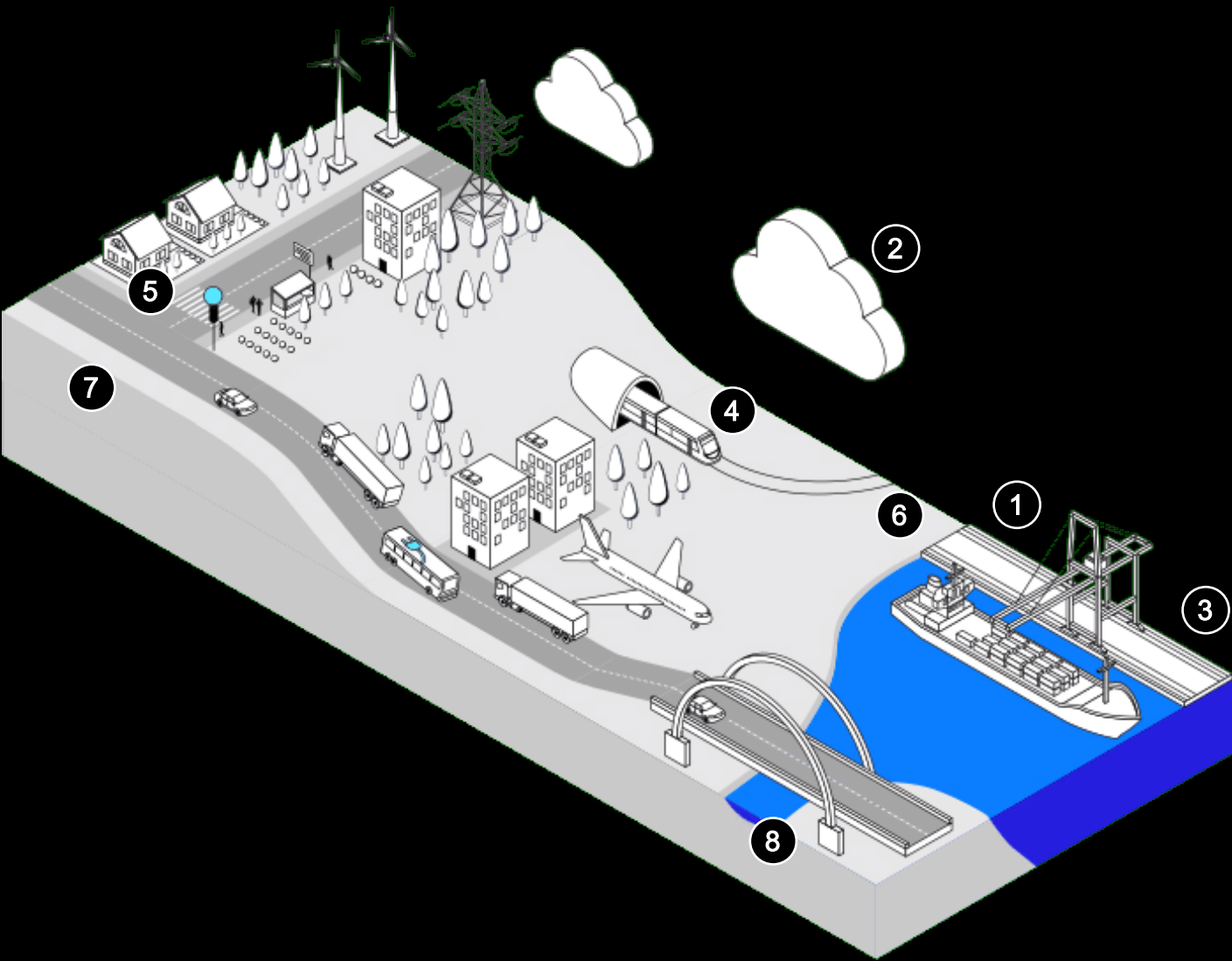
1. Introduction
2. Data Analytics: Decarbonization Analytics for Port Equipment (DAPE)
3. Solution Development
4. Implementation Roadmap



Addressing the entire Port ecosystem

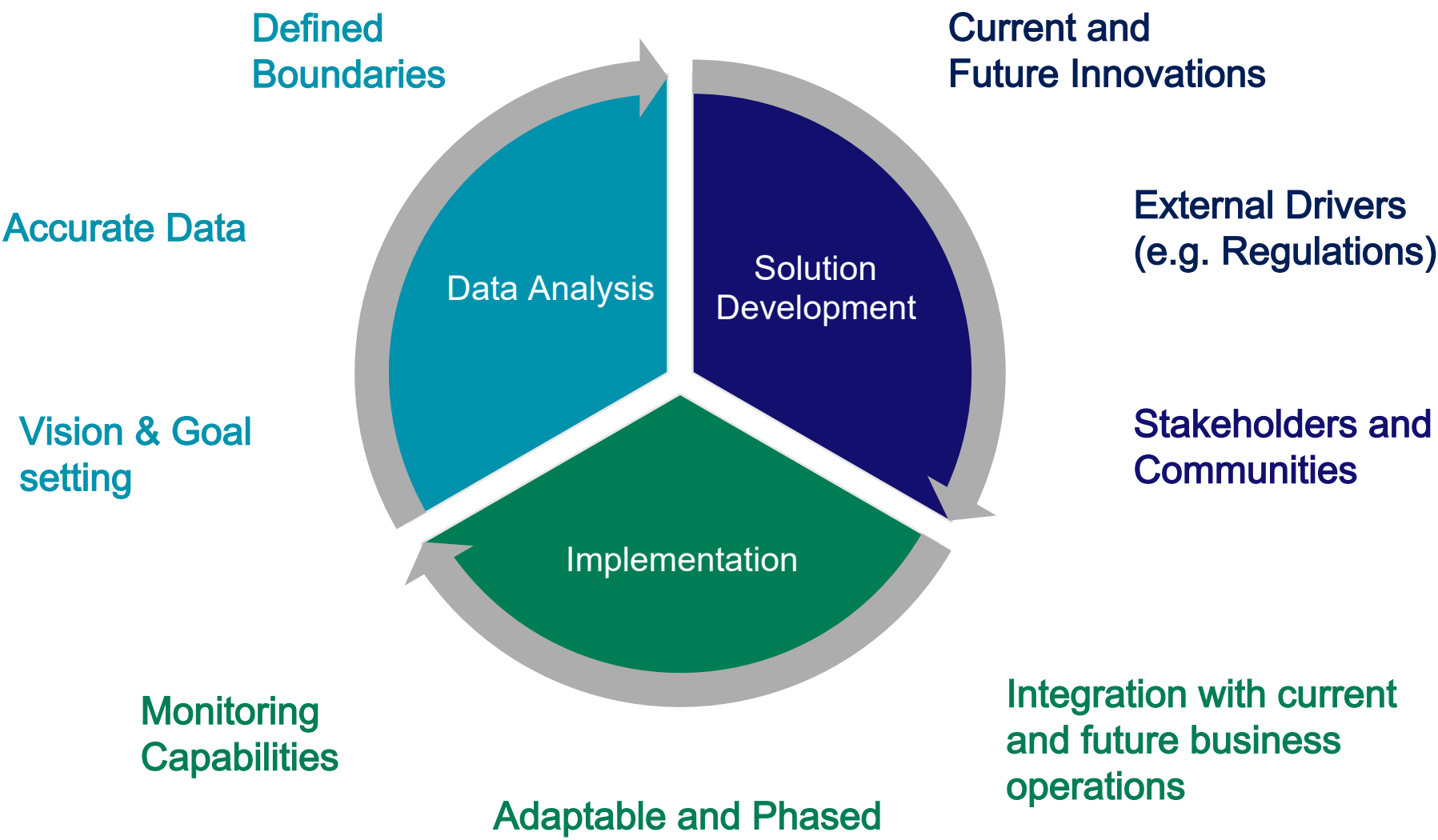


- ① Climate Resilient Infrastructure
- ② Digital Services
- ③ Ports, Ferries, and Related infrastructure
- ④ Intermodal - Rail
- ⑤ Smart Assets
- ⑥ Asset Management
- ⑦ Decarbonization of Equipment/Vehicles
- ⑧ Major Crossings & Complex Bridges



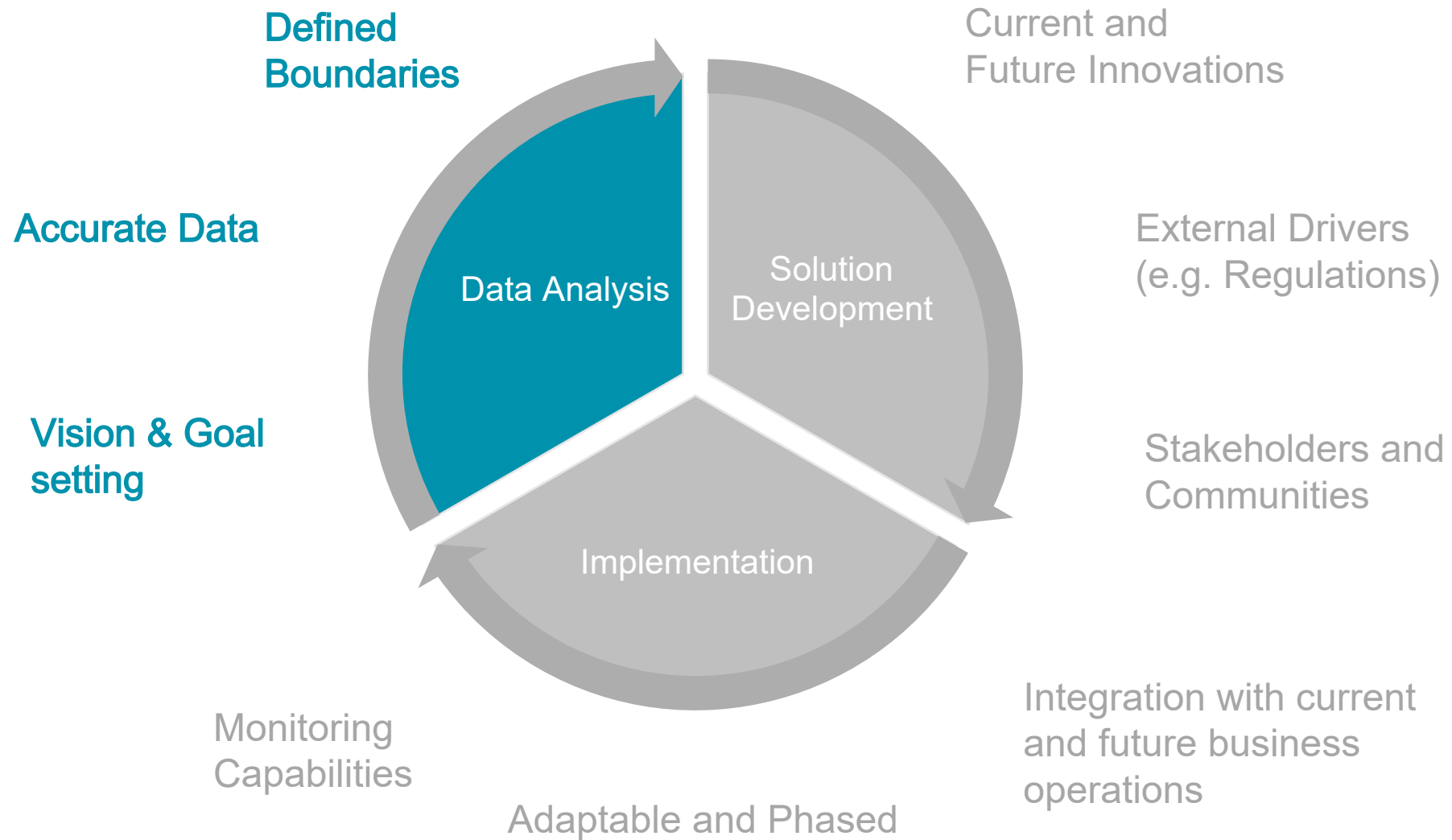
Introduction

Developing a successful Decarbonization Roadmap:



Introduction

Developing a successful Decarbonization Roadmap:





Decarbonization Analytics for Port Equipment (DAPE)

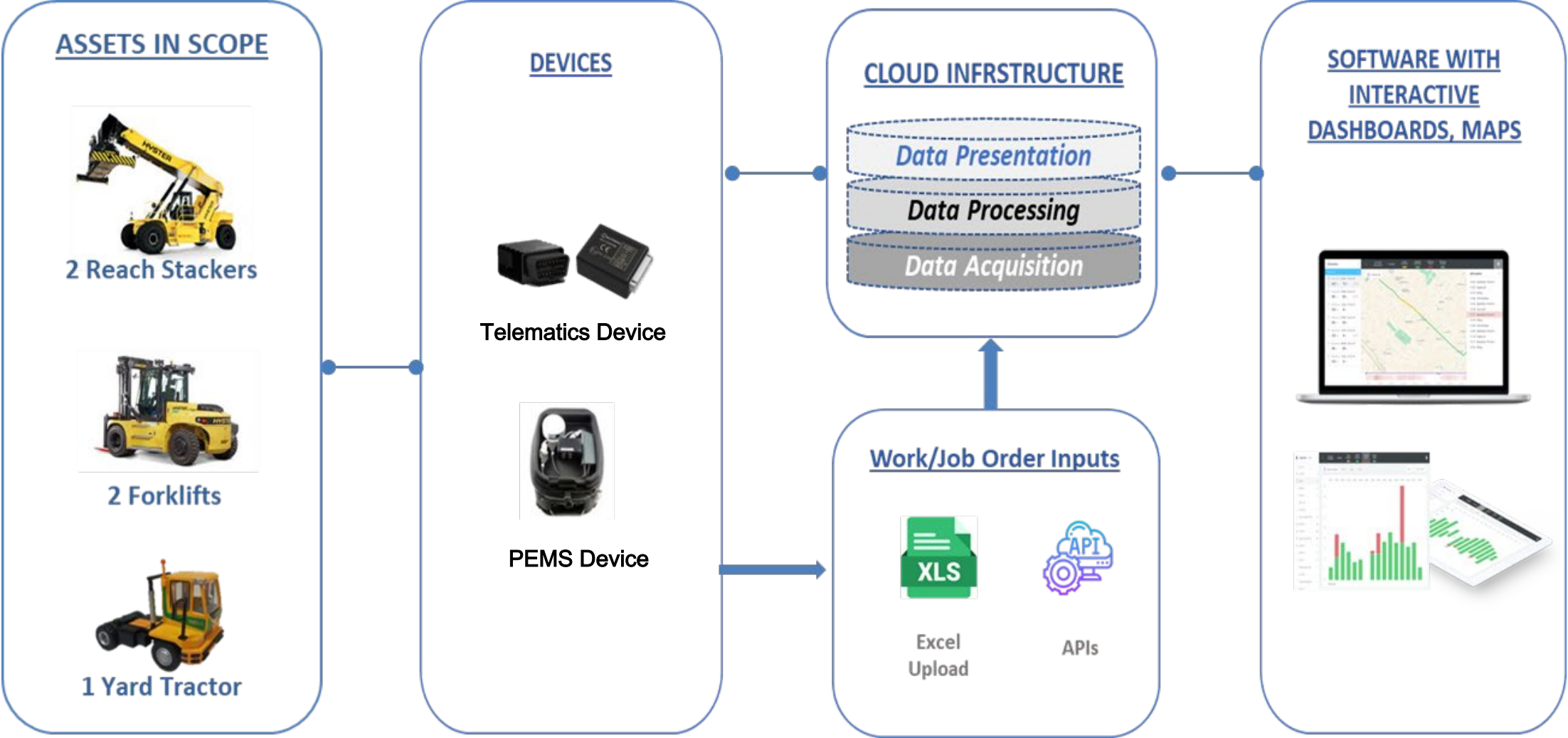
Port of Everett Pilot Study

What is DAPE?

- First-of-its-kind platform which captures and analyzes real-time emissions and equipment data.
- Combines telematics + Portable Emission Measurement Systems (PEMS) data into one scalable, cloud-based dashboard.
- Provides live insights on equipment emissions, movement, and health.
- Enables data-driven decision-making for decarbonization, maintenance, and operational efficiency.



How Does it Work?



Why Develop DAPE?

- You can't manage what you don't measure.
- Challenge outdated inventories that overlook real-world variables unique to port equipment.
- Unlock operational insights by quantifying factors like idle time, routes, and operator behavior that drive emissions.
- Enable data-driven planning for decarbonization and smarter infrastructure investments.

DAPE Dashboard

Search

154

Type: Reach Stacker
Make: Hyster
Model: RS46-36CH
Fuel type: Diesel



Inactive

165

Type: Forklift
Make: Hyster
Model: H360HD2
Fuel type: Diesel



Active

190

Type: Reach Stacker
Make: Hyster
Model: RS46-41XD/75S
Fuel type: Diesel



Inactive

223

Type: Forklift
Make: Hyster
Model: H240XD
Fuel type: Diesel



Stopped

5186

Type: Yard Tractor
Make: SISU
Model: TT120
Fuel type: Diesel



Inactive

Asset #: 165

MapSatellite



Google

StatisticsInsights

Total

Engine hours0d 13h 55m

Idle hours1d 13h 9m

Stoppage hours28d 20h 54m

Weekly Average

Engine hours0d 3h 28m

Idle hours0d 9h 17m

Stoppage hours7d 5h 13m

Daily Average

Engine hours0d 0h 27m

Idle hours0d 1h 14m

Stoppage hours0d 23h 5m

- Zone events
- Enter South Terminal2025-09-18 09:15:15

Exit Pacific Terminal2025-09-18 09:15:15

Enter Pacific Terminal2025-09-18 09:13:37

Exit Hewitt Terminal2025-09-18 09:13:37

Enter Hewitt Terminal2025-09-18 09:09:42

ECU data

Last update2025-09-18 09:50:30

IMEI861492068475018

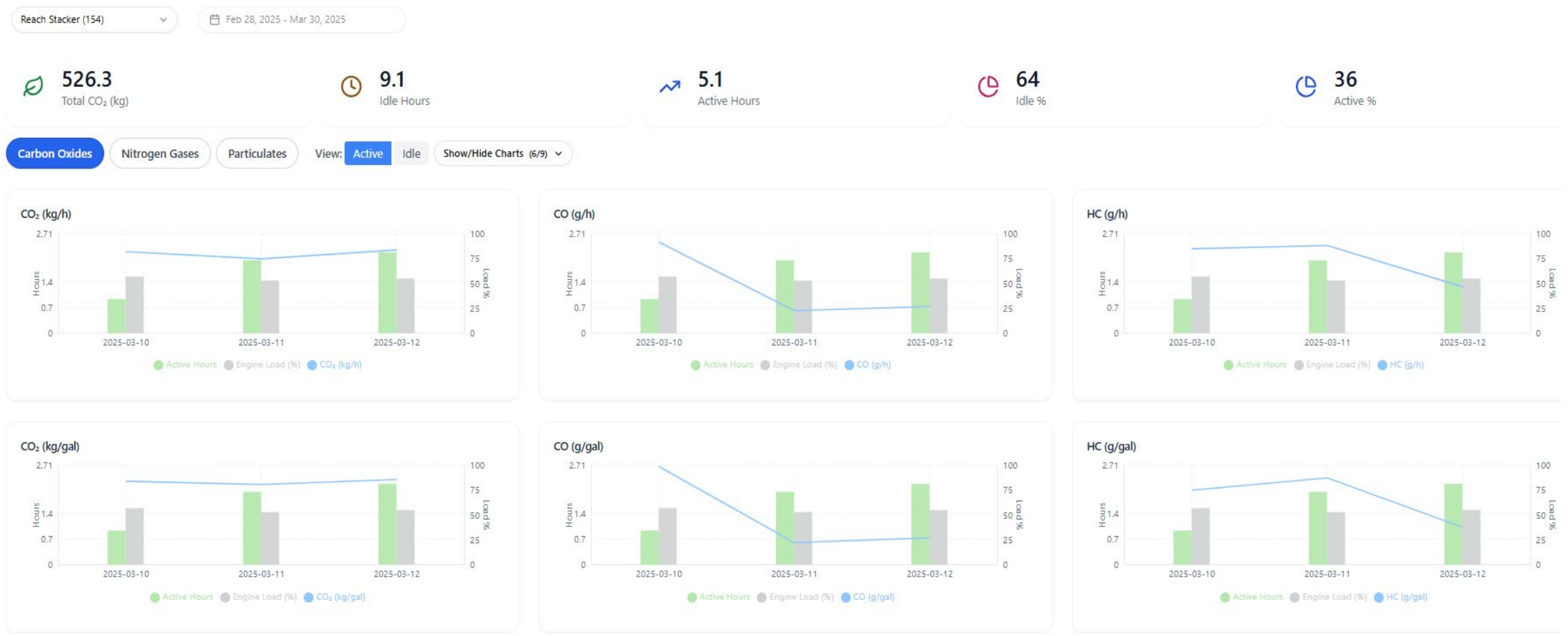
Current zoneSouth Terminal

OBD IgnitionON

RPM810

Engine Hours

DAPE Dashboard- Emissions



Telematics Data



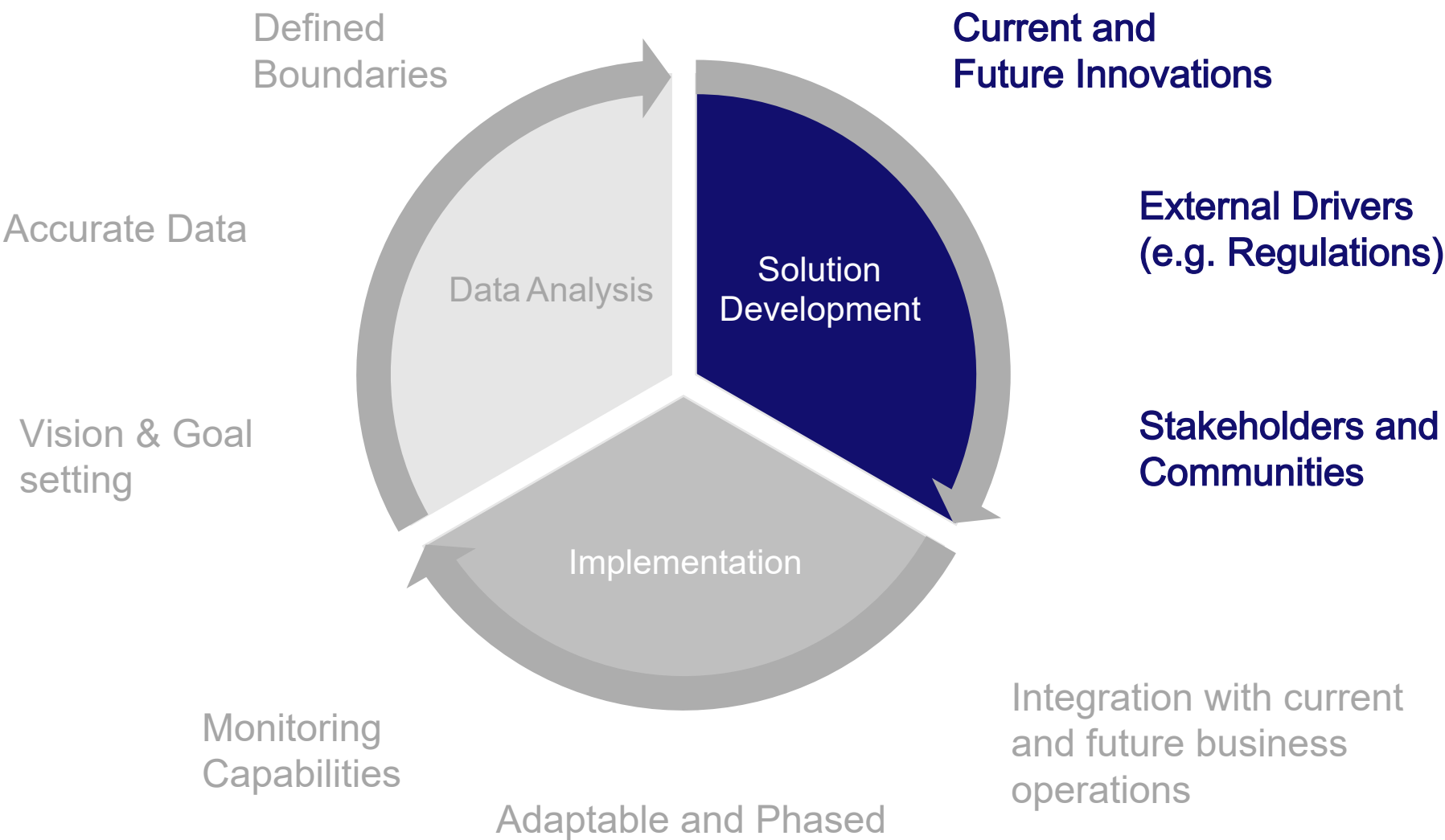
Key Takeaways

- Real-time emissions and operational data provide accuracy beyond traditional inventories.
- Idle time reduction offers immediate emissions and cost savings.
- Plug-and-play technology works across old and new equipment without major infrastructure changes.
- Data visualization tools (heat maps, dashboards) drive operational efficiency and spatial planning efforts.
- Future prediction of emissions and scenario simulation analysis.

**You've Analyzed the Data –
Now What?**

Introduction

Developing a successful Decarbonization Roadmap:

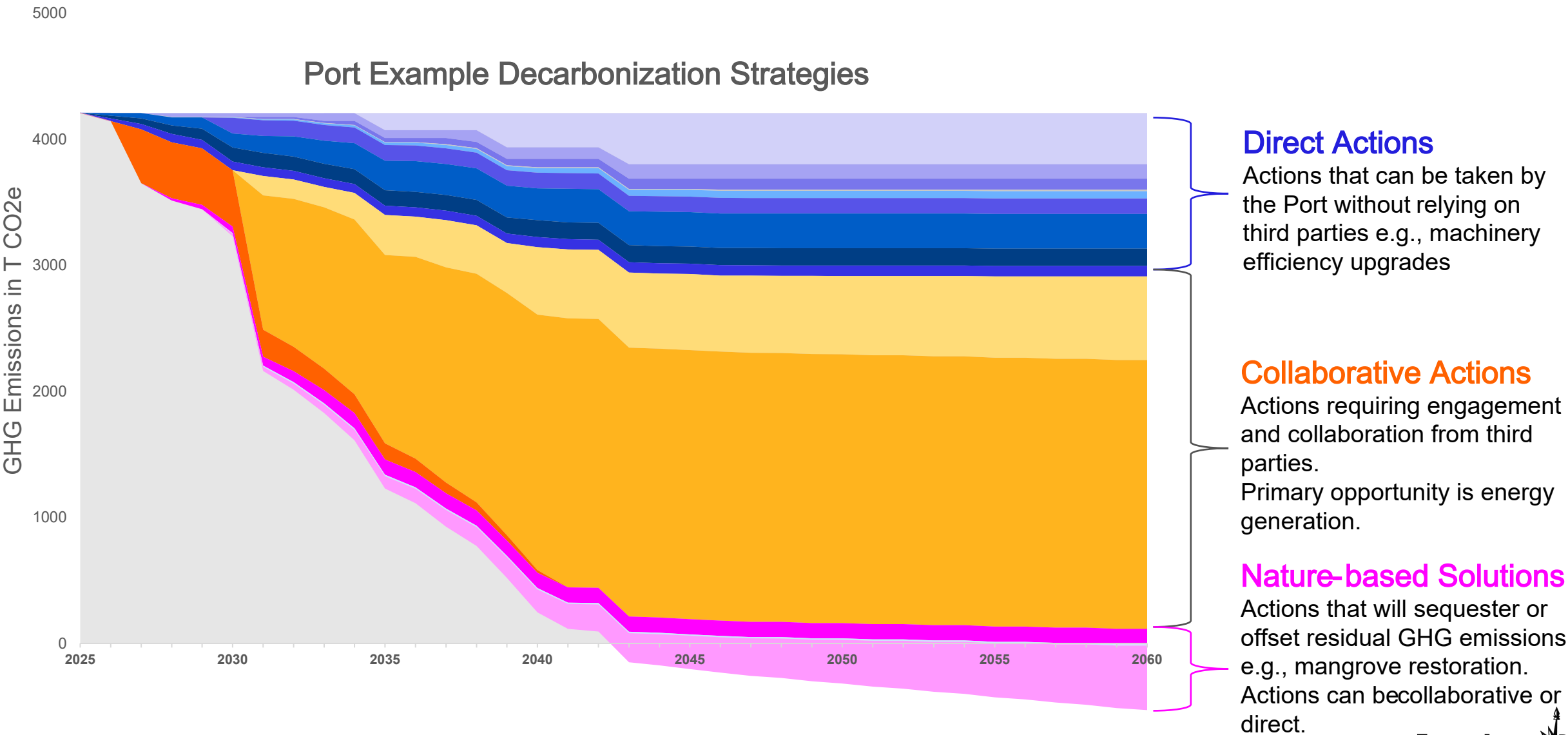


GHG Reduction Tool

Strategy	Solutions	Carbon Savings	Cost	Additional Benefit		Start	Frequency	#	Max
Hybrid	STS Cranes		\$ \$ \$ \$ \$		Yes	2045	1	3	3
Electrification	Top Loaders		\$ \$ \$ \$		Yes	2040	5	4	11
Electrification	Tractors		\$ \$ \$ \$		Yes	2035	3	4	21
Electrification	Forklift (5, 10 & 20 ton)		\$ \$ \$		Yes	2033	9	3	13
Electrification	On-Road Fleet		\$ \$ \$		Yes	2030	1	5	86
Strategy	Solutions	Carbon Savings	Cost	Additional Benefit		Start	Frequency	#	Max
Energy	On-site Energy Gen (Solar)		\$ \$ \$ \$		Yes	2030	5	1	1
Strategy	Solutions	Carbon Savings	Cost	Additional Benefit		Start	Frequency	#	Max
Operations	ECM		\$ \$ \$ \$		Yes	2026	1	1	1
Operations	Employee Engagement		\$ \$		Yes	2026	1	1	5
Operations	Sub-metering		\$ \$ \$		Yes	2026	1	1	3

GHG Reduction Tool Results

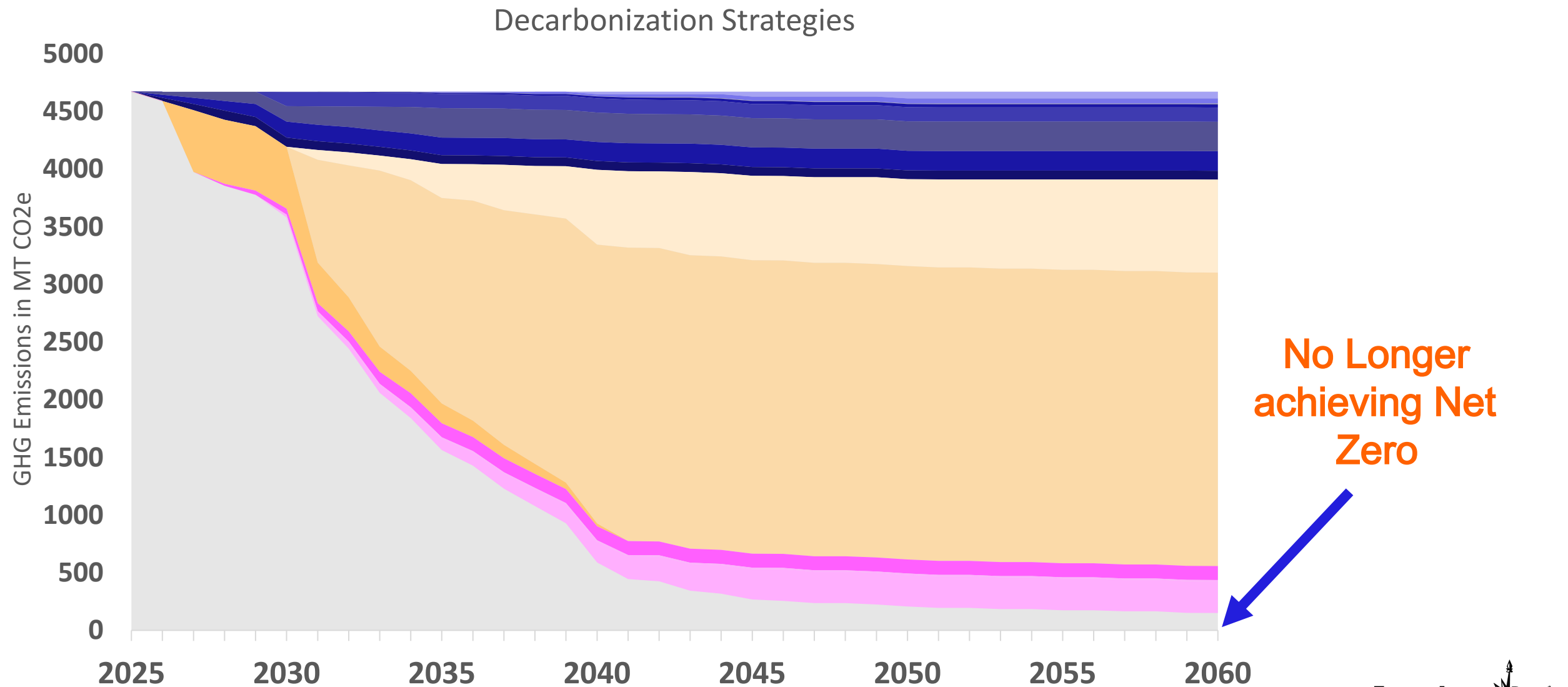
Port Example Decarbonization Strategies



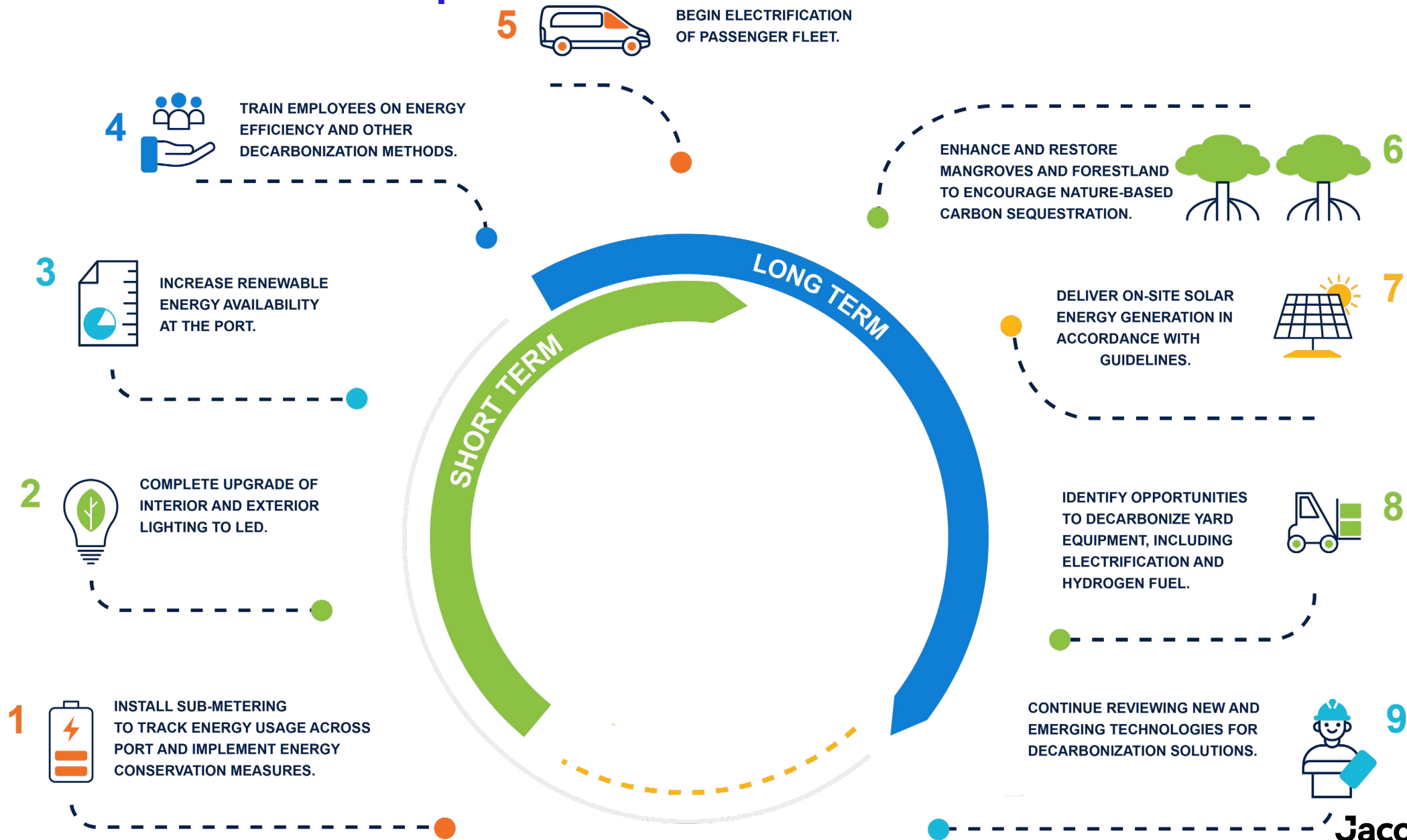
GHG Reduction Tool

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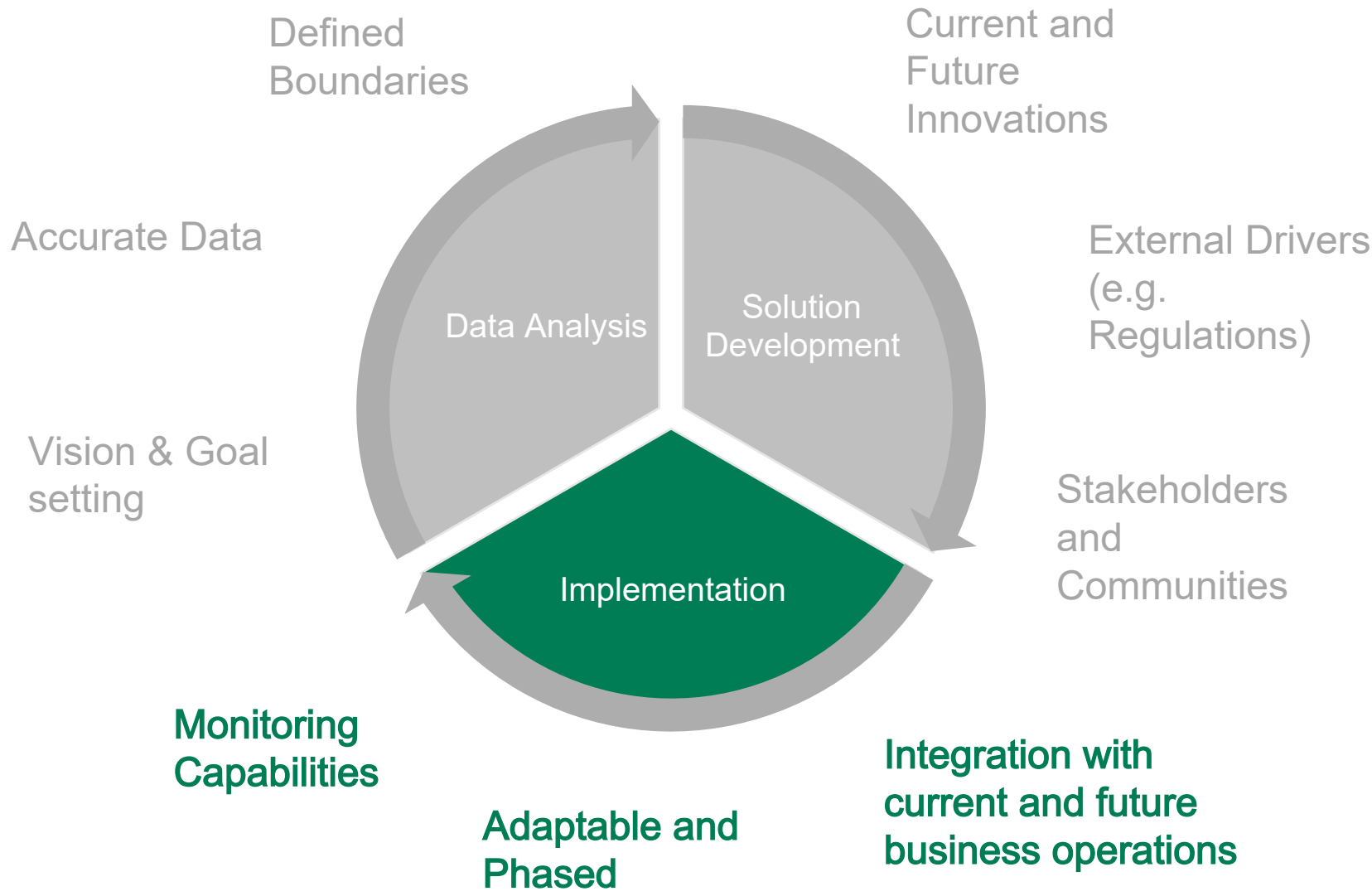
GHG Reduction Tool Results



Decarbonization Roadmap



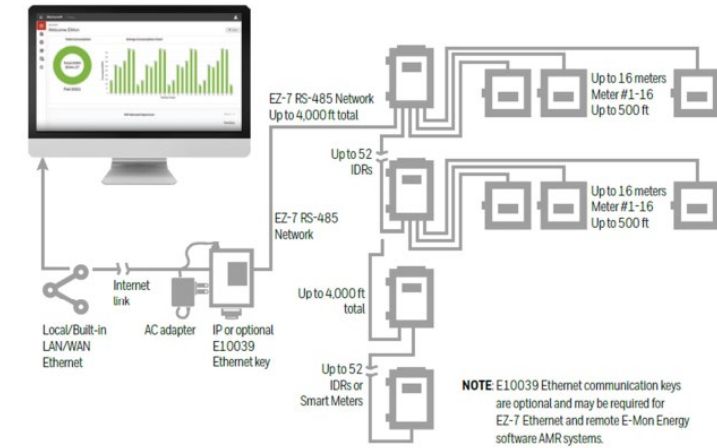
Implementation Plan



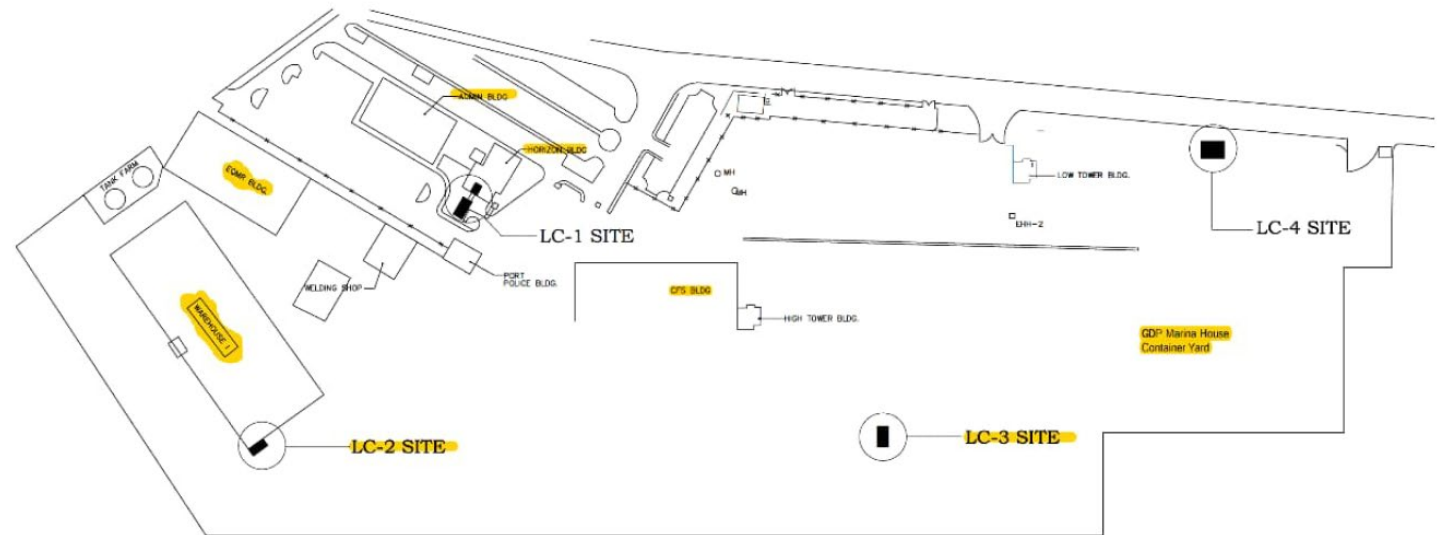
Implementation Plan Example

Strategy #1:

Install sub-metering across the Port to track energy usage of buildings and infrastructure and implement energy conservation measures (ECM).



Sample commercial submetering architecture from Honeywell



Proposed (highlighted) locations for submetering across Port property

Thank you!

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Reinventing tomorrow.



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