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Reaching Higher: Crafting Long-Term Strategies for Building Portfolio Improvements Beyond the Low-Hanging Fruit

May 1, 2025

11:30 am – 1:00 pm ET

Nathaniel Allen

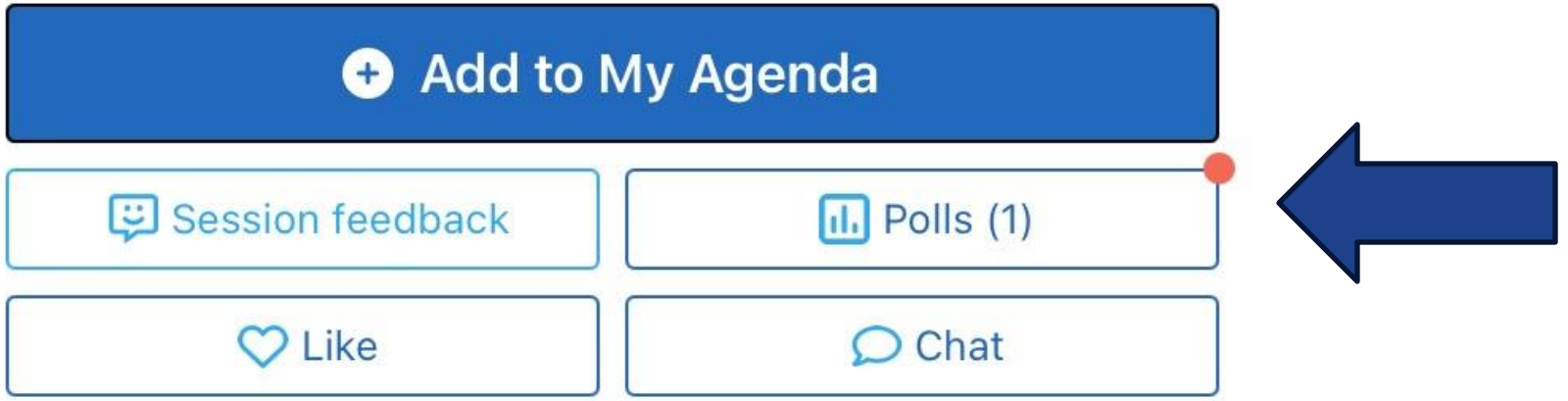
Department of Energy

Agenda

1. Welcome and Introductions
2. State of Massachusetts: Paving the Way
3. Carnival Corporation: The Service Power Package
4. Q&A and Audience Discussion
5. Audience Activity and Closeout

Polling Instructions

Please navigate to the session in the app and select "Polls" from the menu



Polling Questions

- What sector does your organization fall under?
  - Commercial Real Estate
  - Healthcare
  - Higher Education
  - Hospitality
  - Industrial
  - K-12 School District
  - Local or State Government
  - Multifamily Housing
  - Retail/Food Service/Grocery
  - Other

Polling Questions

- Through long-term planning, what challenges are your organizations trying to solve? Choose all that apply to your organization.
  - Cohesion and buy-in across multiple teams
  - Maintaining interest or ambition in project work over longer stretches of time
  - Staff technical knowledge or workforce development
  - Engagement and support from facility staff
  - Budgeting and financing for larger scale projects
  - Funding and/or financing for multiple-year projects
  - Deferred maintenance and emergency replacements for end-of-life equipment
  - Procurement and vendor difficulties that impact project timeline
  - Other

Today's Presenters

- **Morgan Bowler, *Clean Energy and Sustainability Coordinator***
  - Massachusetts Department of Energy Resources

- **Admiral William Burke, *Project Visionary* and Julien Prodhomme, *Director of HVAC Programs***
  - Carnival Corporation

Morgan Bowler

Massachusetts Department of Energy Resources

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Paving the Way

Reaching Higher: Crafting Long-Term Strategies for Building Portfolio Improvements Beyond the Low-Hanging Fruit

May 1, 2025

Presented by
Morgan Bowler, Massachusetts Department of Energy Resources

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Setting the Context

MA Climate Goals and MA DOER

The Global Warming Solutions Act (GWSA) requires MA to achieve **Net Zero in 2050.**

MA Clean Energy and Climate Plan for 2050 (**2050 CECP**) outlines a roadmap on the infrastructure, technologies, and solutions needed to meet **sector-specific sublimits for emissions** to reach net zero by 2050.

MA Department of Energy Resources supports the Commonwealth's clean energy goals by focusing on transitioning our energy supply to lower emissions and costs, reducing and shaping energy demand, and improving our energy system infrastructure

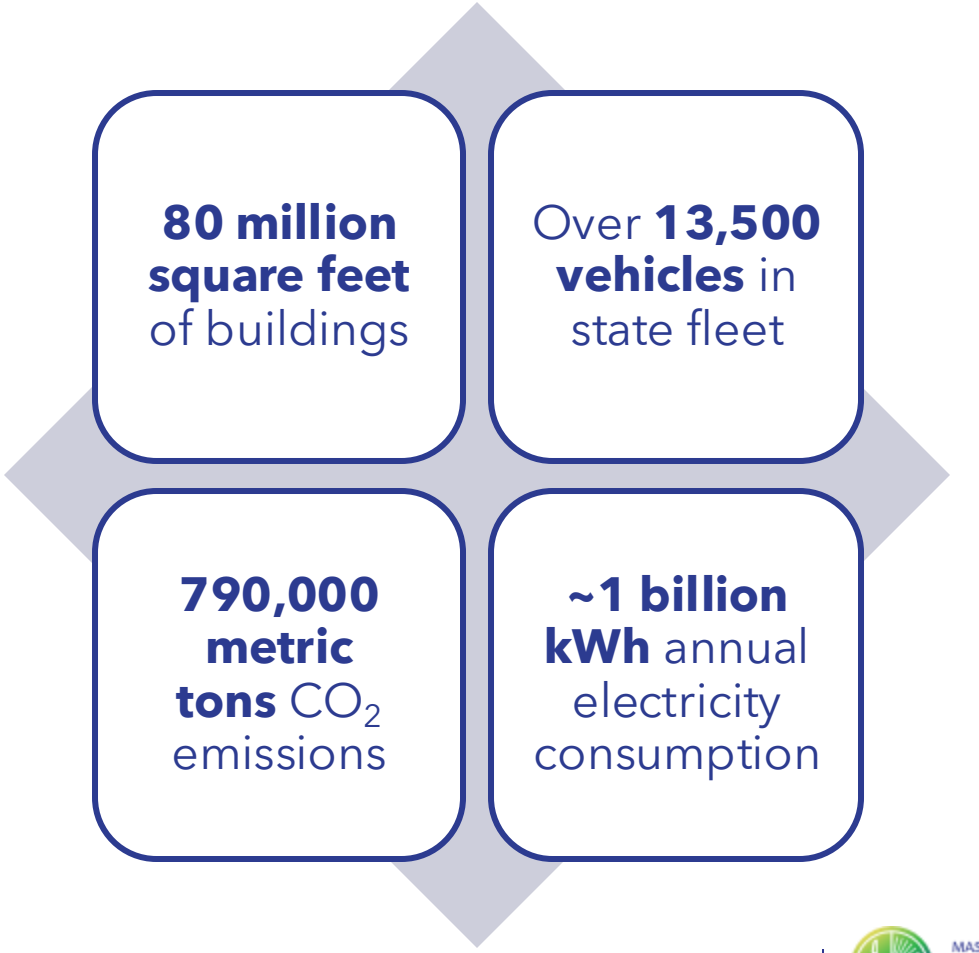
What is the Leading by Example Division (LBE)

LBE works collaboratively with state agencies and public colleges and universities to advance clean energy and sustainable practices that reduce the environmental impacts of state government operations.

LBE oversees efforts to ensure compliance with **Massachusetts Leading by Example Executive Order 594: Decarbonizing and Minimizing Environmental Impacts of State Government**.

Key LBE Actions:

- Coordination across state government
- Technical assistance
- Data tracking and progress reporting
- Grant funding



Decarbonizing the State Portfolio?

What does it take to decarbonize the MA state portfolio?

Buildings and Operations:

- Eliminate onsite fossil fuels
- Prioritize envelope improvements, renewables, energy storage, and resilient design
- Track energy use and improve operational efficiency

Transportation:

- Electrify state fleet of 13,500 vehicles, including medium- and heavy-duty vehicles and emergency vehicles
- Establish charging across the state to support electrification

Challenges that LBE and Stakeholders Face

Time

Changes won't happen over night; takes years to be ready for system replacements

Technology

New tech is unfamiliar; needs buy-in

Planning

Projects are complex; need phased approach over time

Funds

Limited funds and decarbonization/clean energy projects have higher upfront costs than replacing fossil fuel systems in kind

When we had the opportunity to use $2.45M for grants had to ask:

“What can we use this for?”

LBE Equipment Decarbonization Grant

Paving the way for executive branch agencies, public institutions of higher education, and quasi-public authorities

Offers funding for several small scale decarbonization projects.

Funding ranges from 40% to 55% depending on project type with varying maximum funding per site address by project type.

There are also optional Climate and Economic Justice and Pollinator Habitat Creation adders.

Air Source Heat Pumps

Source: Nu-Heat

Heat Pump Water Heaters

Source: PMMAG

Electric Commercial Kitchen Equipment

Source: KaTom

Electric Facilities Maint., Ops, and Landscaping Equipment

Why Equipment Decarbonization?

Time

These replacements happen more often; accomplish work now

Technology

The technology is fairly simple to get introduced to

Planning

Can be part of larger decarbonization planning effort but small enough to handle

Funds

Still higher upfront costs but overall lower total project costs

Helps Pave the Way

Paving the Way

Paving the Way

1. Target relevant stakeholders and projects
2. Establish introductory opportunities
3. Start with small projects
4. Building Up and Reaching Higher

1. Target relevant stakeholders and projects

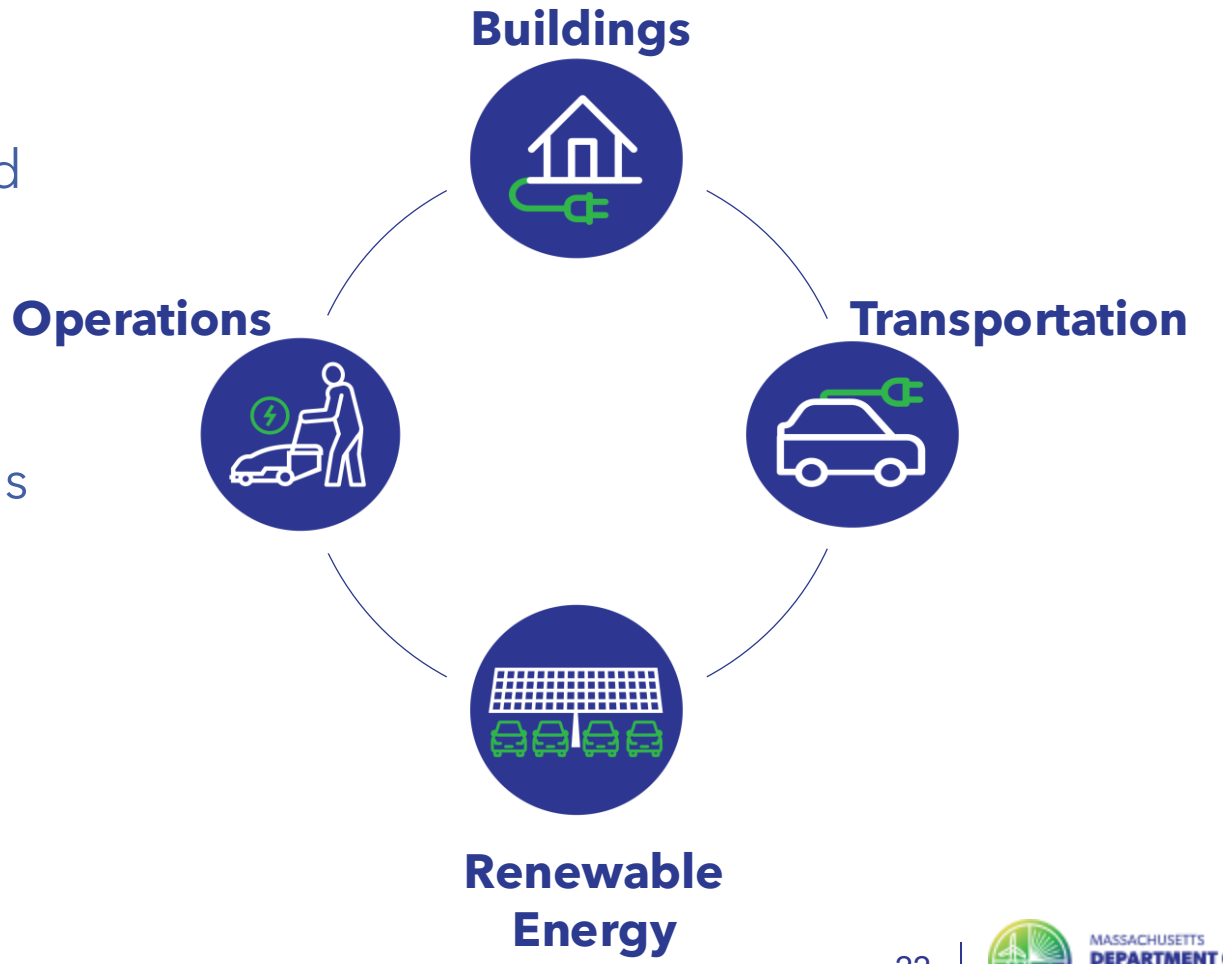
Stakeholders

Using emissions data and context of the sites' facilities and operations, created a targeted approach to identify the needs and challenges of the stakeholders.

Examples:

- Department of Conservation - state lands and landscaping for BPLE
- College campuses - dining halls and electric kitchen equipment
- Sites with CHP – not best audience for ASHP

Projects



2. Establish Introductory Opportunities

Provide agencies an opportunity to learn more about the technology, see it in action, and ask questions from those who are familiar:

- Show and Mows
  - 11 vendors with variety of landscaping equipment
- Coordination with Purchasing Office
  - Work to highlight offerings on statewide contract
- Innovative Technology Lunch and Learns
  - Demonstrate innovative solutions to sites with unique challenges
- Focus on Early Adopters
  - Who is ready to adopt now and act as leader


Source: LBE & OSD Show and Mow

Source: LBE & OSD Show and Mow


Source: LBE & OSD Show and Mow

3. Start with small projects

Starting with small decarbonization projects, like the LBE Equipment Decarbonization grant, can build a foundation before large transitions and progress:

Benefits	In the context of LBE Equipment Decarb Grant
Make staff familiar with technology	• ASHP and Heat Pump Water Heaters as one-off projects prepares folks for sitewide adoption
Grow the state workforce in their skills	• Skills learned with the state can be brought to other positions
Get buy-in from staff	• Familiarity and comfort leads to support for future projects • Health benefits to employees that are using this equipment
Facilitate future transition to electric	• Electrify site so that when grid is fossil fuel free so is the site
See immediate emissions reductions	• Not just small, low-hanging fruit projects; can have significant emissions benefits as well
Provide community benefits	• Award adders in disadvantaged communities • Create pollinator habitat and increase green space

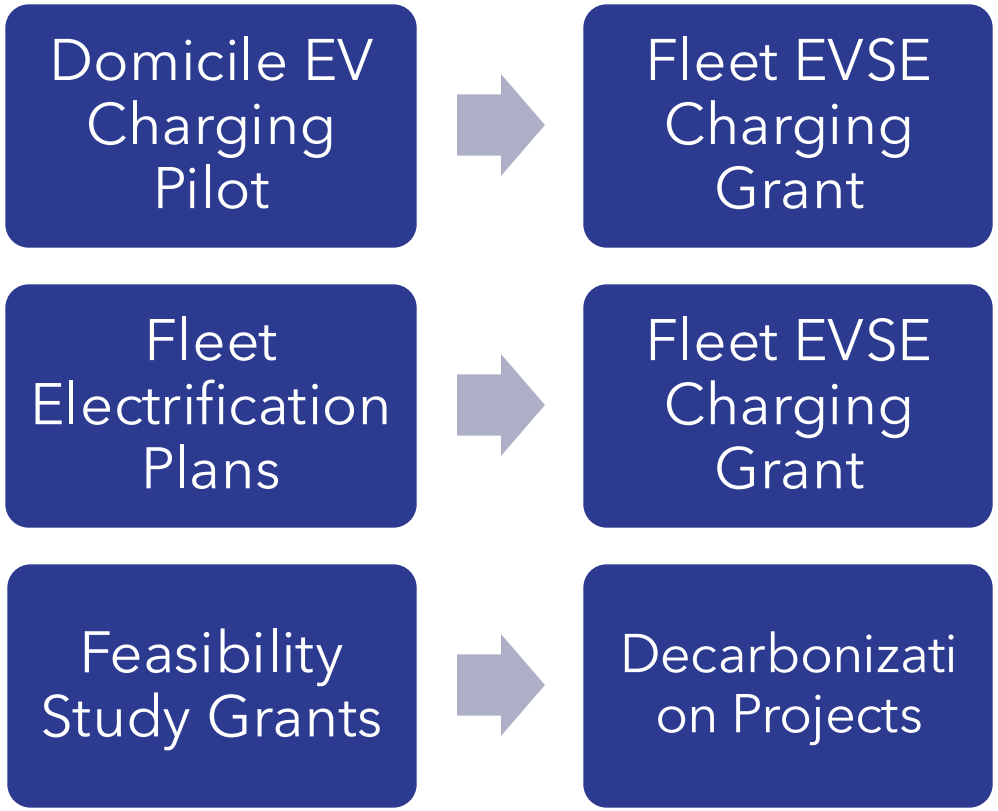
4. Building Up and Reaching Higher

After an introduction through smaller projects, offer opportunities for bigger change

After the LBE Equipment Decarbonization Grant, entities could pursue our upcoming **Decarbonization Implementation Grant**, which offers greater funding amounts for decarbonization projects for new and existing facilities:

- New facilities
  - Only efficient electric or renewable thermal tech for space heating and cooling
  - Follow all-electric compliance pathway
- Existing facilities:
  - results in significant emissions reductions (85%-95%) at existing facilities

Other ways we are building up



Impacts

Impacts So Far

While still young, the grant program has officially awarded four projects with six others in various stages in the queue for approval and award.

However, projects like this have influenced staff using equipment. At recent Show and Mow staff mentioned:

- Benefits to their own health
- Acceptance by their crew and even excitement
- An understanding of the technology

Closing Remarks

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Thank You!

William Burke and Julien Prodhomme

Carnival Corporation

CARNIVAL CORPORATION & PLC

Service Power Package

DOE Better Building Summit

May 2025

Intro to Carnival Fleet and Service Power Package

Carnival Corporation Fleet Overview

- **Total Ships: 95**
- **8 Brands: Carnival Cruise Line, Princess Cruises, Holland America Line, Seabourn, Costa Cruises, AIDA Cruises, P&O Cruises and Cunard Line**

- Significant strides in six focus areas to minimize our environmental footprint and promote responsible cruising, particularly
  - **Reducing greenhouse gas emissions**
  - **Promoting a circular economy model to reduce waste**.
- Achieved several 2030 environmental goals early.
- Also reduced food waste by 44% since 2019, improved energy efficiency, and enhanced water conservation across its fleet.
- Actively involved in the **Better Buildings Alliance.**
- Honored to receive the **Better Practice Award.**

We are committed to leading the way in responsible cruising and setting a standard of environmental excellence for the travel industry.

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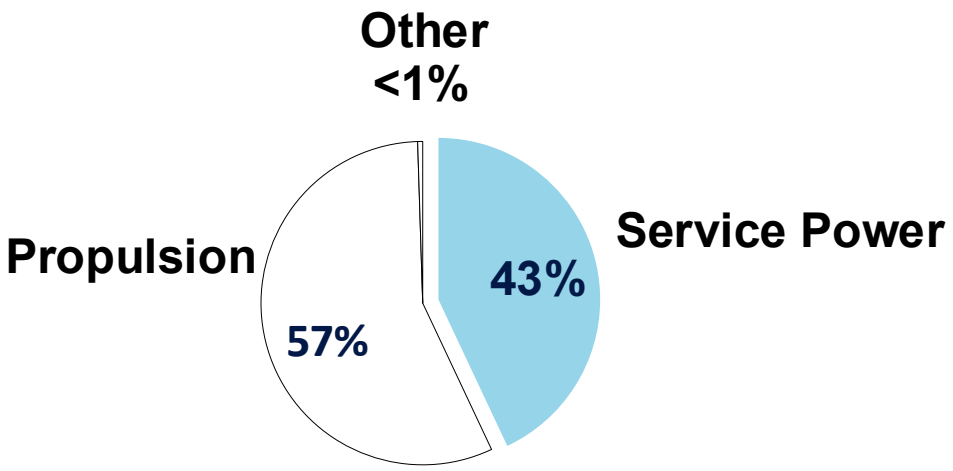
Intro to Carnival Fleet and Service Power Package

Service Power makes up ~43% of our total power demand, but offers the most opportunity for reduction



Background on Program:

- Service Power Package is designed to reduce service power – or what is otherwise referred to as 'hotel load'
- Consists of a group of capital investments in:
  - **HVAC**
  - **Lighting**
  - **Engine Room Pumps**
- Is a package since there are strong synergies between systems
- Comes with continuous monitoring and maintenance

Program began in late 2021 and is expected to go through end of 2026, about 75% completed so far, reducing about 5% of entire energy bill

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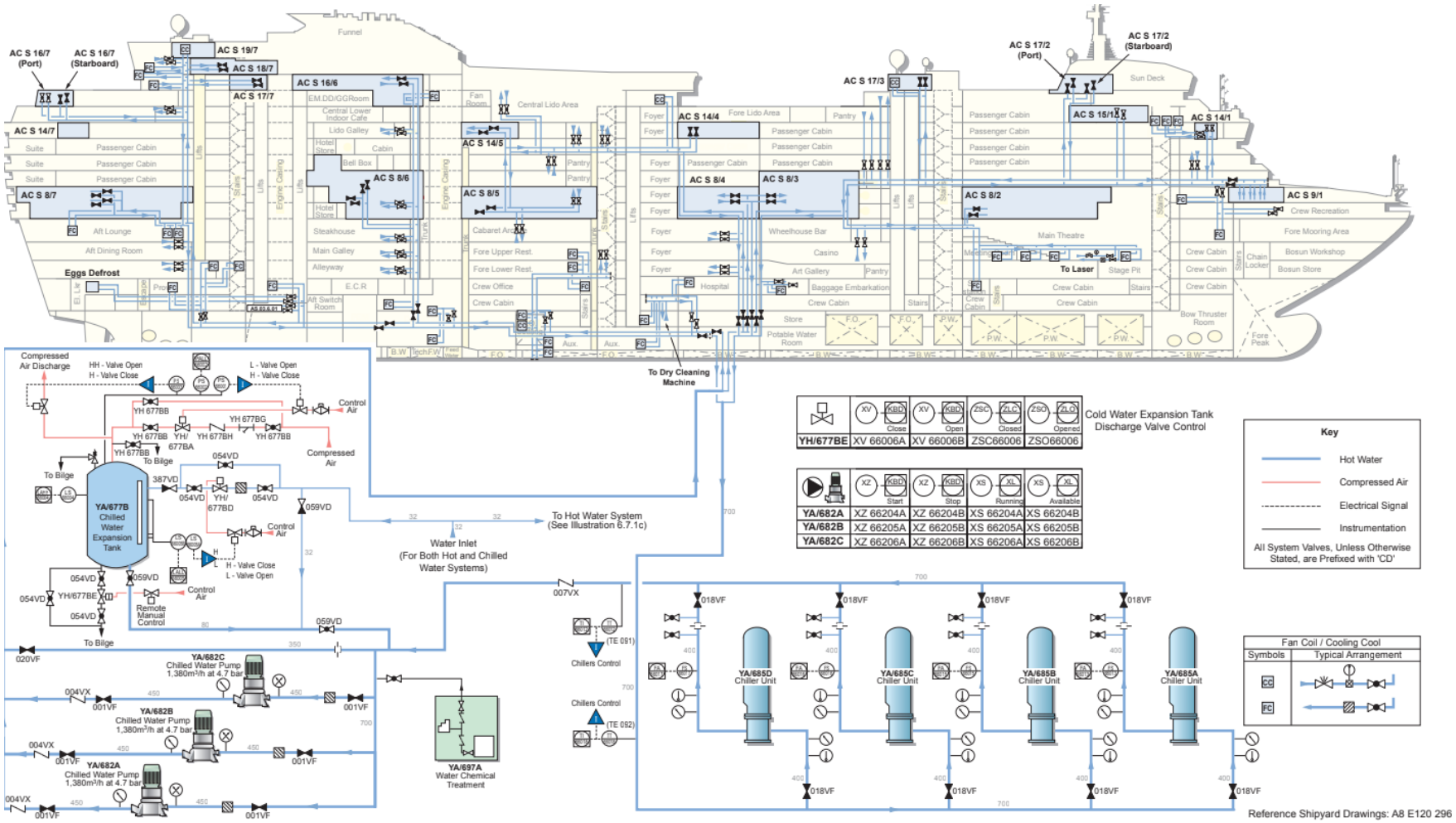
Technical challenge: upgrading the entire HVAC plant



- 40-60 engine rooms fans, up to 200 KW each
- 200-300 hotels fans, up to 50 KW each
- 3-10 chilled water pumps, up to 450 KW each
- 3-5 chillers, up to 1.5 MW each

The automation/ controls of the systems have been heavily modified/ tuned during these upgrades.

- A ship typically has approx. 800,000 sqft under AC

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Service Power Package details

Service Power Package Projects details

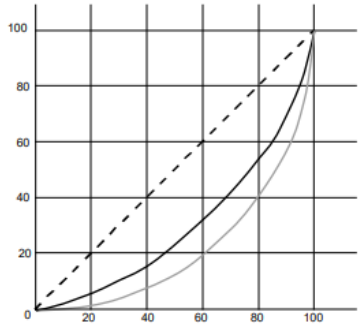
Engine Room Ventilation		Installation of VFDs on fans
Hotel Ventilation	Fans	Cabin Area Fan VFD installation
		Public Area on demand systems with CO2 and VFDs on fans
		Galley Fans VSD
	Pumps	Chilled Water Demand Flow implementation by adding VSD on the pumps and pressure independent valves
	Chillers	Chiller Replacement or Compressor replacement with more efficient centrifugal compressor
		Installation of a VSD to control compressor speed
Lighting		LED Public Spaces
		LED Technical Spaces
Engine Room Cooling		Installation of VFDs on pumps
Data		Service Power Connectivity

- *VFD variable frequency drive and VSD variable speed drive, same thing*

Affinity Law and its role on energy efficiency

Affinity Law

- Exponential relationship between speed and power
- Applies to virtually all energy efficiency areas: fans, pumps, compressors, propellers, etc.
- Fundamentally what enables energy efficiency



50% speed = 12% power!!!

Flow Rate Reduction

As the fan speed decreases, the flow rate also decreases significantly, demonstrating the sensitivity of airflow to speed adjustments.

Impact of Speed Reduction

A minor reduction in fan speed can lead to a significant reduction in power consumption, promoting energy efficiency.

Power Consumption Savings

We have implemented a multi-layered control system, which includes a time schedule and CO2 sensors, to maximize energy savings when spaces are unoccupied. This means that we can maintain optimal thermal comfort for occupants while efficiently managing our energy consumption

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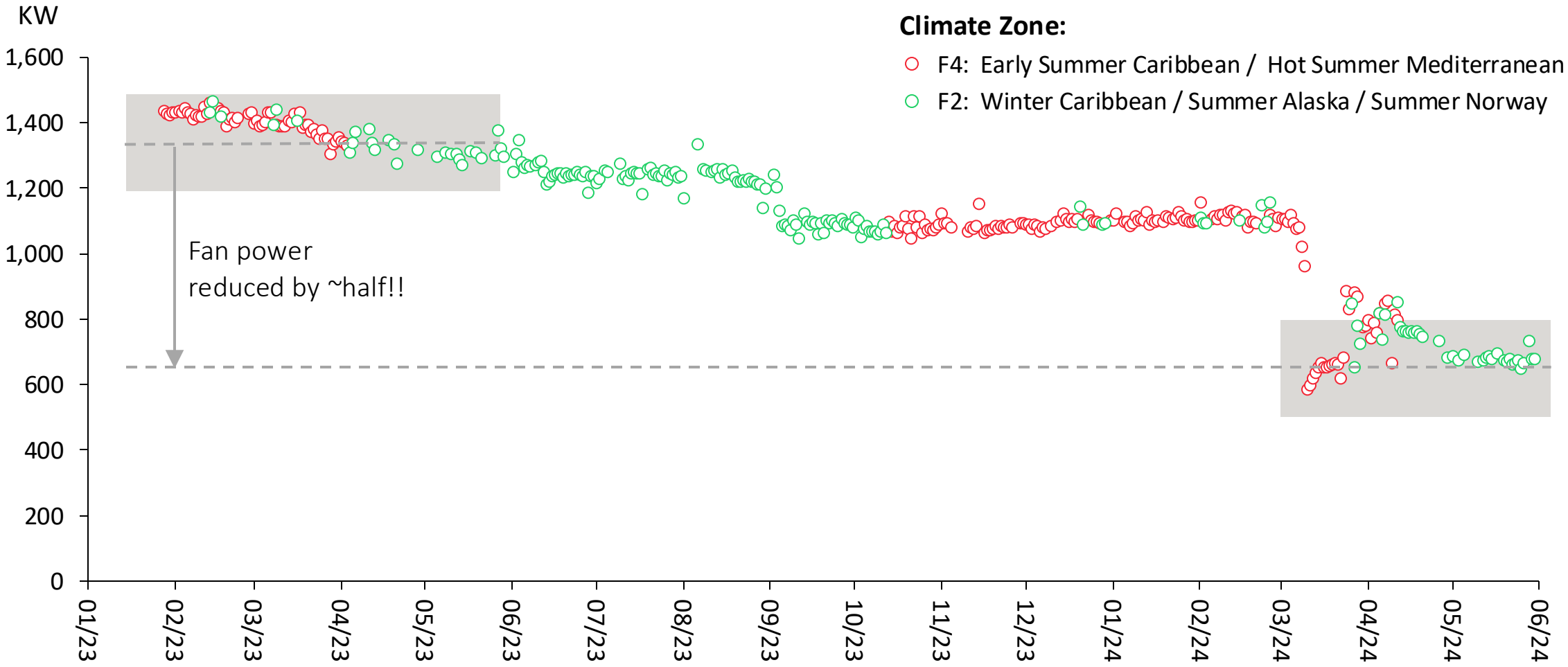
Case Study: a ship Hotel Ventilation Power reduction after SPP commissioning



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Synergies benefits between systems:

Hotel Load impacts the chilled water distribution and production

Hotel Fan

Running fans at lower speed in mild climate zones or when spaces are unoccupied.
Particular attention is taken on the:

- Public Spaces
- Cabins spaces
- Galleys

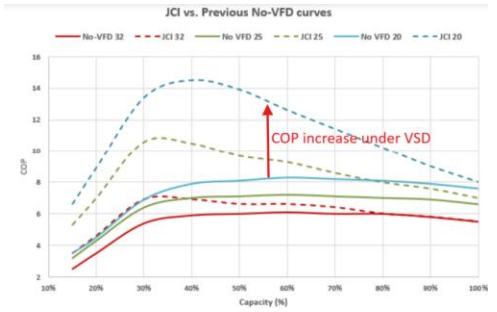
that are the biggest consumers

Chilled water demand flow

Chilled water distribution system is now on demand, under VSD.
Pumps adjust flow to only what is needed and required by consumers in hotel side.

Chillers

Chillers only produce load asked by Hotel and distributed by chilled water demand flow.
Under VSD are operating at much higher COP (Coefficient of Performance)



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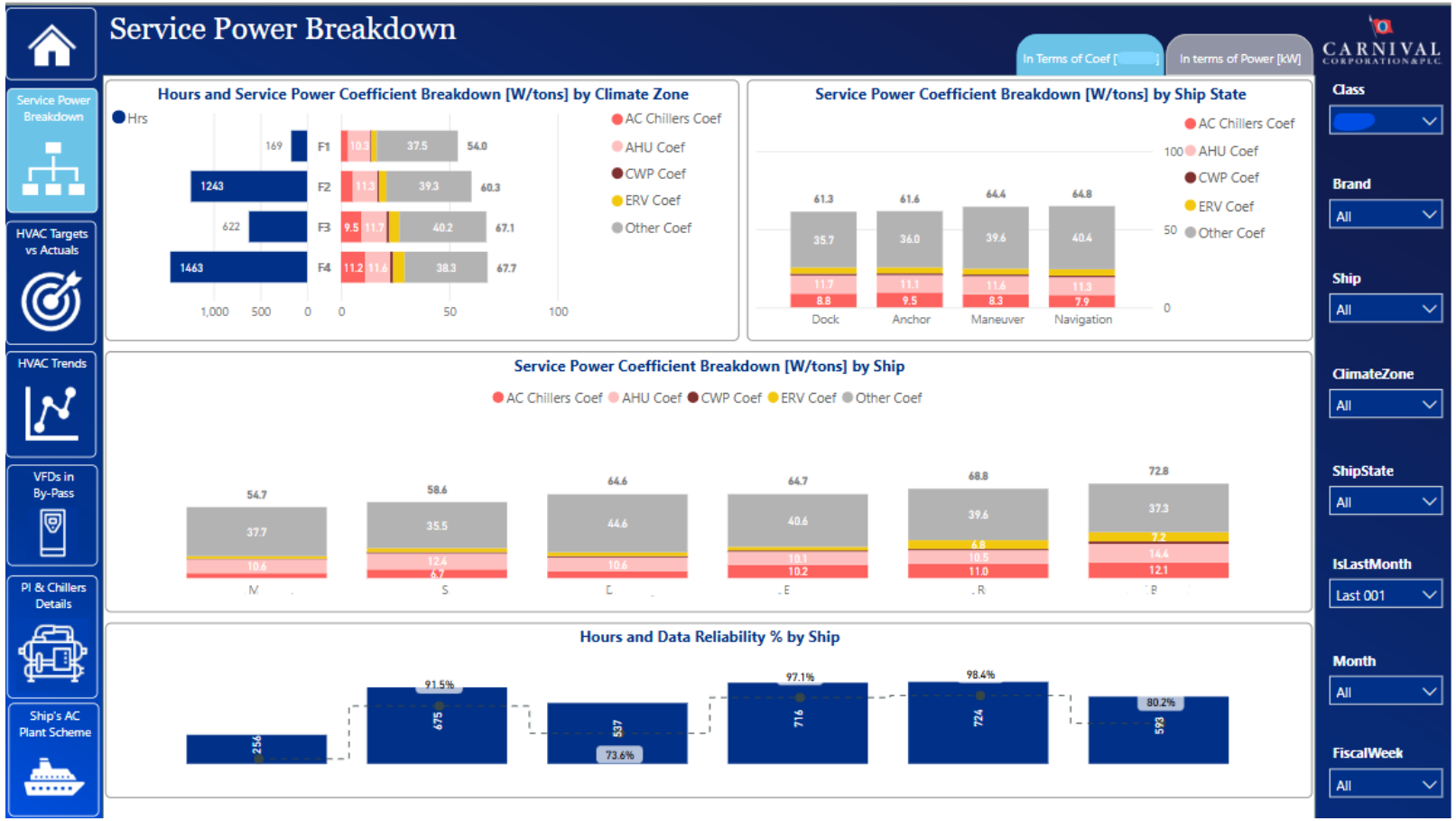
Monitoring the fleet energy consumption



Monitoring system installed for the SPP items

Special attention has been made to standardize signals and measure consumption of upgraded systems.

ERV: engine room ventilation fans

AHU: Hotel Fans

CWP: Chilled water pumps

AC Chillers: Chiller

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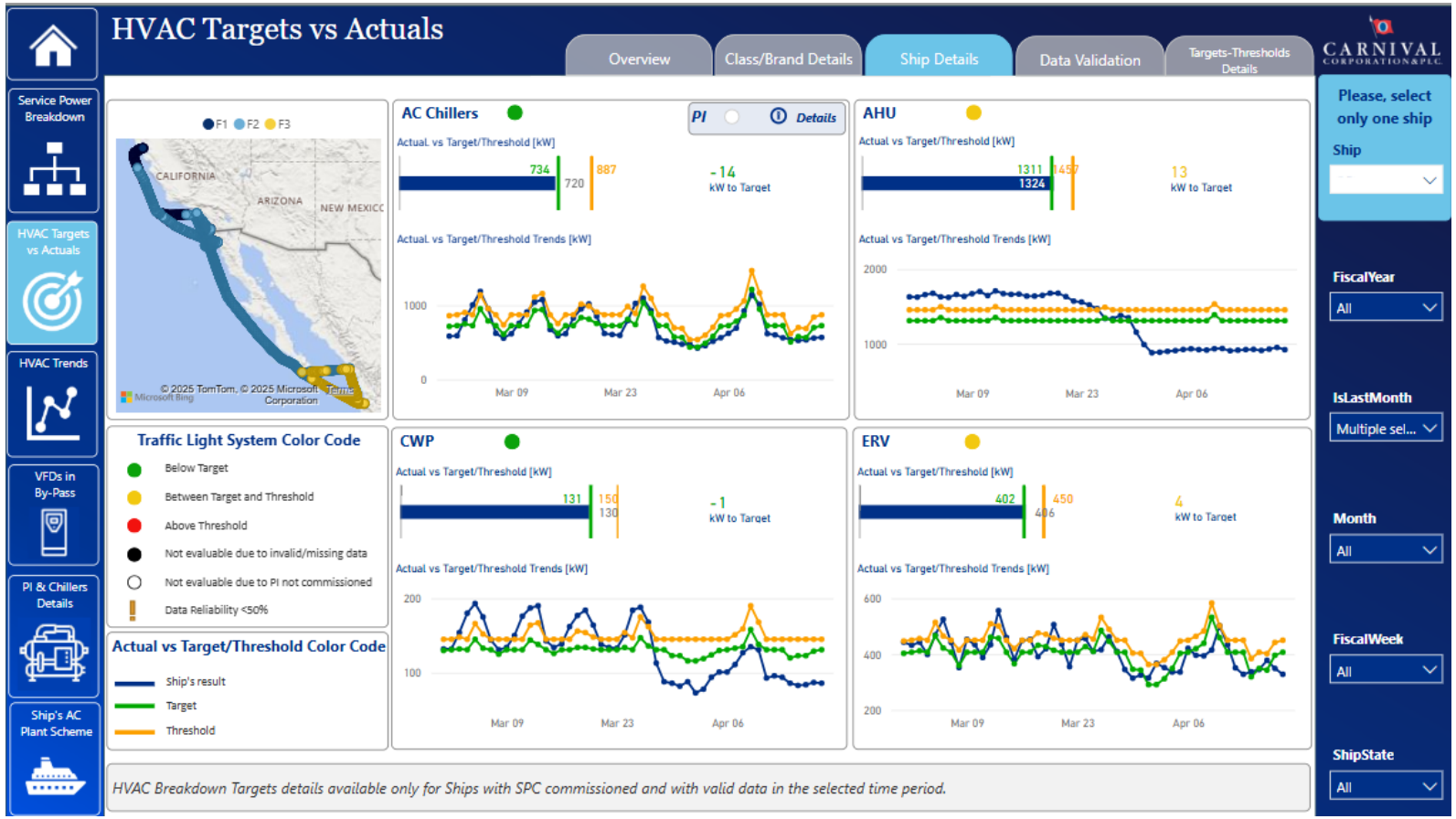
Monitoring the fleet energy consumption: HVAC Targets



HVAC Targets have been established

Blue = consumption

Green = target

- each ship
- each climate zones,
- each HVAC component

This ship has recently commissioned the SPP, we could monitor the reduction of power consumption on the hotel fans, the chilled water production and the engine room ventilation.

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Summary Slides

SPP 1.0

- About ¾ completed
- Program is expected to be completed by end of 2026.

Development of SPP 2.0 is underway:

While SPP 1.0 was a standard package, “one package fits all”, SPP2.0 is expected to be much more tailored to the ship, ex: ship itinerary and speed profile with some of the items below:

- Absorption chillers, using waste heat recovery from the engines while sailing
- Heat Pumps, in order to reduce the use of boilers
- IAQ, Indoor Air Quality will be enhancing the time schedule and CO2 measurements.

Other positive impacts

- On latest chiller upgrades as part of SPP, low GWP Refrigerants was preferred, R513 Refrigerant with a GWP of 570
- New ships AC Chillers are coming with new gen HFO refrigerant with a GWP of 4, and cold rooms systems are now using natural refrigerant, CO2 (R744) with GWP of 1

Lessons Learned and Tips

Challenges

Some rejection of parts of the package by evaluating individual projects on their own merit

- Miss out on synergy and full savings potential
- Tends to happen when projects are implemented across years, under separate approval periods.

Quality of commissioning

- Commissioning of HVAC projects requires weeks onboard, which is sometimes cut short
- Best results requires an in-house commissioning engineer with technical competence to challenge vendors

There is a need for proper Survey before committing with projects

- Check the real maintenance status of the equipment
- Don’t assume they are still “as new”

Lessons Learned and Tips

Tips: maintaining efficient operations

Operators' training on new systems is critical:

- Some have operated old systems for many years and need to understand the new control philosophy, or there is a tendency to go back to "old factory settings"

Monitor savings:

- Use updated monitoring tools, with remote capabilities
- To maintain savings
- To quickly diagnose and address deterioration

Development of a maintenance plan with OEMs:

- Make sure your maintenance plan is updated with all the new equipment installed
- Use of OEM support long term, in order to maintain efficiency should be evaluated

Q & A

Session Activity

Audience Activity

Activity

In groups, develop a long-term energy reduction strategy for your organization by discussing key components of the following steps:

1. Set Goals and Priorities
2. Target Stakeholders of Project
3. Determine Opportunities
4. Identify Next Project - 2.0

Instructions

Break into two groups

- Right-side of the room will be with Nate Allen
- Left-side of the room will be with Nina Wuerch

Use the Flipchart provided to brainstorm four key steps of long-term planning

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