

DATA-DRIVEN MARITIME ENERGY SYSTEMS

From Design to Operation.

Decision support for efficient maritime energy systems
-> a framework built with Flotte Hamburg.



Your ships were designed once. **They operate every day.**

Designed for one operating point but run across thousands. That gap is where emissions and cost hide.

WHAT WE'LL COVER

Agenda

01

Exploring the gap

02

A data-driven framework

03

From data to decisions

01

Exploring the gap

Cutting emissions means closing the gap between how a vessel is designed and how it really operates.

Exploring

The Gap

Load profiles

DESIGN

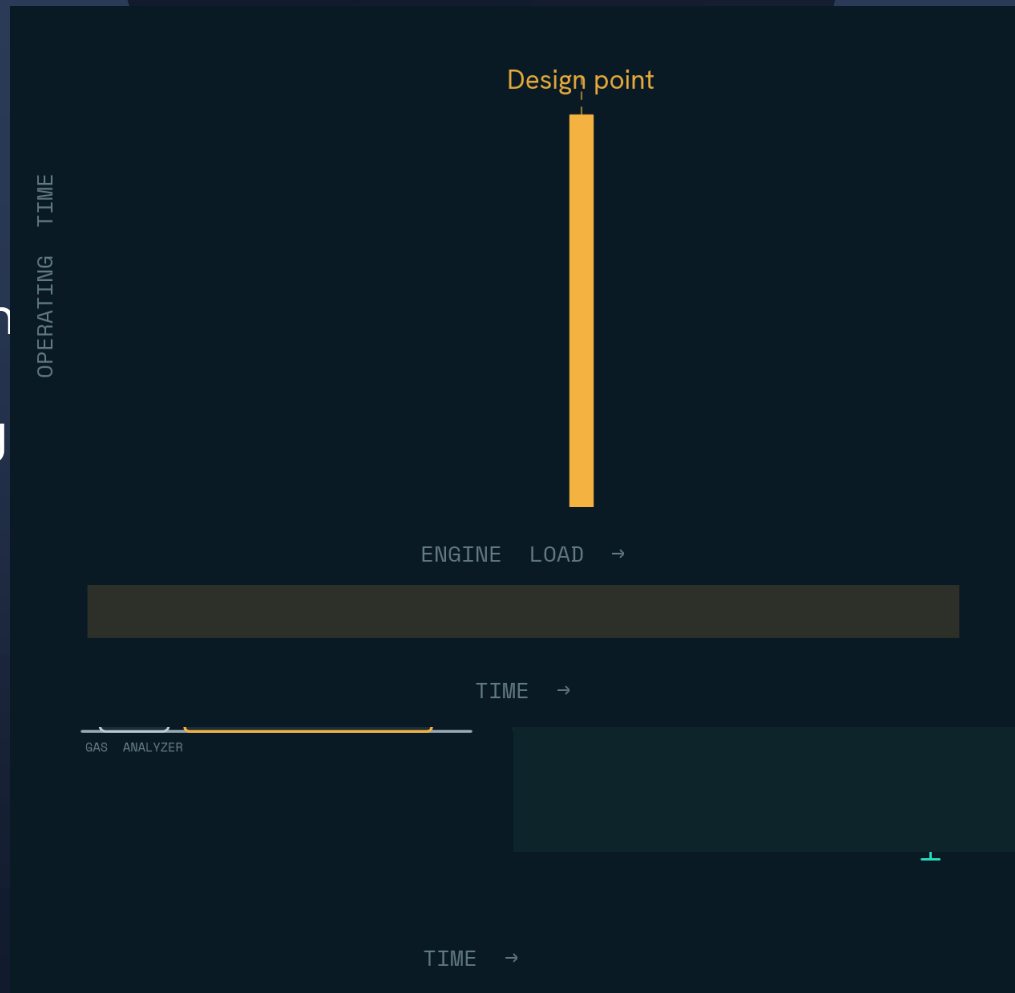
AT DESIGN TIME

- ✓ Parameter Optim
- ✓ EMS / PMS fitting
- ✓ Retrofit Analysis

OPERATION

IN SERVICE

- Speed Analysis
- Maneuver Analysis
- Re Suggestions



02

A data-driven framework

One pipeline from raw ship-signals to optimized energy decisions
-> built and validated with Flotte Hamburg.

Five steps from signal to decision.

01



Data collection

AIS, sensors & operating logs.

02



Emission tracking

Measured & forecast emissions.

03



Energy simulation

Digital-twin power & fuel use.

04



Hybrid optimization

Best battery + genset mix.

05



Decision support

Dashboards & crew hints.

STEP 01 / 05 • DATA COLLECTION

It starts with real data.

We begin from real operation: AIS position streams, onboard sensor data and operating logs become one clean, unified record for every vessel.

AIS Database

Temporary Sensors

External Cloud





STEP 02 / 05 • EMISSIONS

Emissions, measured and predicted.

We track CO₂, NO_x and energy use against every operating mode

-> then forecast them for planned routes and retrofit scenarios.

CO₂ / NO_x

Per mode

Forecasts



STEP 03 / 05 • SIMULATION

A digital twin of the powertrain.

We model each vessel's energy system from its real duty cycle
-> simulating power demand, fuel burn and battery behaviour
before anything changes on board.

Digital twin

Power demand

Fuel & battery

System Info

Project:
Project FRISIA II 211272270

Vessel:
FRISIA II

Name:
System 1

Commissioning:
2026

Decommissioning:
2046

Yearly usage factor:
100 %

Scenario: *
Select a Scenario

Saved System:
Load system...

System Visualization

~ AC 400 V

PE

Components

Energy Sources

GenSet

Turbo

FuelCell

Shore Power

Consumers

E-Motor

Ship Grid

Mechanical Drive

Direct Drive

Dual Drive

Energy Manager

SOC (%)

Default (0% - 100%)

Default (Fallback)

Fallback - when no rule applies

ENGINES
All on

POWER
Demand Driven

SHORE POWER
Engines off

STEP 04 / 05 • OPTIMIZATION

The right hybrid, sized right.

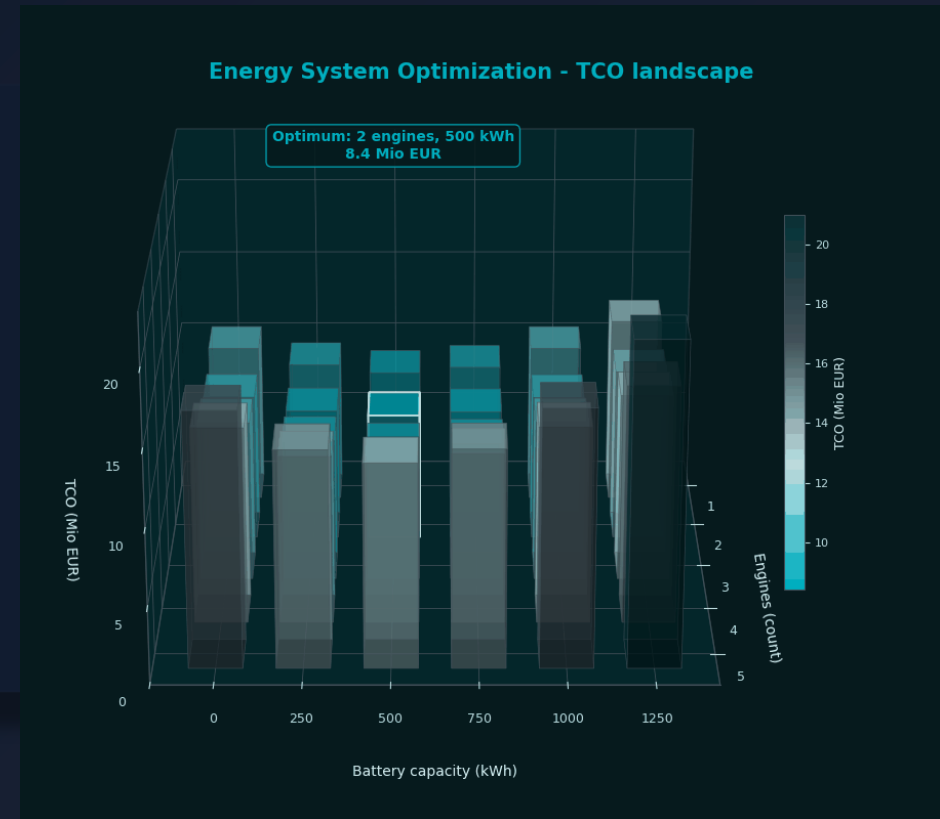
Simulation and emissions feed an optimizer that finds the best battery, genset and operating strategy

—> balancing cost, emissions and reliability.

Battery sizing

Genset mix

Cost vs CO₂



03

From data to decisions

Three ways the analysis reaches the people who act — on shore, on the bridge, and on demand.

The results, on one screen.

Live telemetry

Scenarios



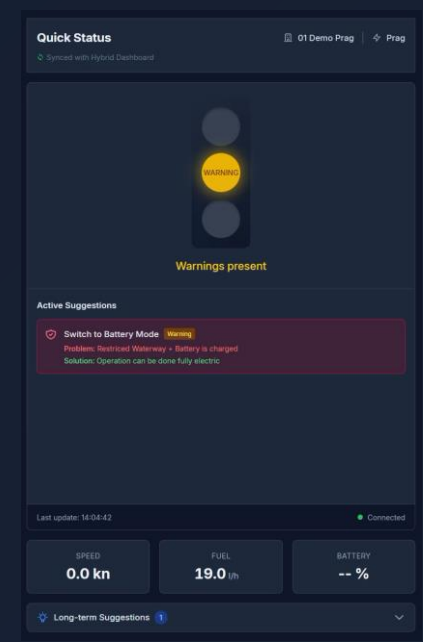
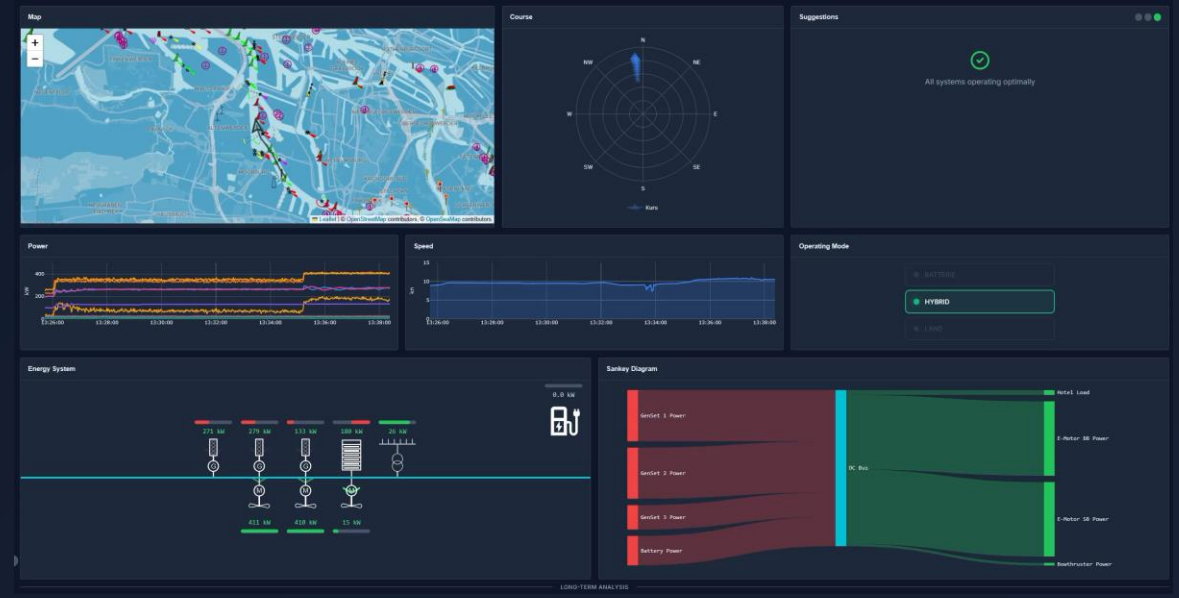
WAY 2 / 3 • ONBOARD

Live support on the bridge.

On the bridge, the same models become simple, timely prompts

→ when to run on battery, when to ease off, how to share load.

- Battery in port
- Speed advice
- Load sharing



WAY 3 / 3 • AI COPILOT

Just ask your fleet data.

Ask in plain language; get charts and recommendations on demand. It's a harness, not a model

-> plug in any major LLM provider or run your own self-hosted AI.

LLM-agnostic

Self-hosted

Natural language

WattShip AI Assistant

</> Debug



Welcome to the WattShip AI Assistant

I can help you with questions about your fleet, components and emissions. I can also create charts and export data.

Model:

Claude Sonnet 4.6 (Standard, empfohlen)

Which battery offers the best trade-off between C-rate and capacity?

Which ship is the longest in my fleet?

Where are all my ships right now?
Show me a map.

Which 3 ships had the most CO2 emissions in 2022?

Create a bar chart of the ship lengths in my fleet

Show me the route of my largest ship over the last 24 hours

Which |



SUMMARY • KEY TAKEAWAYS

Key takeaways

What to remember about hybrid energy systems and the role of data.

01

**Hybrid systems are
complex**

02

**Data make complexity
manageable**

03

Data turns into impact

Let's close the gap.

DESIGN

OPERATION

THE GAP

Thank you for listening!

Questions?

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