PORTS AND TERMINALS / PROPOSED USE CASE

Port Energy and Capacity Planning

Planning today's shifts and tomorrow's investment together

This proposed Propel application would link a port's operations with its energy and capacity planning. Vessel calls, cargo work, shore power and equipment charging would all feed one forecast of electricity demand. Teams could then compare daily schedules and longer-term investments, within the limits of the grid connection, the equipment and the service the port has committed to.

GOING DEEPER

A shared demand model driven by berth plans, cargo schedules and charging needs, supporting constrained scheduling and investment scenario analysis.

THE VALUE CASE AT A GLANCE

The problem

Electrifying a port quickly runs into the limits of its grid connection, and the investments needed are large and have to be made before future demand is known.

The value

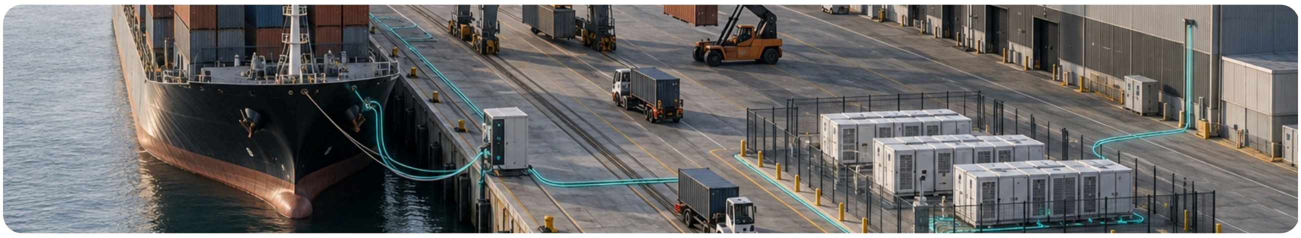
More use from the connection you already have, and investment made in stages to match real need, with fewer expensive surprises.

Extra value, at little or no extra cost

A clear, well-supported forecast of demand strengthens grid connection applications and funding bids. Reducing peaks could lower capacity charges. The same model can support energy agreements with tenants, and knowing which calls must connect, and for how long, helps with planning for FuelEU Maritime.

Why Propel

Practical experience of port and energy operations, combined with planning and scheduling skills, in a planner that the grid operator, the board and tenants can all follow. It is supported by ship-side products already in service: voyageGRAPH™ and Full Fathom AI.



Concept illustration created for this use case; not a photograph of a customer's site.

Energy demand follows the operating plan

Shore power, electric cargo-handling equipment and vehicle charging can all need power at the same time when vessel calls and cargo work coincide. Responses to the Department for Transport's 2026 call for evidence on net zero ports make the same point: peaks may coincide with berthing and cargo work, some ports face waits of years for a new grid connection, and uncertain take-up of shore power makes forecasting difficult. Regulation adds urgency: from 2030, FuelEU Maritime requires container and passenger ships over 5,000 gross tonnes to use shore power at major EU and EEA (TEN-T) ports unless alongside for under two hours, and those ports must provide it.

Ports therefore face two linked decisions: how to work within today's capacity, and what to build next. A sound plan brings the port, its tenants, vessel operators and engineers together on shared assumptions.

THE APPROACH

How it would work

The suggested starting point is one terminal, or one area where power is limited. Connect the existing operational and metering data, work out a typical pattern of demand, then compare changes to operations with investment options. The same forecast would support both next week's schedule and the next decade's infrastructure.

THE OPERATIONAL THREAD

Connect — Operations and energy data

Forecast — Demand and scenarios

Compare — Schedules and equipment

Decide — On the evidence

01

Bring operations and energy data together

Collect meter readings, connection limits, equipment ratings, berth plans, vessels' power needs, cargo schedules and charging requirements, linked to the existing terminal, maintenance and energy systems. Record how complete the data is and where each item came from, with controls over who can see port and tenant information.

GOING DEEPER

APIs and adapters linking berth plans, asset data and energy metering into a shared asset and time model, with data-quality indicators and access controls.

02

Forecast demand from planned activity

Turn expected vessel calls and equipment use into electricity demand over time. Combine engineering calculations with patterns learned from the data, where there is enough data. Test late arrivals, several ships alongside at once, take-up of shore power and growth in electric equipment as separate scenarios, rather than relying on a single view of the future.

Knowing the ships improves the forecast: when each vessel will actually arrive and leave, its base electrical load at berth, and what else will run while it is alongside, such as cargo and ballast pumps, compressors and refrigerated containers.

GOING DEEPER

Engineering load models combined with machine-learning forecasts, and scenario simulation of arrival uncertainty, uptake and electrification; vessel-side inputs from reconciled event-time arrival and departure records, at-berth auxiliary fuel history, and vessel electrical load analyses and equipment ratings.

03

Compare schedules that will actually work

Look at charging times, battery use and agreed flexibility within the limits of the connection, the equipment available and service deadlines. Show which limit is behind each proposed change. If no workable plan exists, show the shortfall in capacity clearly instead of hiding it in an optimistic schedule.

GOING DEEPER

Constrained optimisation against power, energy, availability and service constraints, with replanning and explicit infeasibility.

04

Test the next stage of investment

Compare phased shore power, charging capacity, battery size, on-site generation and connection upgrades against the same demand scenarios. Include capital and running costs, battery wear, space and engineering limits. The results support an investment case and a grid connection application, subject to review by specialists.

GOING DEEPER

Investment option comparison with sensitivity analysis on uptake, prices, utilisation and timing.

TECHNOLOGY AND TRUST

Black box or glass box?

A black box recommendation might simply state what size of battery to install. Propel's approach would show where the demand comes from, which limits apply and why the options differ: the assumptions about vessels, the charging commitments, the grid limits and the trade-offs behind each choice.

THE TYPICAL BLACK BOX

Question or data

"Here is the answer"

Evidence: Not shown

Verification: You have to take the recommendation on trust

Decision: Made for you

THE PROPEL GLASS BOX

Evidence	Verification	Decision
Planned activity and meter readings	The limits and scenarios behind every option	Change the schedule now, or invest later, with the reasons shown

For example, a change to a charging time would be linked to the berth demand peak it avoids and the deadline it still meets, with any effect on service shown.

THE TECHNOLOGY, IN PLAIN TERMS	WHAT IT WOULD DO
One set of connected data Connected operational model	Links berth plans, equipment data and energy readings, with checks on data quality and controls on access, so everyone works from the same figures.
Forecasts and scenarios Forecasting and scenario simulation	Engineering models and suitable forecasting methods estimate demand over time. Scenarios test uncertain arrivals, take-up and equipment changes, and keep the assumptions behind each result.
Schedules within real limits Constrained optimisation	Compares workable options against power, energy, equipment availability and service commitments, and re-plans when arrivals or demand change. When no plan fits, it says so.
Investment options side by side Investment and sensitivity analysis	Compares connection, storage and generation options on the same basis, and shows where a case is robust and where it depends on uncertain assumptions.

Note: the analysis here is forecasting, simulation and scheduling. AI could help explain checked results, but it would never set electrical protection limits or approve an investment. The first stage is advice to people who make the decisions, subject to engineering checks.

Planning support, within operating limits.

An energy model is not an electrical protection system or an automatic berth controller. Network studies, protection settings, marine safety, tenant agreements and service commitments always come first. Any move from advice to automatic control would need a separate, fully tested scope of work.

THE USER EXPERIENCE

From the next shift to the next investment

The proposed screens would show a demand timeline for operations alongside a comparison of investment options. Teams could see when capacity is tight, which activities cause it, and whether a change to operations or new infrastructure is the better answer. Shared screens would respect agreed limits on who can see what.

Two planning horizons, one demand forecast

ILLUSTRATION ONLY / NO CALCULATED OR MEASURED RESULTS

NEXT SHIFT

Combined demand against the capacity limit

Which activities cause the peak, and which loads can be moved without affecting service

NEXT STAGE OF INVESTMENT

Shore power, storage, charging and connection

Options and phasing tested against the same demand scenarios and take-up assumptions

Service requirements, grid limits and assumptions shown throughout

Illustration only. Not measured demand, an optimised result or a delivered customer system.

Operations and energy managers

See expected demand alongside vessel calls, charging and battery schedules. Find what is behind a peak, and the effect on service of moving a load to another time.

Engineering and investment teams

Compare options for grid capacity, shore power, storage and on-site generation, with the demand scenario, assumptions and limits behind each option and its timing.

Port and its tenants

Share agreed capacity needs and planning assumptions, keeping commercially sensitive details private while making clear the limits that need to be coordinated.

Joining up ship and shore

Shore power only works well when the port knows what is coming alongside. That information already exists on the ship side, in systems Propel builds. Connected, with the operator's agreement, they give the port a much clearer view of when power is needed, and how much.

SHIP-SIDE INFORMATION, SHORE-SIDE PLANNING / HOW PROPEL'S PRODUCTS CONNECT

VOYAGEGRAPH™ · CASE STUDY 03

When, and for how long

Reconciled arrival and departure times, time alongside, and energy used at berth on earlier calls

FULL FATHOM AI · CASE STUDY 02

What is on board, and how to connect

Electrical load, equipment such as cargo and ballast pumps and compressors, and the shore-connection procedure

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PORT ENERGY AND CAPACITY PLANNING · USE CASE 08

When power is needed, and how much

Where capacity is tight, what can be moved, and what to invest in next

BUSINESS VALUE AND INDUSTRIAL RELEVANCE

The value for ports

The proposed value comes from bringing operational demand, engineering limits and commercial choices together in one model that everyone can review. It can start with a single capacity problem, then grow as the quality of the data, agreement between the parties and proven usefulness allow.

FOR TODAY'S OPERATIONS

- **More from the existing connection.**
  Identify coinciding peaks and flexibility worth testing. Coordinating charging, batteries and agreed service windows could make better use of existing capacity, without hiding the effect on operations.
- **Commitments protected.**
  Readiness deadlines, berth obligations and equipment limits are shown alongside the energy target. If capacity will fall short, the shortfall shows up in time to act.

FOR FUTURE INVESTMENT

- **Investment in stages, better supported.**
  Infrastructure options are tested against demand scenarios, helping to avoid both building too much too soon and upgrades that leave foreseeable needs unmet.
- **Better coordination between parties.**
  The port, tenants and engineering advisers share one basis for discussing demand and limits, supporting investment planning and discussions with the grid operator without revealing unrelated commercial details.

WHERE TO START

Choose one terminal, group of berths or constrained connection, with a named person responsible. Agree a representative period of data and one decision to improve. Check the starting figures with the port and tenant teams before using the model to recommend schedules or investments. Propel's Northstar Framework® would start by agreeing the value to be delivered, then build the system with the people who will use it, with a first working system typically within one to two weeks.

Proposed use case, September 2026. An illustrative application, not a delivered port project. The benefits described are what the approach is designed to deliver.
Sources: Department for Transport, Net zero ports: challenges and opportunities, summary of responses (2026); Lloyd's Register, FuelEU Maritime zero-emission requirements at berth. thepropelgroup.com