Port of Bilbao

Building a Renewable Port Energy Community

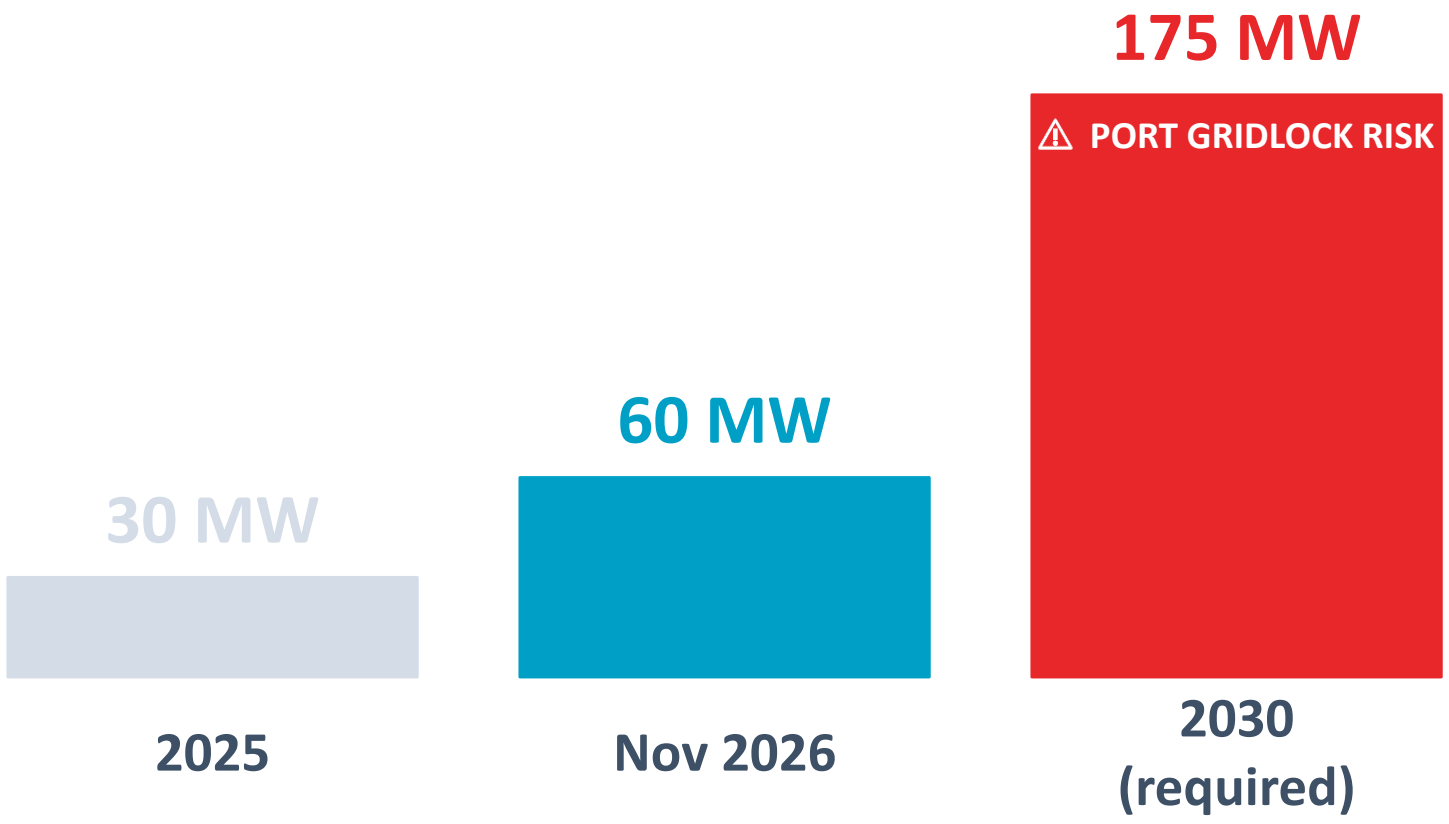
A collaborative model for competitiveness, resilience and decarbonisation

WORLD PORTS SUSTAINABILITY PROGRAM

JUNE 2026

The real challenge: Port grid capacity

Transport electrification and cleantech industries are accelerating — but grid capacity is not keeping pace.



×6
Electricity demand growth expected by 2030

6–12y
Waiting time for upstream grid reinforcement via standard operators

175 MW
Required grid capacity — current: 60 MW

42-50 MW (25%)
Can be locally produced within port area — if we act now

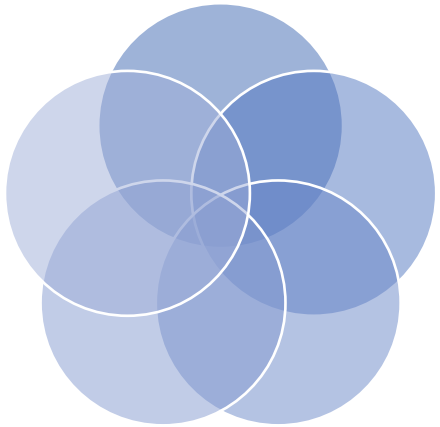
Energy infrastructure is becoming the new strategic infrastructure for ports.
Bilbao is already responding to protect future port competitiveness and energy resilience.

The response: Community Renewable Energy Sharing Model

PRODUCE – RETAIN - SHARE

Shipping Lines
Zero Emissions at
Berth

Port
Renewable
Energy
Production



Alternative
Fuels Services

Petronor

BH2C
BASQUE HYDROGEN CORRIDOR

Net Zero
Industries
energy needs

Terminal
Handling
Equipment

The response: Community Renewable Energy Sharing Model

Investment & Partnerships

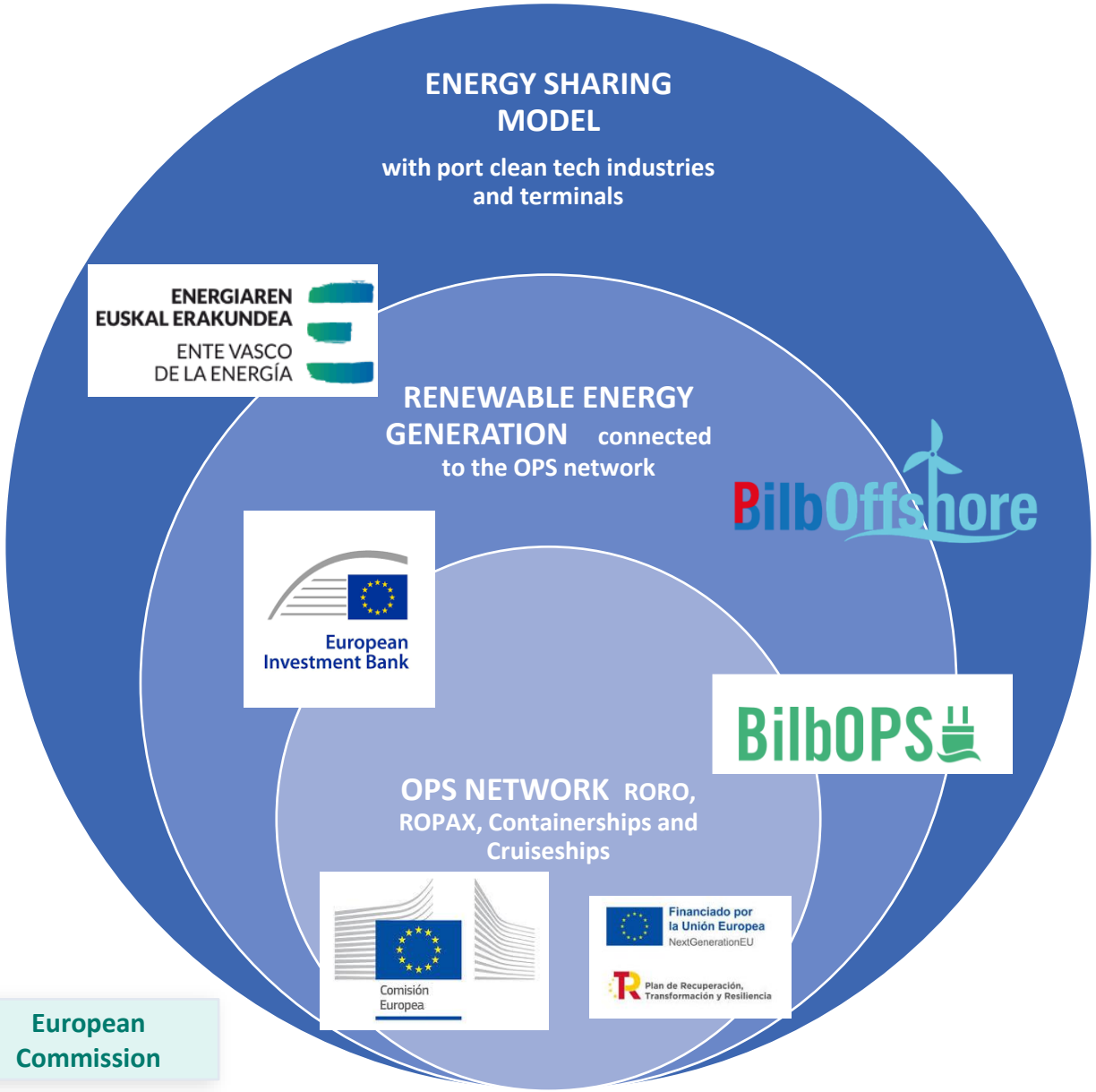
EUR 160 Million

Port Authority of Bilbao investment
(Co-funded by RRF, CEF Transport & EIB)

The Energy Cornerstone

OPS network · Energy Storage Systems (BESS) · Renewable Energies · Digital Platform

Evolving from OPS infrastructure into a full port energy community.



Working with:

- Basque Energy Agency (EVE)
- ESPO
- IAPH
- CPRM
- European Commission

Bilbao 2030 Renewable Port Energy Community

One integrated energy ecosystem instead of multiple isolated energy projects.

ALTERNATIVE FUEL SERVICES

- LNG Refuelling Station (2022)
- H2, Biofuels & e-fuels (2026)
- 11 OPS for Ro-Ro/Ro-Pax ferries, cruiseships and containerships (2026 - 2027)

GREEN ENERGY COGENERATION HUB

- 4 OPS Photovoltaic Plants 4MW (2026)
- OPS Wind Turbines 11 MW (2027 & 2028)
- 2 Energy Storage Systems (2027)
- 5 Wind Turbines 20 MW (2028 & 2029)
- Concessionaire Roof-top solar plants 16 MW (2030)

SHARING RENEWABLE ENERGY

- Shipping Lines (OPS)
- Net Zero Industry (H2, e-fuels, offshore wind)
- Terminals
- Warehouses

11 OPS
connection points

42-50 MW
renewables

~16 MWh
storage

160 M €
Carried out by the Port Authority of Bilbao

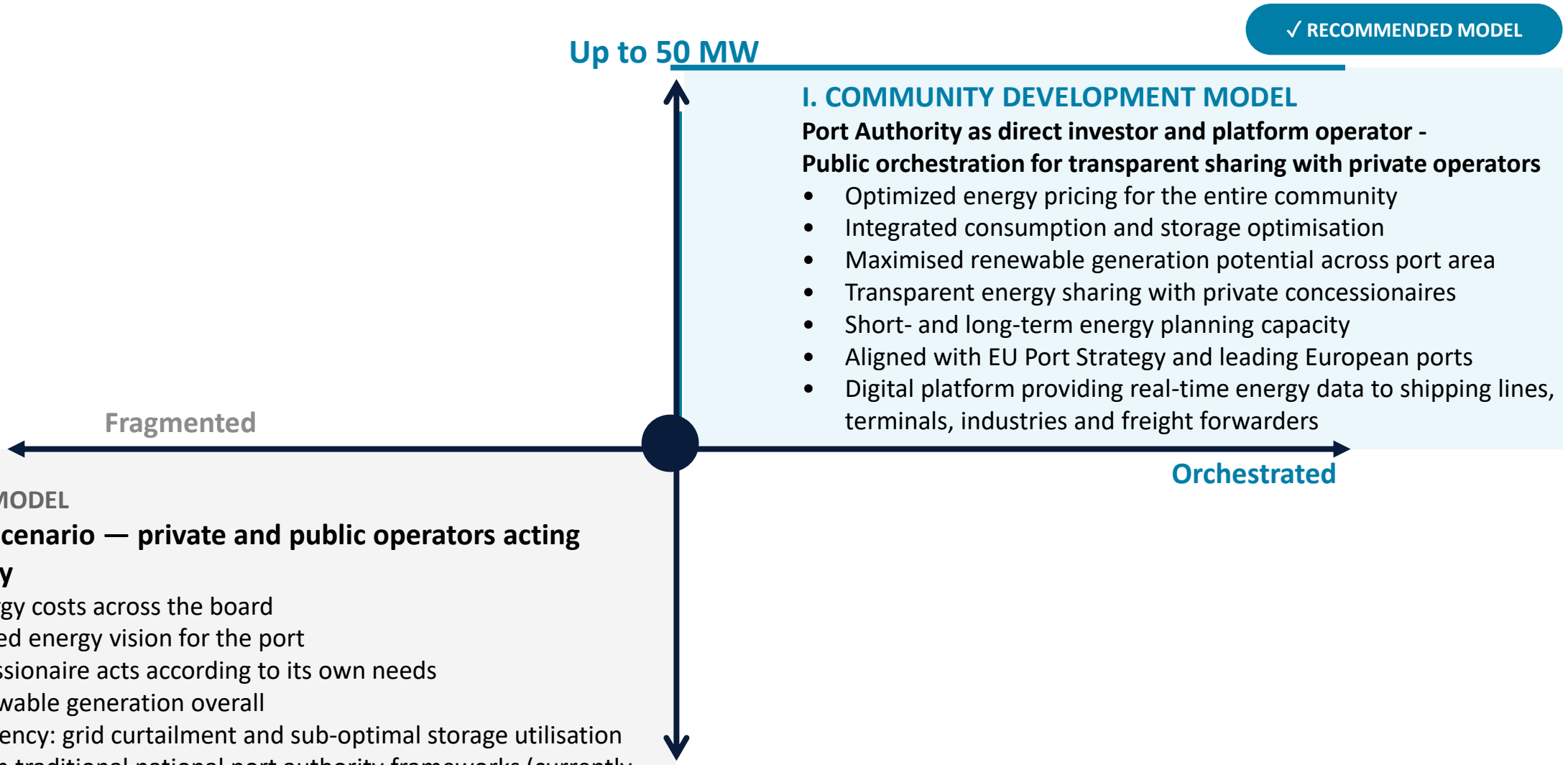
Energy Sharing: Industries, Shipping Lines & Terminals

More competitive & Predictable prices

The organizational innovation: why orchestration beats fragmentation

In ports, renewable energy potential and energy demand are often disconnected.

The Port Authority can act as a neutral orchestrator, unlocking greater value across the port ecosystem.



I. COMMUNITY DEVELOPMENT MODEL

Port Authority as direct investor and platform operator -
Public orchestration for transparent sharing with private operators

- Optimized energy pricing for the entire community
- Integrated consumption and storage optimisation
- Maximised renewable generation potential across port area
- Transparent energy sharing with private concessionaires
- Short- and long-term energy planning capacity
- Aligned with EU Port Strategy and leading European ports
- Digital platform providing real-time energy data to shipping lines, terminals, industries and freight forwarders

II. LANDLORD MODEL

Fragmented scenario — private and public operators acting independently

- Higher energy costs across the board
- No integrated energy vision for the port
- Each concessionaire acts according to its own needs
- Lower renewable generation overall
- Lower efficiency: grid curtailment and sub-optimal storage utilisation
- Aligned with traditional national port authority frameworks (currently evolving within EU context)

Choosing the right model: a rigorous analysis

Modelled jointly with EVE (Basque Government Energy Agency) · Saitec · Tecnalia

I — Closed Electricity Network

Port operates a fully closed internal grid. Maximum control; limited scale.

II — Shared Self-use — Surplus to Port Community

APB manages OPS+RES+BESS with (physical energy delivery to vessels) and sells surplus energy to terminals and industries through digital platform (virtual delivery) within the port community.

★ RECOMMENDED

III — Self-use (OPS) + PPAs to Port Stakeholders

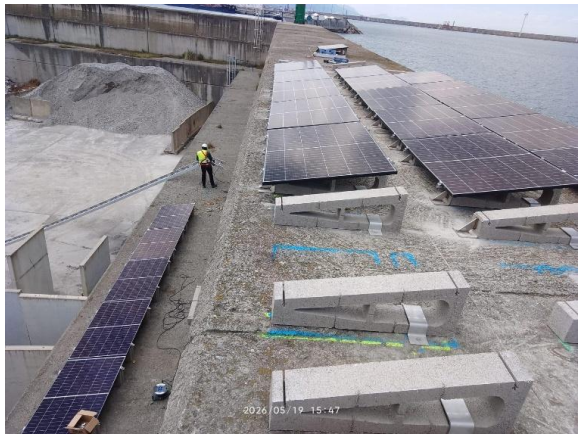
OPS self-consumption priority; renewable surplus sold via Power Purchase Agreements to members outside the port community.

IV — Production Selling to National Grid

All the surplus renewable energy not delivered to vessels through the ops network is sold to the national grid. Simpler model, loses community benefit and price optimisation.

Contributing to the regulatory framework progress— from 500 m (Dec 2023) to 2 km (2024), now covering the whole port area (oct 2025). A model designed to be replicable in other ports.

Evidence it’s working: milestones delivered



Main electrical substation — OPERATIONAL
30 MW repowered to 60 MW. The backbone of the entire port energy network.

OPS shore power network — DEPLOYING
11 berth connection points for ferries, RoRo & cruise — zero emissions at berth.

Energy distribution network — UNDER CONSTRUCTION
Port-wide high-voltage cabling connecting all 12 community members.

Shore connection points — PILOT OPERATIONAL
RoRo pilot: operational. Full deployment across all vessel types in progress.

Solar, wind + BESS — MULTIPLE STAGES
4 MW rooftop PV: under construction. Wind 11 MW + 16MWh BESS: technical project. Tenant rooftops + offshore 35 MW: in design.

Digital energy platform — IN DESIGN
12 community members mapped. Architecture and specifications in design. APB leading development.

OPERATIONAL DEPLOYING / PILOT UNDER CONSTRUCTION / MULTIPLE STAGES IN DESIGN

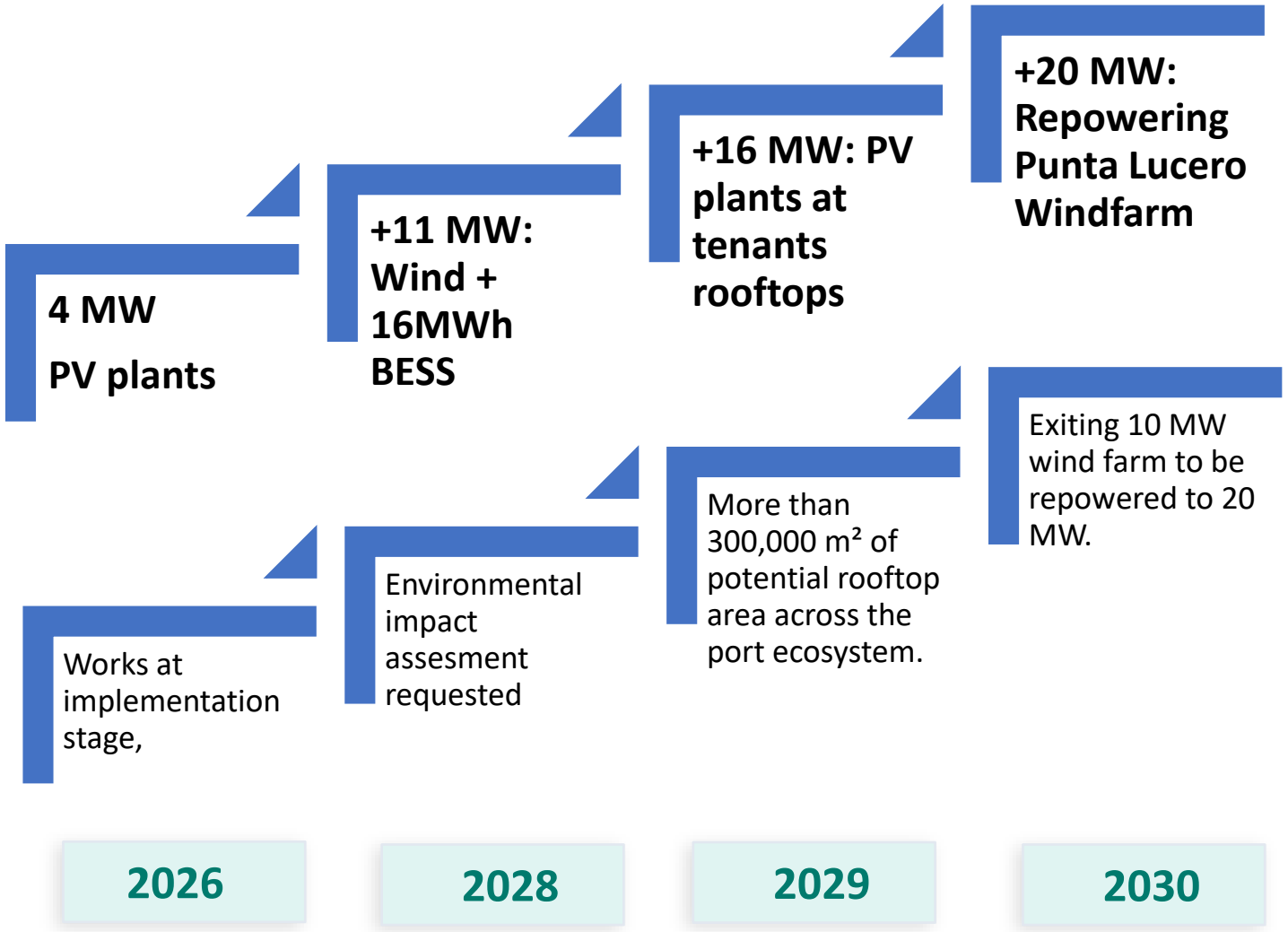
Roadmap to 50 MW of Renewable Energy Generation

Building the foundations of the Renewable Port Energy Community

UP TO

50 MW

PRODUCTION POTENTIAL WITHIN THE PORT AREA



Ports do not suffer from a lack of renewable energy opportunities. They suffer from a lack of connection between those who can produce energy and those who need it most. The Renewable Port Energy Community was created to bridge that gap.

Real ecosystem energy modelling

Data collected from our port community

To support the development of the Renewable Port Energy Community, the Port Authority engaged a diverse group of stakeholders including shipping lines, terminals, industrial companies, an e-fuels producer, a shipyard, offshore wind manufacturers and energy authorities.

Through a structured process of data collection, bilateral consultations and joint scenario assessment, participants contributed to the analysis of four alternative energy models and the definition of a shared long-term energy vision for the port ecosystem.

The conclusion is clear: the greater the integration, the greater the value; the greater the fragmentation, the greater the opportunity cost.

This idea emerged from conversations across our port community. Why does a 20,000 m² warehouse have only a handful of solar panels on its rooftop? Because it does not need more energy. Yet only a few hundred meters away, industries require large amounts of electricity but have limited space to generate it.

These discussions revealed a simple reality: renewable energy potential and energy demand are often disconnected within ports. The Renewable Port Energy Community was created to bridge that gap.

Now we have the data

Real ecosystem energy modelling

Data collected from our port community

12
Agents Modelled

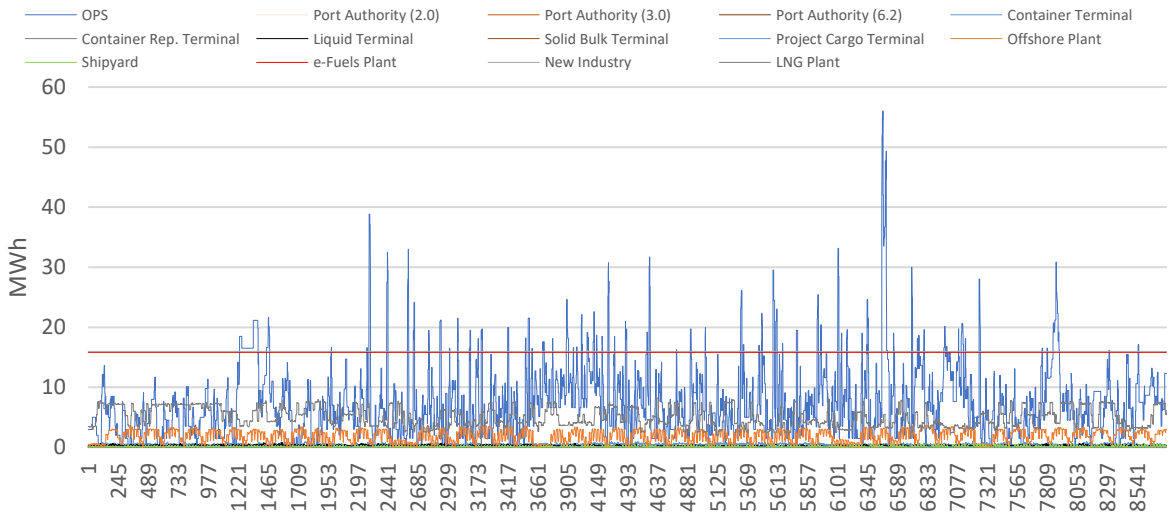
351,9 GWh/year
Total Demand

76,6 GWh/year
Renewable Energy Production

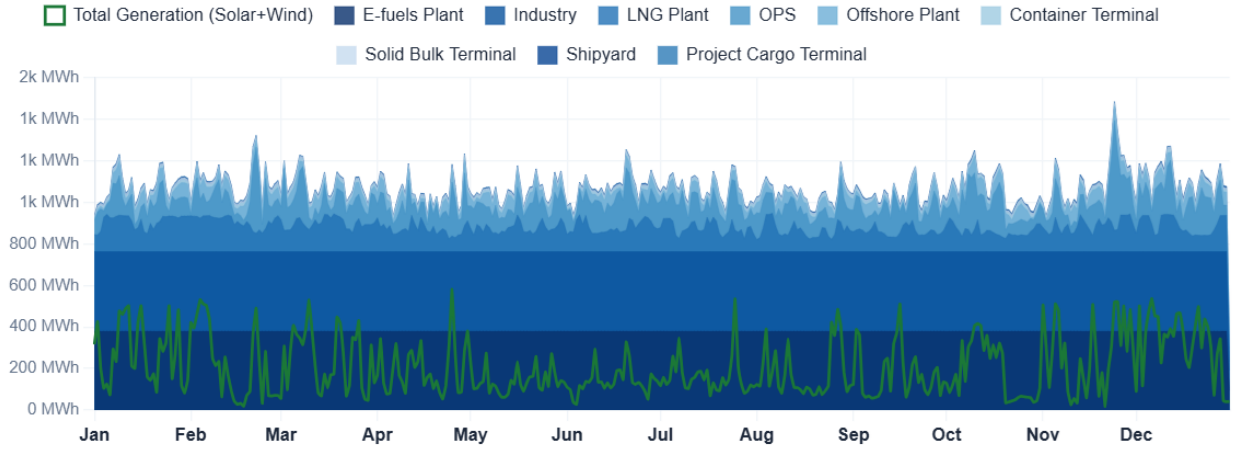
21.8%
Self-sufficiency Ratio
vs. ~3–5% EU port average

'A community approach makes energy costs more predictable, with savings for the community of 27–40% vs. a fragmented approach.'

A fragmented approach



A community approach (more competitive, resilient and stable)



Retaining renewable energy value within the port community

Source: Tecnalia · SAITEC · Basque Energy Agency — Characterisation of hourly electricity demand across all port consumers · 2026

Contributing to the UN Sustainable Development Goals

SDGs 7 · 8 · 9 · 11 · 12 · 13 · 17 — systemic impact through public orchestration

7 Affordable and clean energy

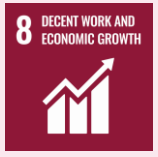
21.8% self-sufficiency ratio

vs. ~3-5% EU port average. 27-40% projected energy cost savings for 12 community members vs. fragmented approach.

8 Decent work and economic growth

EUR 160M APB direct investment

Energy cost reduction strengthens competitiveness of port operators and the Basque maritime cluster, protecting jobs across the supply chain.



9 Industry, innovation and infrastructure

60 MW substation · 11 OPS points

Resilient port energy infrastructure owned directly by the Port Authority — OPS network, BESS storage and digital energy platform.

11 Sustainable cities and communities

Zero emissions at berth

OPS shore power eliminates vessel auxiliary engine emissions — direct air quality improvement for Bilbao (pop. 350,000) and the Basque metropolitan area.

12 Responsible consumption and production

Proximity energy model

Energy produced within the port is consumed within the port — eliminating grid transmission losses, reducing market dependency and maximising the local value of every kWh generated.

13 Climate action

38.8% GHG reduction — OPS

76.6 GWh/year renewable production. Zero-emission shore power for TEN-T maritime flows. Aligned with FuelEU Maritime, CEF Transport and EU Port Strategy 2030.

17 Partnerships for the goals

Co-created regulatory framework

Jointly developed with EVE, EIB, European Commission, ESPO, IAPH, Tecnalia and Saitec. Replicable model for any port with a mixed public-private concession structure.

A port community that collaborates produces more energy, retains more value and remains more competitive & resilient

BUILDING A RENEWABLE PORT ENERGY COMMUNITY

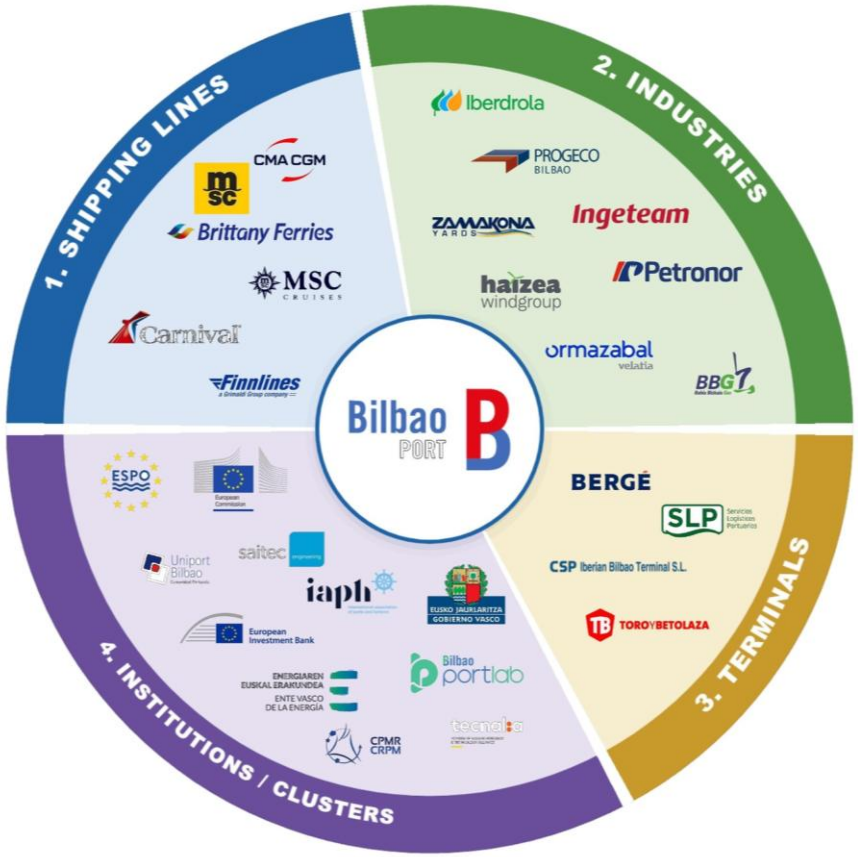
The project's greatest innovation is not technological but organisational.

Produce • Retain • Share

12 stakeholders | 352 GWh analysed | 50 MW renewable potential |

€160M invested by the Port Authority |21,8% self-sufficiency

Advancing SDGs 7, 8, 9, 11, 12, 13 and 17



A replicable framework for ports seeking competitiveness, resilience and decarbonization under grid constraints

From Bilbao to the global port community