

#Onshore Power Supply - #OPS

THE UTILITY TRAP

Roland Teixeira de Mattos
Professor John Prousalidis
Syb ten Cate Hoedemaker
Dr. Alex Papalexopoulos, Ph.D.

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#ENERGIZING PORT ELECTRIFICATION
#LETSGETCONNECTED
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Foreword

I am particularly proud to introduce The Utility Trap, not least because of the exceptional people with whom I have had the privilege of developing this paper.

Working alongside Professor John Prousalidis, Dr Alex Papalexopoulos and Syb ten Cate Hoedemaker has been an immensely rewarding experience. Their knowledge, experience and willingness to challenge established thinking have brought different perspectives to a subject that is considerably more complex than it may first appear.

But this paper is also the fruit of something much broader.

Over recent years, through EOPSA's activities, our participation in the European Sustainable Shipping Forum (ESSF) and its working groups, our work with DG ENER's team, and countless exchanges with port authorities, shipowners, electricity-sector specialists, associations, technology providers, policymakers and investors, we have had the opportunity to listen, question, debate and learn.

These conversations have progressively shaped our understanding of what port electrification really entails.

Our earlier **Age of OPS** work recognised that shore power was becoming part of a much wider transformation of Europe's ports and electricity systems. The Utility Trap takes that reflection a step further, questioning whether the responsibilities, commercial structures and investment mechanisms emerging around this transformation are truly fit for purpose.

This paper is not intended to criticise the ambition of European policy. Quite the contrary. It is born from our shared determination to see that ambition succeed.

I would therefore like to express my sincere appreciation to my fellow authors and to the many individuals and organisations whose expertise, openness and sometimes challenging opinions have contributed to our thinking.

The conclusions are ours, but the conversations that inspired them belong to a much wider community.

I hope this paper will encourage further debate, constructive challenge and, above all, the cooperation needed to turn Europe's port electrification ambitions into reality.

Roland Teixeira de Mattos
President, EOPSA

How did we get here?

The electrification of vessels at berth is not a recent policy nor technological discovery. Its operational origins predate today's climate framework by many decades. Shore-based electricity enabled vessels to shut down onboard machinery while maintaining essential services; the operating condition from which the term “cold ironing” emerged. In naval and commercial applications, the practice reduced fuel consumption, machinery operating hours, maintenance requirements, noise, vibration and local emissions associated with running auxiliary engines alongside.

The rationale for shore-side electricity subsequently broadened. What began principally as an operational practice increasingly became an instrument for improving local air quality and reducing emissions in port cities. California established one of the earliest regulatory approaches to emissions from ocean-going vessels at berth, while Nordic (e.g. Gothenburg) and other north European ports developed OPS installations ahead of binding EU requirements. Rotterdam was surprisingly among the early European adopters (ca. 2008), albeit losing momentum later. Underpinning this early European progress, IAPH established, in 2017, the World Ports Sustainable Program with a dedicated OPS database and library.

AFIR and FuelEU Maritime should therefore be understood as the latest regulatory layer in a much longer technological and operational evolution, rather than the origin of OPS itself. Over time, its role has expanded from operational efficiency and strategic utility, to local air quality, decarbonisation and, increasingly, electricity-system integration.

This progression matters. The technology preceded the policy; the policy progressively expanded its purpose and scale.

The European Green Deal established the strategic context for the next phase. Presented by the European Commission in December 2019, it defined itself as the EU's “new growth strategy”, seeking a fair and prosperous society underpinned by a modern, resource-efficient and competitive economy. Its direction subsequently received explicit political endorsement across the EU institutions: the European Council endorsed the objective of a climate-neutral EU by 2050 in December 2019, while the European Parliament adopted its resolution on the Green Deal in January 2020 by 482 votes to 136, with 95 abstentions. The climate-neutrality objective was subsequently given binding legal effect through the European Climate Law.

Electricity was integral to that transformation. The Green Deal called for a power sector based largely on renewable sources, within an increasingly integrated, interconnected and digitalised European electricity market, while maintaining secure and affordable supply for consumers and businesses. Decarbonisation, competitiveness, prosperity and the transformation of Europe's electricity system were therefore components of the same policy trajectory.

The Fit for 55 package of July 2021 translated that ambition into a broad legislative programme spanning climate, energy and transport. Within maritime transport, the Alternative Fuels Infrastructure Regulation (AFIR) and FuelEU Maritime established complementary interventions at the ship-shore interface.

Their regulatory logic is deliberately aligned. Article 9 of AFIR requires Member States to ensure minimum shore-side electricity supply in qualifying TEN-T maritime ports. Article 6 of FuelEU Maritime requires qualifying vessels, from 2030, to connect to OPS and use it for their electrical power demand at berth in ports covered by AFIR, subject to defined exemptions and conditions. During the legislative process, the Council expressly confirmed that the shore-side electricity provisions under AFIR had been aligned with FuelEU Maritime.

The institutional pathway is relevant. Both instruments progressed through the EU's ordinary legislative procedure, with the Commission proposing and the European Parliament and Council co-legislating. Member States shaped the Council position through **their transport ministers**; in June 2022, the **Transport Council** adopted its general approaches on both AFIR and FuelEU Maritime. The resulting framework thus reflects a European policy commitment shared across the EU institutions and Member States.

It was within this transition from policy ambition to implementation that EOPSA emerged. OPS deployment requires an industrial ecosystem extending beyond the port perimeter: technology providers, port authorities and terminal operators, electricity suppliers, distribution and transmission system operators, shipowners, financiers and investors all form part of the delivery chain. As deployment moves from individual installations towards system-wide electrification, its dependence on grid capacity, substations, electricity procurement, PPAs, storage, flexibility, metering and the allocation of investment and commercial risk increases accordingly.

This exposes a structural issue within the implementation model.

AFIR and FuelEU Maritime establish obligations at both ends of the ship-shore interface: electricity must be available ashore and qualifying vessels must increasingly use it at berth. The framework is materially less prescriptive on the commercial, financial and electricity-market architecture required between those two obligations.

This distinction becomes increasingly consequential as OPS moves from individual infrastructure projects towards large-scale port electrification. Port electrification now sits at the confluence of European transport, climate, energy and infrastructure policy. Treating its implementation predominantly as a port infrastructure obligation risks understating both the scale of the electricity system required and the institutional coordination necessary to deliver it.

The question is therefore no longer whether Europe should electrify its ports. That policy direction has been established.

The question is whether the implementation model, and particularly its allocation of responsibilities, risks and investment, is equipped to deliver that ambition efficiently, competitively and at scale.

The UTILITY TRAP

Port authorities are being required to manage the consequences of an electricity-market transformation they were neither constituted, regulated nor necessarily equipped to perform.

The starting point is deceptively simple. AFIR requires Member States to ensure sufficient shore-side electricity supply in qualifying ports, while FuelEU Maritime creates the corresponding requirement for qualifying vessels to use that electricity at berth. Neither regulation, however, establishes that the port authority itself should become the electricity supplier, electricity trader, flexibility provider or long-term bearer of electricity-market risk.

Yet implementation can produce precisely that outcome.

At small scale, OPS can appear to be conventional port infrastructure: a grid connection, transformer, frequency converter, cable-management system and connection point at the berth. At scale, that interpretation becomes increasingly incomplete. Electrifying multiple berths introduces substantial coincident and intermittent electrical loads, requiring decisions on grid capacity, connection agreements, substations, peak demand, storage, flexibility, electricity procurement, PPAs, metering, tariff structures and the allocation of volume and price risk.

These are no longer exclusively questions of port infrastructure. They are functions of an increasingly sophisticated electricity system.

This distinction matters because the location of electricity demand does not determine who is best placed to manage the electricity business required to serve it.

An airport is not expected to become an electricity utility because aircraft, terminals and ground operations electrify. A railway infrastructure manager does not automatically become an electricity trader because trains require electricity. Ports accommodate the supply of conventional marine fuels without the port authority necessarily producing, refining, procuring and commercialising those fuels itself.

Equally, the presence of large electrical loads within a port does not, by itself, establish the port authority as the natural party to finance, procure, aggregate, balance and commercialise the electricity required to serve those loads.

This is the Utility Trap: the progressive transfer, whether by design or by default, of electricity-system functions and associated commercial risks towards port authorities because the physical point of delivery happens to sit within the port perimeter.

The trap develops incrementally. Responsibility for providing the infrastructure can lead to responsibility for securing grid capacity. Grid capacity creates long-term financial commitments. Infrastructure investment requires cost recovery. Cost recovery requires decisions on tariffs and utilisation. Electricity supply introduces procurement and price exposure. Intermittent vessel demand introduces forecasting and capacity risk. At each step, another function can migrate towards the port authority without an explicit decision having been taken that the port authority is the institution best placed to perform it.

Independent work undertaken within the OPS and electricity sectors increasingly points to the same structural problem. Recent analyses have highlighted the absence of a sufficiently clear allocation of responsibilities between port authorities, terminal operators, grid operators and electricity-market participants, as well as the commercial and operational risks created when these functions overlap. This reinforces a concern EOPSA has raised as OPS has moved from individual installations towards system-wide electrification (cfr. [Age of OPS = energy hubs](#)): the physical responsibility for enabling a connection should not automatically determine the commercial responsibility for the electricity system behind it.

The consequences extend beyond institutional competence. OPS infrastructure combines high upfront investment with potentially low utilisation during ramp-up, substantial peak-capacity requirements and an electricity customer whose demand is determined by vessel calls rather than continuous industrial consumption. Where these characteristics are combined with responsibility for electricity procurement, grid-capacity commitments and long-term investment recovery, the port authority can become the residual bearer of risks originating elsewhere in the electricity and maritime value chains.

This creates a potential contradiction within the European implementation model. A mechanism intended to accelerate electrification can inadvertently concentrate risk in the entity controlling the physical location rather than allocate individual risks to those actors best equipped to manage them.

That is the Utility Trap.

The issue is not whether port authorities should participate in the electricity transition. They necessarily will. Ports control critical infrastructure, land, concessions and interfaces and will increasingly become sophisticated energy hubs, integrating electricity demand, renewable generation, storage, alternative fuels and flexibility.

But a port becoming an energy hub does not necessarily mean that the port authority must become its utility.

A port can orchestrate an electricity ecosystem without owning every asset within it. It can enable investment without financing every investment. It can facilitate electricity supply without becoming the electricity supplier. And it can provide the physical interface between vessel and electricity system without becoming the residual bearer of every commercial risk created between them.

The distinction is therefore between orchestrating an energy ecosystem and becoming its utility by default.

The former is a strategic evolution of the port.

The latter is an institutional assumption that requires examination.

The Age of OPS

The Utility Trap concerns the allocation of responsibilities within port electrification. It should not be confused with the scale or ambition of the transformation itself.

That transformation is accelerating.

For much of its development, OPS could reasonably be considered as a discrete infrastructure proposition: electricity is made available at a berth, enabling a vessel to switch off its auxiliary engines while alongside. AFIR and FuelEU Maritime necessarily reinforce this ship-to-shore interface by establishing requirements around the availability and use of shore-side electricity.

But the electricity transition taking place within the port ecosystem is considerably broader than OPS alone.

Vessels are electrifying. Terminal equipment is electrifying. Tugs, pilot boats, fishing vessels, workboats, crew transfer vessels and other harbour and service craft increasingly present opportunities for battery-electric and hybrid operation. Vehicles and logistics equipment create additional electrical demand. At the same time, the production of alternative maritime fuels, including renewable hydrogen and hydrogen-derived fuels, could itself create very substantial requirements for renewable electricity.

The result is a fundamental change in both scale and purpose.

OPS should increasingly be understood not as the end-point of port electrification, but as one of its principal building blocks.

This is what EOPSA is describing in the “Age of OPS” position paper: the transition from individual shore connections towards integrated electricity ecosystems in which vessel supply, terminal demand, industrial activity, renewable generation, battery storage, smart electricity management and interaction with the wider grid increasingly coexist within the same geographic and economic environment. EOPSA's earlier work describes OPS as the physical and operational interface connecting maritime transport with this broader electricity system.

European policy is now moving in the same direction. The European Commission's 2026 EU Ports Strategy describes ports as evolving beyond their traditional functions into multi-functional industrial hubs and places energy transition, improved grid connections and electrification among its strategic priorities. It explicitly links the future of ports with clean energy, resilience, security and competitiveness.

The Electrification Action Plan, published in July 2026, broadens the context further. Its ambition is to increase electricity's share of European final energy consumption from around 23% today towards 46% by 2040, while strengthening competitiveness, reducing fossil-fuel dependence and improving energy security and resilience. European Commission Port electrification therefore no longer sits at the margins of European transport policy. It forms part of a much larger transformation of Europe's electricity system. This changes the fundamental question.

Rather than asking only how much electricity individual AFIR-regulated vessel categories will require at individual berths, the relevant system question becomes: what will the total electricity ecosystem within and around a port look like over the coming decades?

That ecosystem contains very different and potentially complementary demand profiles. Home-based and frequently returning vessels (fishing vessels, tugs, pilot boats, workboats, CTVs and other service craft) can provide recurring and comparatively predictable electricity demand. Large visiting vessels create much greater but more intermittent loads. Terminal equipment, logistics, industrial activity and potentially the production of new maritime fuels introduce further demand profiles.

Taken together, these loads create an entirely different proposition from a collection of isolated OPS installations.

Taken together, they begin to resemble the demand portfolio underlying a utility's day-to-day business.

Recurring demand can contribute to underlying utilisation and revenues. Intermittent high-power users can contribute according to both the electricity they consume and the capacity that must be available when they call. Storage, renewable generation, flexibility and intelligent energy management can potentially optimise the system across different users and different periods.

The significance of the energy hub therefore lies not in assigning these activities to the port authority, but in recognising the opportunity to optimise them as a system.

That distinction is essential.

The physical assets, commercial activities and associated risks within such an ecosystem may ultimately be distributed between port authorities, terminal operators, DSOs and TSOs, electricity suppliers, generators, aggregators, infrastructure investors, technology providers and vessel operators. Different ports may develop different models. The Age of OPS does not predetermine that allocation.

It describes the system opportunity.

That opportunity increasingly includes resilience. As electricity becomes more important to maritime and industrial activity, continuity of supply becomes correspondingly more important. Local generation, storage, microgrids, flexible demand and intelligent energy-management systems can create options for reducing peak grid requirements and supporting the wider electricity system under normal conditions. Appropriately configured systems can also provide greater continuity during grid disruption and, potentially, preserve defined critical functions through islanded operation during major emergencies.

For strategically important European ports, this introduces a dimension extending beyond decarbonisation and commercial optimisation. Energy resilience can contribute to supply-chain continuity, civil protection and, where applicable, defence and military mobility. This is particularly relevant as the EU Ports Strategy increasingly treats ports simultaneously as transport infrastructure, industrial nodes, energy interfaces and strategic assets.

The *Age of OPS* therefore represents a considerably larger proposition than shore power.

OPS creates an interface. Electrification creates demand. Storage and generation create flexibility. Digital energy management creates the ability to optimise those elements together. The result can be an energy hub.

Who should invest in it, own its constituent assets, operate them, sell the electricity and carry the corresponding risks is a separate question.

Indeed, this is precisely where the Age of OPS reconnects with the Utility Trap.

The emergence of the port energy hub strengthens the case for defining the respective roles of the actors within it; it does not justify assigning those roles by default to the port authority.

€100Bn bankable investment opportunity

The *Age of OPS* creates an investment proposition considerably larger than OPS itself.

Earlier analysis undertaken by EOPSA together with Sustainable Ships calculated that OPS could create an aggregate annual electricity demand of **approx. 6–13 TWh** across European ports indicating the scale of the electricity ecosystem required to generate, transport, balance, reserve and manage and ultimately deliver that electricity to vessels.

The opportunity is to structure that proposition so that [Utility's] capital can participate in it.

The transition described in the previous section will require investment across an entire electricity ecosystem. Shore-side connections are only its most visible component. Behind them sit grid reinforcement and new grid connections, substations and electrical distribution systems, renewable electricity generation, battery storage, microgrids, charging infrastructure, digital energy-management systems, metering, flexibility and market services. The transformation will also require engineering capability, software, operations and maintenance, new commercial services, training and the development of skills and jobs that do not exist at the required scale today.

EOPSA calculates that the wider European economic opportunity associated with this transformation could exceed €100 billion over the coming years, representing the pool of investment and economic activity that will be mobilised as European ports and their surrounding industrial ecosystems electrify.

The starting point for bankability is utilisation. An electricity system designed exclusively around the calls of large AFIR-regulated vessels can face an inherently difficult utilisation profile: substantial capacity must be available when a vessel arrives, while the same infrastructure may be lightly used for significant periods between calls. The economics improve when the system is considered across the broader electricity ecosystem described by the *Age of OPS*.

Frequently returning and home-based vessels (fishing vessels, tugs, pilot boats, workboats, CTVs and other harbour craft) can create smaller but recurring and comparatively predictable electricity demand. Terminal equipment, vehicles, logistics operations and industrial activity add further loads. Larger visiting vessels bring substantial, although more intermittent, demand. Future production of renewable hydrogen and hydrogen-derived maritime fuels may add significant additional electricity consumption.

Viewed individually, these activities can present difficult investment cases. Viewed as a portfolio of demand, they begin to create an electricity business.

Recurring users can underpin utilisation and recurring revenues. Intermittent high-power users can contribute not only for the electricity consumed, but for the capacity that must be available when required. Storage and intelligent energy management can help manage peaks and optimise the use of grid capacity. Local generation can introduce additional sources of electricity and value. Flexibility can potentially create further revenue streams within the wider electricity system.

Bankability therefore begins with aggregation (bundling) rather than isolation: combining different electricity loads, users, assets and revenue streams so that the economics of the whole can become stronger than those of an individual OPS connection.

This is also where the Utility Trap becomes economically relevant.

A bankable electricity ecosystem should make it possible to allocate individual investments and risks to the actors best able to finance and manage them. Grid infrastructure, generation, storage, shore connections, electricity supply, digital platforms and flexibility services do not necessarily require the same investor, owner, operator or commercial model. Nor do they carry the same risk profile.

The objective should therefore not be to construct one enormous investment proposition and place it on the balance sheet of a port authority. It should be to unbundle the wider opportunity into investable propositions while retaining the system benefits created by their integration.

This opens the market to a much wider capital base: utilities and electricity suppliers, regulated network operators, infrastructure funds, institutional investors, renewable developers, storage providers, terminal operators, technology companies, aggregators and specialist energy-service businesses. Different actors can invest in different parts of the ecosystem according to their expertise, cost of capital and capacity to manage the associated risks.

Public intervention consequently has a different purpose from simply paying for infrastructure. Grants may remain appropriate where economics cannot initially support investment, particularly for first-of-a-kind projects or infrastructure with significant public benefits. But the larger objective should be to use public policy to mobilise private capital, by addressing those risks that prevent otherwise valuable projects from reaching investment.

The 2026 Electrification Action Plan already points towards several components of this architecture. In its discussion of ports as energy hubs, the Commission connects OPS deployment with grid planning, electricity-demand forecasting, energy storage, integration into local energy systems and access to funding. It also identifies transparent and non-discriminatory OPS pricing, including tariff structures and cost components, as important to the transformation.

This is significant because bankability ultimately depends upon the relationship between investment, risk and revenue.

Capital can finance substantial infrastructure when there is sufficient confidence that investment can be recovered over its economic life. Where future utilisation, electricity prices, grid costs or revenues remain uncertain, the cost of capital rises, or capital chooses another opportunity altogether.

And capital has many strategic, resilience, renewables and growth choices (e.g. AI related data centres).

Europe has already developed sophisticated mechanisms to mobilise private investment into other strategic elements of the energy transition. Renewable generation, offshore wind, electricity networks and other decarbonisation infrastructure have benefited, in different forms and at different stages of their development, from mechanisms designed to reduce specific investment risks and create sufficient revenue visibility to attract capital.

Port electrification will compete for investment against those opportunities.

Nonetheless, the opportunity is substantial. The policy direction is established. Electricity demand is emerging. The technology exists. And the *Age of OPS* expands the potential revenue base well beyond the calls of the vessels captured by today's regulatory thresholds.

The remaining task is to make those opportunities investable.

Bankability is therefore not simply a financing question. It is the mechanism through which the *Age of OPS* can move from regulatory ambition to an investment market.

And that leads directly to the next question:

Is port electrification competing for capital on a level playing field?

A level playing field for port electrification

The investment case for port electrification should not be considered only from the perspective of maritime decarbonisation. It should also be considered from the perspective of Europe's electricity system (cfr. Electrification Action Plan).

Europe is rapidly adding renewable electricity generation. As the proportion of variable renewable generation increases, periods of abundant electricity increasingly coexist with periods of scarcity. (24) ACER's monitoring shows that renewables supplied 50% of EU electricity generation in 2025, while daily wholesale electricity price swings were around five times higher than in 2020, highlighting the growing importance of flexibility within the European electricity system.

At the same time, renewable electricity is already being lost because the system cannot always transport, store or consume it where and when it is produced. In 2024, more than 10 TWh of renewable electricity was curtailed in the EU because of grid congestion.

Europe therefore faces an unusual investment challenge: it needs simultaneously to produce more renewable electricity and to create more intelligent demand for that electricity.

Port electrification can contribute to both sides of this equation.

The electricity demand associated with the Age of OPS has the potential to become substantial. OPS, vessel charging, terminal equipment, port vehicles, industrial processes and potentially the production of hydrogen and hydrogen-derived fuels all create new sources of electricity demand. Combined with battery storage, local generation and intelligent energy management, parts of that demand can potentially be shifted towards periods when renewable electricity is abundant and electricity prices are low.

This changes the way the investment should be viewed.

Additional electricity demand is not necessarily a burden on Europe's electricity system. Properly located, connected and managed, it becomes an asset to it.

A vessel connected for several hours, a battery charging within a defined operating window, or an industrial process capable of adjusting consumption does not necessarily require electricity at every moment. Where operational requirements allow, smart energy management can respond to electricity prices, available grid capacity and renewable generation. Storage can separate the moment electricity is taken from the grid from the moment it is ultimately consumed.

The potential system value therefore extends beyond the decarbonisation of the vessel itself. Flexible port demand can help absorb electricity during periods of abundant generation, improve utilisation of renewable assets, reduce curtailment and create additional demand at times when wholesale electricity prices are low or negative. ACER identifies demand response and storage as important sources of flexibility capable of balancing supply and demand, reducing price swings and supporting the integration of variable renewable generation.

There is a further opportunity in considering where this new electricity demand can originate. Europe's renewable energy industries themselves operate substantial maritime and port-based supply chains. Offshore wind, in particular, depends upon CTVs, SOVs, installation vessels, tugs, harbour craft, maintenance bases, terminals, warehouses and associated logistics.

Electrifying these activities creates an unusually compelling circular proposition. Renewable electricity can increasingly be used to decarbonise the supply chain responsible for producing and maintaining renewable electricity.

This is already moving from theory into practice. The development of electric CTVs, electrified CSOV operations and offshore charging demonstrates how vessels serving offshore wind farms can increasingly operate using electricity generated by the sector they support. Offshore charging extends the concept further by allowing renewable electricity to be consumed directly within the offshore wind operating ecosystem.

The system benefit can go further still. Where renewable generation would otherwise be constrained, curtailed or sold during periods of very low electricity prices, flexible vessel charging and storage can create an additional productive use for that electricity.

The opportunity therefore delivers a double dividend: more renewable electricity, and a progressively decarbonised industrial and maritime supply chain to build, operate and maintain it.

Ports provide a natural interface through which this circularity can extend beyond offshore wind. Electrification of workboats, harbour craft, terminal equipment, logistics and other port-based activities can create recurring electricity demand around renewable-energy supply chains, strengthening utilisation of the wider port electricity ecosystem while reducing its own emissions.

This creates an investment proposition with value on both sides of the electricity system. Port electrification can contribute to decarbonising maritime and industrial activity while simultaneously creating new demand, flexibility and storage capacity for an electricity system increasingly characterised by variable renewable generation.

Yet the investment conditions applying to the two sides of that equation remain markedly different.

Europe has developed sophisticated mechanisms to de-risk investment in renewable electricity generation, while much of the infrastructure and equipment required to consume that electricity, including the electrification of the supply chains supporting renewable generation itself, must still compete for capital without comparable mechanisms.

Depending upon the technology and Member State, instruments including auctions, feed-in support, long-term contracts and Contracts for Difference have reduced revenue uncertainty and helped make large-scale renewable generation investable.

This is well established in other capital-intensive electricity sectors. ACER identifies well-designed PPAs and CfDs among the mechanisms capable of strengthening long-term electricity markets and investment signals, while WindEurope and WFO similarly identify long-term revenue visibility, including through CfDs and PPAs, as central to de-risking investment, reducing financing costs and improving project bankability.

Those mechanisms have served a clear public-policy objective: accelerating the supply of low-carbon electricity.

The next phase of electrification requires attention to the other side of that equation: creating the demand, flexibility, storage and infrastructure capable of using that electricity efficiently.

If capital can obtain materially greater revenue certainty from one decarbonisation investment than from another, capital will respond accordingly. This is not a failure of investors; it is the rational allocation of capital according to risk and return.

Port electrification is therefore competing for capital not only with other transport infrastructure, but with renewable generation, storage, grids and other energy-transition assets whose investment risks may already benefit from established de-risking mechanisms.

A level playing field does not require identical support. It requires comparable attention to comparable investment risk.

The objective should consequently not be to shield port electrification from normal commercial risk. It should be to identify those risks (utilisation, early-market demand, grid capacity, electricity-price exposure, long investment horizons and revenue uncertainty) that prevent strategically valuable infrastructure from attracting capital, and determine which mechanisms can address them most efficiently.

Those mechanisms may differ from those developed for renewable generation. They could include long-term offtake arrangements, capacity-based tariff components, guarantees, concession structures, PPAs, availability mechanisms, blended finance or, where appropriate, CfD-type instruments designed around the particular economics of port electrification.

Europe has created mechanisms to make the production of renewable electricity investable. It should now ensure that the infrastructure capable of consuming, storing and intelligently managing that electricity can compete for capital on similarly credible terms.

Doing so does not require port authorities to become utilities. On the contrary, a bankable port electricity ecosystem should enable responsibilities, investments and risks to be allocated to those actors best equipped to carry them. The role of the port authority can remain one of facilitation, coordination and orchestration, while utilities, system operators, energy suppliers, infrastructure investors, technology providers and users participate according to their respective capabilities.

A level playing field should therefore achieve two objectives at once: attract capital towards port electrification and avoid making the port authority the investor of last resort.

A call to action

Europe has established the regulatory direction. AFIR requires shore-side electricity to be made available, FuelEU Maritime increasingly requires vessels to use it, and the EU Ports Strategy and Electrification Action Plan now place port electrification within the wider transformation of Europe's electricity system.

The next opportunity is implementation.

Port electrification should no longer be treated predominantly as a transport infrastructure programme. It sits at the intersection of transport, electricity, climate, industrial, infrastructure and investment policy. Delivering it at scale therefore requires those policy areas to converge.

First, Europe should establish a coordinated implementation framework for port electrification. At European level, DG MOVE, DG ENER, DG CLIMA and the relevant competition, industrial, infrastructure and financing functions should address the implementation challenge together. The same coordination is required within Member States between transport, energy, climate, infrastructure and finance authorities.

Second, responsibilities and risks should be explicitly allocated. Port authorities, terminal operators, DSOs and TSOs, electricity suppliers, generators, investors, technology providers and vessel operators all have roles to play. The objective should be to allocate each function and its associated risk to the actor best equipped to manage it, rather than allowing responsibilities to migrate by default towards the port authority.

Third, Europe should turn port electrification into an investment market. EOPSA estimates that the wider transformation represents an economic and investment opportunity exceeding €100 billion. The objective is to structure bankable propositions capable of mobilising utilities, infrastructure investors, institutional capital and specialised energy companies.

Fourth, port electrification should compete for capital on a level playing field. Europe should examine the investment risks currently preventing capital from entering the sector, including utilisation, grid capacity, early-market demand and revenue uncertainty, and develop appropriate de-risking mechanisms. These need not replicate those used for renewable generation, but they should provide similarly credible conditions for investment.

Finally, Europe should recognise port electrification not only as a source of additional electricity demand, but as part of the electricity-system solution. Flexible vessel demand, storage, local generation and intelligent energy management can help absorb renewable electricity, reduce curtailment and strengthen the economics of the wider energy transition.

The ambition is therefore considerably larger than installing OPS.

It is to create a competitive European port electricity ecosystem capable of attracting investment, creating skilled employment, developing new digital and AI-enabled electricity-management solutions, supporting renewable electricity, strengthening resilience and decarbonising maritime transport,

while preventing port authorities from falling into the **Utility Trap**.

About the Authors

Professor John Prousalidis 	John Prousalidis is professor of marine electrical engineering at the National Technical University of Athens (NTUA). He is the vice-chairman of the IEEE Marine Power Systems Coordinating Committee (IEEE-MSCC), member of the European Public Policy Committee (IEEE/EPPC) Working Group on Energy and member of the IEC/ISO/IEEE JWG28 dealing with 80005 series of standards on ship-to-shore interconnections and head of the Industrial Connection Activity Sustainable Maritime of IEEE(ICA-22-013). He is the co-chairman of the ESSF Workstream of OPS of the European Commission aiming to resolve technical issues of implementation shore power connections.
Dr. Alex Papalexopoulos, Ph.D. 	Dr. Alex Papalexopoulos, an authority in energy market design, is the Founder and CEO of ECCO International, Inc., based in San Francisco, California, which provides consulting and software services in the area of market design and smart grid development to a wide range of clients such as Governments, Regulators, ISOs/RTOs/TSOs/PXs, Utilities, Generators and Traders. He is also the CEO & Chairman of the Board of ZOME Energy Networks which designs energy programs for the building sector and Digital Twins for asset management, equipment maintenance, operational efficiency and cost reduction. Alex has designed over the last 25 years organized energy markets in 18 countries in North, Central and South America, Western and Eastern Europe and Asia. Prior to forming ECCO, Alex worked at PG&E in San Francisco where he was Director of the Electricity Restructuring Group. He has published hundreds of papers in scientific journals, is the 1992 recipient of PG&E's Wall of Fame Award, the 1996 recipient of IEEE's First Prize Paper Award and a Fellow of IEEE. He is in the Board of Directors of several startup companies in Silicon Valley. In 2010 he was awarded the Top Ten Entrepreneurs Award from the magazine RED HERRING. Alex received the Electrical and Mechanical Engineering Diploma from NTUA, Athens, Greece and the M.S. and Ph.D. degrees in Electrical Engineering from the Georgia Institute of Technology. In 2016 he was bestowed the award of the honorary Professor at the Department of Electrical and Computer Engineering at the University of Patras, Greece.
Syb ten Cate Hoedemaker 	After studying Marine Engineering at the Delft University of Technology, Syb joined the R&D department at Damen Shipyards where he performed research on the aging of batteries in electric vessels, developed a battery sizing and selecting method and worked on the design of many different types of battery powered vessels. In 2021 he joined the Maritime Battery Forum as managing director, focusing on the promotion of batteries in the maritime industry and supporting the sector with all battery related challenges.
Roland Teixeira de Mattos 	Roland Teixeira is President of the EOPSA, Europe's premier association regrouping top port electrification and OPS experts. As a former GE executive, Roland oversaw installation of OPS for inland shipping in Rotterdam back in 2008. This was a successful partnership between GE, the utility, the DSO and Port of Rotterdam. From 2011, Roland held various responsibilities including member of the Rotterdam Economic Development Board, board member of employer federation VNO-NCW-Rotterdam, Chair of ECB Committee at the WFO, Chair of the EU ESSF Port Electric Systems & Grid Subgroup and others. Alongside EOPSA, since 2025, Roland is a director of Seabridges Insights, specialised in OPS Ecosystems and Port Energy Hubs working on a key demonstrator in Cherbourg.

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- (2) European Commission, *The European Green Deal*, COM(2019) 640 final, 11 December 2019. The Commission defines the Green Deal as its “new growth strategy” and links it expressly to prosperity, resource efficiency and competitiveness. [EUR-Lex](#)
- (3) European Commission, *Annual Sustainable Growth Strategy 2020*, COM(2019) 650 final, 17 December 2019. The strategy links the Green Deal with competitiveness, productivity, innovation and lasting prosperity. [EUR-Lex](#)
- (4) European Commission, *The European Green Deal*, COM(2019) 640 final, section 2.1.2, “Supplying clean, affordable and secure energy.” [EUR-Lex](#)
- (5) European Commission, Fit for 55 legislative package, July 2021. [For the final paper I would cite the original Commission communication and legislative proposals rather than a Commission webpage.]
- (6) Regulation (EU) 2023/1804 (AFIR), Article 9, *Targets for shore-side electricity supply in maritime ports*. [EUR-Lex](#)
- (7) Regulation (EU) 2023/1805 (FuelEU Maritime), Article 6, *Additional zero-emission requirements for energy used at berth*. [EUR-Lex](#)
- (8) Council of the European Union, *Fit for 55 package: Council adopts its position on three texts relating to the transport sector*, 2 June 2022. The Council records that AFIR’s shore-side power provisions were made fully consistent with FuelEU Maritime. [Consilium](#)
- (9) Council of the European Union, Transport, Telecommunications and Energy Council, 2 June 2022; general approaches on AFIR and FuelEU Maritime.
- (10) Council of the European Union, Fit for 55 package: Council adopts its position on three texts relating to the transport sector, Press Release 504/22, 2 June 2022. Under AFIR, the Council states that, as regards on-shore power supply in maritime ports, “the provisions have been made fully consistent with the FuelEU Maritime proposal.” Council of the European Union. [Council](#)
- (11) Council of the European Union, Transport, Telecommunications and Energy Council (Transport), 2 June 2022 – Main Results. European transport ministers adopted the Council’s general approaches on the Fit for 55 transport proposals, including the Alternative Fuels Infrastructure Regulation (AFIR) and FuelEU Maritime. The Council records unanimous support for the AFIR objectives and approach and unanimous adoption of the FuelEU Maritime general approach.
- (12) Regulation (EU) 2023/1804 (AFIR), Article 9, *Targets for shore-side electricity supply in maritime ports*; Regulation (EU) 2023/1805 (FuelEU Maritime), Article 6, *Additional zero-emission requirements for energy used at berth*. AFIR places the obligation on Member States to ensure minimum shore-side electricity supply in qualifying TEN-T maritime ports, while FuelEU Maritime establishes the corresponding obligation for qualifying ships to connect to OPS and use it for their electrical power demand at berth from 2030. [Eur-Lex](#)
- (13) Regulation (EU) 2023/1804 (AFIR), in particular Article 9 and relevant maritime-port recitals; Regulation (EU) 2023/1805 (FuelEU Maritime), Article 6. The Regulations prescribe availability and use of OPS but do not prescribe that the port authority must itself act as electricity supplier, trader, flexibility provider or residual bearer of electricity-market risk. AFIR notably formulates the shore-side supply obligation at Member State level. [Eur-Lex](#)
- (14) EOPSA analysis of the electricity-system requirements associated with large-scale OPS deployment; see also A. Papalexopoulos, *Maritime Electricity Market Conference*, June 2026, on grid investment, electricity procurement, demand forecasting, PPAs, smart metering, market participation and associated commercial risks; and [S. Rouan/CENAQ, \[2023 EUROPEAN REGULATORY FRAMEWORK, STRATEGIC OPTIMISATION LEVERS, AT ENVIRONMENTAL, OPERATIONAL, INDUSTRIAL AND FINANCIAL LEVELS\]](#), March 2026, on OPS infrastructure, allocation of responsibilities and electrical infrastructure within ports.
- (15) S. Rouan/CENAQ, *[full report title]*, March 2026, section on responsibilities and project ownership. The analysis identifies the need for clearer allocation of responsibilities between maritime and port stakeholders and examines the respective roles of port authorities and terminal operators. See also A. Papalexopoulos, *Maritime Electricity Market Conference*, June 2026, calling for clearly differentiated roles between ports, distribution companies and other electricity-market participants.
- (16) [S. Rouan/CENAQ](#), analysis of OPS utilisation and infrastructure sizing. The report highlights the combination of substantial infrastructure investment, peak electrical capacity and potentially low annual utilisation for certain vessel segments, particularly during deployment and market ramp-up.
- (17) A. Papalexopoulos, *Maritime Electricity Market Conference*, June 2026. The analysis identifies high capital costs, unpredictable vessel electricity demand, electricity-price volatility and increasing commercial exposure among the principal challenges of shore-side electricity deployment, while distinguishing the respective roles of distribution companies, ports and other market participants.
- (18) EOPSA, *The Age of OPS – Why We Can*, 2026. the transition from individual shore connections towards integrated electricity ecosystems combining vessel supply, terminal demand, renewables, storage and smart electricity management. AGE OF OPS

(19) European Commission, *EU Ports Strategy*, Communication adopted 4 March 2026. European policy is moving in the same direction, with ports evolving beyond traditional transport functions and electrification, grid connections, clean energy, resilience and competitiveness becoming strategic considerations. AGE OF OPS

(20) European Commission, *Electrification Action Plan*, COM(2026) 595 final, 17 July 2026, pp. 16–17. Used immediately afterwards. This is the particularly strong Commission reference explicitly connecting OPS and ports becoming energy hubs with grid planning, demand forecasting, storage, integration into local energy systems, funding and transparent OPS pricing.

(21) EOPSA, *The Age of OPS – Why We Can*, 2026. EOPSA's analysis of the evolution of OPS from individual shore connections towards a wider port electricity ecosystem integrating renewable generation, battery storage, electricity management, microgrids and multiple sources of port and vessel demand.

This supports the opening proposition that the investment opportunity extends substantially beyond OPS equipment itself.

(22) EOPSA estimate, 2026 – European port electrification investment ecosystem. EOPSA estimate of the potential scale of investment and associated economic activity arising from European port electrification, encompassing OPS and vessel charging, grid connections and reinforcement, substations and port electricity distribution, renewable generation, battery storage, microgrids, digital energy-management systems, flexibility services, engineering, operations and maintenance, and associated skills and employment.

(23) European Commission, *Electrification Action Plan*, COM(2026) 595 final, 17 July 2026, pp. 16–17. The Commission identifies OPS and port infrastructure as important enablers of maritime and fisheries electrification and explicitly links the development of ports as energy hubs with timely integration into grid planning, electricity-demand forecasting, energy storage, integration into local energy systems and access to funding. The Action Plan also identifies transparent and non-discriminatory OPS pricing, including tariff structures and cost components, as important to this transformation.

(24) European Union Agency for the Cooperation of Energy Regulators (ACER), *Electricity and Gas – Key Developments 2026*, 2026. ACER reports the increasing penetration of renewable electricity in the European electricity system and the associated importance of flexibility and management of electricity-price volatility.

(25) ACER, *Monitoring Report on Cross-Zonal Electricity Trade and Congestion Management in the EU*, 2025, p. 58. ACER reports that more than 10 TWh of electricity from renewable energy sources was curtailed in the EU in 2024 due to grid congestion. [Acer Europe](#)

(26) ACER, *Unlocking Flexibility: No-Regret Actions to Remove Barriers to Demand Response*, 2025. ACER identifies demand response, energy storage and distributed generation as important sources of electricity-system flexibility and notes that demand response can facilitate the integration of variable renewable generation and reduce electricity-price volatility. [Acer Europe](#)

(27) Tidal Transit, *e-Ginny / Electrify Everything programme*, company project information. Development and operation of electric Crew Transfer Vessels and associated charging solutions for the offshore wind sector.

(28) Bibby Marine, project and industry publications concerning electric/hybrid CSOV operations and offshore charging for offshore wind support vessels. Bibby Marine has highlighted the potential for offshore charging to use renewable electricity directly within offshore wind operations and contribute to decarbonising the sector's maritime supply chain.

(29) ACER, *EU Electricity Market Integration – 2025 Monitoring Report*. ACER identifies insufficient depth in long-term electricity markets as a constraint on investment signals and recommends stronger forward markets, including well-designed Power Purchase Agreements (PPAs) and Contracts for Difference (CfDs), to provide more reliable price signals and support investment. [Acer Europe](#)

(30) ACER, *Developments and Initiatives in the EU Power Purchase Agreements Market*, 2026. ACER describes PPAs as long-term contracts capable of providing price stability and investment predictability, reducing exposure to market volatility and encouraging investment in renewable electricity generation.

AGE OF OPS Infographic.

