SUMMARY

Subject:	**LOCATION AND TECHNICAL CONCEPT OF THE OPS SYSTEM – ONSHORE POWER SUPPLY IN THE SEAPORTS IN SZCZECIN AND ŚWINOUJŚCIE**
LOCATION:	**Port Szczecin – Nabrzeże Fińskie i Nabrzeże Norweskie Port Świnoujście – Terminal Promowy Świnoujście**
Investor:	**Zarząd Morskich Portów Szczecin i Świnoujście S.A. 70-603 Szczecin, ul. Bytomska 7**

PREPARED BY:
mgr inż. Marcin Pluta
upr. proj. ZAP/0104/PWBE/20

PREPARED BY:
mgr inż. Paweł Felisiak
upr. proj. nr ZAP/0201/PBE/22

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1. Introduction and purpose of the study

The location and technical concept of the OPS (Onshore Power Supply) system covers Terminal Promowy Świnoujście as well as Nabrzeże Fińskie and Nabrzeże Norweskie in Port Szczecin. The purpose is to identify technical and organisational variants enabling ships to be supplied with electricity from shore, together with an estimate of power demand, schedules, costs, and the selection of the preferred variant using a multi-criteria analysis method.

The concept was developed with co-financing from EU funds under the Interreg Południowy Bałtyk programme titled "Concept of the OPS implementation in the Ports of Szczecin and Świnoujście", as part of the task "Maritime ports and their regions as moderators of transition towards blue renewable energy - Costs of external expertise WP.2.7", project No. STHB.02.01-IP.01-0001/24-00. The project assumes, inter alia, the preparation of methodological frameworks for a ports' energy transition strategy, a value-chain model for green fuels and digital tools supporting investment decisions and emission reductions; educational activities and cross-border cooperation are also planned.

The study aligns with the implementation of EU policies on decarbonising maritime transport and improving air quality. It indicates solutions that reduce the operation of onboard auxiliary generators (burning fossil fuels) during port stays in favour of drawing electricity from shore-based infrastructure.

2. Regulatory and technical conditions (summary)

The document refers to EU regulations on the development of alternative fuels infrastructure and the use of renewable and low-carbon fuels in maritime transport, which strengthen the obligation to implement OPS in TEN-T network ports.

Solutions consistent with the key standards for supplying ships from shore were adopted, including HVSC (medium-voltage) systems and - as a supplementary option - the LVSC (low-voltage) approach for smaller units, taking into account safety requirements, energy metering/billing and continuity of terminal operations.

3. Investment location and functional context

The ports of Szczecin and Świnoujście are class A ports and belong to the core TEN-T network. The total land area of both ports is 18 289 172 m² (Szczecin: 8 929 966 m²; Świnoujście: 9 359 206 m²), and the area of port waters is 7 124 110 m² and 14 537 104 m² respectively.

The scope of the concept includes: (1) Port Szczecin - Nabrzeże Fińskie and Nabrzeże Norweskie (handling containerised cargo), (2) Terminal Promowy Świnoujście - berths 1-5 (ferry operations).

4. Usage profile and key parameters

For Port Szczecin, container ship calls in the first half of 2025 were analysed (varied vessels, including those operating intensively). For Terminal Promowy Świnoujście, data on ferry calls were collected for the period 02.01.2024-23.11.2024.

For TPŚ, based on the ferries' connection capacities and arrival/departure schedules, the maximum power demand was estimated at approx. 5-6 MW for 60 Hz and 3-4 MW for 50 Hz, assuming that the total power concentrated at the GSZ TPŚ substation will not exceed 10 MW.

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With regard to the ergonomics of handling connections at TPŚ - based on information from shipowners and the location of connection points - it was assumed that the mobile device for supplying voltage should have a minimum cable reserve on the reel of 80 m.

5. Existing infrastructure (brief)

Terminal Promowy Świnoujście: as part of earlier investments, the following were built, among others: a containerised SB1 15/15 kV substation with a 50/60 Hz converter rated at 3 MVA, shore stations SSI1-SSI5 and 11 10,7 kV power-supply points on berths 1-5.

Port Szczecin (Fińskie/Norweskie): the power infrastructure is based on an SN 15 kV network supplied from GSZ Hryniewieckiego; the supply serves, among others, STS cranes, lighting and terminal infrastructure. Spatial constraints and crane operations limit the possible types of connection arrangements (risk of collision with the crane travel path).

6. Concept for Terminal Promowy Świnoujście (TPŚ)

The concept for upgrading OPS at TPŚ focuses on ensuring the ability to handle growing power demand while maintaining compatibility with existing connection points. It includes retrofitting/expanding the electrical infrastructure (including the ShoreBox station) and selecting mobile equipment for delivering cables to ferries.

6.1. Mobile equipment variants (TPŚ) and costs

Three variants of mobile equipment for servicing 5 ferry berths were considered (assuming use of existing elements):

- W1 - mobile trolley on an aerial work platform structure with a cable carrier (4 new units + 1 existing).
- W2a - mobile CMS system (mobile crane with a traditional boom; 4 new CMS + 1 existing CMS + 2 new drive trolleys).
- W2b - mobile CMS system (boom with a motorised reel; 4 new CMS + 1 existing CMS + 2 new drive trolleys).

Variant (TPŚ)	Estimated equipment cost (million EUR)	Equipment lead time assumptions	Total works (PLN)
W1 - trolley/aerial platform	2,00	up to 12 months	21 661 200 zł
W2a - CMS (traditional boom)	3,01	15-21 months	26 013 200 zł
W2b - CMS (boom with reel)	3,68	15-21 months	28 891 200 zł

The total costs include both infrastructure works and the selection of mobile equipment; the study adopted an indicative exchange rate of 1 EUR = 4,26 PLN (06.11.2025) for converting the costs of imported equipment.

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6.2. Schedule and formal requirements (TPŚ)

A set of decisions and arrangements required to commence and implement the investment was indicated, including, inter alia: connection conditions (increase of capacity), extracts from plans/land arrangements, maps for design purposes, approvals of Urząd Morski, arrangements with the OSD/network operator, fire-safety arrangements, and, if necessary, geological and engineering documentation as well as arrangements in the vicinity of rail infrastructure.

6.3. Multi-criteria analysis (TPŚ) - weights and result

To select the preferred variant, a multi-criteria analysis with a point score (1-5) and weights [%] was used: Cost 35; Technical fit 20; Risks 15; Time 10; Ergonomics 10; BHP 10.

Criterion	Weight
Implementation cost	35%
Technical fit	20%
Potential implementation risks	15%
Implementation time	10%
Ergonomics and failure rate	10%
Safety and BHP	10%

Variant (TPŚ)	Final score (0-5)	Conclusion
W1	4,46	Highest score - preferred base variant.
W2a	3,98	Better automation/BHP, but higher cost and longer implementation.
W2b	3,74	Highest CMS functionality, but the most expensive and with no time advantage.

The result of the analysis indicates W1 as the preferred variant - providing the best compromise of cost, schedule and fit to the TPŚ infrastructure.

7. Concept for Port Szczecin - Nabrzeże Fińskie and Nabrzeże Norweskie

For the container terminal in Szczecin, a concept was developed to supply container vessels from a 6,6 kV medium-voltage system (HVSC) with the possibility of operation at 50/60 Hz. Two berthing positions were assumed - one at each quay - enabling simultaneous supply of two units (2 x 2 MVA or 1 x 4 MVA). The concept takes into account the need to maintain clearances and minimise conflicts with STS crane operation.

7.1. Technical variants (Szczecin)

Two basic implementation variants were considered:

- Variant 1 - mobile SN 6,6 kV socket moving along the quays (MSPO) - base variant.
- Variant 2 - W1 + additional nN pits (0,4-0,69 kV) for smaller units (LVSC) - extended variant.

The target arrangement includes containerised transformer-converter stations (SB1 and SB2) each rated at 4 MVA (15 kV/6,6 kV) with 50/60 Hz frequency converters (AFE technology), a PLC/SCADA control system and supply from the existing SN infrastructure. On the quay side, a mobile MSPO connection system is envisaged, with cable routing and protection in carriers adapted to the marine environment.

7.2. Costs and schedule (Szczecin)

Variant (Szczecin)	Total cost (PLN net)	Implementation time (indicative)
Variant 1 (SN 6,6 kV - MSPO)	42 056 000	approx. 17-19 months (min. approx. 510 days)
Variant 2 (SN 6,6 kV + nN pits)	49 496 000	approx. 21-24 months

The minimum estimated implementation time for variant W1 was assumed as the sum of stages: design (approx. 90 days), approvals (approx. 60 days), deliveries (180-210 days) and installation (180-210 days).

Variant W2 extends the implementation due to additional distributed works (nN pits and connections) and increases the scope of hydrotechnical works.

7.3. Multi-criteria analysis (Szczecin) - weights and result

An analogous scoring approach (1-5) and weights [%] was applied: Cost 35; Time 10; Risks 15; Fit 20; Ergonomics 10; BHP 10.

Variant (Szczecin)	Final score (0-5)	Key conclusion
Variant 1	4,35	Best balance of CAPEX and time; base implementation for larger units (6,6 kV).
Variant 2	4,02	Higher versatility (SN + nN), but higher cost and longer implementation; potential formal/standard uncertainty for LVSC.

Recommendation: implement W1 as the base stage (faster operational effect), with the possibility of phased expansion with elements of W2 where justified by the unit profile and operational needs.

8. Decarbonisation and carbon footprint (summary of Section 7)

The analysis of OPS climate impact was presented as the combined emission reduction effect resulting from the implementation of all OPS installations in both ports in a representative operating year 2040.

Indicator (year 2040)	Value
Baseline emissions (Be) - “without project” scenario	8 366 tCO2e/year
Emissions with the project (Ab)	5 795 tCO2e/year
Net reduction (Re = Ab - Be)	-2 572 tCO2e/year
Estimated decrease in the carbon footprint of vessel operations	approx. 2,6 thousand tCO2e

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The emission reduction results from replacing the operation of ships' auxiliary generators with shore power supply. It was assumed that 90% of ferries and container vessels calling at the ports will use OPS and that 11% of the electricity supplied to units will come from renewable energy sources.

According to the EIB methodology (Project Carbon Footprint Methodologies), the project does not exceed the thresholds of "significant emissions" (20 000 tCO_2e/year), which eliminates the need to monetise emissions at the climate impact assessment stage. The project supports the "climate neutrality" pillar and the long-term transformation of the ports towards "green ports".

9. Conclusions and recommended next steps

Key conclusions from the concept:

- TPŚ (Świnoujście): preferred mobile equipment variant - W1 (score 4,46/5), with total costs of approx. 21,66 million PLN.
- Szczecin: preferred base variant - W1 (4,35/5) at a cost of 42,06 million PLN net; W2 as an optional extension (49,50 million PLN net).
- The implementation priority in Szczecin is to ensure the capability of SN 6,6 kV supply for units with higher demand and to maintain 50/60 Hz compatibility.
- Key risks: spatial and organisational conflicts at the quays (Szczecin), extended equipment delivery times (TPŚ - CMS), and formal/standard uncertainty of LVSC solutions.
- The next stage should include: confirmation of connection conditions and the power balance, preparation of maps and inventory, refinement of hydrotechnical solutions (fenders/pits), and detailed design documentation with a work phasing plan.