

THE ZERO EMISSION TERMINAL - HOW TO CONNECT TO THE GREEN FUTURE



Porto, 29.04.2026

**IN 2025, VAHLE GETS
THE WORLD MOVING.**



 **> 215** Mio.

TURNOVER IN
EURO (2025)

 **> 900**

EMPLOYEES

 **13**

MARKET
ORGANIZATIONS

 **5**

PRODUCT
GROUPS

 **4**

TARGET
MARKETS

VAHLE at a glance

 **> 215 Mio.**

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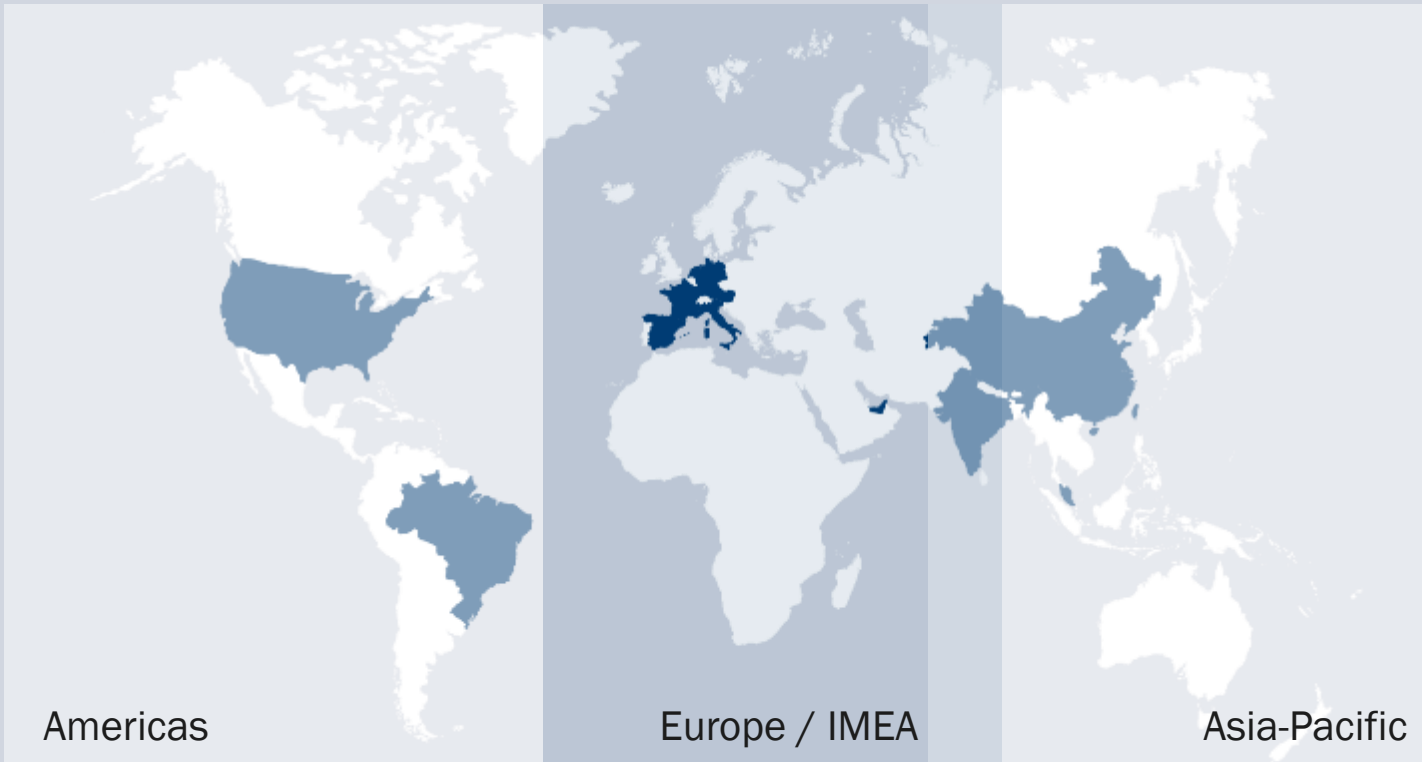
MARKET
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Energy Transmission



Intralogistics



Data Communication



Crane Technology



Positioning



Automotive



Control Systems



Port Technology



System Solutions

PORT TECHNOLOGY CONTAINER HANDLING



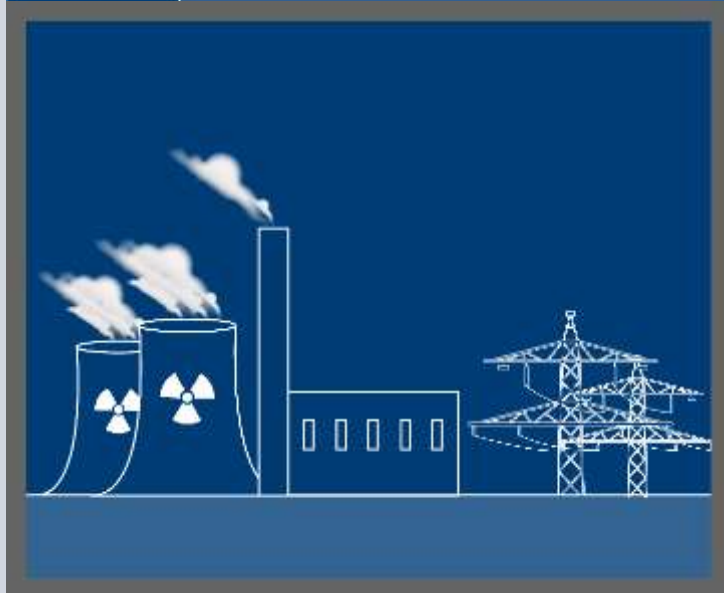
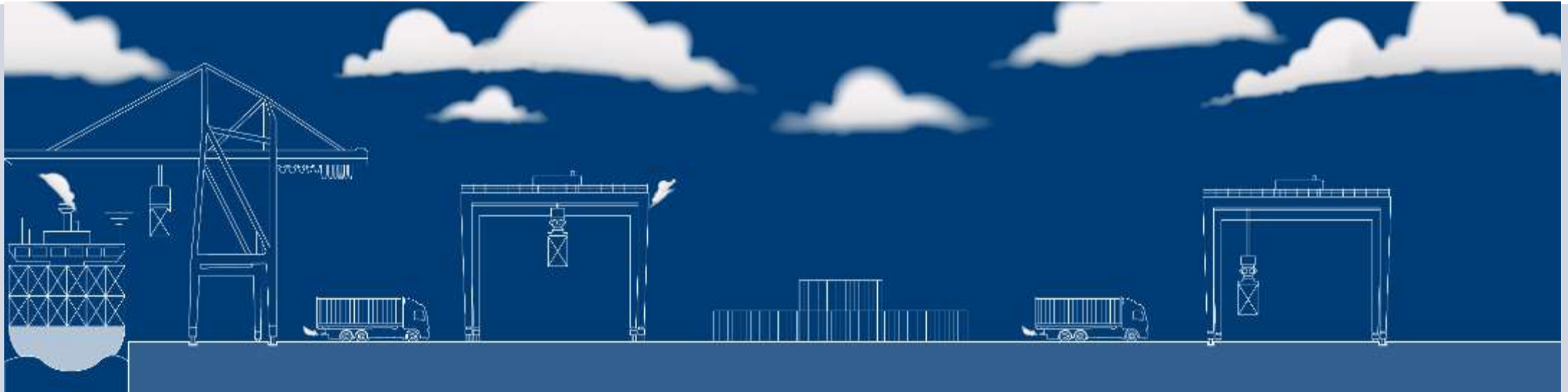
SPECIAL PROJECTS Ferris Wheels, ...



PEOPLE MOVER TRAMS, TRAINS, ...

Simplified Container Terminal Overview

In a changing world – 20 years ago



Simplified Container Terminal Overview

Nowadays and in the future



Simplified Container Terminal Overview



Ship to Shore / Quay Cranes



Vessels / Ferries



RMG Cranes / ASC



Mobile Equipment (AGV / TT)



RTG Cranes



Container Terminal Automation

Step by step approach

1.0 ELECTRIFICATION

Insulated conductor rails 1000V, 1000A with aluminium/stainless steel

2.0 POSITIONING

Precise position feedback with a contactless reading head

3.0 DATA COMMUNICATION

Interference-free and safe data & video

2020 - 300 Mbps

2024 - 600 Mbps

2026 - 1 Gbps

4.0 - AUTOMATION

Combination of electrification, positioning and data communication for remote control



Case study – Great Britain, HPH UK – Port of Felixstowe

Innovations and Milestones



2014 – today



Brownfield

66 ZPMC RTGs



RTG Retrofit

59 blocks (15,3 km)



Case study – Great Britain, HPH UK – Port of Felixstowe

Innovations and Milestones



2020 – today



Greenfield



8 Remote ZPMC AeRTGCs

17 Remote KC AeRTGCs

Container Blocks

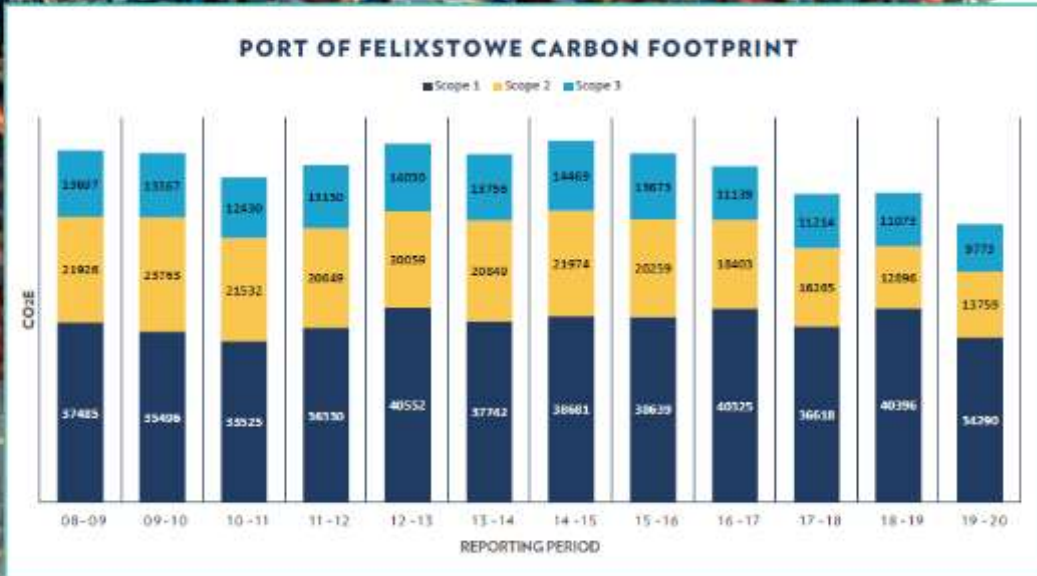
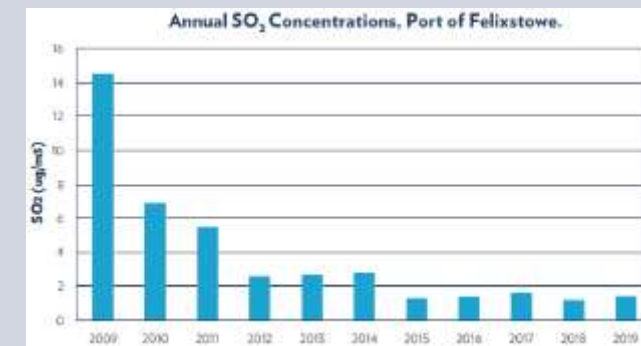


18 blocks (5,2 km)



ENVIRONMENT REPORT 2019-2020

PERFORMANCE



Scope 1 (direct) emissions produced on-site by fossil fuel combustion; mainly by RTG cranes, internal movement vehicles and port vehicles.

15% REDUCTION IN SCOPE 1 EMISSIONS WHEN COMPARED TO THE PREVIOUS PERIOD.

10% REDUCTION IN OVERALL CARBON FOOTPRINT.

20% REDUCTION IN OVERALL CARBON FOOTPRINT IN THE LAST TEN-YEAR PERIOD.

37% REDUCTION IN SCOPE 2 EMISSIONS SINCE RECORDING BEGAN.

Total savings since 2015-2020:

89.620 tons CO₂

Source: PoF Environment Report 2020

Thailand, HPT Laem Chabang – Terminal D

Greenfield Project Success Stories



2017 - today

World's
first fully
automated
terminal



Remote operation with 20 new AERTGCs



Automation of 20 container blocks
in phase 1 – 5,040 m



Including **SMGX data communication system**



Case study – Thailand, Laem Chabang – HPT Terminal D

Container Terminal Automation



Functions for retrofit and new OEM cranes



- **Block change batteries** to charge during the exit of the conductor bar powered block. We use NCA cells for this type of battery solution,
- **Hybrid batteries** in combination with smaller Diesel genset and/or conductor bar for a full eRTGC. We use NCA cells for this type of battery solution.
- **Peak shaving batteries** to cap load peaks above a defined limit. The power grid reference is kept within a defined value.

VAHLE Battery Storages for RTGCs



Retrofit projects in a VAHLE energy battery storage container



New OEM cranes in OEM e-room or battery power pack

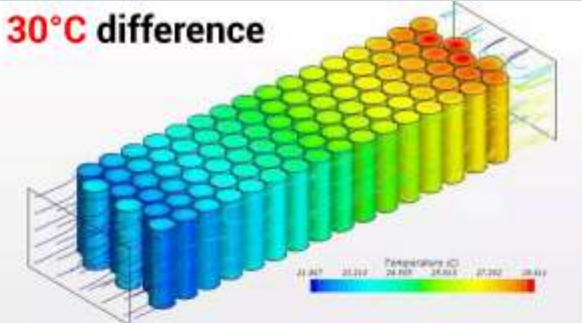


AIR COOLED

- Big space need
- Air contamination
- Low efficiency



30°C difference

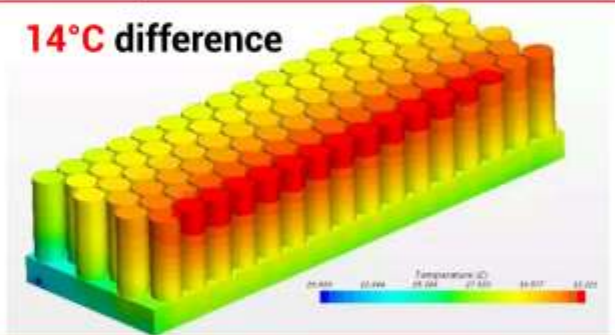


WATER COOLED

- Cold plate (volume/weight)
- Isolate water from live parts
- Water leakage risk



14°C difference

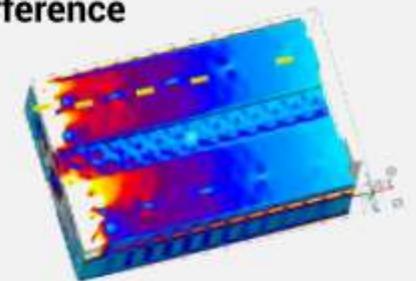


Immersion Cooling

- Best cooling efficiency
- No additional parts
- Homogeneous temperature
- Improved safety



2°C difference



Intelligent Battery Management System (BMS)



Safety BMS / BSM

Battery Management System

Battery Safety Management

European hardware and software electronics BMS

Prevent overcharge/discharge, overcurrent

Prevent over/undertemperature

- Best-in-class functional safety reaching ASIL C
- World first immersion cooled battery conforming to ISO 26262

ISO 26262 = automotive standard for safety of electronic/electronic components

ASIL = Automotive Safety Integrated Level, ranging from A to D



Project study - Khalifa Port | Abu Dhabi

Impressions – Trimotion compact – Installation and commissioning



Project study - Khalifa Port | Abu Dhabi

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Benefits of VAHLE Electrification & Automation Solutions



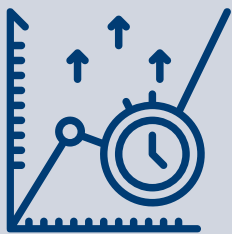
ECONOMIC

- Optimized OPEX by reduced fuel cost and idle time
- Reduced dependency on fossil fuel supplies
- Reduced GenSet maintenance cost
- Smart / remote maintenance
- Personnel costs are saved
- Productivity is increased
- Optimized Total Cost of Ownership



ECOLOGIC

- Reduction of CO₂ emissions and noise pollution
- Sustainable and green – at best with renewables



EFFICIENT

- Flexible yard operation
- Automatic connection system
- Autosteering
- Seamless synchronization
- Human Safety



ELECTRIFICATION OF RTG CRANES

**CMA TERMINALS
KHALIFA PORT**



