

Terminal Operation in a changing world
-
**Efficiency improvement by lean operation
with humans and equipment**

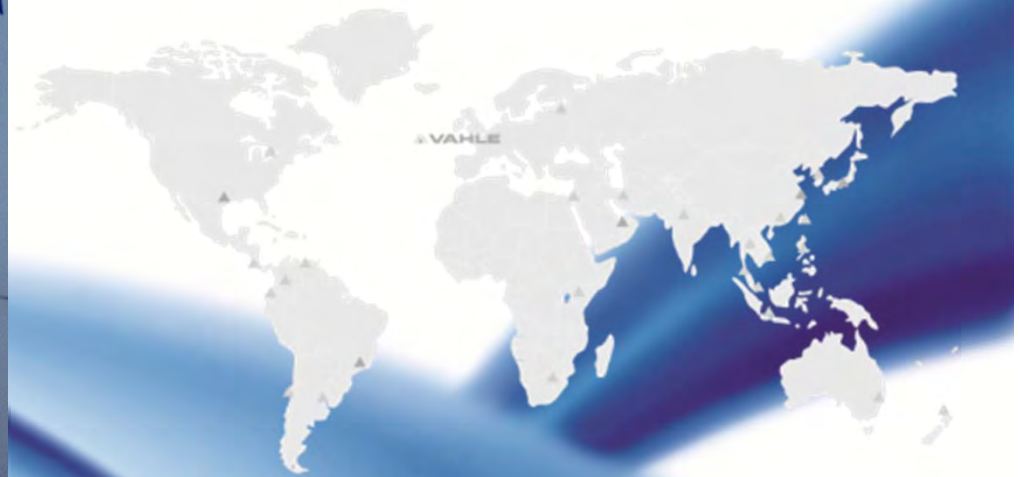
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For over **100 years**, VAHLE has been the leading manufacturer and provider of energy and data solutions.

VAHLE offers solutions for mobile electrification systems, festoon cable systems, data/communication systems, absolute positioning systems, battery charging and contactless power systems.





Corporate Data

- ▲ Founded 1912
- ▲ > € 130 mil. in sales (2015)
- ▲ 670 employees worldwide (01.10.2015)
- ▲ 12 VAHLE subsidiaries worldwide
 - Engineering, Sales, Service, Aftersales
- ▲ Representations in 52 countries
- ▲ 100% family owned
- ▲ Production based only in Germany

- ▲ Subsidiaries
- ▲ Representative firms



Ship to Shore / Quay Cranes:

- ✓ Festoon Systems
- ✓ Motor driven cable reels
- ✓ Trench systems
- ✓ USMGX for high speed applications

RTG Crane Electrification

- ✓ OEM Installations
- ✓ Retrofitting of existing equipment
- ✓ Data Communication
- ✓ Absolute Positioning
- ✓ Automation

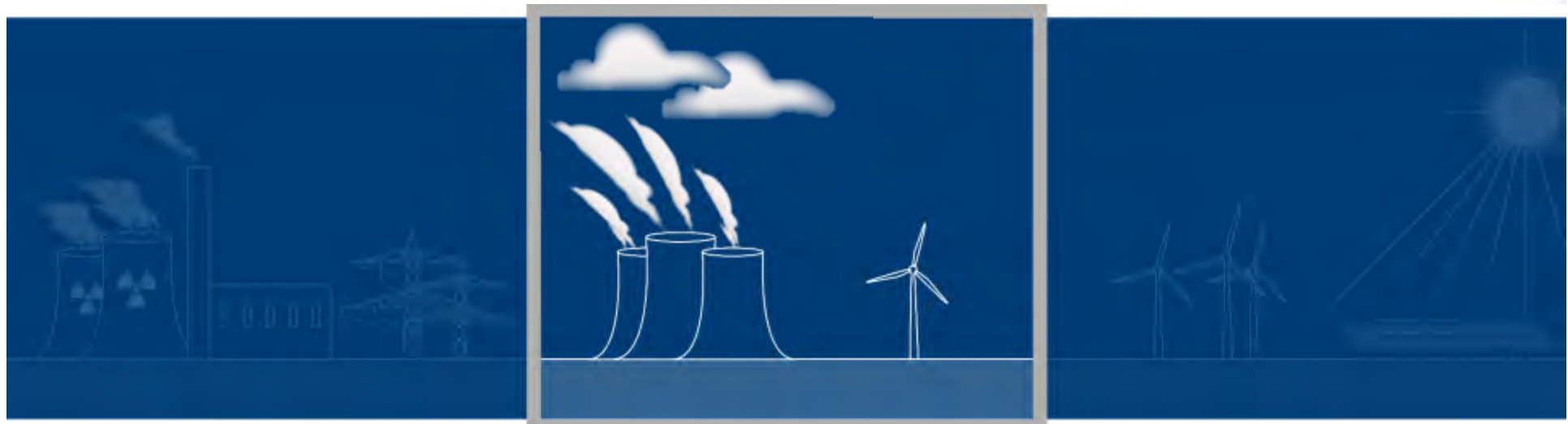
RMG / ASC Cranes

- ✓ Electrification with motor driven cable reels
- ✓ Electrification with conductor rails for high speed applications
- ✓ Data Communication
- ✓ Absolute positioning

Energy Management

- ✓ Energy storage technology up to 50MWh
- ✓ Containerized Substations
- ✓ Inductive charging of AGVs / Terminal tractors





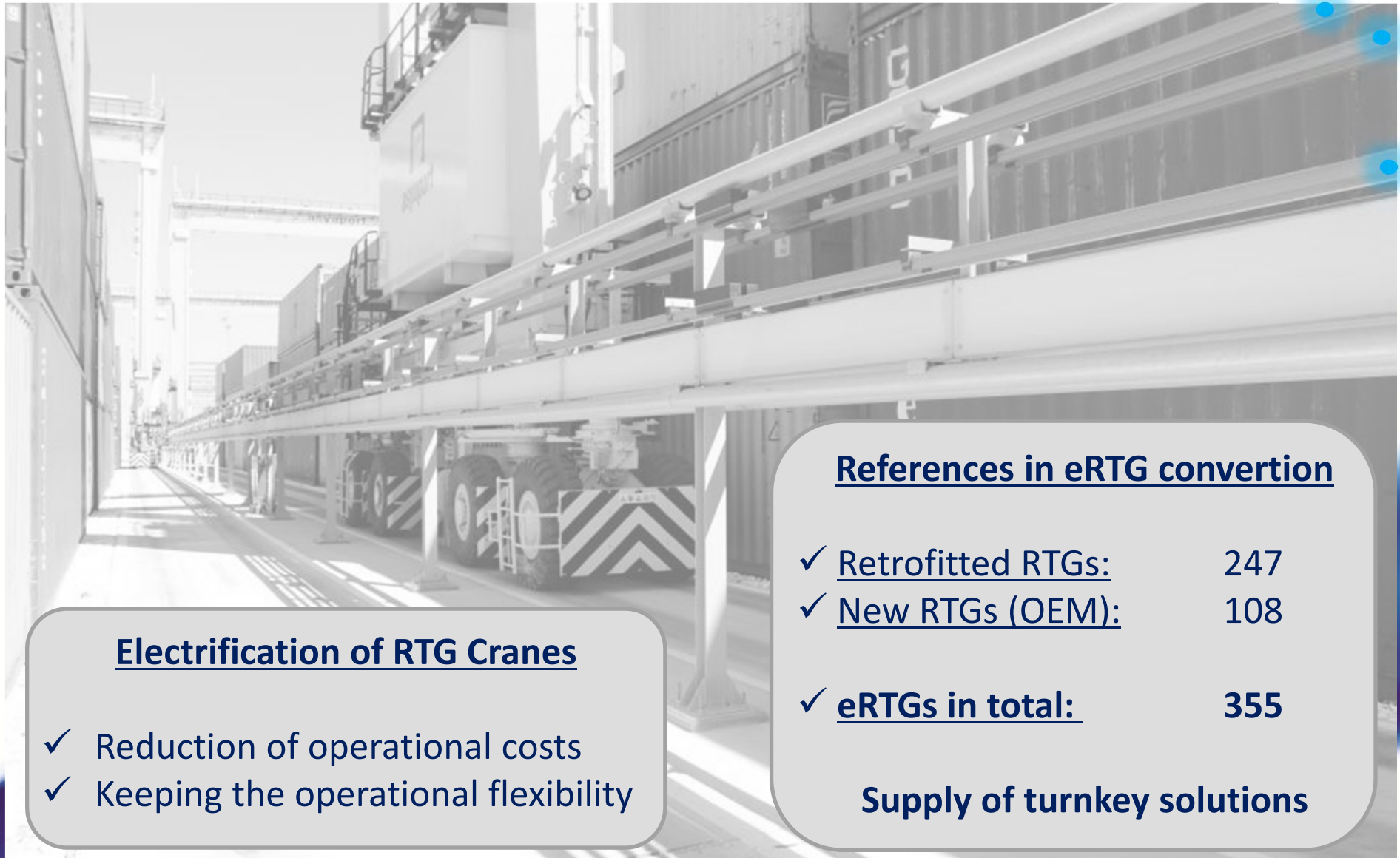
- ✓ Ultra Large Container Vessel are getting bigger and bigger
 - At present overcapacity in the market
 - Container rates are on a low level and still decreasing

- ✓ High utilisation on equipment to handle the un-/ uploading of mega vessels
- ✓ Un-/Uploading within a tight time schedule to match the requirements
- ✓ Increasing of demand on horizontal and hinterland transportation could be a bottleneck

- ✓ Cost drivers:
 - Liners (overcapacity)
 - Employees
 - Operational costs (fuel, maintenance, ...)

Conclusion for Operators:

Operational cost reductions and increase of efficiency will help to maintain the container rates.



Electrification of RTG Cranes

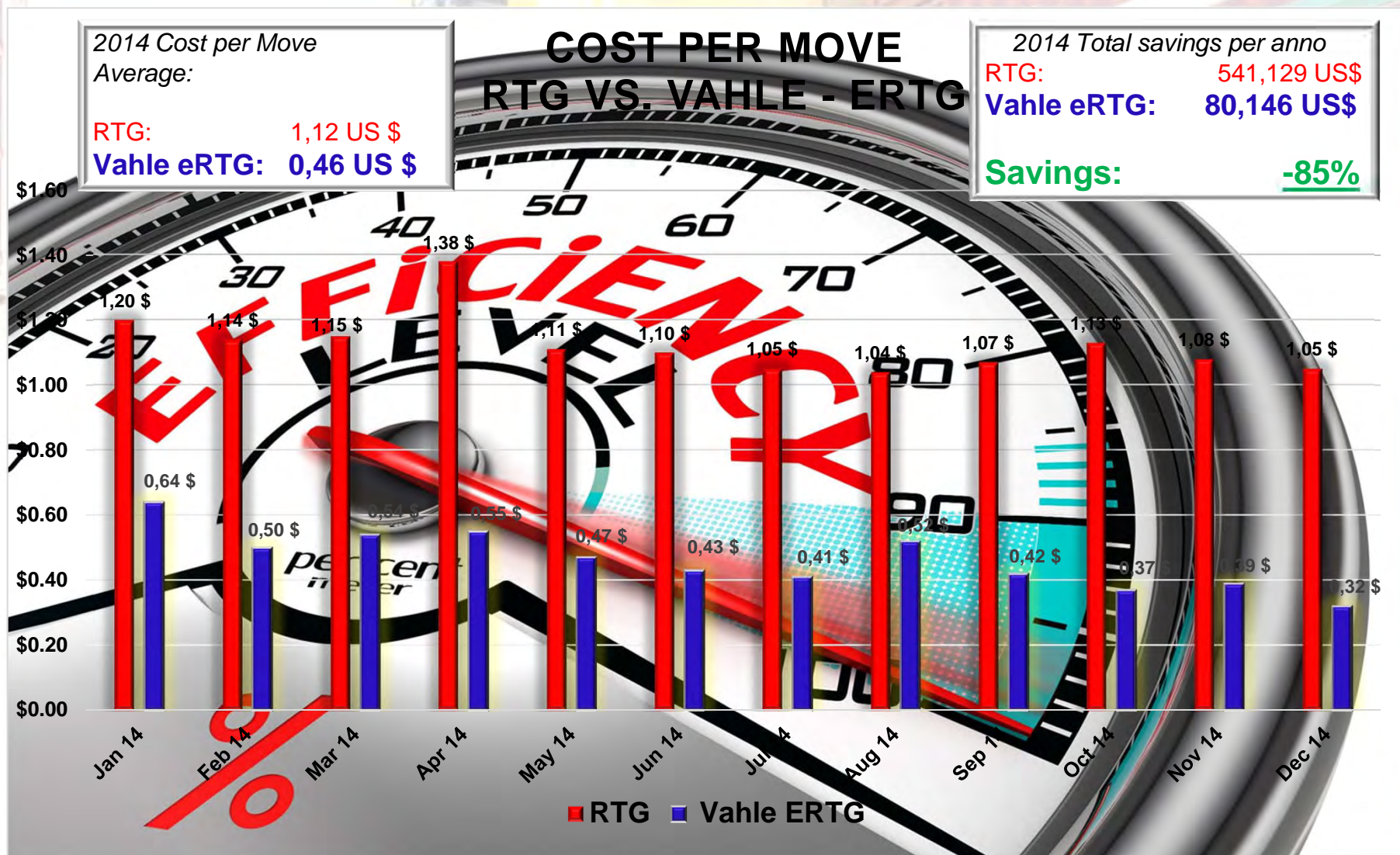
- ✓ Reduction of operational costs
- ✓ Keeping the operational flexibility

References in eRTG conversion

- ✓ Retrofitted RTGs: 247
- ✓ New RTGs (OEM): 108

- ✓ eRTGs in total: 355

Supply of turnkey solutions



Source: 1 of World's Top 3 Terminal Operator



**Shielded communication
(slotted waveguides)**

Data Communication

- ✓ Different Technologies available
 - Radio frequency, Cable, Waveguides

Positioning Systems

- ✓ Different Technologies available
 - GPS, D-GPS, Position Beacons, Optical Systems, RFID

CRUCIAL ASPECTS

- Reliability of safe data communication
- Average availability of data
- Protection against external influences

Flagship project – Port of Oslo

- RTG electrification with Vahle conductor rails and mobile equipment
- Vahle **Slotted Microwave Guide** data communication system
- Vahle WCS absolute positioning system
- 8 new **KALMAR** RTG cranes

**Grand Opening of the Terminal:
21st April 2016**

**Retrofitting existing RTG cranes
for Remote Operations:
HPH Port of Felixstowe, UK**

The Port of Oslo is proud to be the first terminal to deploy this revolutionary technology in RTG that makes our operations more sustainable, safer and quieter. Through these innovative features that Kalmar delivering us, our RTG drivers will be among the most efficient RTG operators in the world.“

Svein Olav Lunde
Director of the Technical Department
at the Port of Oslo

Source: Yilport Oslo, Norway



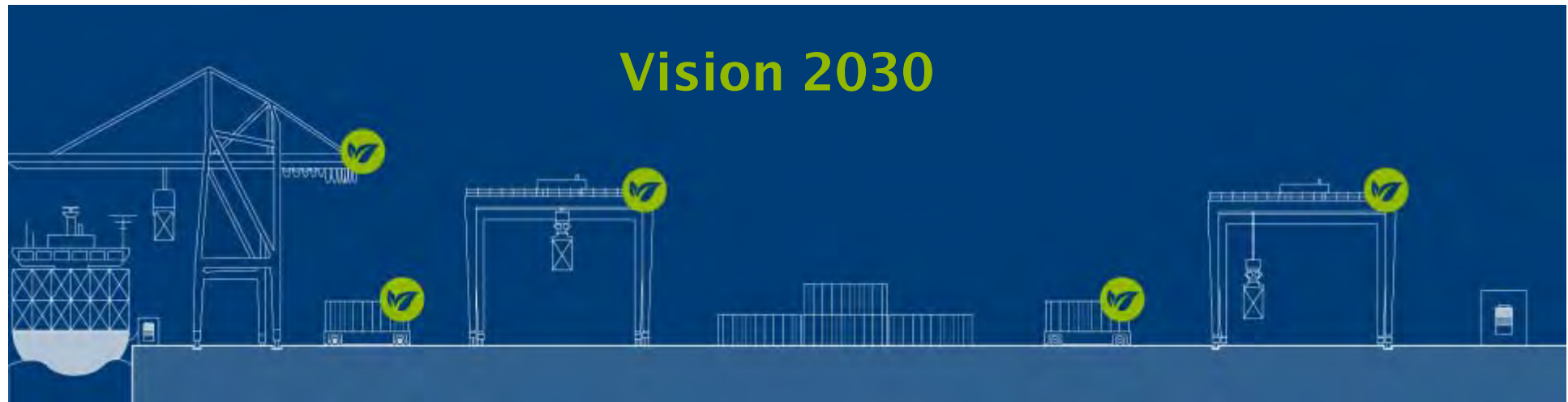
Energy Storage Technology (LiFePO₄)

Modular Energy Storages from 1 kW up to 50 MW capacity available

- Peak load management (operational cost savings)
- Power oscillation damping
- Voltage support and control
- Black start capabilities



Optimisation of own-consumption (photovoltaics)



Conclusion

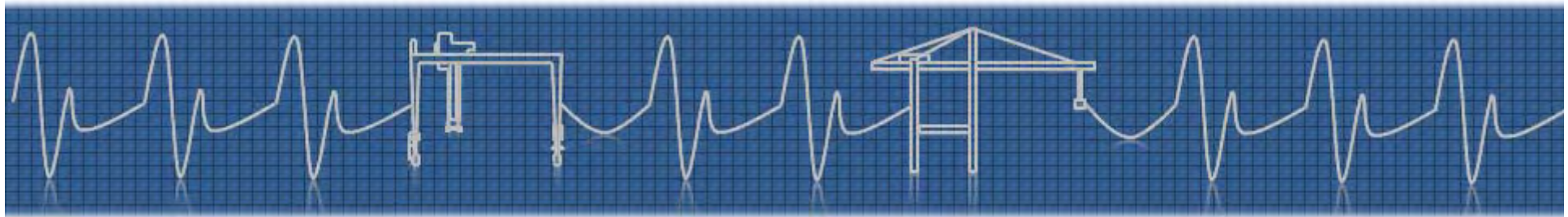
- ✓ Energy costs will increase again
- ✓ Ports are having to load / unload containers faster and more reliable
- ✓ Dozens of eRTG projects completed or in progress to improve existing infrastructure
- ✓ Main three characteristics are: **cost effective, efficient and ecological**

Pointers for the future

- ✓ Automation is fast becoming a standard in various ports and terminals, with recent interest in semi-automating and even full automated RTGs.
- ✓ Data transmission and positioning technology will improve yard container handling significantly



The heartbeat of Electrification Systems!



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