4TH BLACK SEA PORTS & SHIPPING 2015

VAHLE ELECTRIFICATION SYSTEMS

Tools and Technologies for electrifying container terminal yards: case of E-RTGs

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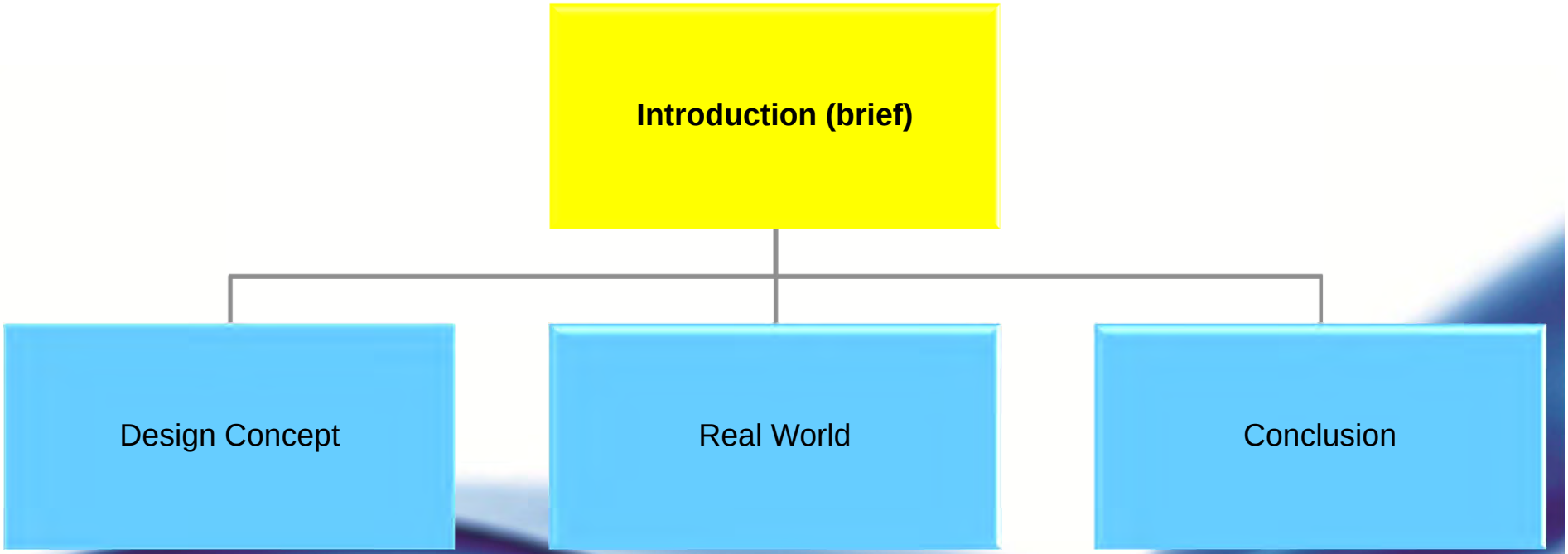
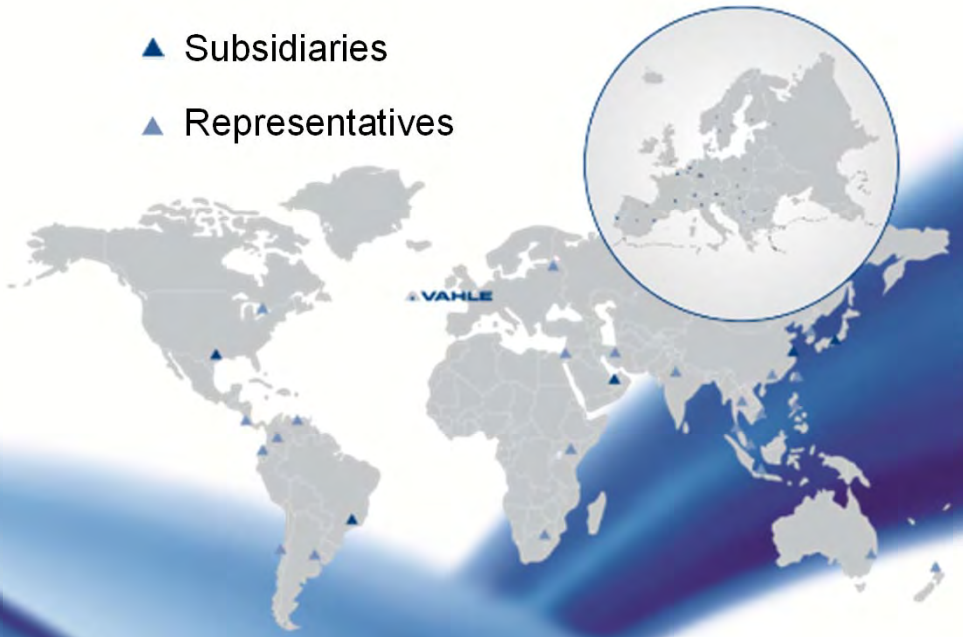
In 15 minutes……

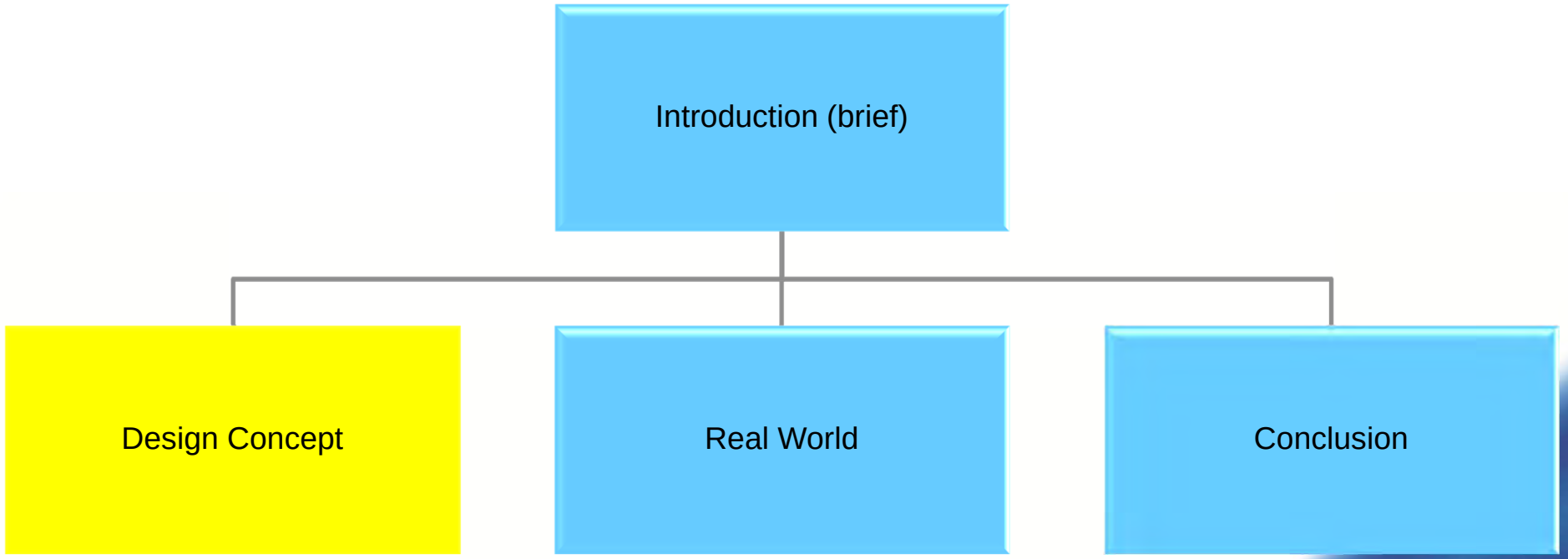


Vahle Group
Corporate Data

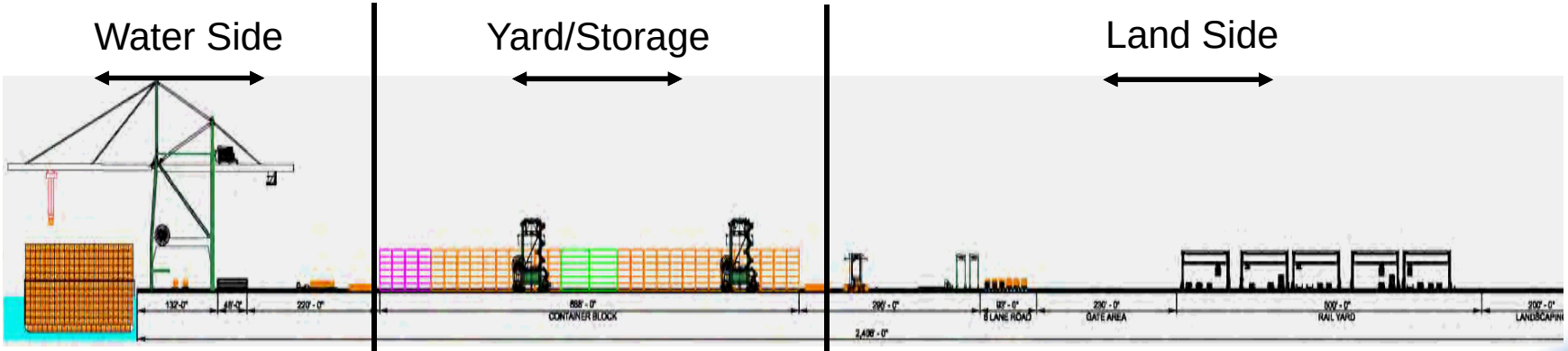
Corporate Data

- > € 100 mil. in sales
- 620 employees worldwide (01.01.2014)
- 11 VAHLE subsidiaries worldwide
- Representated in 52 countries
- 100% family owned




Introduction (brief)
Design Concept
Real World
Conclusion

Scope for optimising container processes



Water Side	Yard/Storage	Land Side
Current State: 55% Future State: 100%	Current State: 75% Future State: 100%	Current State: 80% Future State: 100%

Container handling solutions for horizontal transport should be prioritized, since it has the greatest impact on throughput. The **stack is the main** problem - its low service levels is the main reason contributing to the other container 'handling' processes.

Cost to delay an 18,000 TEU ship for one day

Capital cost of vessel (in US $)	$\$190\,000\,000 \times 0.1 \times \frac{(1+0.1)^{20}}{(1+0.1)^{20}-1} \times \frac{1}{350}$	**63 764**
Daily operating cost (in US $)	$\frac{\$17\,500\,000}{350}$	**50 000**
Daily cost of containers (in US $)	**Assuming 20 % 20 ft / 70 % 40ft / 10% reefer boxes 18 000 TEU x 2.4 (sets per vessel) x [(0.20 x US$0.58) + (0.70 x US$0.90) + (0.1 x US$8.00)**	**66 787**
Cargo inventory (in US $)	**18 000 TEU x 0.8 (load coefficient) x 10 ton / TEU x 0.08 x US$ 3 000 / ton x (1 / 365d)**	**219 000**
Total		**$399 441**

Source: Dr. Lawrence Henesey, Blekinge Institute of Technology, Sweden

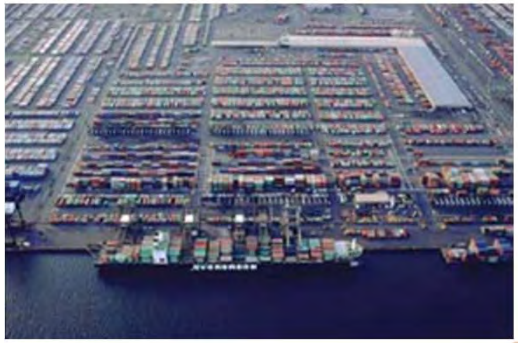
Cost to delay an 8,000 TEU ship for one day

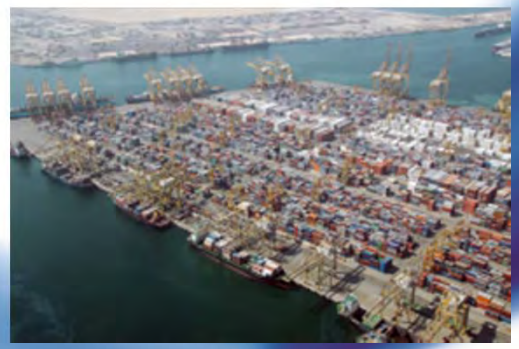
Capital cost of vessel (in US $)	$\$85\,000\,000 \times 0.1 \times \frac{(1+0.1)^{20}}{(1+0.1)^{20}-1} \times \frac{1}{350}$	**28 526**
Daily operating cost (in US $)	$\frac{\$14\,494\,000}{350}$	**41 411**
Daily cost of containers (in US $)	**Assuming 20 % 20 ft / 70 % 40ft / 10% reefer boxes 8 000 TEU x 2.4 (sets per vessel) x [(0.20 x US$0.58) + (0.70 x US$0.90) + (0.1 x US$8.00)**	**28 147**
Cargo inventory (in US $)	**8 000 TEU x 0.8 (load coefficient) x 10 ton / TEU x 0.08 x US$ 3 000 / ton x (1 / 365d)**	**42 082**
Total		**$140 166**

Source: Dr. Lawrence Henesey, Blekinge Institute of Technology, Sweden

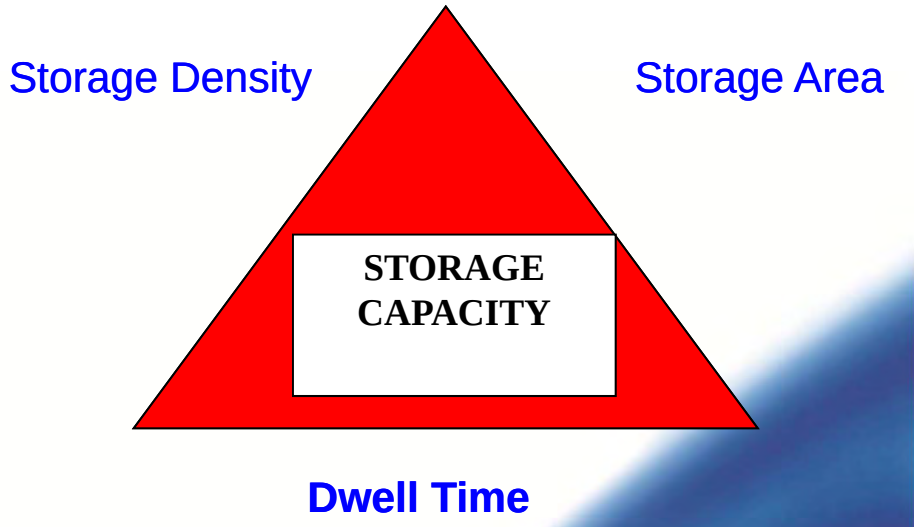
Yard Management Philosophy

We agree with the management philosophy that a container terminal's performance is **"steered"** by it's container yard

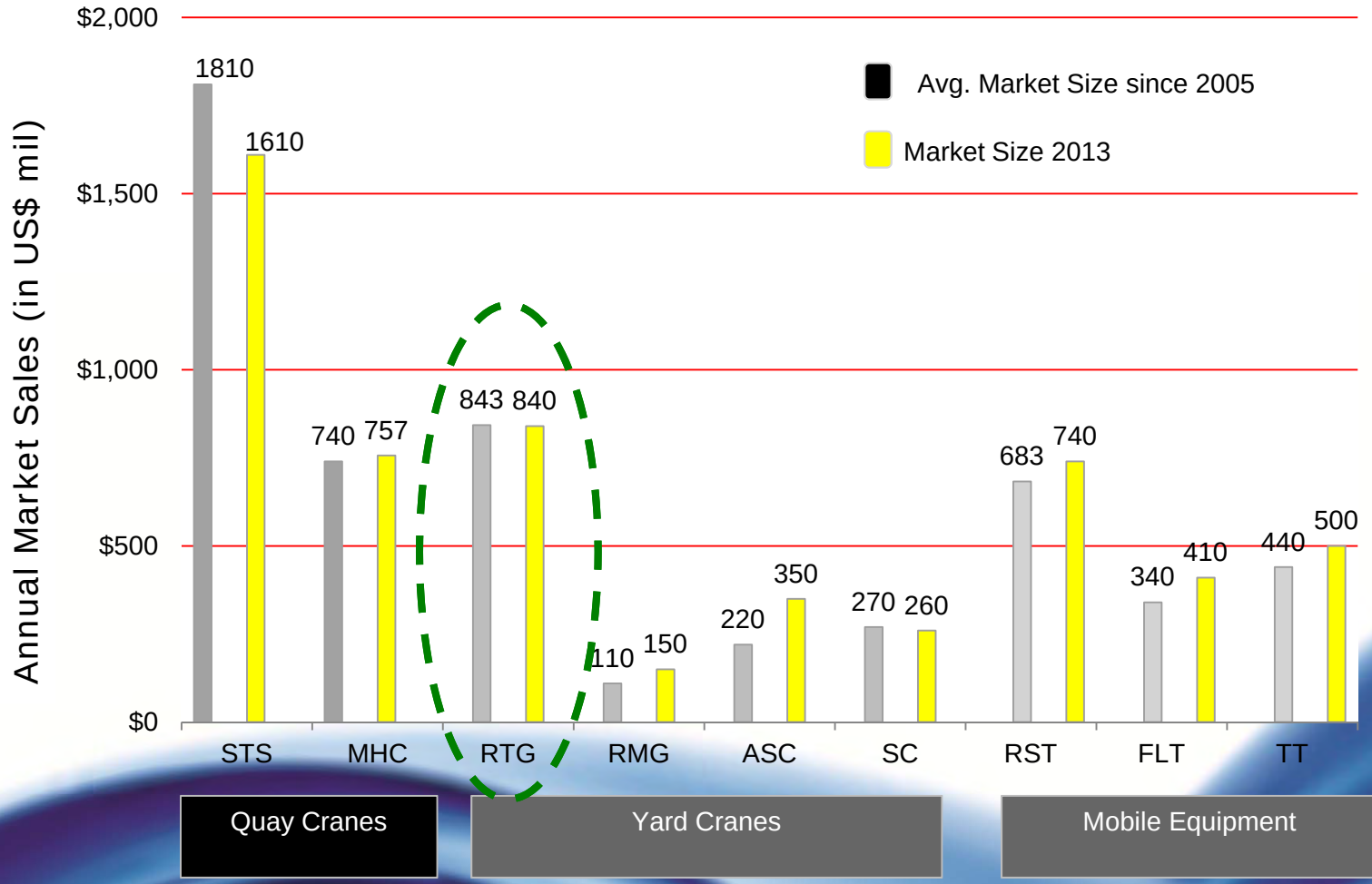


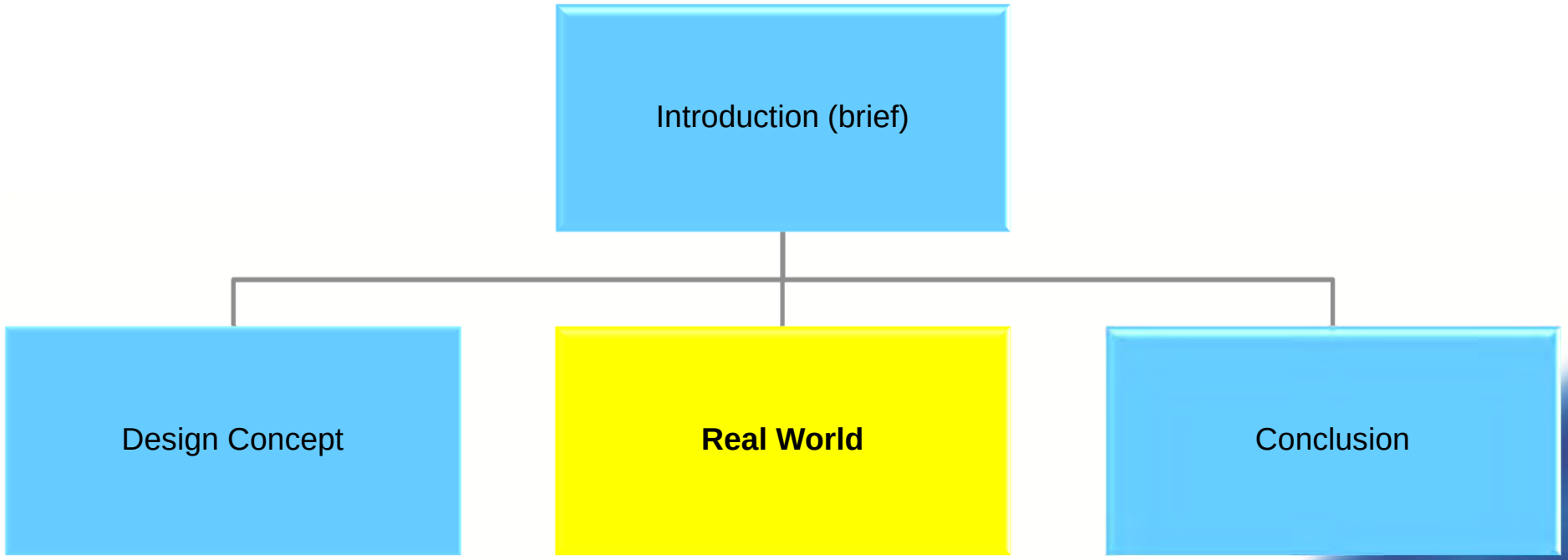


- The three determinants of yard capacity are area, density and dwell time.
- KPI: throughput per acre.
- Transhipment cargo is less demanding on the yard than gateway cargo
- Different stacking equipment achieve different storage densities
- The dwell time that the containers spend in the yard is probably the most important factor affecting yard capacity



Market for Port Equipment - 2013

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Rubber Tyred Gantry Cranes

Facts + Figures / Effects

Facts + Figures

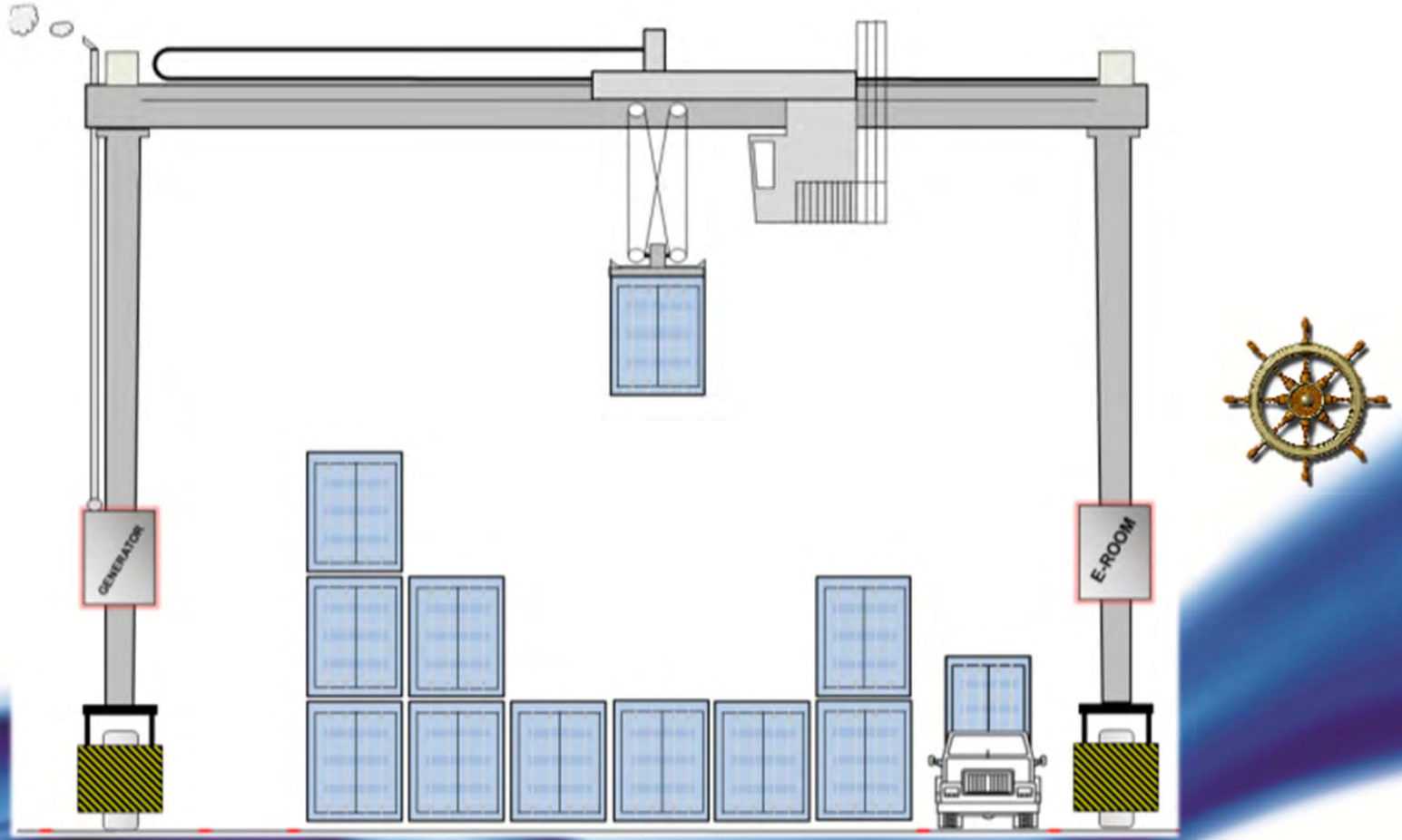
- Diesel engines are the main source of RTGs
- Container handling increases
- At the same time diesel prices increased rapidly
- In some cases RTGs account for 50 % of a container terminals‘ diesel consumption

Effects

- High fuel consumption & costs
- High dependecy on fossil fuels that have unpredictable prices
- High cost in larger size Genset service (- USD 20k / year)
- Environmental; carbon emissions, air and noise pollution

Full Electric RTGs: eRTG

Principle Function:



Full Electric RTGs: eRTG

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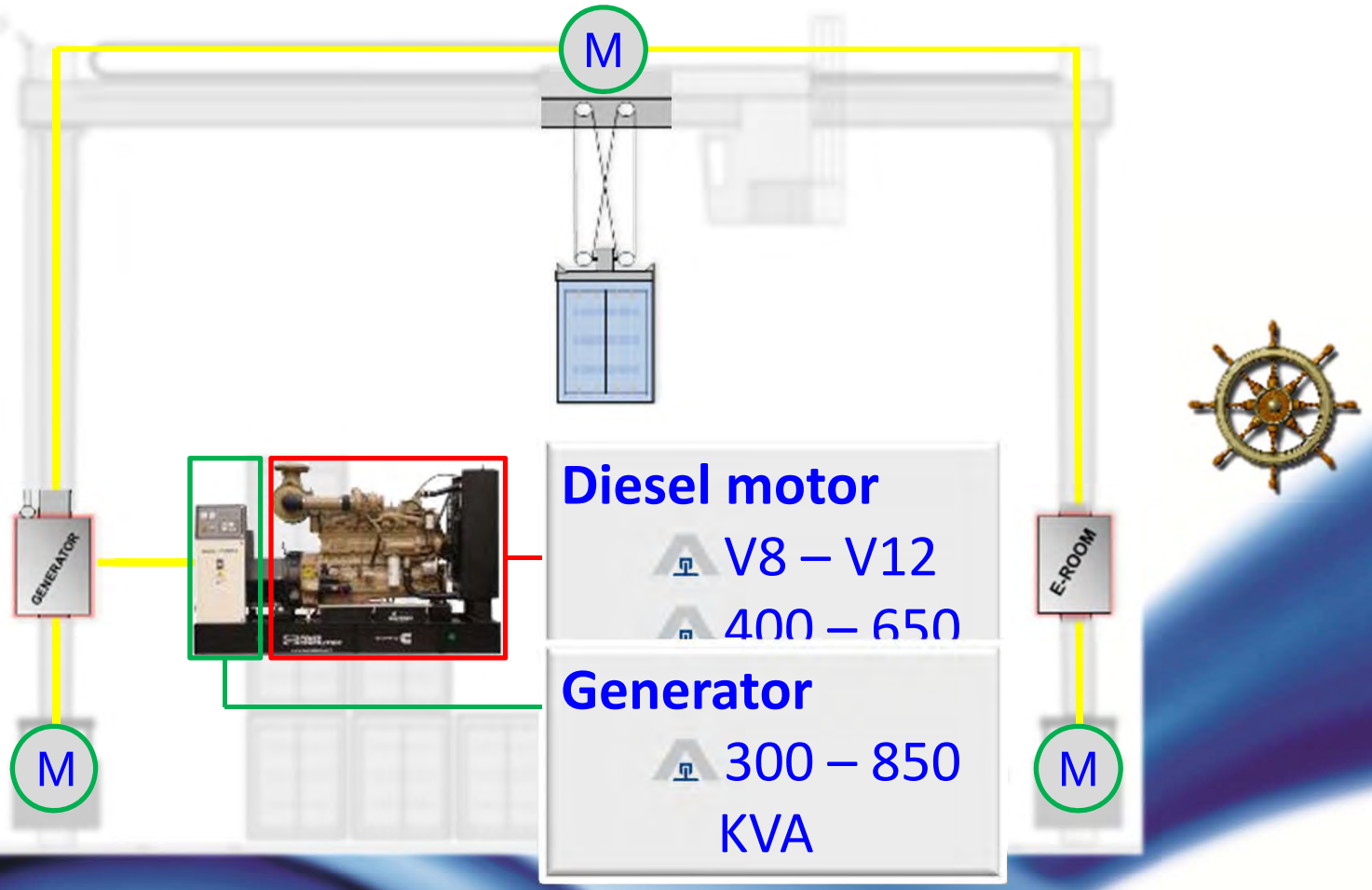

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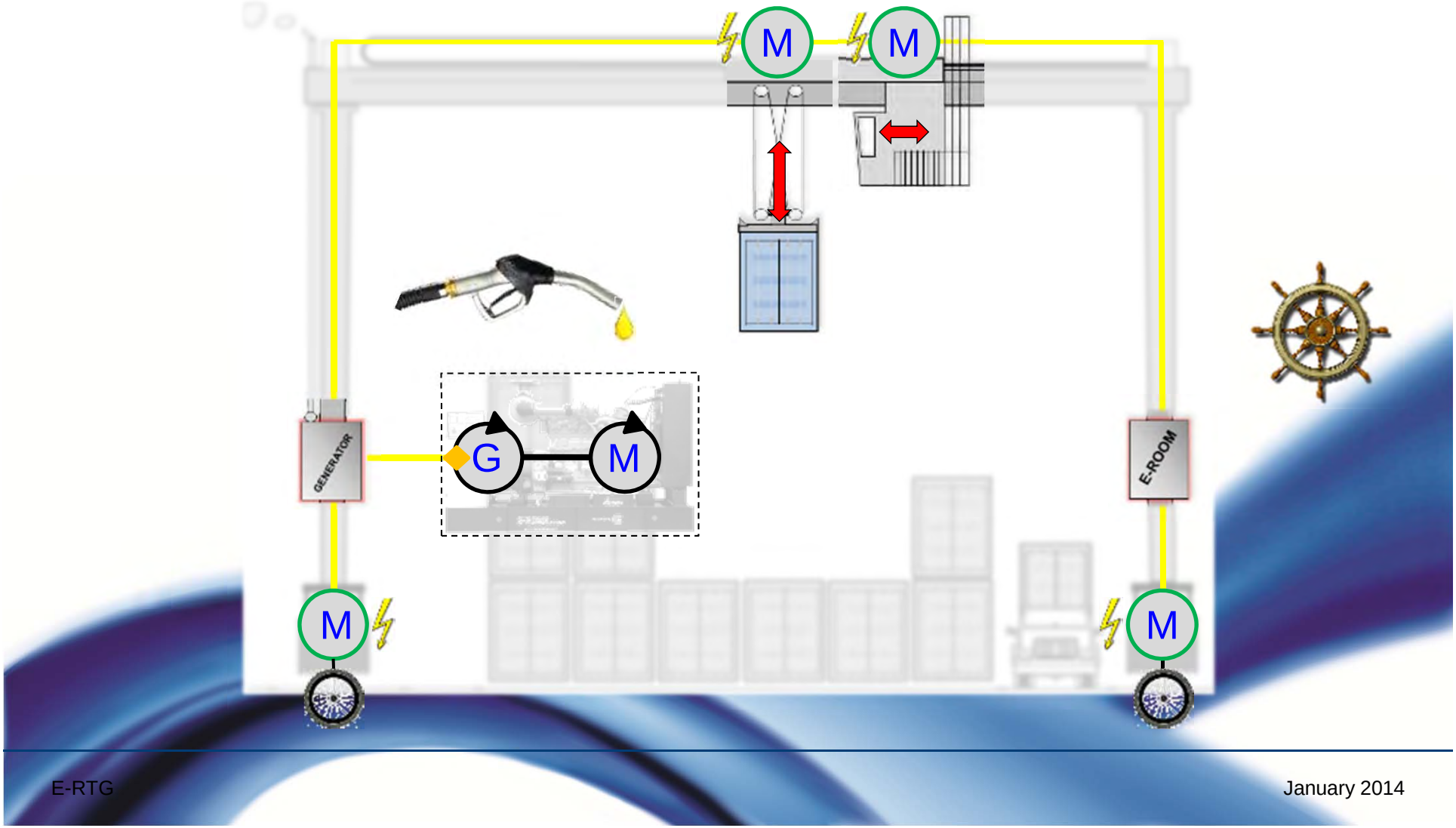

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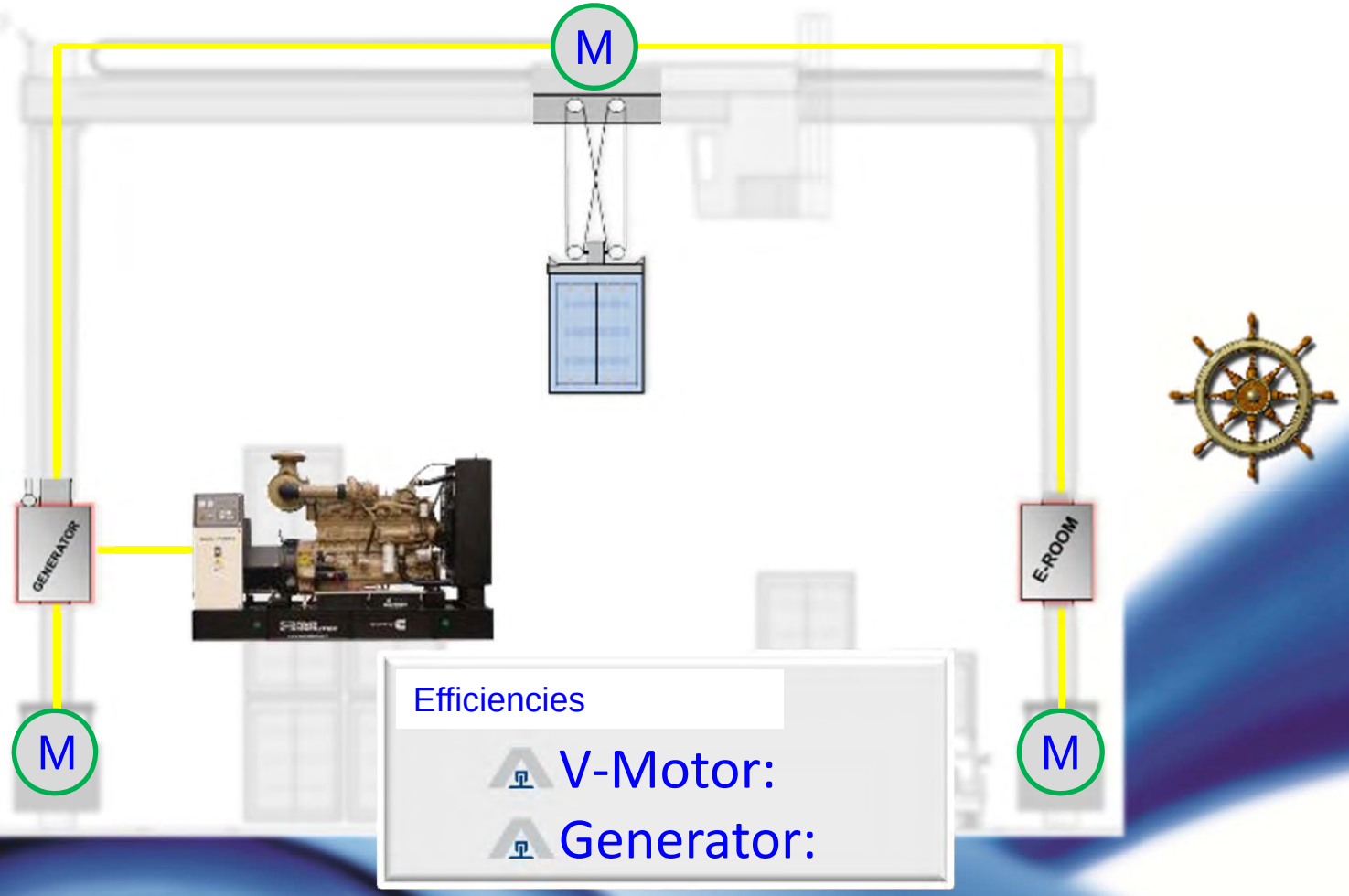


Efficiencies

- V-Motor:
- Generator:

Conductor bar solutions for e-RTGs

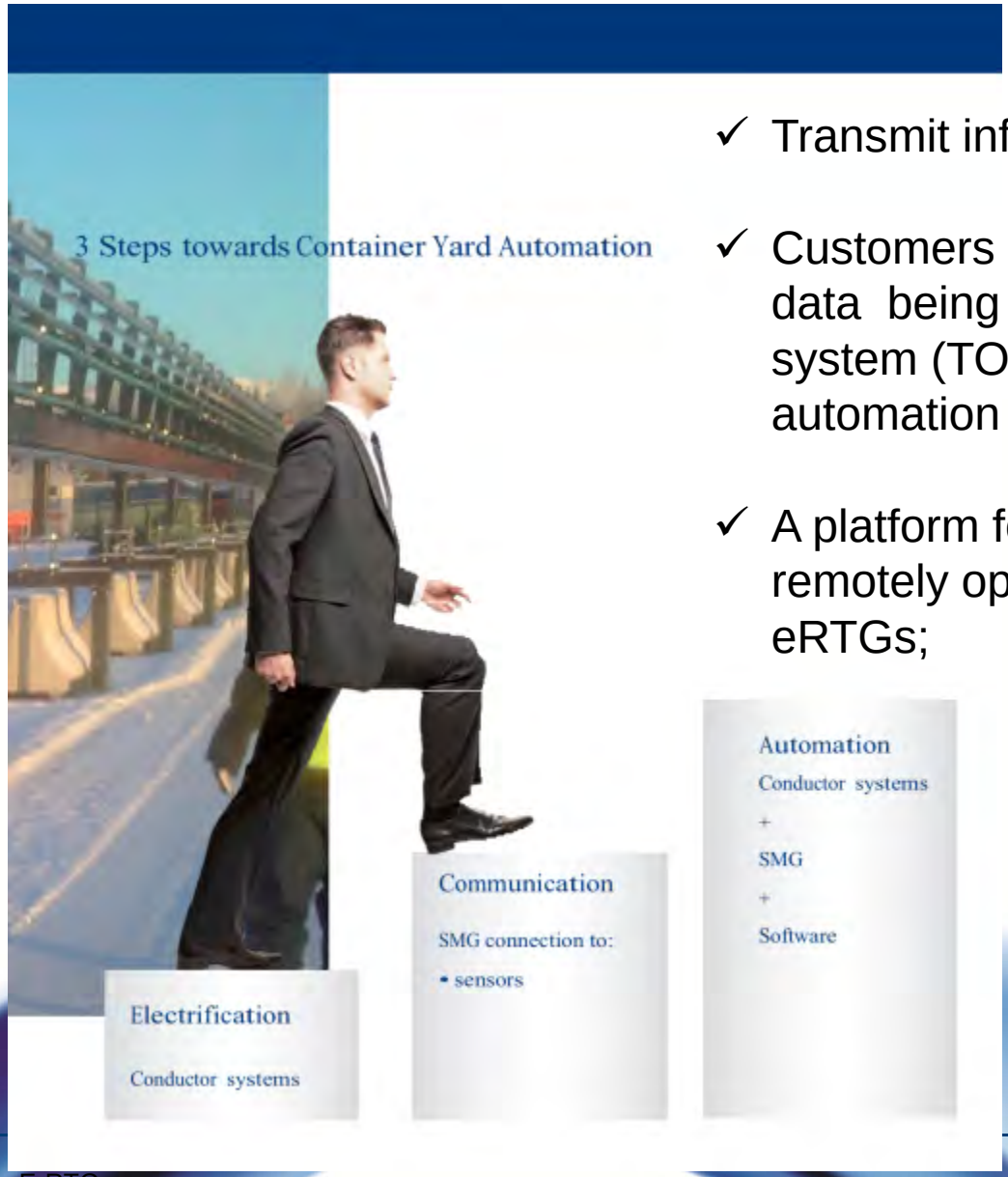
Aisle Eletrification System in a Container Yard

- space saving due to vertical arrangement
- electrification of two aisles from one steel structure
- minimized moving wear parts (3 rollers only)

- fully electrical driven, no lifting cylinder
- max. horizontal stroke: 1700mm
- vertical track tolerances: ± 200 mm
- reduction of wear parts

SMG for eRTG

DATA communication



- ✓ Transmit information alongside electricity.
- ✓ Customers considering low density ‘process’ data being transmitted to the terminal operating system (TOS), a step on the way to full automation of E-RTGs?
- ✓ A platform for the further development of remotely operated, semi or fully automated eRTGs;

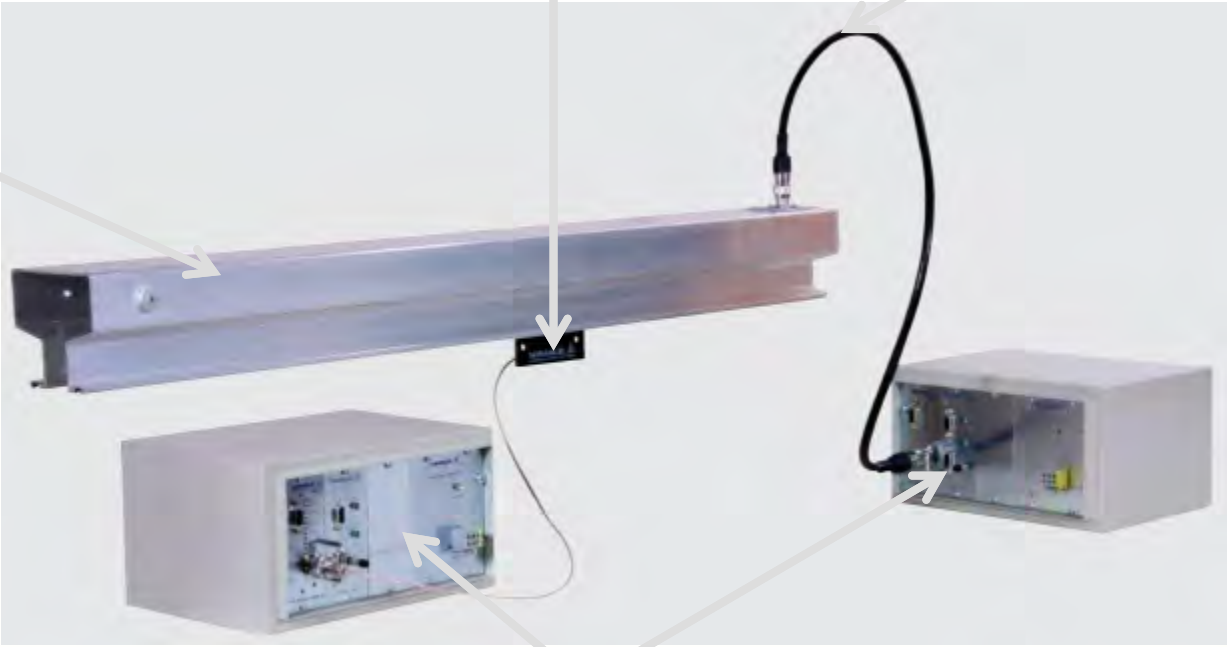
TESTING

Vahle SMG-System – the components

Antennas (on request with guidance)

RF-cable

Profile



Vahle SMG Transceiver

application assignment

- up to three eRTG in every lane
- arbitary and flexible order
- communication is needed for video signals and PLC signals on the eRTG
- vision: remote control / automating eRTG

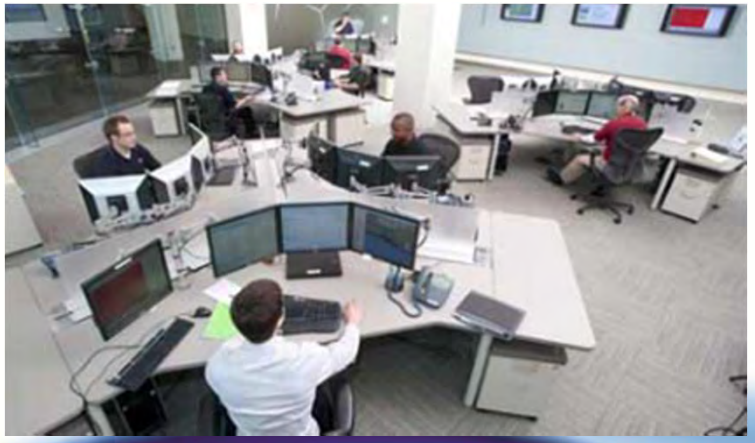
Remote Control, Semi – Automation of RTGs

All-Electric RTGs can be integrated (either gradually or from star-up) with a range of process automation solutions in such as:

- Automated gantry steering
- Automated job selection
- Real time inventory
- Linked to TOS for control and optimisation
- Safety (stack profiling and anti-truck lifting)

Remote Control, Semi – Automation of RTGs

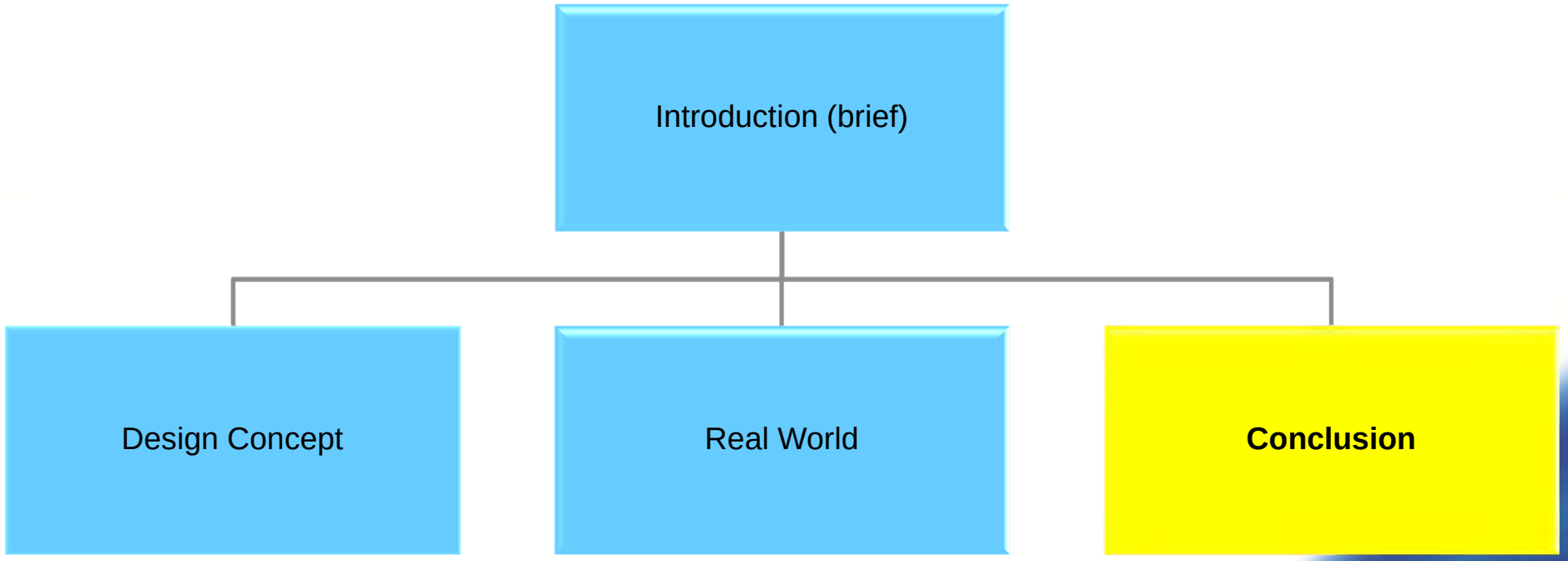
29 rubber-tyred Gantry cranes (RTGs) at HIT's Container Terminal 9.



Control Room example for RTGs

FUTURE: Fully Automated e-RTGs

The Busbar power connection converts the RTGs to fully electric operation. **Image: Konecranes**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Comparison of Yard container handling equipment

Comparison of the operating performance of different types of handling equipment			
ITEM	RTG	**E-RTG**	RMG
Mobility	Average	**Average**	Poor
Safety	Average	**Average**	Good
Operating system integration method	Wireless transmission system	**Wireless transmission system**	Fiber transmission system
Stability of Signal	Unstable	**Stable with SMG**	Stabe
Stable Breakdown frequency	Average	**Average**	Low
Mechanical method	Hydraulic	**Hydraulic / Electric Control**	Electric control
Repair and maintenance time	Average	**Average**	Short
Energy source	Diesel	**Diesel/Electric**	Electric
Maintenance cost	High	**High**	Low
Air pollution	Severe	**Zero**	Zero

REFERENCE: Yang, Y-C and Chang, W-M, 2013. Performance Analysis of Electric- Rubber Tired Gantries from a Green Container Perspective, In the Proceedings of the Eastern Asia Society for Transportation Studies, Vol 9., 2013

Conclusion

- Energy costs are increasing
- Ports are having to load / unload containers faster and more reliable
- Dozens of eRTG projects completed or in progress
- 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 automating RTG.s
- SMG – Slotted Microwave Guide, is a data transmission technology for transmitting and recieveing data to eRTGs, which can improve yard container handling.

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Thank You