



Advanced Technologies for Lower Emissions and Efficiency in Overseas Ports

Faster Freight Cleaner Air
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Some Green Features of Overseas Terminals

- Reduced emissions from berthed vessels
- Automated transport vehicles with low emission technology
- Electric yard cranes
- Electric cranes serving on-terminal rail yards
- Advanced street truck processing systems

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Vessel Emissions Reduction

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Techniques to Reduce Vessel Emissions

- Electric shore power for hoteling of vessels (AMP)
 - In limited use in overseas ports – but expanding
- Use of cleaner fuels on vessel while near land or in port
- Reduce the amount of time vessels spend in port
 - Automated mooring systems
 - Faster loading and discharging of vessels

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Automated Mooring Systems

- Reduce ship idle time during line handling
- Typical time to attach and secure vessel ~ 12 seconds



Ferry Terminal
Auckland, NZ



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Faster Discharging and Loading

Indented berth with up to nine cranes working simultaneously



Ceres Paragon Terminal
Amsterdam, Netherlands

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Increased Crane Lifts per Hour

Dual hoist cranes;
up to 20% increase
in number of lifts per
hour



Container Terminal
Altenwerder, Hamburg,
Germany

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Increased Crane Lifts per Hour

Tandem 40/quad 20;
up to 50% increase
in number of containers
handled per hour



Jebel Ali Container Terminal,
Dubai, UAE

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AP Moeller Terminal, Algeciras, Spain

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Electric Yard Cranes

Electric Rail-mounted Gantry Cranes (RMGs)

Zero emissions



Gottwald Design for Antwerp, Belgium



Container Terminal Altenwerder,
Hamburg, Germany



European Combined Terminal,
Rotterdam, Netherlands

Rubber-tired Gantry Cranes (RTGs)



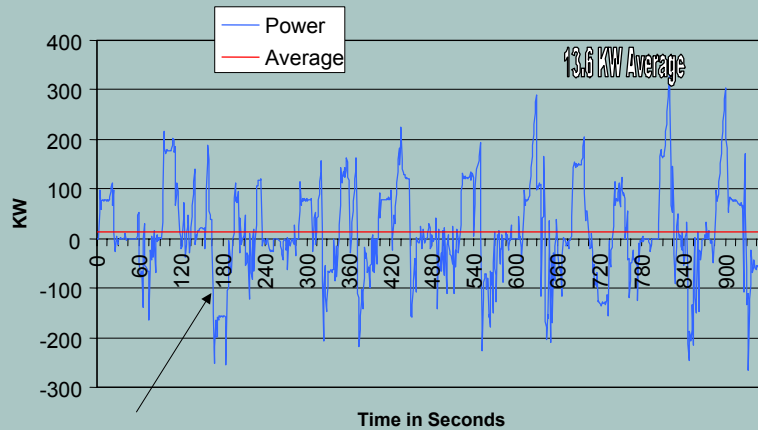
Kalmar Electric RTG
Oslo, Norway
Zero emissions



ZPMC Capacitor RTG
Seattle, Washington
10% - 13% fuel reduction
Significant emissions reduction

Power Consumption over Time

Full Regeneration System



Negative values indicate power re-generation

On-terminal Intermodal Yards are Greenest

- Trains emit less per ton-mile than trucks.
- If cargo is destined for rail, on-terminal is better than off-terminal
- On terminal transport via cleanest possible yard tractor technology
- Electric cranes to load and unload trains; common practice in Europe



APL Pier 300 Terminal, Los Angeles



Transport Equipment

Automated Guided Vehicles

- Automated vehicles are typically linked with end-loaded yard stacks
- This minimizes travel distance
- Robots drive more smoothly than humans
- Robot vehicles can be hybrid-electric with diesel or natural gas
 - Regenerative braking
 - Engine off during idle



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AGVs Do Require A Little Wiring



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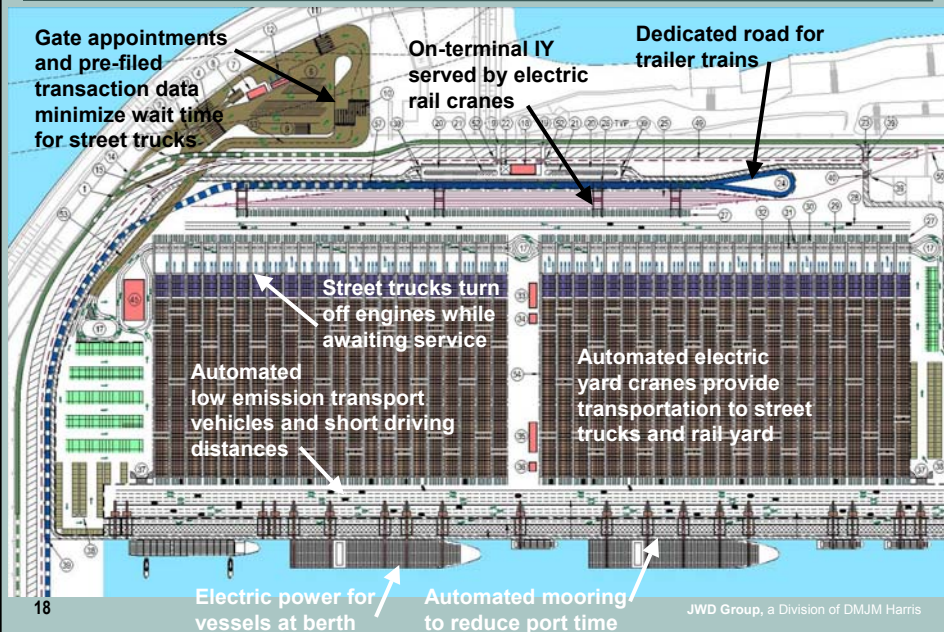
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Appointments and Gate Technology can Reduce Street Truck Time on Terminal

- Terminals have little control over emissions from street trucks
- Terminals can minimize truck turn-time by:
 - Appointments to eliminate congestion at gate and in yard
 - Pre-filing transaction data reduces exception handling and allows terminal to pre-position the container
- Automated data capture at entry and exit gate can fully automate the gate process



Review of Green Terminal Features Euromax Terminal, Rotterdam – Conceptual Design



Rough Comparison

Euromax		West Coast	
– Quay cranes	20	– Quay cranes	23
– Vessel Strads (diesel)	80	– Vessel UTRs (diesel)	140
– Yard cranes (electric)	88	– Yard cranes (diesel)	66
– Intermodal cranes (electric)	4	– Intermodal cranes (diesel)	4
– Intermodal strads (diesel)	12	– Intermodal UTRs	24
– Chassis flipping	0	– Chassis flipping (diesel)	3
Total diesel engines	92	Total diesel engines	234

Diesel engine reduction of approximately 60%

Light and Noise Advantages of Automation

- Machines do not need light for navigation
- Electric operations are quieter than diesel
- Automated cranes place containers more precisely and quietly than humans:
- *“Another notable impression was the almost silent operation. There was no audible noise from the spreader hitting a container or the containers contacting with each other.”*
 - From World Cargo News, July 2005 describing automated RMGs in Korea

Conclusion

- An automated terminal is safer
 - Fewer people = fewer injuries
 - No need for trucks to drive underneath yard cranes
- An automated terminal is more secure
 - Street truckers cannot access containers directly
 - Fewer terminal personnel
 - Computer control and recording of all container movement
- ***An automated terminal is a green terminal***



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Thank You



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