



Minimizing Air Emissions at Marine Terminals

Faster freight - Cleaner Air Conference

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JWD Group

- Founded 1964
- Involved in container handling since design of the first container crane
- Introduced new concepts to marine terminal planning and facilities design
- Since 1985, used simulation as planning tool to test alternative layouts, marine and rail terminal performance, operating systems and equipment



Types of Projects

- Greenfield site planning
- Brownfield site planning
- Port-wide master planning
- Operations analysis
- Capacity analysis
- Labor and technology implementation
- Architecture
- Graphics
- Consulting for industry legislation
- Port security operations



Overview

- The challenge
- Main sources of air pollution at container terminals
- Options to reduce air pollution



Background

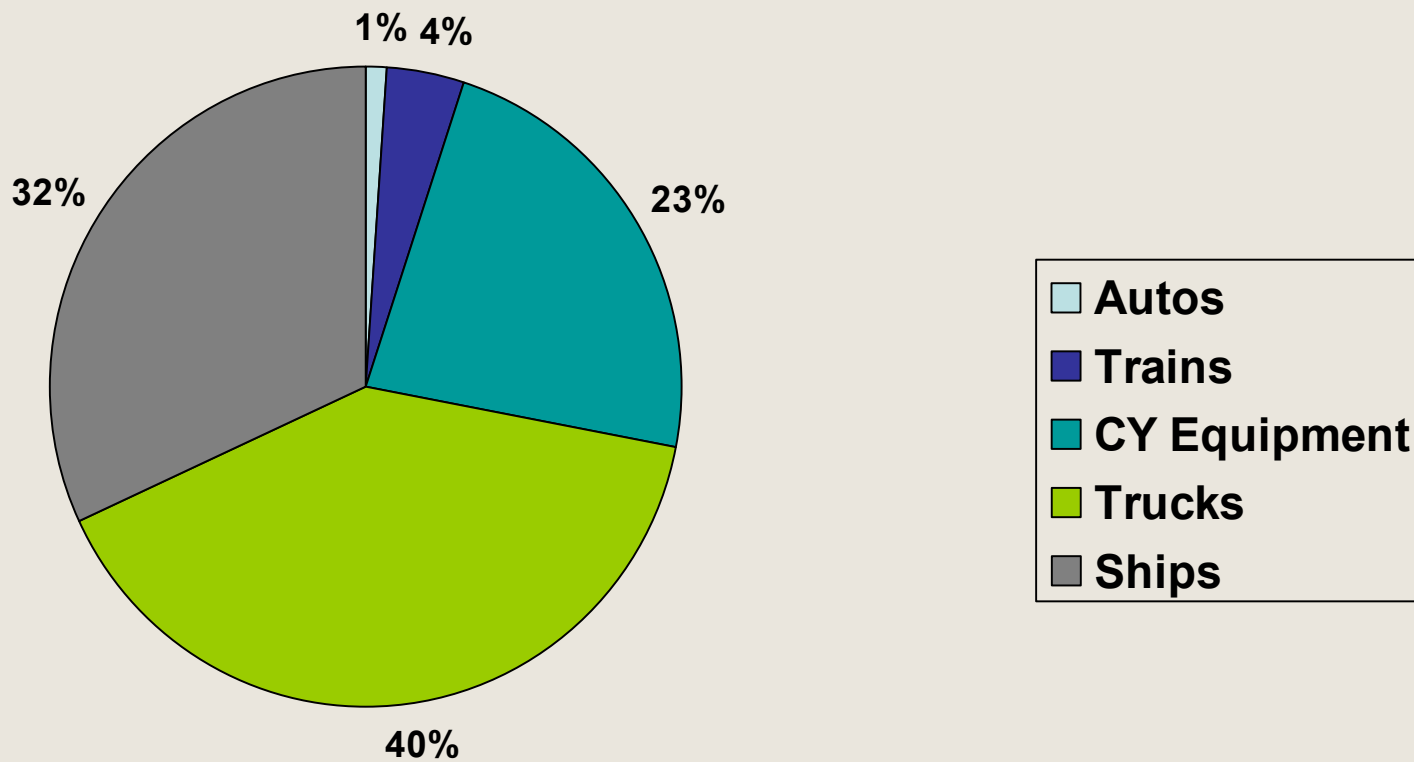
- In many developed countries, ports are a significant source of air pollution
- Compared to other large sources like factories and autos, ports have been lightly regulated
- More regulation is likely in the near future as awareness of the problem grows

The Challenge

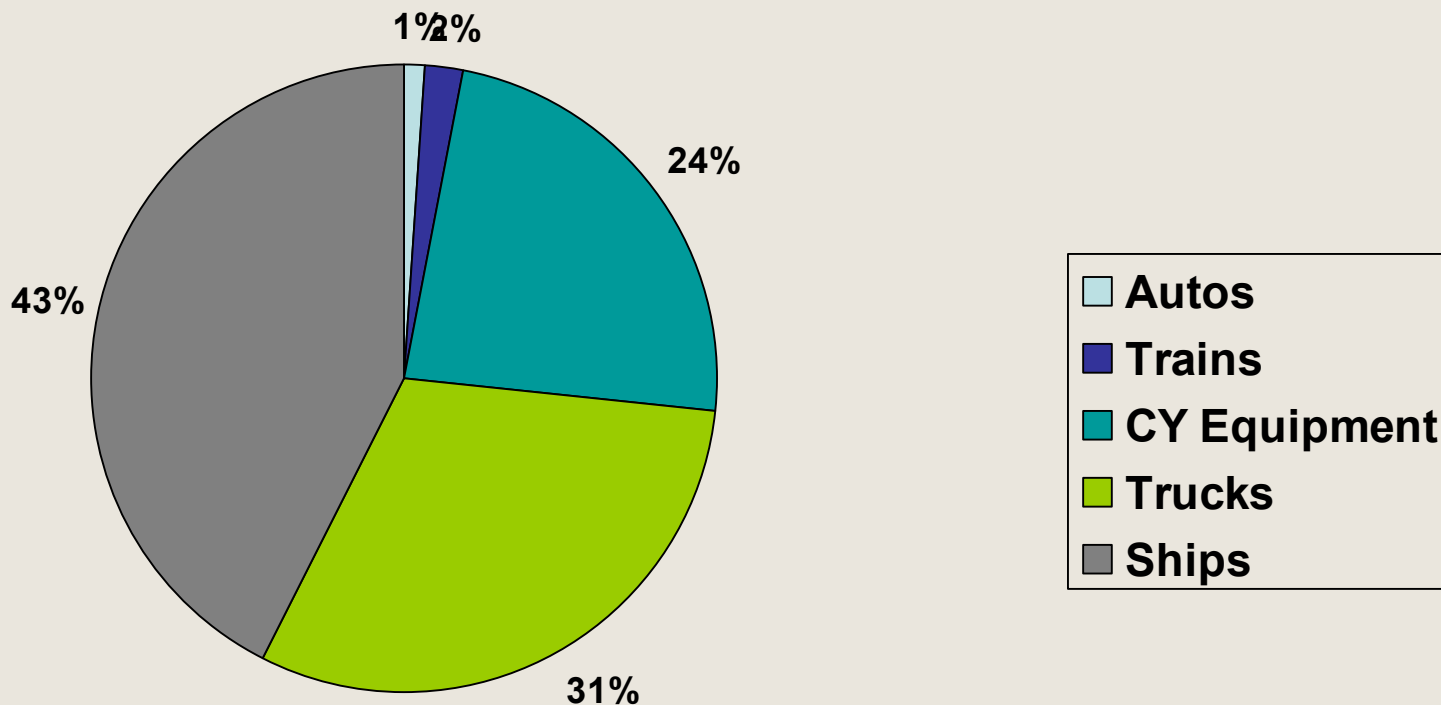
- Deriving maximum emission savings per dollar spent
- Understanding potential synergy between advanced operations and lower emissions



Sources of NOx at US Container Ports



Sources of PM10 at US Container Ports



Strategies for Emissions Reduction

- CY Equipment
- Street Trucks
- Vessels



CY Equipment Strategies

- Adaptation of newer, cleaner diesel equipment
- Use of alternative fuels
- Electric yard cranes
- Alternate layouts that make better use of equipment



Modernization of Existing Equipment

- Very easy to do, no changes to infrastructure required
- Typically the most cost effective way of reducing emissions in the short term



Alternative Fuels

(excluding electricity)

- Can reduce air emissions
- May not be substantially cleaner than the cleanest standard diesel technology
- Will typically add cost for alternate engines and alternate fuel delivery systems





Electrified Yard Cranes

- Typically Rail Mounted Gantries (RMGs)
- Oslo has Electric RTGs
- No local emissions
- Other potential advantages of high density container storage and ease of automation
- Higher capital cost
- Less flexibility than RTGs (can't change runways)



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Conventional RMG





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Electric RTGs in Oslo





Close-up of Cable Reel on Oslo RTG

source - Kalmar

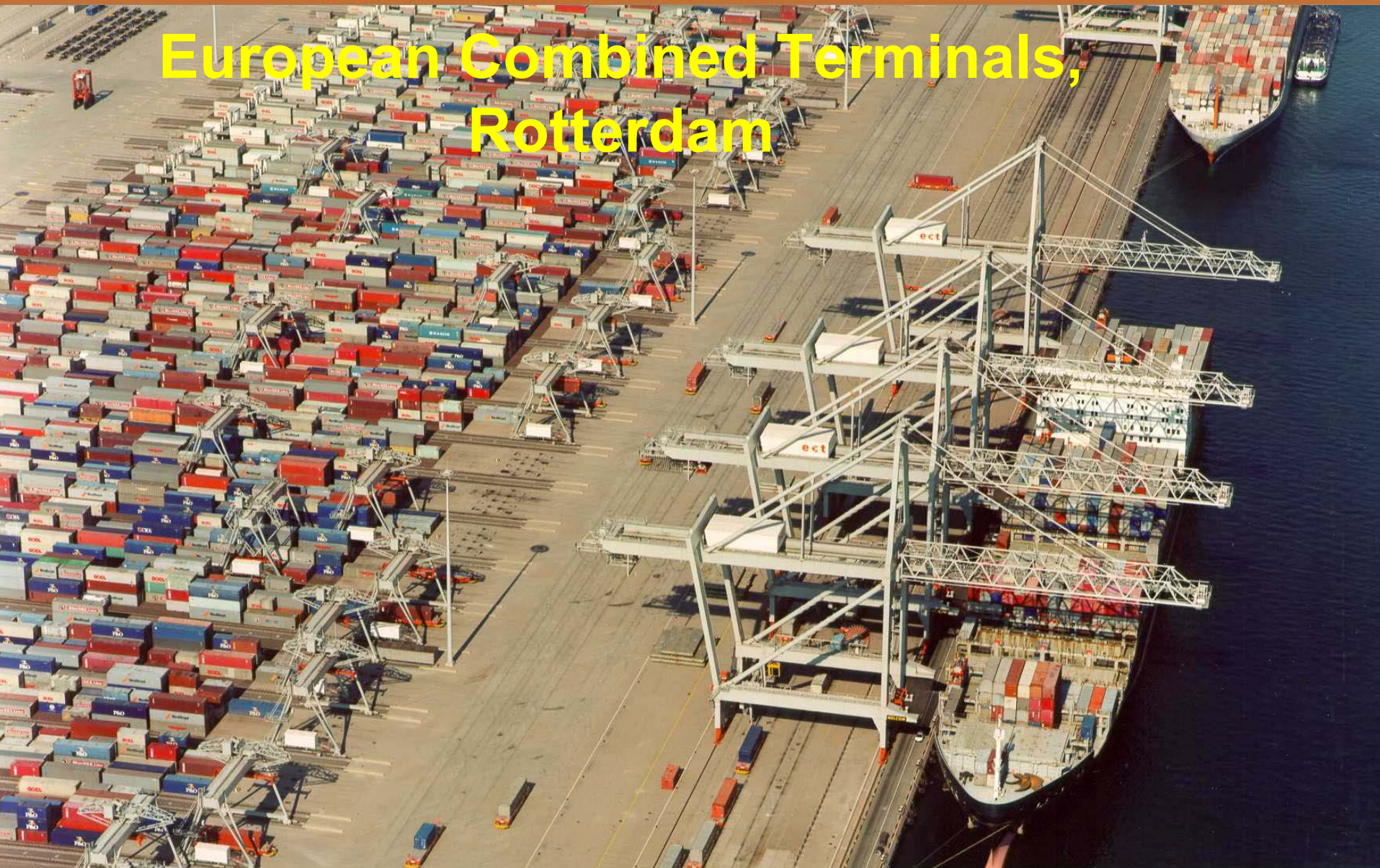




Automatic Stacking Cranes (ASCs)

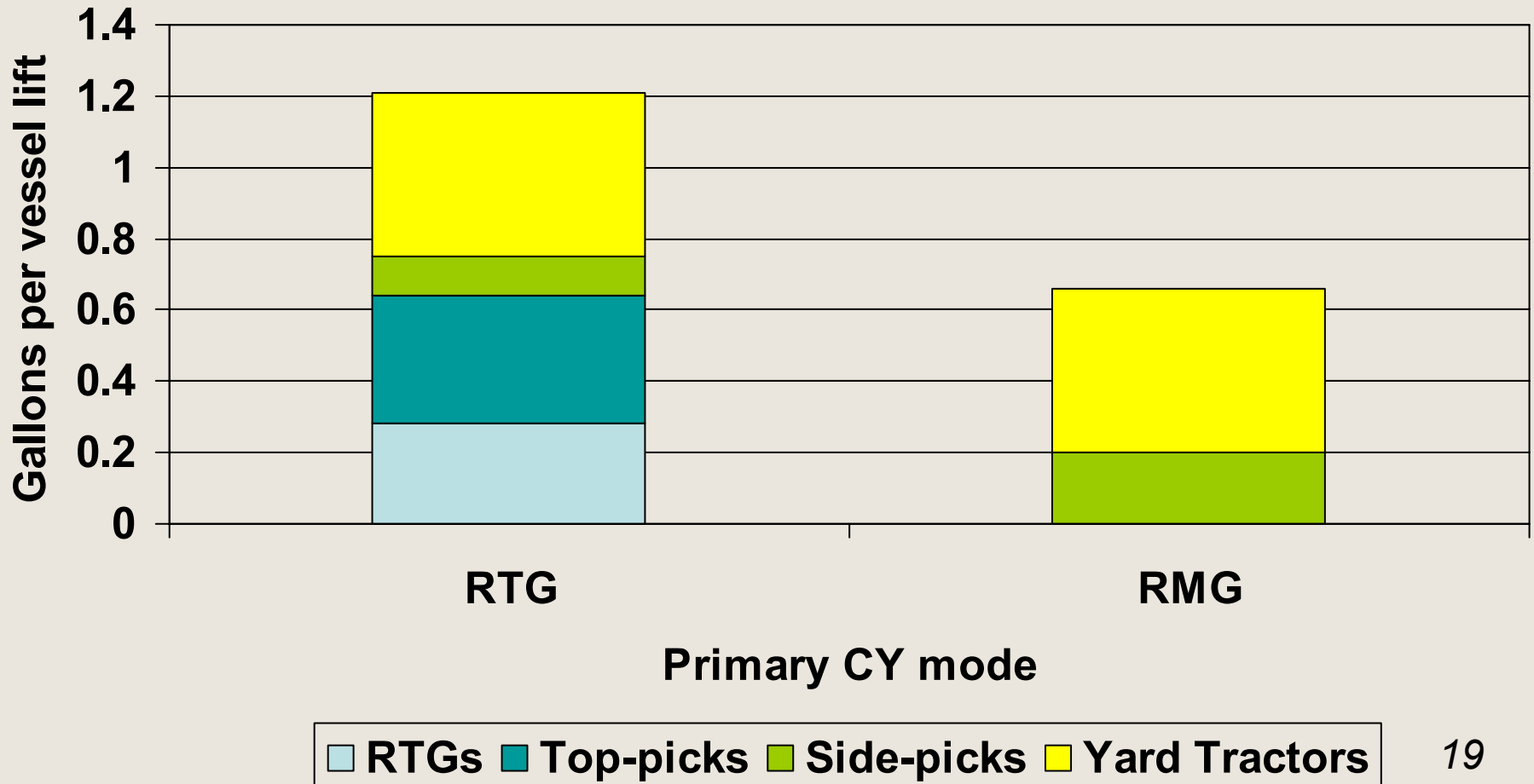
- RMGs (or potentially bridge cranes) aligned perpendicular to the wharf
- Cranes gantry with the container to its stack location
- Very low emissions. Electric machines do most of the work, travel distance of diesel AGVs, strads, and street trucks is minimized

European Combined Terminals, Rotterdam





Example comparison of fuel consumption per vessel lift



Street Trucks

- Appointment systems to smooth arrivals and reduce queuing at the gate
- Faster gate processes
- Faster CY service – linked to appointments and automatic data transfer



Appointment Systems

- Trucks select a fixed window (typically one hour) for arrivals
- Trucks receive preferred treatment during that window
- Terminal can optimize the CY stacks with advance information (pre-filing of data)
- Synergy of reducing peaks in arrivals and rehandles, may reduce amount of equipment required



Modern Gate Process

- Based on automatic data capture
 - Optical Character Recognition (OCR)
 - Radio-frequency ID (RFID)
 - Smart cards, biometric ID
- Largely automated
- Can reduce air emissions by reducing time on terminal per truck visit

Faster CY Service Reduces Street Truck Emissions

- Terminal can add machines –cost increase may exceed productivity increase
- Early information transfer is crucial to plan and optimize the CY
- RMGs and ASCs that can rehandle automatically with no local air emissions have great advantage
- RMGs and ASCs also allow for segregation of gate and vessel traffic to minimize congestion



Vessels

- Reduced speed near ports
- Low sulphur fuels
- Electric shore power (cold ironing)





Reduced Vessel Speed

- In place in Los Angeles and Long Beach
- Voluntary – level of compliance varies
- Modest impact
- Shippers do not like longer sailing time – marketing disadvantage vs other Ports



Alternative Vessel Fuels

- Standard vessel fuel is very cheap but dirty
- Higher quality fuels can be used while in Port, but these are more expensive
- Alternate fuels require dual infrastructure on vessels, another expense
- North Sea and Baltic require max. of 1.5% sulphur at sea and 0.2% in territorial waters, effective May 19, 2005

Electric Shore Power (Cold-ironing)

- Can eliminate emissions during time at berth
- Does not eliminate all vessel emissions
- Costly to install (on vessel and on quay)
- Very costly to retrofit
- Additional labor cost and berth time to plug and unplug vessel



Conclusions

- Ports and terminals will be under increasing pressure to be “green”
- Many options exist to reduce air pollution
- Strategies should be developed in context of overall facility goals including cost, performance and capacity
- Planning and analysis can help evaluate alternatives





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