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Eco-efficient technology in container terminals

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Eco-efficiency is becoming a standard in cargo handling operations.

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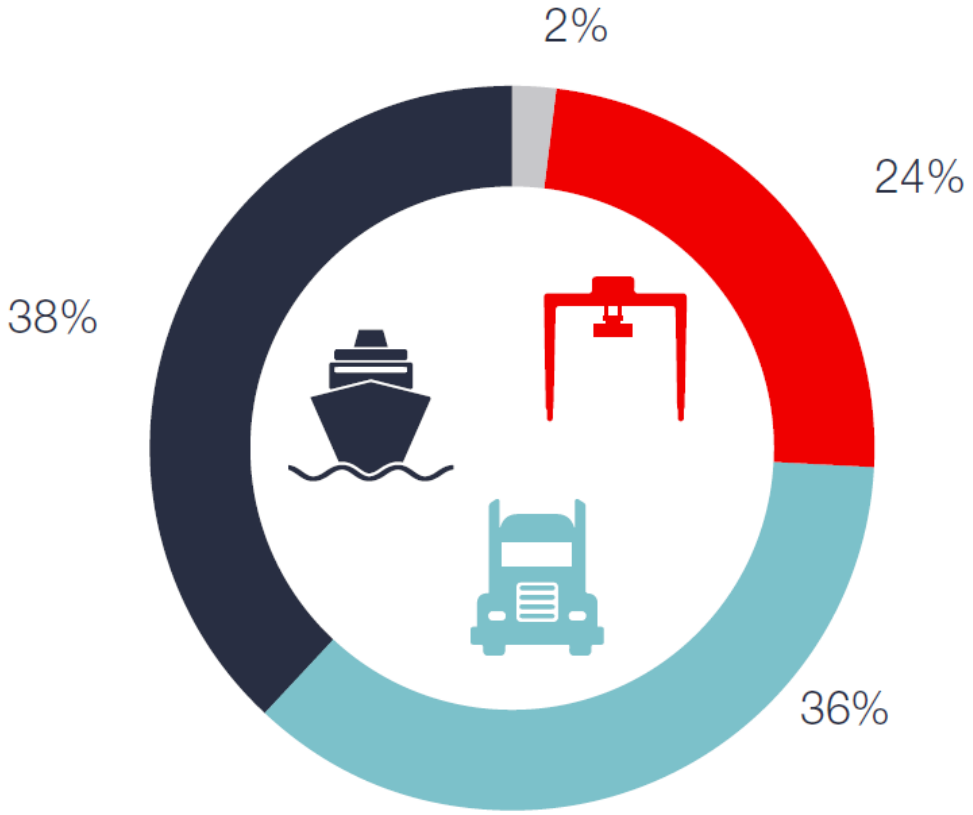
Big focus and need to reduce fuel usage, lower exhaust emissions and cut noise levels in ports and terminals.

- Environmental legislation for CO2 and NOx.
- Coming “EU stage 5” diesel legislation.
- Tougher demands on “business approvals”, for operations nearby residential areas, requires lower emissions and noise levels.
- Economic drivers.
- Local pressure groups.

Emissions in port and container terminals

Average breakdown of emission sources in a container terminal.



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How can we respond to these needs?

Three angles to eco-efficiency





A. Systems efficiency

Solutions that use technology and data to optimize operational eco-efficiency.

B. Eco-efficiency

Industry shaping solutions and technical content that minimize the environmental impact of port and terminal operations.

C. Resource efficiency

Upgrades and refurbishments that extend the equipment life by making resources last longer and being more efficient.

ECO-EFFICIENCY AT WORK

Eco-efficient solutions to minimize environmental impact of container handling.

Typical means to reduce air emissions produced by container handling equipment

Technology and innovations

- Ultra-efficient drivelines based on cleaner diesel engines and optimized transmissions
- Intelligent and smart control system
- Hybrid and “re-gen” technology
- Electric and “re-gen” technology
- Automated equipment

Fleet management (InSight)

- Optimizing fleet sizes (machinery)
- Optimizing cargo flows (driving)
- Optimizing productivity and speeds
- Minimizing waiting time
- Automation software assistance

Knowledge and training

- Understand the big picture
- Learn new ways of working
- Knowledge of future solutions
- Education on key KPI’s
- Operations training
- Services training
- Drivers training

Eco-efficient products and solutions

Kalmar’s full offering to be available as electrically powered by 2021.

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Extend your choice.

- Built on a proven automation platform
- Uses latest (LION) battery technology
- Easy to integrate into your existing operational model and fleet
- Configurable navigation system that can operate across a mixed fleet
- Optimised steel platform that can handle loads of up to 70 tonnes
- Carry 20, 40 or 45ft containers
- First delivery operational at PSA Singapore

AGV:

- All-electric drive (with Fast-Charge)
- For full automation usage
- Latest LION battery and ultra-fast charging solutions.

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Automated equipment reduce emissions

- Automation solutions **reduces fuel consumption and exhaust emissions**, by removing inefficiencies and optimizing the running fleet sizes.
- Automated equipment is **always driven optimally**, which saves on “wear and tear”, running hours, needed stops for maintenance, fuel, reduces emissions and contributes to extended equipment lifespans.
- The productivity, utilization levels and performances are **greatly improved**.

Straddle and Shuttle Carriers:

- Normal diesel-transmission drive
- Eco-efficient Hybrid drive (diesel-electric)
- All-electric drive (with Fast-Charge)

Hybrid solutions (SC & ShC)

- Approx. 60-80% of straddle and shuttle carriers currently deployed worldwide are diesel-electric machines
- Hybrid systems account for a significant portion of new units sold, and are rapidly becoming the default choice for terminals
- Hybrid machines typically operate on battery power with their engines switched off up to 30% of the time.
- The most efficient hybrid straddle carriers on the market consume up to 40% less fuel than diesel-powered models, and emit on average over 50 tonnes less CO2 per year.
- The Hybrid drive save up to 40 % on fuel and emissions.

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Key enablers for electrification: Li-on and fuel cells

Light forklifts (**5 to 9 tons** lifting capacity) are already routinely electric powered.

The development of battery technology has recently enabled the electrification of medium forklifts (**9 to 18 tons**).

In the coming years, this development will extend to the heavier product ranges with lifting capacities **18 to 52 tons**.

Smaller EC operators can run all-electric machines

- Based on the ECG90-180 medium electric forklift, with EC-type mast and attachment.
- Available in 3 models:
  - ECG70-35E3 (7 ton, 3-high, short WB 3,50 m)
  - ECG70-35E4 (7 ton, 4-high, short WB 3,50 m)
  - ECG160-12 (8 ton, 3-high, short WB 3,50 m)
- Different attachment depending on handling:
  - 20-40 ” Containers (Bromma)
  - Double Containers (ELME)
- Long operating times available.
- Battery packs sufficient for 1-shift operations.

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Efficient EC operations with modern technology

- Various levels of “basic and advanced” diesel driveline can be offered, with different results in fuel usage and exhaust emissions.
- Learnings from their industries with smart transmissions (gears / HVT), more optimized engine usage (lower rpm’s) will save fuel, emissions and noise.
- All-electric machinery are being coming, the first range is available from today, Kalmar ECG70 in E3 and E4 versions.
- The most modern diesel drivelines save up to 40% on the fuel and emissions.

Empty Container Handlers:

- Modern 3-speed transmission and diesel engines
- Eco-efficient 4-speed / lockup transmission with smart controlled low-rpm diesel engines
- ECO Drive Modes for optimizing the fuel and emissions

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Different technologies is available and coming

- Basic diesel driveline can be optimized when using the best combinations.
- Learnings from their industries with smart transmissions (gears / HVT), more optimized engine usage (lower rpm's) will save fuel, emissions and noise.
- All-electric machinery (1st generation) are being developed, will be commercial with a few years, this will be a big step forward towards a greener operations.
- The most modern diesel drivelines save up to 40% on the fuel and emissions.

Reachstackers:

- Modern 5-speed diesel-transmission drive
- Eco-efficient HVT drive (ultra efficient)
- All-electric drive (with Fast-Charge)

The Eco Reachstacker solution

- Fuel guarantee with training and SmartFleet
- Enhanced drivability, handling and precision
- Improved performance (acceleration / hydraulics)
- Reduced fuel consumption and less emissions
- Less vibrations and and lower noise levels
- ECO Drive Modes in 3 levels
- ECO Brake Modes in 3 levels
- Easier servicing - all the support you need
- Optional Kalmar Complete Care package
- Enhance your environmental credentials

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Fuel Saving Guarantee Calculator

The Kalmar Eco Reachstacker, guaranteed to cut fuel costs

Metric | US Imperial | Chinese Metric

What is the average travelled cycle distance in feet?

Feet: 603

What is the average container mass in pounds?

Pounds: 35072

What is the average number of moves per hour?

Moves: 15

Running hours per year:

Hours: 2000

Cost of diesel per gallon:

USD/gallon: 1.3

Eco Reachstacker model: 60 | 65

Estimates:

3.2 gallons/hour	6,483 gallons/year
0.2 gallons/move	8,428 USD/year

ECO-EFFICIENCY AT WORK

FUEL SAVING GUARANTEE

Kalmar Fuel Saving Guarantee

The Kalmar Eco Reachstacker DRG450-60S5 with the driveline Volvo TAD-872-VE engine and Dana Rexroth R2-RS transmission is specified by the customer A. Customer to be used with the following driving and handling patterns:

Feet per move:	600 feet on average
Pounds per move:	35000 pounds on average
Moves per hour:	15 moves on average

For the Kalmar Eco ReachstackerDRG450-60S5 with the driving and handling pattern listed above and under the terms and conditions listed below, we can offer a fuel warranty of:

3.2 gallons per hour.

Failure to comply with the stated fuel warranty will result in a one-off financial compensation to the customer according to the following deviations:

- +0-10%: No compensation
- +10-15%: 3.500 USD compensation
- +15-20%: 7.000 USD compensation
- +20-25%: 10.500 USD compensation
- +25-30%: 14.000 USD compensation

Ljungby, 16 September 2018

On behalf of Cargotec Sweden AB

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On behalf of Customer

A. Customer
CEO, Company

Terms and conditions
- The fuel consumption warranty evaluation will be done after 6 months
- The Reachstacker must have Kalmar SmartFleet installed
- Eco Reachstacker drivers must receive the specified Driving Training
- The fuel consumption measurements for the evaluation will be based on SmartFleet data.
- All services and maintenance has been performed on the Reachstacker according to Kalmar recommendations and specifications
- No unauthorized alternations can be made to the Reachstacker
- Fuel consumption is based on the current overall average idle time for Kalmar's entire Eco Reachstacker fleet.
- This Guarantee is subject to the Kalmar Global Warranty Policy.

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Electric Terminal Tractors

- Electric terminal tractors lower the environmental impact
- Eco-efficient electric terminal tractors will save you money, enhance your businesses reputation and prepare you for a low carbon future.
- Plug and play technology
- Improved driver experience due to less noise, vibrations and fumes, making it safer to operate indoors or out.

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Kalmar Ottawa T2e with all-electric drive

- Significantly reduced noise when driving and attaching trailers
- Creep torque function negates the necessity to collide with trailers to latch – latch more gently
- Integrated controls featuring unique on-board inverter-charger unit
- Charges rapidly at high power
- Electric on-demand accessories saving energy
- Unique modules with advanced battery mgmt
- Greatest operating range and battery life
- Increased safety, by reduced vibrations equal to reduced driver fatigue
- No diesel emission or fumes

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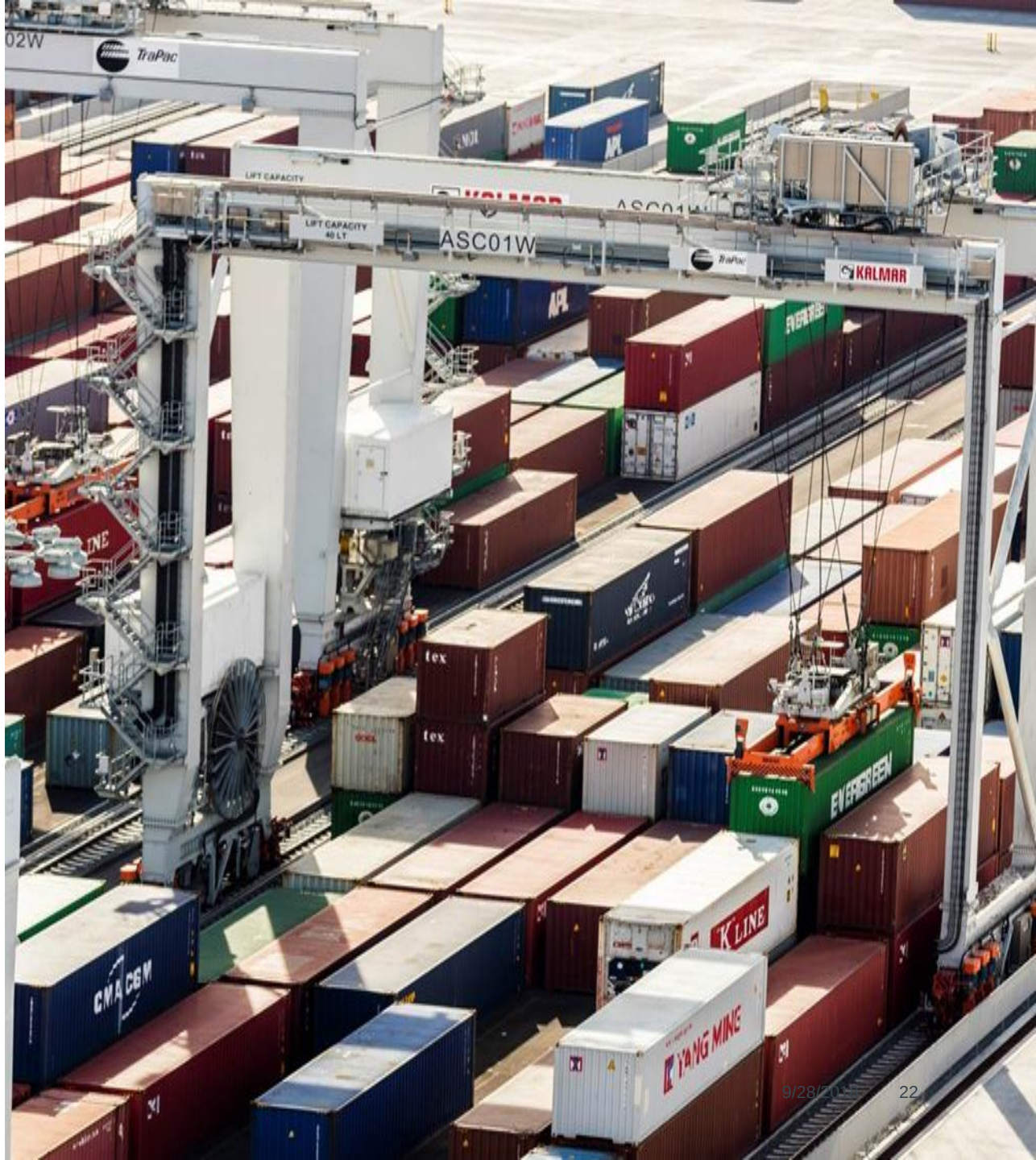
Automatic Stacking Cranes

- Automatic stacking cranes (ASCs) always operate on grid power, so they are, by default, eco efficient systems on-site.
- They include a kinetic energy recovery system, which feeds the energy harvested during deceleration back to the grid.
- Additionally gantry operation on rail is more efficient than on rubber tyres so ASCs also exhibit very high efficiency ratios.



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Summary

Our future is full electric and automated.

Three angles to eco-efficiency:

- Systems efficiency
- Eco-efficiency
- Resource efficiency

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Making your every move count.