

Toyota unveils environmentally friendly lift trucks

Toyota Material Handling has introduced its new 8-Series line of lift trucks, which includes 3000 to 6500 lb (1360 to 2950 kg), cushion- and pneumatic-tire models.

Powered by Toyota-designed and manufactured 4Y and 1DZ-II gas and diesel engines, the new line features a closed-loop fuel system that automatically adjusts and optimizes the air-fuel ratio. The fuel system works in conjunction with a three-way catalytic converter to minimize such emissions as hydrocarbons, nitrogen oxides, and carbon monoxide. As a result, says Toyota, the 8-Series lift trucks will produce on average 70% less smog-forming emissions than the 2007 federal **EPA** standards.

The large spark-ignited 4Y engine that powers the 8-Series lift trucks has been granted official 2007 certification from the **California Air Resource Board** (CARB). The 4Y engine also meets CARB's stringent 2010 emissions standard.

The CARB plan, which addresses emissions from off-highway equipment with large spark-ignition engines producing more than 25 hp (18.6 kW), will require fleet owners to progressively reduce emissions through a variety of means including more stringent new engine emission standards, fleet-average emission requirements for equipment users, and the development of optional low-emission certification guidelines for new engines. For California end users, the environmentally friendly Toyota 8-Series models configured to run on gasoline, liquefied petroleum, or compressed natural gas will count as 0.6 g/bhp-hr (0.8 g/kW-hr) toward CARB's end-user fleet average calculation.

Toyota's new 8-Series models also feature an electrical system that integrates weatherproof connectors and a sealed box to isolate critical controllers and relays from pressure washing, adverse weather conditions, and corrosive applications. An improved cooling system layout provides optimal airflow through the radiator and counterweight, which further reduces the likelihood of overheating and helps to extend the overall life of critical engine and hydraulic-system components. A fully sealed air intake system is located high on the overhead guard pillar, which helps to safeguard the intake system against contamination from low-lying dust and debris.

Toyota fully redesigned the chassis for the new 8-Series lift trucks, which resulted in reduced cosmetic sheet metal and plastic usage. The new design also incorporates a durable engine hood and stamped-steel side panels.

Critical 8-Series drivetrain components are protected from abusive full-speed directional shift changes by Toyota's newly developed Intelli-Shift option, which allows such shift changes to occur only at



According to Toyota, the 8-Series lift trucks will produce on average 70% less smog-forming emissions than the 2007 federal EPA standards.

specified speeds. For brake pad-consuming high-cycle, short-run applications, a new optional wet brake system can provide exceptionally long life while reducing heat build-up, dust intrusion, and brake noise.

Increased visibility has been engineered into the 8-Series lift trucks with a dash-mounted digital display, low-profile cowl, and repositioned lower mast cross-member. A wide-view mast, angled overhead guard bars, and ergonomically designed operator assist grips also help to give the 8-Series better forward and upward visibility.

Ergonomics drove a number of design features for the new lift trucks, including a synchronized steering option that enhances operator comfort by automatically correcting misalignment between the angle of the steering wheel and turn angle of the steer tires. This feature also helps to maintain a consistent steering-wheel position for improved hand placement during operation. The steering wheel has also been downsized to help reduce operator effort, which helps to minimize operator shoulder strain.

A larger entry step and a curvilinear overhead guard help to reduce the operator's effort during entry and exit. Additional ergonomic improvements include expanded floor space and overall legroom, a swivel seat, mini-lever and joystick hydraulic controls with Ergo-Shift, and a rear-assist grip with horn button. Non-cinching seatbelts also help to improve operator comfort by preventing the seatbelt from ratcheting down on the operator's waist, particularly during reverse travel.

The 8-Series lift trucks incorporate Toyota's System



Toyota's 8-Series lift trucks will feature Toyota's new Intelli-Shift option, which helps to protect critical drivetrain components from abusive full-speed directional shift changes.

of Active Stability (SAS), which addresses specific safety issues that are unique to lift truck operation, such as the tendency for the vehicle to tip when maneuvering around a sharp bend. To counteract this problem, the SAS includes an active control rear stabilizer, which is based on a swing lock cylinder that fixes the machine body to the rear axle, helping to maintain vehicle stability and keep all wheels on the ground when making a sharp turn. The system also includes an active mast function controller that automatically calculates the critical front and rear tilt angles based on the load and the mast height, and restricts the mast-tilting angle to help reduce the risk of spilling of loads or tipping over forward or backward.

The SAS also incorporates an active steering synchronizer that returns the lift truck's steering wheel to its original position after completing a turn, which helps the turning point of the wheel remain constant. Automatic fork leveling helps the operator set the empty forks to the level position with the press of a button.

Toyota offers a travel speed/acceleration control system option on the lift trucks to help secure load handling, as well as an integral sideshifter that improves load capacity retention and forward visibility. Optional ease-of-service features include a built-in analyzer that allows the lift truck to perform self-diagnostics, and a programmable planned maintenance monitor that alerts the operator to the need for routine service and maintenance. Routine maintenance areas incorporate accessibility features such as a one-touch fuel tank bracket, a no-tool floorboard, and the location of the hydraulic filter outside of the hydraulic tank for easier service and replacement.

All 8-Series lift trucks sold in North America are produced at **Toyota Industrial Equipment Manufacturing**, Toyota Material Handling USA's Columbus, IN, manufacturing facility.

Darlene Fritz

Hitachi revamps two in rigid dump truck line

Hitachi Construction Machinery recently updated its rigid dump truck lineup with the introduction of the newly revamped EH750-3 and EH1100-3 models.



The EH750-3 (above) is powered by an inline six-cylinder Detroit Diesel engine, while the EH1100-3 uses an MTU Detroit Diesel 12 V series 2000 diesel engine.

An inline six-cylinder **Detroit Diesel** series 60 diesel engine powers the EH750-3, while the EH1100-3 is equipped with an **MTU** Detroit Diesel 12 V series 2000 diesel engine. The engine in the EH750-3 is certified to U.S. **EPA** Tier 3 and EU Stage III regulations, while the EH1100-3's engine is certified to EPA Tier 2 and EU Stage II. The fully automatic, planetary-type **Allison** H5610A (EH750) and H6610A (EH1100) transmissions provide 6F/2R speeds.

Fully fabricated box sections feature frame rails that are tapered from front to rear for more even load distribution. Castings have been replaced by cold rolled steel, which is more homogeneous and easier to repair. One-piece top and bottom flanges eliminate crossmember tie-in joints and provide a large exposed center area for access to major components. Large radii at the frame junctions are blended and ground to minimize stress concentrations. The frame uses 345-MPa (50.4-ksi) yield high-strength low-alloy steel that is robotically welded to ensure consistent, high-quality welds. For increased strength and longer life, weld joints are oriented longitudinally to the principal flow of stress, and the frame is ultrasonically tested to ensure greater durability and reliability.

A single sloped floor in the trucks' bed promotes even distribution of material shedding during dumping. The body is continuously exhaust-heated to reduce carry-back of material and muffle the exhaust. Horizontal floor and side-rail stiffeners help to distribute load shocks evenly over the entire body length,



Like the EH750, the EH1100 rigid dump truck (above) offers a low loading height and large target area to facilitate easy, quick loading by a variety of loading tools.

minimizing stress concentrations in any one area. Closely spaced floor stiffeners also help to reduce wear due to impact loading.

The EH750-3 body uses a 16-mm (0.63-in) floor plate and 8-mm (0.31-in) side plates made from 400 BHN high-tensile steel, which helps to provide high resistance to wear and impact. The EH1100 body uses the same 8-mm (0.31-in) side plates, but a slightly thicker, 18-mm (0.71-in) floor plate. A low loading height and large target area facilitate easy, quick loading by a variety of loading tools.

Both trucks use Hitachi's Accu-Trac suspension system with independent trailing arms for each front wheel. The design features pivot mounting, which allows only axial input to the strut and wheel movement to the vertical plane. The trailing arm layout also helps to reduce vehicle weight by eliminating the frame bulk that would be needed for mounting the king-pin.

Dynamic friction (sidewall force) within the strut is also reduced with the Accu-Trac design, which thus allows the use of a lighter strut engineered to a smaller diameter and longer stroke. Hitachi uses Neocon struts, which contain energy-absorbing helium and compressible silicone-based Neocon-E fluid to provide improved isolation, stability, and control, as well as longer equipment life, greater operator comfort, and more-predictable machine performance.

Struts are mounted between the king-pins and the frame, creating a

wider front track that Hitachi says provides a better ride, improved stability, and a reduced turning circle. The struts are mounted with spherical bushings to eliminate extreme sidewall forces by ensuring a purely axial input to the ride strut. The rear struts are mounted more vertically, which allows a more pure axial loading, thus reducing the tractive and braking forces transmitted to the nose cone. The front struts can be removed and installed without removing the trailing arms, brakes, or tires.

The frame and Accu-Trac suspension system are designed to work in unison to provide maximum structural integrity and operator comfort. The fabricated rectangular frame rail construction provides resistance to bending and torsional loads while eliminating unnecessary weight.

Both trucks use hydraulic actuated front dry disc breaks and rear wet disc brakes. Located at the rear axle, the wet disc brakes provide service braking, secondary braking, and retarding. The wet disc brakes, which are oil-cooled, employ a multiplate design and are sealed for protection against environmental contamination. A unique variable front-to-rear brake proportioning maximizes stop performance under slippery road conditions.

An optional pump-fed auto-lubrication system applies grease to all lube points, which automatically delivers metered quantities of lubricant according to a time-based schedule.

Darlene Fritz



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New wheel loader expands Komatsu America fleet

Komatsu America expanded its line of wheel loaders with the recent addition of the WA430-6. The new WA430 offers increased breakout force, fuel efficiency, and operator comfort compared to the WA400-5 model that it replaces.

Komatsu's own 231-hp (172-kW) SAA6D114E-3 turbo-charged and aftercooled diesel engine powers the new loader. The low-noise, high-torque engine has helped to significantly reduce fuel consumption, as have a closed-center load sensing system and a large-capacity torque converter with maximum efficiency in the low range. A heavy-duty electronic common-rail fuel-injection system provides fast throttle response while optimizing fuel combustion. The loader's engine is U.S. EPA Tier 3, EU Stage IIIA, and Japan emissions certified.

Two operating modes are available to the operator: the E mode provides maximum fuel efficiency for general loading, and the P mode has a maximum power output for hard digging operation and hill climbing. For load-and-carry or hill-climb operations, the torque converter with optional lock-up transmission provides increased production efficiency, reduced cycle times, and optimum fuel savings. An Eco Indicator informs the operator when the machine is maximizing fuel efficiency.

An electronically controlled modulation valve allows the automatic transmission to select the proper gear speed based on conditions such as travel and engine speed. With the touch of a finger, the kick-down switch automatically downshifts from second to first when beginning the digging cycle; in reverse, it automatically upshifts from first to second. This feature results in increased tractive effort for better bucket penetration and reduced cycle times. The kick-down switch also acts as a power-up switch when the machine is already in first gear and economy mode. Conversely, the hold switch keeps the transmission fixed to either the third or fourth gear speed when auto shift is selected. The loader also includes a two-lever electronic shift control for operator gear selection and directional changes.

When equipped with a 4.6-yd³ (3.52-m³) general-purpose bucket with bolt-on cutting edge, the loader has an operating mass between 40,840 and 41,226 lb (18,525 and 18,700 kg) and a dumping clearance of 9.92 ft. (3.02 m).

Operator comfort upgrades include a newly designed, spacious cab with wide pillar-less flat glass to enhance front visibility, and a low-noise design that reduces noise at the operator's ear level to 74 dB and dynamic outside noise levels to 112 dB(A). The new cab is mounted with Komatsu's viscous mounts to help minimize noise and provide a low-vibration, clean operating environment. Cab layout has been improved for easy lever access, and the air conditioner has been relocated to the front of the cab to increase seat reclining and backward slide adjustment.

Fingertip controls help to reduce operator fatigue and improve fine work equipment control and productivity. The work equipment lever console can be moved forward or backward, and the large armrest can be adjusted up or down to provide the operator with a variety of operating positions.

Designed for easy service and maintenance access, the new loader is also equipped with the exclusive Komatsu equipment management monitoring system. An easy-to-read monitor keeps the operator informed of all machine functions, including fluid and filter-change intervals and troubleshooting memory display functions. An automatic reversible hydraulic radiator fan allows the operator to quickly clean out the cooling system at preset intervals or with the flip of a switch. A

Komtrax technology feature uses wireless technology to send the machine's operating information to a secure Web site for analysis. The Komtrax fleet-monitoring system increases machine availability, reduces the risk of machine theft, and allows for remote diagnosis by the distributor.

Komatsu manufactures the wheel loader's engine, torque converter, transmission, hydraulic units, and electric parts. Machine parts are produced within an integrated production system to create a reliable machine with very low maintenance costs.

Darlene Fritz

Komatsu's new WA430-6 wheel loader boasts improved breakout force, better fuel efficiency, and enhanced operator comfort compared to the previous model.

Case IH runs with a Puma

Designed for the grower who needs a multi-purpose machine that is easy to use, with plenty of power, and solid reliability, the **Case IH Puma** tractor handles a wide variety of tasks in many different types of farm enterprises—from row-crops to hay and forage to vegetables.

The Puma name has a heritage that dates back 20 years, when **Steiger** introduced the high-power Puma 1000 row-crop tractor. Steiger Tractor became part of Case IH in 1986.

The Tier 3-certified Case IH 6.75-L engine is a six-cylinder, four-valve electronic powerplant that the company says was engineered for high performance and fuel efficiency. An engine commonly used in other Case IH machines, it is rated at up to 180-hp (134-kW), with an additional 25- to 35-hp (19- to 26-kW) Power Boost available for PTO and transport.

Case IH says Power Boost allows the operator to move through tough crop conditions or steep grades without losing speed or productivity. For example, Power Boost will give the Case IH Puma operating a disc mower conditioner extra power to keep the mower conditioner running at full speed while also easily moving up a steep incline.

The engine in Puma tractors has an "industry-leading" 600-h service interval to save maintenance time and investment. It also provides the basis for an "outstanding weight-to-horsepower ratio, for the fuel efficiency needed in today's farm economy," says the company. There are four models available, which include the Puma 165 at 135-hp (100-kW) PTO, Puma 180 at 150-hp (112-kW) PTO, Puma 195 at 165-hp (123-kW) PTO, and the Puma 210 at 180-hp (134-kW) PTO.

Another key feature of the new Puma tractor models is the 18F/6R Full Powershift transmission. A standard Auto-Shift setting for field and transport provides automatic shifting based on the load, for increased productivity and fuel savings.

In addition, a Constant Engine RPM setting shifts to hold the engine speed within a desired range. It holds the speed in a chosen range, helping the operator reduce fuel usage while maximizing productivity. A new optional 19th EconoGear economy transport gear reduces engine speed in 19th gear for additional improved fuel economy at top road speeds.

The Puma cab puts armrest-mounted gear, throttle, and hitch controls within easy reach, along with a new optional electrohydraulic joystick. A central digital instrument center located at the front cab corner post provides critical information at a glance. A programmable, electronic end-of-row function automates headland routines and allows the operator to focus on the tractor's outstanding tight turning capability.

Visibility in all directions is enhanced with up to 63 ft² (6 m²) of cab glass. The cabs also feature an automatic climate-control system, a suspended cab option, and the new Positive Response heated seat option. Positive Response seats adapt continuously and automatically to each individual driver and terrain, using a sensor and controller system mounted inside the seat suspension that sends electronic signals to the shock absorber. The shock absorber changes from soft to firm up to 500 times per second.

A large, front toolbox; flip-up hood; central service points; and a swing-out radiator-oil cooler were designed to make



New Case IH Puma tractors are powered by a 6.75-L engine and designed for the grower who wants a multipurpose machine that is easy to use, with plenty of power, and solid reliability.

maintenance tasks more efficient and productive.

With a hitch-lift capacity of up to 15,873 lb (7200 kg), a fender-mounted raise/lower switch, and a hitch dampening system, Case IH says its Puma tractors are designed to handle the heavy three-point loads generated by larger implements and allow precise adjustments in the field.

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Kobelco introduces SK350LC excavator

Kobelco Construction Machinery America has introduced its new SK350LC **Acera** Mark 8 hydraulic excavator. The new excavator is powered by a 264-hp (197-kW) turbocharged electronic fuel-injected **Hino** engine that is Tier 3 certified and delivers 736 lb-ft (998 N-m).

Suitable for digging trenches, carrying and setting large pipe and trench boxes, backfilling, clearing sites, and loading trucks, the SK350LC has an operating mass of 79,600 lb (36,106 kg), digs to 24.8 ft (7.6 m), and reaches to 36.3 ft



Kobelco's new SK350LC hydraulic excavator offers a power boost switch that provides 10% more power on command for increased bucket breakout force with no time limitations.

(11.1 m) at ground line. It offers four power modes for heavy-duty excavation work, standard digging and loading work, breaker work, and demolition work with the crusher. The operator can change from one operating mode to another with a switch on the readout display. There is also a power boost switch that provides ready access to 10% more power on command for increased bucket breakout force, without time limitations.

Smooth hydraulic response for very fine finishing and grading applications is provided by an Independent Total Control System. A high-capacity hydraulic system allows the operator to adjust pump flow from the cab, and the standard high-flow valve can be switched from one-pump to two-pump flow to power attachments, mode selection switches, heavy lift switches, and independent travel switches.

The SK350LC's ergonomically designed cab features large panels on all sides for optimized visibility, a seven-position suspension seat that adjusts to accommodate a wide range of operators, and a programmable climate-control system. All major controls are located on the operator's right side for easy access. Viscous silicon cab mounts help to minimize vibration and shocks.

All routine servicing and fluid checks can be performed from ground level, with access to filters, batteries, sight gauges, and couplers. The radiator, oil cooler, and intercooler are mounted side-by-side for easy access, but can be removed separately for service.

Darlene Fritz

Bobcat adds two compact excavators

Contractors looking for a compact excavator have two new options to evaluate from **Bobcat**—the new 329, an entry-level compact excavator with conventional tail swing, and the 335, a compact excavator that offers the power and performance of a larger machine.

Powered by a 1.65-L, 27.7-hp (20.7-kW) liquid-cooled diesel engine, the 329 provides a maximum digging depth of 122.1 in (3100 mm) and a maximum reach of 191.9 in (4874 mm) at

ground level. The unit offers improved lifting ability, due to the conventional tail swing, as well as competitive arm and bucket forces for demanding applications.

Company representatives say the Bobcat 329's hydraulic system will appeal to contractors because it provides improved control while digging. Featuring a dual-outlet piston pump that minimizes lugging, the 329's hydraulic system enables it to maintain constant digging. A torque-limiting piston pump is able to sense and react to hydraulic loads for better utilization of the engine's torque curve, and 14 gal/min (53 L/min) of auxiliary flow is also available. The unit's two-speed travel system provides a 1.9-mph (3 km/h) high travel speed as well as a 1.2-mph (1.9 km/h) low travel speed.

Turf-friendly 12.6-in (320-mm) wide rubber tracks distribute the 329's 7098-lb (3220-kg) operating mass over a larger area to lower the ground pressure to 4.2 psi (28.7 kPa), thus helping to minimize damage to landscapes, paving stones, and other established areas. Steel tracks are also available for harsher working environments. With an overall width of 61 in (1549 mm), the 329 is able to go in areas where larger excavators and tractor loader backhoes cannot.

A hydraulic breaker or hydraulic clamp attachment is approved for use on the 329, which is useful for demolition applications,



Bobcat's new entry-level 329 compact excavator features a torque-limiting dual-outlet piston pump that provides smooth, predictable hydraulic control.

and seven trenching bucket sizes are offered for general digging purposes.

Additional features include hydraulic joystick controls, an extra-wide rear door opening, and an optional enclosed cab with heater. The exclusive Bobcat X-Change mounting system facilitates quick and easy switching between attachments.

Bobcat's new 335 compact excavator steps above and beyond its 4 to 5 t (4.4 to 5.5 ton) size class to provide the power and performance of a larger machine. This unit would serve as an ideal entry-level machine or upgrade for customers with excavators in the 3 to 4 t (3.3 to 4.4 ton) size class. Its compact size makes it possible for contractors to upgrade from a smaller excavator without needing to purchase a larger trailer or towing vehicle.

Powered by a 2.2-L, 40-hp (30-kW) liquid-cooled diesel, the 335 compact excavator features a maximum digging depth of 142.3 in (3614 mm) and a maximum reach of 215.5 in (5472 mm) at ground level. Its conventional tail swing provides excellent lifting ability, and its 5262-lb (23.4-kN) arm breakout force and 7892-lb (35.1-kN) bucket breakout force provide ultimate digging power. The unit's two-speed travel system provides a 3.4-mph (5.5-km/h) high travel speed as well as a 2-mph (3.2-km/h) low travel speed.

Turf-friendly 12.6-in (320-mm) wide rubber tracks distribute the 335's 9170-lb (4160-kg) operating mass over a larger area to lower the ground pressure to 4.8 psi (33.1 kPa) and minimize damage to landscapes, paving stones, and other established surfaces. Steel tracks are also available for harsher working environments. With an overall width of 70 in (1780 mm), the 335 is able to access areas that larger excavators and tractor loader backhoes cannot.

The 335 features a load-sensing hydraulic system for optimum use of hydraulic power in digging applications. Because the operator does not have to compensate for changes in flow or load condition, lugging is minimized, making the excavator easier to control. In addition, the load-sensing system provides precision at all engine speeds, resulting in faster cycle times. The system also reduces fuel consumption.

The 335 also offers 19.8 gal/min (75 L/min) of auxiliary hydraulic flow, which is controlled by a thumb switch located on the right joystick. With this fingertip auxiliary hydraulic control, the operator can precisely control the direction and the rate of flow, thus significantly enhancing operation of attachments such as the hydraulic clamp.

Standard equipment includes a dual-cylinder blade-float feature that is beneficial when backfilling material on hard or finished surfaces because the blade is able to follow the contour of the finished surface, removing only the previously excavated material. This feature is also useful when for back dragging material, and the dual-cylinder design provides a durable support for work in tough operating conditions.

The 335 also features a spacious cab with easy entry and exit and an optional factory-installed heating and air-conditioning package. Quick and easy switching between attachments is facilitated by X-Change.

The instrumentation system on the 335 monitors vital machine fluid temperatures and pressures. In the event a system sensor reads an abnormal condition, it will shut down the engine before catastrophic damage to the engine or the hydraulic system occurs. The monitoring system also provides the operator with engine temperature, fuel level, engine speed, and machine hours.

Bobcat representatives say the performance and economy



The 335 compact excavator delivers 5262 lb (23.4 kN) of arm breakout force and 7892 lb (35.1 kN) of bucket breakout force from its compact, 70-in (1780-mm) track width.

of operation of both new compact excavators—the 329 and the 335—will likely appeal to a wide range of customers from rental companies to contractors who perform excavation, trenching, demolition, and material handling and placement.

Darlene Fritz

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Warner Robins goes round with ODV tractors

Omi-directional vehicles (ODVs) have proven to be a valuable resource for maintenance operations at Robins Air Force Base, GA, and the Air Logistics Center there has recently ordered seven more ODVs from Houston-based **Hammonds Technical Services**. The Model G-30 ODV tractors, at an average price of \$38,495, are being used for material positioning and maintenance support for C-5, C-17, and F-15 maintenance.



Model G-30 omni-directional vehicles are being used at Warner Robins to assist in aircraft maintenance operations.

The G-30 tractors have a towing capacity of 30,000 lb (13,608 kg), and although designed as aircraft tow tractors they have supplemental capabilities in the positioning of large components such as maintenance stands used to carry engines, landing gear, and other heavy aircraft components. They also have been used to position ground support equipment used in military aircraft service.

The ODV is a round vehicle capable of rotating 360° and then moving in any direction. There is no need to back up, turn in an arc, or reposition, since at any point it can change directions—all within the space it occupies. When used as an aircraft tug or baggage tractor, a radial hitch moves about the ODV's circumference. The operator does not have to back up, look over his shoulder, or move without full view of his direction of travel.

Hammonds delivered the first G-30s to the **U.S. Air Force** in 2005.

"Other groups within **Warner Robins** now want ODVs," said company President Carl Hammonds. "We believe these tractors have potential for system-wide use in our Air Force, since major maintenance is performed at a number of bases throughout the U.S. and foreign countries. While this was a one-time order, we are expecting many opportunities for add-ons."

Barry Rosenberg

Kalmar to test hybrid terminal tractors

Kalmar will integrate three of its terminal tractors with hybrid systems in support of a project to help reduce pollution in ports. The West Coast Collaborative of the U.S. **EPA** is also participating in the two-year, \$1.2-million project, as are the **Port of Los Angeles** and the **Port of Long Beach**, where the terminal tractors will be operated and tested for six months. The green hybrid equipment is expected to reduce air emissions by 93%, which equates to 19 tons (17.2 t) of nitrogen oxide and 200 lb (91 kg) of particulate matter.

As part of the project, Kalmar will help with the selection of the hybrid system, which will use either a hybrid-electric system

to combine a diesel engine with an electric motor, or a hybrid-hydraulic system to combine a diesel engine with components that use hydraulic fluid compression to store energy. Kalmar will also carry out the research and development associated with integrating the new system into the machines.

"Our customers are interested in terminal tractors with hybrid systems because the new technology helps reduce fuel consumption, exhaust emissions, and maintenance intervals," said Stefan Johansson, Vice President of Trailer Handling Product Development, Kalmar. "Strategically, it's the right way to go. In the U.S., fuel is relatively cheap, but most people believe the cost will rise, therefore increasing the need and urgency for alternative methods."

Hybrid technology has the potential to reduce or eliminate emissions during idling, which can represent more than 50% of the terminal tractor's duty cycle. "As it conserves the energy necessary for breaking, the hybrid system is ideal for a machine like the terminal tractor, which operates in a continuous stop-and-go fashion," added Johansson.

Hybrid technology also allows operators to preserve their existing operations and maintenance infrastructure. No new type of fueling station is necessary because the system runs with a diesel engine.

This project is part of the San Pedro Bay Ports Clean Air Action Plan, a larger program that aims to significantly reduce emissions and associated health hazards resulting from port operations within the next five years.

Following requests from its customers concerned over yard trucks' high emissions levels, Kalmar has been working toward development of more environmentally friendly terminal tractors since the late 1990s. Through its development work, Kalmar has produced a series of machines that could run on alternative fuels such as compressed natural gas, liquefied natural gas, and liquefied petroleum gas.

Darlene Fritz



Kalmar will integrate three of its terminal tractors with hybrid technology as part of a project to reduce pollution at ports.