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Equipment Electrification Resource Guide for Port of Los Angeles Tenants

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REPORT SUMMARY

U.S. Port Authorities are looking for ways to reduce oxides of nitrogen (NO_x), particulate matter (PM), and other air emissions associated with public health risks. Replacing diesel powered landside equipment with electric power is one feasible option to meet this goal. This resource guide summarizes information on available electric equipment, analyzes the general costs and benefits of electrification, and provides contact information for electric equipment manufacturers.

Background

In 2006 the Ports of Los Angeles and Long Beach published a Clean Air Action Plan (CAAP) to help the region meet its air quality goals. The CAAP was designed to develop mitigation measures for port-related emissions and incentives for emission reductions. Although both ports are landlord ports, and thus do not operate the facilities or equipment within their boundaries, they have committed to accelerate efforts to reduce emissions related to goods movement. One way of reducing emissions is to use electricity as a cleaner alternative to diesel source of power for cargo handling and other equipment. Electrification of equipment can occur in many aspects of port operations, including:

- Replacement of diesel land side equipment with electric equipment
- Ship to Shore Power, which is using shore-side electricity in place of the auxiliary engines of berthed ships
- Electric and hybrid electric on-road vehicles
- Truck stop electrification and truck refrigeration unit electrification
- Electrification of rail activities

The resource guide focuses on the replacement of diesel landside equipment with electric equipment.

Objectives

To provide tenants of the Port of Los Angeles with a resource guide to electric powered equipment that can be used achieve air emission reductions.

Approach

In work cosponsored by the Los Angeles Department of Water and Power, the project team summarized the costs and benefits of the use of electric equipment in landside operations at ports. They described currently available electric equipment and provided contact information on its manufacturers. The team also give information on state and local programs that provide incentives to switch to cleaner port equipment.

Results

Commonly used diesel landside equipment such as cranes, lift trucks, and yard trucks can emit up to 70% of a typical port's total NO_x emissions. These emissions can be offset when diesel equipment is replaced by zero-emission electric equipment. Electric equipment is commercially available now that is priced competitively with its diesel counterparts. While the cost of a new

piece of electrical equipment can be slightly higher than comparable diesel equipment, electric equipment offers reduced operating costs due to fuel savings. At recent diesel and electricity prices, the cost per year of operating a small forklift on diesel is estimated at $13,000 compared to $5,300 for electric. In addition to being cleaner than its diesel counterparts, and therefore easier and less expensive to maintain, electric equipment requires fewer moving parts to service and replace. The result is a lower operating cost for electric equipment compared to diesel. There are several incentive programs at the state and local level to help equipment owners offset the costs of cleaner equipment. The report lists some of the programs that may be available to land side equipment operators.

This electrification resource guide describes currently available electric equipment, including forklifts, side loaders, and several types of cranes, and provides contact information on the manufacturers of electric equipment. New equipment is under development. For example, several Port Authorities are cosponsoring the development and testing of hybrid-powered cargo-handling equipment that combine the cleanest available diesel engine technology with an electric motor.

EPRI Perspective

Some electric equipment is less available in the United States than in other parts of the world. Many manufacturers sell a wider range of electric equipment products outside of the United States. In the future, these manufacturers may respond to increased demand for electric equipment by offering their electric products in the United States.

Keywords

Electric vehicles
Electrification
Ports
Air emissions
Cranes

ABSTRACT

Port Authorities in the United States have been increasingly interested in ways to reduce the air emissions, primarily oxides of nitrogen (NOx) and particulate matter (PM), associated with their operations. One strategy to reduce emissions at ports is the electrification of equipment used in daily operations.

This resource guide is intended to provide information to cargo handling equipment owners and operators at the Port of Los Angeles looking to implement electric equipment as part of their fleet. The Guide includes information on available electric equipment, the general costs and benefits of electrification, and contact information for electric equipment manufacturers.

CONTENTS

1
BACKGROUND: PORTS AND AIR QUALITY

In recent years, Port Authorities in the United States (U.S.) have begun to investigate ways to reduce the air emissions, primarily oxides of nitrogen (NOx) and particulate matter (PM), associated with their operations. The impetus for this has been an increasing awareness of the public heath risks associated with emissions generated not just at ports, but across industry sectors. This awareness, combined with projected growth in the port sector across the country, has caused many port authorities to address the adverse environmental impacts associated with their operations.

At the Port of Los Angeles (POLA), for example, a recently published Clean Air Action Plan (CAAP) outlines the POLA the Port of Long Beach's 5-year plan to help the region meet its air quality goals. The CAAP was designed to develop mitigation measures for port-related emissions and incentives for emission reductions. Although both ports are landlord ports, and thus do not operate the facilities or equipment within their boundaries, they have committed to accelerate efforts to reduce emissions related to goods movement. The strategies outlined in the CAAP include emission reduction targets from various port sectors, including on and off road vehicles, ocean-going vessels, locomotives, and harbor-craft vessels.

Achieving Emission Reductions at Ports

In order to achieve emission reductions, ports and their tenants have a range of strategies available to them, including vessel speed reductions, utilizing shore power for ships at berth, cleaner heavy duty vehicle engines, and the use of cleaner fuels in cargo handling and other equipment. When the latter strategy is employed by equipment owners and operators, electricity as the cleaner alternative to diesel should be considered.

Electrification of equipment can occur in many aspects of port operations, including:

- Replacement of diesel land side equipment with electric equipment
- Ship to Shore Power, which is using shore-side electricity, rather than using ships' auxiliary engines for ships at berth
- Electric and hybrid electric on-road vehicles
- Truck stop electrification and truck refrigeration unit electrification
- Electrification of rail activities

The first point listed above, replacement of diesel land-side equipment with electric equipment, and the logistics of this strategy, will be the focus of this resource guide.

2
COST AND BENEFIT OF EQUIPMENT ELECTRIFICATION

Electrification of land side equipment at ports can be employed as a strategy by port tenants or any equipment operators. Commonly used diesel land side equipment, such as cranes, lift trucks, and yard trucks can emit up to 70% of a typical port's total NOx emissions.[1] Offsetting these emissions can be achieved when this diesel equipment is replaced by electric equipment, which has zero emissions associated with it. As will be discussed below, electric equipment is commercially available now, and is typically priced competitively with its diesel counterparts. In cases where electric equipment costs are greater, financial incentives may be available to help offset these incremental costs. As in any strategic business decision, costs and benefits of equipment electrification must be weighed to find an appropriate solution.

Equipment electrification costs, including capital, operating and infrastructure costs, vary depending on the equipment type and electricity option selected for operation. In general, the cost of electric equipment can be comparable to the cost of diesel equipment, and benefits include not only substantial emission reductions, but also lower operating costs, and in many cases maintenance efficiencies.

Costs

In considering the costs associated with land-side equipment electrification, one must consider three cost categories: capital costs, operating costs, and infrastructure development costs. Although a detailed analysis of each of these three costs is beyond the scope of this guide, the factors associated with each are described briefly below.

Capital Costs

Electric equipment capital costs differ depending on whether a port will purchase new equipment, buy used equipment, or retrofit existing equipment. The following discussion focuses only on new original equipment manufacturer (OEM) purchases.

In general, the cost of a new piece of equipment can be slightly higher for electric compared to diesel. The cost of the battery charger and associated equipment may comprise the bulk of this cost difference.[2] However, there seems to be a trend toward a lower price differential. This may largely be due to higher costs associated with producing diesel equipment due to environmental regulations that have recently come into effect and cost efficiencies associated with producing greater quantities of electric equipment.

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[1] *2002 POLB Emissions Inventory*. Starcrest Consulting Group. pg 8.

[2] http://www.buyerzone.com/industrial/forklifts/printable_bg.html

Research associated with the production of this resource guide revealed the following information regarding incremental costs of electric equipment:

- One equipment manufacturer has estimated that its electric side loader runs about 10-15% higher in price than the comparable diesel side loader.[3]
- Another manufacturer of forklifts has estimated that the price differential between electric and diesel is less than it was a few years ago, and would estimate that it now costs only about 5% more for an electric forklift compared to a diesel.[4]
- In some cases, electric equipment can be even less expensive than its diesel counterpart. KoneCranes, for example, has estimated that its electric crane is slightly less expensive than its diesel equivalent.[5]
- One crane manufacturer has estimated that there is approximately a 25% price increase for its all-electric RTG compared to its diesel counterpart and notes that this price increase is largely a reflection of the civil work necessary to install such equipment.[6]

Operating Costs

A primary benefit of electric equipment is reduced operating costs due to fuel savings. Although diesel costs – which vary drastically according to many factors – are eliminated with electric equipment, there are electricity costs, representing the majority of operating costs, associated with the operation of this equipment. The price of electricity varies, but ranges from 8 to 15 cents per kilowatt-hour.[7] The price of diesel also varies, but currently ranges from $2.50 to $3 per gallon for on-highway diesel.[8] In general, this price differential leads to substantially lower operating costs for electric equipment compared to diesel. For example, the cost per year (at 2,000 hours of operation) of operating a small forklift on diesel (at an average price of $3/gallon) compared to electricity (at an average price of $0.10/kw-hr) is estimated at $13,000 compared to $5,300.[9] Of course, as the price of both diesel and electricity fluctuates, this operating cost differential will change.

In addition to electricity costs, electric equipment operating costs also may include battery maintenance and occasional battery replacement for battery-powered equipment. When comparing the maintenance costs of electric vs. combustion equipment, it should be noted that electric requires no oil changes, tune-ups, spark plugs, carburetors, etc. Electrics have few moving parts and when repairs and maintenance are necessary, it is often as simple as changing

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[3] Bauman Handling Systems, John Burns. 1-11-07.
[4] Carl Meininger (503) 598-4040, Hyster
[5] Juha Aatola, Director, Container Cranes, KONECRANES
[6] Dan House, Kalmar.
[7] http://www.eia.doe.gov/cneaf/electricity/epm/epm_sum.html; http://www.energy.ca.gov/electricity/statewide_weightavg_rates.html
[8] http://tonto.eia.doe.gov/oog/info/wohdp/diesel.asp
[9] Sam Wells, Starcrest Consulting Group.

out an electronic circuit board.[10] These costs are offset by cost efficiencies in general maintenance of the equipment as well as the fuel savings discussed above.[11]

Infrastructure Costs

Although not long-term, the costs associated with the infrastructure necessary for electric land-side equipment can vary depending on what infrastructure is already in place at a port and which electric strategy is selected for the equipment, including direct electric hookup or battery power.

For direct electric hookup to the power grid, a power cord is typically run to the equipment motor, plugging directly into the power supply for the port. This strategy, commonly used for equipment such as the rail-mounted gantry crane, necessitates an appropriate level of electric capacity. If that is not available, then adding electric capacity must be factored into potential infrastructure costs. Additional infrastructure costs for direct electric hookup include the power cords and associated equipment needed for "plugging in" the equipment. In addition, upgraded electric circuits and wiring may be necessitated.

Battery power may involve fewer infrastructure costs because each piece of electric equipment in effect powers itself. Infrastructure costs associated with this option may include battery recharging and change out stations, as well as upgraded electric circuits and wiring.

Benefits

There are several benefits associated with equipment electrification, including emission savings and lower operational and maintenance costs, both of which were alluded to above.

The table below illustrates approximate NOx and PM emissions for commonly utilized diesel port equipment. The tons per year shown in this table represent what one average piece of diesel equipment in each of the four equipment categories emits in NOx and PM. Of course, these emissions vary by equipment specifications and usage, and as such are only an approximation.

Table 2-1
Emission Estimates by Single Piece of Diesel Equipment

Equipment Category	NOx (tons per yr)	PM (tons per yr)
Forklift	0.48	0.23
Yard Truck	2.77	0.18
Crane	4.30	0.23
Top/Side Loader	3.04	0.16

As seen in the table above, a typical diesel crane, for example, operating at a port emits approximately 4.3 tons of NOx per year. The table above can be used to extrapolate more wide spread emissions savings in the case of multiple pieces of diesel equipment being replaced with

[10] Robert Hawkins, Ultimate Business Solutions.
[11] Gross & Associates, 2001, 'How to Choose the Right Lift Truck that's Right for You'. See also: www.grossassociates.com.

electric. For example, an emissions savings of approximately 91 tons of NOx and 25 tons of PM may be realized if 100 diesel forklifts and 10 diesel cranes were replaced with electric equipment.

Aside from emissions savings, a primary benefit of electric equipment is operational and maintenance cost savings. In addition to being cleaner than its diesel counterparts, and therefore easier and less expensive to maintain, electric equipment requires fewer moving parts to service and replace. The result is a lower operating cost for electric equipment compared to diesel.[12]

[12] http://www.eere.energy.gov/afdc/altfuel/elec_benefits.html

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COMMERCIALLY AVAILABLE LAND SIDE EQUIPMENT

Several types of electric equipment relevant to port operations are currently commercially available, including:

- Ship to shore/wharf cranes
- Gantry cranes (rail-mounted and rubber-tired)
- Forklifts
- Side loaders

Although electric equipment in a range of equipment types and specifications is available and will be discussed below, it should be noted that the availability of electric equipment in the United States is somewhat more limited than in other parts of the world. Many manufacturers sell a wider range of electric equipment products outside of the U.S. These manufacturers may respond to increased demand for electric equipment by offering their electric products in the U.S. at some point in the future.

Description of Equipment

Forklifts

Forklifts, a very common piece of equipment at ports of all sizes, are typically used for both cargo and non-cargo handling activities. Forklifts, which also may be called counterbalanced lift trucks, may be equipped with cushion tires (for inside use or on flat surfaces) or pneumatic tires (for use on rough terrain or outside). Forklift information that follows in this guide is limited to forklifts with pneumatic tires. Forklifts are commonly found in diesel, liquefied petroleum gas (LPG) and electric models. Figure 3-1 below shows a typical forklift.[13]

[13] http://www.mit-lift.com.

Figure 3-1
A Mitsubishi forklift

Side Loaders

Side loaders, one type of container handler found at ports, are commonly used at larger ports. Side loaders typically move and stack empty containers. Side loaders are available in diesel and electric models. Figure 3-2 below shows a side loader in operation.[14]

Figure 3-2
Side Loader

Rubber-tired Gantry (RTG) Cranes

The RTG crane moves containers to and from container stacks at ports. The RTG, shown in Figure 3-3[15] below, straddles the stacks of containers and has room for a heavy-duty truck/yard

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[14] *http://www.cal-lift.com*
[15] *http://www.pacecocorp.com.*

tractor to pull under and move containers between the stacks and vehicles. It is also used to consolidate the stacks as containers are added and removed from the terminal. RTGs can be found in either diesel or electric models.

Figure 3-3
Rubber Tired Gantry Crane

Rail-Mounted Gantry (RMG) Crane

An RMG, like that shown below in Figure 3-4,[16] is a mobile gantry crane running on two rails, able to move along the wharf or dock to position containers at any point along the length of the ship. It is often used to transfer cargo containers from barges and ships to train cars. RMGs are widely available as electric models.

16 http://www.kciamericas.com/portal/equipment/harbour_and_shipyard_cranes

Figure 3-4
A KoneCranes Rail Mounted Gantry Crane

Ship to Shore Cranes

These massive cranes, see Figure 3-5 below,[17] can be found at container ports. They typically haul ship containers from ships to docks. Ship to shore cranes are commercially available as diesel or electric.

Figure 3-5
A KoneCranes Ship to Shore Crane

[17] Ibid.

Future Availability/Emerging Opportunities

As discussed above, other electric port equipment may become available in the U.S. in the future as the demand for cleaner equipment increases. In some cases, this increased demand is even driving the supply of new electric equipment, as in the case of the Port of Los Angeles' Electric Tow Tractor Demonstration Project and the diesel-electric yard truck project.

The $527,000 Port of Los Angeles Electric Tow Tractor project, announced in late 2006, is being funded by the port and the South Coast Air Quality Management District. It includes the development by Balqon Corporation of a new electric powered tow truck for use at the Port of LA.[18] The tow trucks will be used to tow cargo containers from the Port to local warehouses and rail yards. The tow tractors will have fast charging capabilities and will be able to tow up to 60,000 lbs. They will have a range of 40 miles per charge and a top speed of 25 miles per hour. More information on this project can be viewed through the following link.

http://www.csrwire.com/PressRelease.php?id=7240

Another example of a manufacturer responding to increased demand for electric equipment is the EPA's provision of $300,000 for Hybrid Yard Tractors or Yard Hostlers. The two-year project will cost $1.2 million. The Ports of Long Beach and Los Angeles will contribute $375,000 each, the EPA will contribute $300,000 through its West Coast Collaborative, and the Long Beach Container Terminal will contribute $150,000. This project will fund the development of hybrid-powered cargo-handling equipment and testing at one of the Port's container shipping terminals. Cargo-handling equipment manufacturer Kalmar Industries will integrate the cleaner hybrid system into the yard hostlers. Three of the hybrid yard hostlers will be operated and tested for six months at Long Beach Container Terminal. The hybrid vehicles would use either a hybrid-electric system to combine the cleanest available diesel engine technology with an electric motor, or a hybrid-hydraulic system that would combine the cleanest available diesel engine technology with components that use hydraulic fluid compression to store energy.

[18] Port of LA and South Coast Air Quality Management District Implement Electric Tow Tractor Demo Project**,** *Friday, January 12, 2007***.** http://biz.yahoo.com/bw/070112/20070112005702.html?.v=1

The hybrid-drive system, coupled with the cleanest available diesel engine, is expected to deliver a 93 percent reduction in smog-forming nitrogen oxides and diesel particulate matter compared to typical yard hostlers. In addition, the hybrid technology is expected to reduce or eliminate emissions during idling, which can represent more than 50 percent of the yard hostler duty cycle. The estimated cuts in emissions from idling reductions during the six-month test are about 19 tons of nitrogen oxide and 200 pounds of particulate matter.[19] More information on this project can be viewed through the following link:

www.yosemite.epa.gov

[19] EPA Press Release: EPA Provides $300,000 for Hybrid Yard Tractors September 6, 2006. *www.yosemite.epa.gov*

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FUNDING PROGRAMS TO OFFSET THE COSTS OF ELECTRIC EQUIPMENT

As discussed above, the capital costs associated with electric equipment can be higher than its diesel counterparts depending on the equipment and electricity source. However, various incentive programs exist at the state and local level to help equipment owners offset the costs of cleaner equipment, including electric. Following is a listing of some of the programs that may be available to land side equipment operators.

South Coast Air Quality Management District (AQMD) Technology Advancement Program

Under the Clean Air Action Plan (CAAP) approved by the ports of Los Angeles and Long Beach in November 2006, $15 million has been set aside for a Technology Advancement Program to help these ports and their tenants offset the cost of cleaner technologies for their operating equipment. The electric tow tractor demonstration project described above is the first project to be approved under this CAAP program component.

The Technology Advancement Program will be funded by both ports, with additional funding from participating agencies, other interested ports, and interested port tenants and shipping lines.

The South Coast AQMD has committed $48 million to help replace older diesel trucks in addition to technology advancement projects. As part of the CAAP commitment, the Port of Los Angeles has committed at least $85 million over the next five years for truck replacement and retrofits.[20] For more information on this program, follow the link below.

http://www.aqmd.gov/tao/about.html

Los Angeles Department of Water & Power Incentive Program

Although not yet in place, this approved incentive program will provide financial subsidies to fleets who implement electric equipment at ports. The funding will help to offset the incremental cost of electric equipment, including the cost of batteries and battery chargers. The goal of the program is to equalize the cost of electric port equipment compared to diesel. The program may also provide subsidies to fleets in the installation of electric infrastructure to support electric equipment. Up to $1 million per year will be set aside for this grant program, which will be administered as rebates for participating fleets.

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[20] Port of LA and South Coast Air Quality Management District Implement Electric Tow Tractor Demo Project**.** Press Release**,** *Friday, January 12, 2007*

U.S. EPA's National Clean Diesel Campaign/Clean Ports

The U.S. Environmental Protection Agency (EPA) developed the National Clean Diesel Campaign to reduce pollution emitted from diesel engines across the country through the implementation of various control strategies and the involvement of national, state, and local partners. The campaign includes voluntary programs, regulations and collaborative efforts to achieve its goals. Grants and funding associated with this program are issued either through EPA directly or through its partners on various initiatives. For more information on this program, follow the link below.

http://www.epa.gov/cleandiesel/

The Clean Ports USA program, which falls under the umbrella of the National Clean Diesel Campaign, offers strategic planning advice on technology options and funding for emission reduction strategies to ports. EPA works with port authorities, marine terminal operators, and other partners to overcome barriers to reducing diesel emissions in this sector. For more information on this program, follow the link below.

http://www.epa.gov/cleandiesel/ports/basicinfo.htm

West Coast Collaborative/EPA

Since 2004, the U.S. Environmental Protection Agency and its partner the West Coast Collaborative have given out millions of dollars in grant monies for projects aimed at reducing diesel emissions on the West Coast. Projects are expected to demonstrate new, innovative or experimental approaches to reducing diesel emissions. Past grant projects have included electrifying truck stops and cruise ship terminals, converting restaurant waste oil to bio-diesel fuel and a establishing a revolving loan fund to reduce locomotive emissions. Electric port equipment may qualify for funding under this program. For more information on this program, follow the link below.

www.westcoastcollaborative.org/grants.htm.

California Carl Moyer Program

The Carl Moyer Memorial Air Quality Standards Attainment Program provides incentive funds for the incremental cost of cleaner-than-required engines and equipment. Eligible projects include cleaner on-road, off-road, marine, locomotive and stationary agricultural pump engines, as well as forklifts, airport ground support equipment, and auxiliary power units. Electric port equipment may qualify for funding under this program. Carl Moyer Program workshops are held regularly by the California Air Quality Management District to provide more information to interested parties. For more information on workshops and the program in general, follow the links below:

http://www.arb.ca.gov/msprog/moyer/facts/about.htm

http://www.aqmd.gov/tao/implementation/carl_moyer_program_2001.html

5 MANUFACTURER CONTACTS

Following is a listing of manufacturers, their electric equipment products, and their contact information. The following manufacturers, with electric equipment including RTGs, RMGs, tow tractors, forklifts and side loaders, are listed below:

- Kalmar
- KoneCranes
- Raymond Trucks
- Balqon
- Morris
- Shanghai Zenhua Port Machinery Co.
- Hyster
- Baunman
- Paceco
- Yale

The manufacturer information below is not meant to represent a comprehensive list of manufacturers selling electric equipment in the U.S., but is rather intended to provide equipment operators with some contact information as they investigate electric equipment choices for their fleets. It should also be noted that this information changes constantly and is, as such, subject to change.

Kalmar	
Products	**Contact Information**
Electric RTG • E-One diesel electric RTG can be ordered as all electric with power cord Electric forklift • Models ECE50-80XL, ECE50-90L • Specifications:11,000-20,000 lb lift capacity	www.kalmarind.com Jason Gasparik 253-922-3474 Regional Sales Manager, West Coast Crane contact: Dan House (609-409-2819) dan.house@kalmarind.com Forklift contact: Casey Tubbert (cell: 623.363.3090) casey.tubbert@kalmarind.com

KoneCranes	
Products	**Contact Information**
Electric RTG, 50 ton lift capacity Electric RMG Electric Ship to Shore Cranes	website www.konecranes.com Juha Aatola Director, Container Cranes juha.aatola@konecranes.com

Shanghai Zenhua Port Machinery Company (ZPMC),	
Products	**Contact Information**
Electric Ship to Shore Crane	http://www.zpmc.com/

Hyster	
Products	**Contact Information**
Electric Forklift Specifications: 12,000 lb lift capacity	Carl Meininger (503) 598-4040 http://www.hysteramericas.com/

Raymond Trucks	
Products	**Contact Information**
Electric forklift • Model 4700 • Specifications: lift capacity up to 6,000 lbs Electric side loader • Model: 71 or 76 • Specifications: lift capacity up to 10,000 lbs	http://www.raymondcorp.com/ Chad Fryback, Raymond Handling Concepts (888) 610.6611

Bauman	
Products	**Contact Information**
Electric Side loader • Model EMS/EVS • Specifications: lift capacity 2-15 tons	http://www.sideloaders.com/ John Burns, Bauman Handling Systems (800) 927-0385

Balqon	
Products	**Contact Information**
Electric tow tractor • Model T900 • Specifications: pulls up to 10,000 lbs	Balqon Corporation Corporate 8 Rosewood Aliso Viejo, California 92656. Telephone: +1949 455 0393 FAX: +1 949 455 0363 http://www.balqon.com/

Paceco Corporation (still confirming)	
Products	**Contact Information**
Electric RTGs and ship to shore cranes Transtainers, Portainers (license with Mitsui)	http://www.pacecocorp.com/ 25503 Whitesell St. Hayward, CA 94545 Mr. Mack Cartwright, Marketing & Sales Tel: 510-264-9288 mc@pacecocorp.com

Morris Material Handling	
Products	**Contact Information**
Electric RMG (won the Everett bid for electric crane)	http://www.morriscranes.com/ 'jgieske@morriscranes.com' Jergen Gieske 262.364.5740

Yale	
Products	**Contact Information**
Electric forklift • Model: ERP, ERC • Specifications up to 12,000 lbs	Yale/Chase Materials, 562.463.8000 www.yalepacific.com

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