Technology: Locomotive Engine Exhaust Capture System

Technology Name: Advanced Locomotive Emissions Control System (ALECS)

Company Name: Advanced Cleanup Technologies, Inc. (ACTI)

Technology Description: ALECS consists of two major system components, the Exhaust Capture System (ECS) and the Emissions Treatment System (ETS). Locomotive train diesel fuel engines generate exhaust. The ECS collects exhaust gas emissions from the smoke stack using an emissions intake hose duct via a mechanical hood which is placed over the locomotive engine smoke stack while in maintenance or in rail yards. The ALECS System can be configured to have multiple bonnets to connect a series of locomotive engines and can be mounted on an overhead rail system which can traverse back and forth over the locomotive engines. The exhaust is drawn by a venturi fan blower through a flexible intake hose duct into the ETS for removal and treatment of harmful pollutants. The ETS utilizes state-of-the-art exhaust cleaning technologies such as a Pre-Conditioning Chamber to remove SO2, a Cloud Chamber Scrubber to remove PM and VOC’s and a Selective Catalytic Reduction Reactor to remove NOX and VOC’s. The ALECS technology can successfully remove Sulfur Dioxides (SOX) by 99%, Nitrogen Oxides (NOX) by 99%, Particulate Matter (PM) by 95.5% and Volatile Organic Compounds (VOC’s) 97%. ALECS can be built in a building or alongside the rail tracks. The first successful demonstration was performed at the Union Pacific J.R. Davis Rail Yard in Roseville, California in 2006.
The Intake Hood Is Placed Over Engine Smoke Stack

Double Smoke Stack Switcher Engine

Exhaust Is Captured In The Hood & Sent Through The Intake Duct Pipeline System For Processing

The ECS Delivers Captured Exhaust From Multiple Locomotive To A Centralized Treatment System

Company Contact Info:
Advanced Cleanup Technologies, Inc.
20928 Lamberton Ave.
Carson, California
USA 90745
310-763-1423
www.advancedcleanup.com
**Technology:** Ship Exhaust Capture System  
**Technology Name:** Advanced Maritime Emissions Control System (AMECS)  
**Company Name:** Advanced Cleanup Technologies, Inc. (ACTI)  

**Technology Description:**  
AMECS consists of two major system components, the Exhaust Capture System (ECS) and the Emissions Treatment System (ETS). Ships generate emissions from the ship service diesel generators exhaust (auxiliary engines) and auxiliary boiler exhaust gas.

The ECS collects both auxiliary engine and boiler exhaust gas emissions from a ships smoke stack using an emissions intake hose duct via a collapsible bellows capture bonnet which is placed over the smoke stack. The exhaust is drawn by a venturi fan blower from the bonnet though a flexible intake hose duct into the ETS for removal and treatment of harmful pollutants. The ETS utilizes state-of-the-art exhaust cleaning technologies such as a Pre-Conditioning Chamber to remove SO2, a Cloud Chamber Scrubber to remove PM and VOC’s and a Selective Catalytic Reduction Reactor to remove NOX and VOC’s. The AMECS technology can successfully remove Sulfur Dioxides (SOX) by 99%, Nitrogen Oxides (NOX) by 99%, Particulate Matter (PM) by 95.5% and Volatile Organic Compounds (VOC’s) 97%.

AMECS can be built dockside to service ships at berth, built on a barge and tied alongside a ship while anchored out at sea, tied alongside a ship while being transported from outer harbor to a port terminal dock. AMECS can be used when a ship is not retrofitted or when there is no shore power available.
The Bonnet Is Placed Over The Ship Smoke Stack

Ship Exhaust Can Be Seen Coming Out of Smoke Stack

Exhaust Is Captured In The Bonnet & Sent Through The Intake Duct Pipeline System

The Captured Exhaust Is Treated To Remove PM, NOX, SOX, VOC's

Company Contact Info:
Advanced Cleanup Technologies, Inc.
20928 Lamberton Ave.
Carson, California
USA 90745
310-763-1423
www.advancedcleanup.com
Technology: Electric Shore Power
Technology Name: Alternative Marine Power
Company Name: Port of Los Angeles

Technology Description: Alternative Maritime Power (AMP) Systems also known as Cold Ironing allow ships to be powered by shore-supplied electrical power while at berth. To transfer power from vessel generators to the utility supplied source it is required to connect the ship in parallel to the utility lines. The Los Angeles Dept. of Water & Power supplies the Port with the shoreside electrical power of 6.6 kilovolts. This is converted to 440 volts through a transformer located on a barge that is positioned perpendicular to the stern of the ship. The power is then sent to the ship through nine plugs that are positioned with a crane located on the barge along-side the ship. Alternative Maritime Power technology prevents one ton of nitrous oxide (NOx) and particulate matter from entering into the local environment each day the ship is docked.

Company Contact Info: Port of Los Angeles
425 S. Palos Verdes Street
San Pedro, California
USA 90731
310-732-7678
**Technology:** Zero Emissions Drayage Truck  
**Technology Name:** All Electric Tractor  
**Company Name:** Balqon Corporation  

**Technology Description:** The Balqon all electric tractor is designed to transport containers in terminal or on-road applications. They are powered with a Lithium Iron Phosphate battery pack which has an extended life cycle: 3000 cycles at 80 percent DOD or 5000 cycles at 70 percent DOD - 5 year warranty on all packs. They are 76% more energy efficient than comparable Diesel trucks in Class 7 and Class 8 applications. Fully welded & electro coated steel cab construction (full cab immersion) for enhanced durability, vehicle maintenance virtually eliminated with integrated digital CAN BUS system & proprietary diagnostics, sealed & liquid cooled traction controls – increases power and durability in high torque applications, cab climate control with heating - air conditioning - defrosting capability, heavy duty torque converter - reduces shock and strain on drive line components, streamlines delivery process with Rear cabin door to create additional operator access point to containers and safety & visibility put at a priority with sealed high/low beam headlights - in cabin lighting - back up alarm - fifth wheel lighting - and emergency beacon light.
Nautilus XE-20 GCWR 90,000 lbs. Terminal Tractor features a 4 speed fully automatic Allison 3000 RDS transmission – high torque and efficiency at all speeds, has a maximum speed of 25mph, high performance AC Induction Motor - 200 HP @ 1800-2400 RPM with a Torque of 600 lb-ft @0-1800 RPM. 6.5 hours charging time and 2.5 hrs. quick charge.

Nautilus XE-30 GCWR 125,000 lbs. On-Road Tractor features 5 speed fully automatic Allison RDS transmission – high torque and efficiency at all speeds, has a maximum speed of 45mph, high performance AC Induction Motor - 200 HP @ 1800-2400 RPM with a Torque of 600 lb-ft @0-1800 RPM. 6.5 hours charging time and 2.5 hrs. quick charge.

Company Contact Info:  
Balqon Corporation  
1420, 240 th Street  
Harbor City, California  
USA 90710  
310-326-3056  
310-326-3058 Fax  
www.balqon.com
**Technology:** Witmar Dual Multi Voltage Cold Ironing System

**Technology Name:** Clean Air Marine LNG International Power Supply System

**Company Name:** CleanAir Marine Power

**Technology Description:**

The Wittmar Dual Frequency Multi Voltage (DFMW) Cold Ironing System is a modular containerized LNG fuel powered electric shore-side power system for ships. It provides both 50Hz and 60Hz and a variety of voltages to meet any vessel’s hoteling requirements while docked. Two electric generators are powered by the LNG fuel which provides electric power for the ship. LNG is a lower emissions fuel compared to traditional ship bunker oil fuel. It can be installed temporarily on a dock or built to be a permanent integrated system.

The system is compatible with all ocean going vessel except cruise ships. Each generator can provide up to 2 megawatts of power per hours. Requires minimum ship vessel retrofit.
Emissions Comparison, LNG Cold Ironing of APL China

<table>
<thead>
<tr>
<th>Pollutant</th>
<th>On-board diesel power (0.5% sulfur marine diesel)</th>
<th>LNG cold-ironing</th>
<th>% reduction</th>
</tr>
</thead>
<tbody>
<tr>
<td>NOx</td>
<td>1,059 lbs</td>
<td>56 lbs</td>
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<td>CO</td>
<td>79 lbs</td>
<td>34 lbs</td>
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<td>PM10</td>
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<td>SOx</td>
<td>72 lbs</td>
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<td>100%</td>
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<td>CO2</td>
<td>42,651 lbs</td>
<td>24,430 lbs</td>
<td>42.72%</td>
</tr>
</tbody>
</table>

Company Contact Info: CleanAir Marine Power/CleanAir Logix
3350 Birch Street
Palo Alto, California
USA 94306
www.cleairlogix.com/wwwcleanmarinepower.com
510-839-2970
Technology: Diesel Truck Engine Particulate Trap
Technology Name: Wall Flow Diesel Particulate Filters
Company Name: DCL International Inc.

Technology Description: VATSS can be retrofitted on current 1985-2006 on-road diesel fuel engine trucks, buses and all year models of off-road vehicles and equipment and costs about $15,000. The advanced technology system creates an on-demand and on-board (no fuel storage or refueling) cleaner burning hydrogen-oxygen gas that dramatically increases the combustion efficiency of the diesel engine, increases miles-per-gallon 15%-20%, decreases fuel costs, reduces fuel consumption without altering OEM specifications, lowers life cycle maintenance costs and reduces toxic emissions that are produced. The VATSS has been successfully tested, is currently being test driven under various industry conditions and undergoing CARB certification.

Company Contact Info: Miracle Mile Solutions
6260 Laurel Canyon Blvd., Ste. 202
North Hollywood, California
USA 91606
818-836-9452
Technology: Zero Emissions Electric Container Transportation System

Technology Name: Magnetic Levitation Train Technology

Company Name: General Atomics

Technology Description: The Electric Cargo Conveyor “ECCO” MagLev System is based on a totally passive permanent-magnet, large-air-gap maglev system, which results in lighter vehicles, reduced energy consumption, and more streamlined, less costly guideway structures. A linear synchronous motor (LSM) housed in the guideway provides propulsion. The system uses neodymium iron boron permanent magnets placed in a configuration called a Halbach array. This yields a very high lift-to-drag ratio and leads to an efficient levitation and propulsion system. One of its most significant attributes is its quiet, all-electric, environmentally friendly operation. The system can maneuver tight turns, climb steep grades, has low maintenance costs due to fewer moving parts, and is reliable in all-weather conditions. The systems travels at 90mph at a grade of 10% and has a turn radius of 328ft.
Company Contact Info: General Atomics
3550 General Atomics Court
San Diego, California
USA 92121
www.ga.com
858-455-3000
858-676-7121
Technology: Zero Emissions Electric Container Transportation System

Technology Name: Magnetic Levitation Train Technology

Company Name: American MagLev Technology, Inc. (AMTI)

Technology Description: The Environmental Mitigation & Mobility Initiative “EMMI” Logistics Solutions was invented by American MagLev Technology, Inc. Magnetic Levitation technology uses electromagnetic field forces to lift a cargo carrier into the air against gravity, suspend in the air, propel in the air and guide in the cargo-container carriers. Magnets are built under the carrier which wrap under the track. The carrier is then pulled up against the gravity by magnetic forces towards the track. The air gap distance is approximately one-quarter inch. MagLev Trains are highly reliable computer-controlled electronic transportation systems requiring no moving mechanical parts for suspension, acceleration or braking. MagLev Trains are less expensive to operate and maintain than traditional high speed trains or intercity buses, however, building the initial infrastructure has a higher cost that is easily paid off over time. The technology is all electric, uses no fuel and emits no emissions or green house gases. A Maglev train can be built over any flat area, including along side or over existing rail tracks, freeways, highways or waterways.
**Technology Description:**

The Foss hybrid tug’s drive units are powered by batteries coupled with diesel generators and feature a modified engine room accommodating two 670 horsepower battery packs and two 335 horsepower generators. Although the main engines in the hybrid tug will have lower horsepower than the existing Dolphin engines, overall the tug will have the same total horsepower as its sister tugs. The 5,000 horsepower Foss hybrid tug will be primarily used for harbor assist services-moving vessels such as tankers and container ships in and out of the harbor and into their berths.

Reduced Emissions. The hybrid tug will reduce all emissions (nitrogen oxide, particulate emissions, sulphur dioxide and carbon emissions) due to design efficiencies and lower fuel consumption. Initial estimates show a 44 percent reduction in PM and NOx emissions for the same duty as the current Dolphin tugs in Los Angeles/Long Beach.

Lower Fuel Consumption. The hybrid tug design minimizes fuel consumption by using a power management system to match the required power to the most efficient combination of batteries, generators and main engines for that particular power level. For example, instead of idling the
main engines while in standby mode when alongside a customer vessel awaiting orders from the pilot, the hybrid tug will run on battery power with the main engines shut down. The lower fuel consumption results in reductions of carbon emissions, a contributor to greenhouse gas, as well as sulfur emissions.

Noise Reduction. Overall, the hybrid tug will be much quieter than traditional tugs, running on battery power in standby mode and only bringing the generators and main engines online when higher power is required. This will reduce noise exposure, protecting crews from hearing loss and reducing noise pollution.

Company Contact Info:
Foss Maritime Company
1151 Fairview Ave. N.
Seattle, Washington
USA 98109
206.281.3800
800.426.2885
info@foss.com
Technology: LNG Fuel Drayage Truck

Technology Name: Freightliner M2-112 LNG/CNG Truck

Company Name: Freightliner

Technology Description: Freightliner’s Business Class M2 112 medium duty truck is tough and durable, engineered with the heavy-duty strength and power to make a positive impact on your bottom line. Available as a truck or tractor with GVWR of up to 66,000 lbs and optional 20,000 lb capacity front axles and suspensions, the Business Class M2 112 medium duty truck is built for the most demanding situations. Every model of Business Class M2 features a 2,500 square-inch windshield and up to a 55-degree wheel cut for excellent visibility and maneuverability. Liquefied natural gas or LNG is natural gas (predominantly methane, CH4) that has been converted temporarily to liquid form for ease of storage or transport. Liquefied natural gas takes up about 1/600th the volume of natural gas in the gaseous state. It is odorless, colorless, non-toxic and non-corrosive. The liquefaction process involves removal of certain components, such as dust, acid gases, helium, water, and heavy hydrocarbons, which could cause difficulty downstream. The natural gas is then condensed into a liquid at close to atmospheric pressure (maximum transport pressure set at around 25 kPa/3.6 psi) by cooling it to approximately −162 °C (−260 °F). The reduction in volume makes it much more cost efficient to transport over long distances where pipelines do not exist. Where moving natural gas by pipelines is not possible or economical, it can be transported by specially designed cryogenic sea vessels (LNG carriers) or cryogenic road tankers. The energy density of LNG is 60% of that of diesel fuel.
Company Contact Info:
LA Freightliner
2429 Peck Road
Whittier, California
USA 90601
www.lafreightliner.com
800-366-4621
Technology: LNG Fuel Drayage Truck

Technology Name: Kenworth T800

Company Name: Kenworth

Technology Description: The Class 8 Kenworth T800 - which is available only for liquefied natural gas (LNG) use - can be ordered in a gross combination weight (GCW) of up to 80,000 lb. for over-the-road operation with additional ratings exceeding 100,000 lbs. Kenworth uses a Dewar flask (or cryogenic tank) system that is like a large Thermos® bottle inside a metal cylinder. The LNG fuel tank, which is designed to keep the fuel in its liquid state at minus 260 degrees Fahrenheit, can hold between 56 and 80 diesel gallon equivalent (DGE) gallons per tank.

The Westport HD engine uses approximately 95 percent liquefied natural gas, and 5 percent diesel as the pilot ignition, thus requiring the use of selective catalytic reduction (SCR) technology and a diesel particulate filter (DPF). For the T800, the HD engine is available in power ratings from 400 to 475 hp and torque ratings from 1,450 to 1,750 lb-ft, and uses high-pressure direct injection technology to achieve that horsepower and torque. Natural gas is also a cleaner burning fuel, which provides an environmental benefit through lower greenhouse gas emissions. Since it can be produced domestically, natural gas also has the potential to significantly reduce dependence on foreign oil.
The Paccar MX engine which is a heavy duty Class 8, will last 1 million miles, has 380-485 horsepower, with 1,450-1,750 lb-ft of torque and has a displacement of 12.9 liters. PACCAR engines will achieve near-zero emissions of NOx, a greenhouse gas. Two emissions technologies are available, Selective Catalytic Reduction (SCR) and in-cylinder, Exhaust Gas Recirculation (EGR). PACCAR has carefully evaluated each technology and concluded that SCR will provide the most fuel efficient and cost-effective solution and smog causing compound.

SCR is very simple. There are four major components to the SCR system: a Diesel Exhaust Fluid (DEF) tank, a DEF doser, the SCR catalyst, and an ammonia (NH3) catalyst. These components are all integrated into the exhaust system. Small amounts of DEF are injected into the catalyst where it is mixed and reacts with the NOx found in the exhaust to produce nitrogen gas and water vapor, both of which are harmlessly released into the atmosphere through the vehicle’s tailpipe. SCR improves engine fuel economy and increases engine reliability.

Company Contact Info:
Kenworth Truck Company
10630 NE 38th Place
Kirkland, Washington
USA 98033
www.kenworth.com
425-828-5000
Technology: Fuel Combustion Efficiency Engine Retrofit

Technology Name: Vehicle Additive Technology Solution System (VATSS)

Company Name: Miracle Mile Solutions

Technology Description: VATSS can be retrofitted on current 1985-2006 on-road diesel fuel engine trucks, buses and all year models of off-road vehicles and equipment and costs about $15,000. The advanced technology system creates an on-demand and on-board (no fuel storage or refueling) cleaner burning hydrogen-oxygen gas that dramatically increases the combustion efficiency of the diesel engine, increases miles-per-gallon 15%-20%, decreases fuel costs, reduces fuel consumption without altering OEM specifications, lowers life cycle maintenance costs and significantly reduces toxic emissions that are produced. The VATSS has been successfully tested, is currently being test driven under various industry conditions and undergoing CARB certification.

Company Contact Info: Miracle Mile Solutions
6260 Laurel Canyon Blvd., Ste. 202
North Hollywood, California
USA 91606
818-836-9452
Technology: Solar Powered Cargo Ship

Technology Name: Solar-Power-Assisted Car Cargo Ship Carrier

Company Name: Nippon Yusen Kaisha (NYK)

Technology Description: The world’s first cargo ship to be partially propelled by solar power. The 656-foot, 60,000-ton car carrier will initially transport vehicles being sent for sale overseas by Japan’s top automaker, Toyota Motor Corp, and harness the energy of the sun in order to reduce fuel costs and cut carbon emissions. The vessel, developed by Nippon Yusen K. and Nippon Oil Corp., is capable of generating 10% of the energy used while the ship is docked with its 328 solar panels on the top deck. Nippon Yusen has set a goal of halving its fuel consumption and carbon dioxide emissions by 2010. The panels themselves are not attached to the ship directly, but are rather installed on the ship’s car-carrier, which is capable of carrying 6,400 automobiles, and then connected to the onboard 440 volt electrical network.
Technology: Zero Emissions Drayage Truck

Technology Name: Hydrogen Gas Fuel Cell Electric Drive Power

Company Name: Vision Motor Corp. (VMC)

Technology Description:
Vision Motor Corp designs and manufactures advanced zero emission, hydrogen gas fuel cell hybrid electric drive, Class VIII heavy-duty commercial drayage trucks. Vision Motor Corp has built the Tyrano a Class VIII 80,000lb Drayage Truck and ZETT (Zero Emission Terminal Tractor) a Class VIII 130,000 lb Terminal Tractor (yard dog) for off-road port terminal, rail yard and intermodal facility operations.

Life Cycle Cost Savings: Vision’s heavy-duty trucks will be substantially less expensive to operate on a per mile basis than diesel or natural gas powered trucks. Cost per mile and monthly operating cost are the key drivers and the savings are projected to be 30-40% per mile. Performance: Vision’s hydrogen gas fuel cell electric drive system has approximately 400 HP and 3,200 ft./lb. of available torque - almost double the pulling power of a conventional diesel truck. In addition, Vision maintains a strong competitive advantage over companies such as Balqon and Smith Electric who market battery-only heavy-duty trucks that offer top speeds of only 45 miles per hour compared with Vision’s top speed of 65 miles per hour (electronically limited). A battery truck has a limited driving range of 90 miles before interrupting service, requiring recharging of up to four hours. Vision’s Tyrano truck has an estimated travel range of 200-400 miles.
miles between 10 minute refueling stops allowing eight hours of uninterrupted operations which is comparable to a diesel truck. On board storage of up to 40kg of gaseous hydrogen.

Vision Motor Corp trucks have a longer engine life, have no transmission, lower maintenance costs, have zero noise pollution and are foreign oil dependence free.

**Company Contact Info:**
Vision Motor Corp  
120 Eucalyptus Drive  
El Segundo, California  
USA 90245  
310-454-5658  
www.motorcorp.com
**Technology:** Energy Recycling

**Technology Name:** Mobile Crane Energy Recycling

**Company Name:** Vycon Energy

**Technology Description:** Mobile cranes get their power from an on-board diesel generator set, which provides the required voltage and frequency to variable-speed AC motors by way of an inverter. During lift cycles, peak power is drawn from the generator. During lowering and braking, all regenerated power is sent to a resistor bank where it’s dissipated.

Vycon has developed highly efficient flywheel systems which provide consistent, dependable energy for a variety of applications such as diesel fuel mobile cranes. Vycon’s flywheel-based energy storage system holds kinetic energy in a spinning mass and converts this energy to electrical power through the use of a high speed electric motor/generator. Vycon’s technology reduces significantly the amount of diesel fuel used to power a mobile crane generator and also reduces diesel emissions.

1. **Flywheel** – Heart of the system providing a 20-year life with no maintenance.
2. **Master Controller** – Monitors output demand and controls the various subsystems including charging (monitoring) and discharging (generating) of the flywheel.
3. Magnetic Bearing Controller – Controls the position of the flywheel rotor via a 5-axis active magnetic bearing system.
4. Bi-Directional – Power Converter – Interface between the DC bus and the variable frequency, variable voltage AC generated by the flywheel.
5. Vacuum Pump – Evacuates air within the flywheel to reduce windage losses resulting in increased electrical efficiency.

Company Contact Info: Vycon Energy
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USA 92887
www.vyconenergy.com
714-386-3800