



Clean Air Unplugged

If you build it, industry will come. That's the warm welcome ocean carriers and terminal operators are giving new clean air technology in operation at the Port of Los Angeles. The innovative diesel exhaust treatment system was recently approved as an alternative to shore power for container ships subject to California's at-berth pollution control regulations.

The technology is a first-generation application of the Maritime Exhaust Treatment System (METS-1) built by Clean Air Engineering-Maritime (CAEM) based in San Pedro, Calif. The system was developed and tested at the Port of Los Angeles, where the world's first container ship equipped to run on shore power – also known as Alternative Maritime Power (AMP) – plugged in for the first time more than a decade ago.

"We're really pleased this technology has been approved," said T.L. Garrett, Vice President of the Pacific Merchant Shipping Association, which represents the majority of shipping lines and terminal operators doing business on the West Coast. "We want to know how quickly more systems of this kind can be built and deployed."

The METS-1 Alternative

In June, METS-1 became the first technology approved by the California Air Resources Board (CARB) as an alternative to plugging into shore-based electricity for complying with requirements to reduce emissions from ships calling at the state's major ports. Currently, there is only one METS-1 unit. It operates primarily at LA's TraPac Container Terminal where it was successfully demonstrated over a two-year period. CAEM is proceeding with plans to build more units.

Under the statewide regulation that took effect Jan. 1, 2014, at least 50 percent of a vessel operator's fleet of container, reefer and cruise ships calling at six major California ports must plug into shore power at berth. Additionally, fleets must reduce their at-berth emissions by 50 percent. The compliance rates increase over time to 80 percent in 2020.

The regulation has teeth: It allows the state to seek penalties of up to \$10,000 per day for each violation. To date, no fines have been levied. CARB has focused on compliance.

While the regulatory agency views shore power as the gold standard for cutting at-berth vessel emissions, it is important to have options, said Cynthia Marvin, Chief of CARB's Transportation and Toxics Division. "There can be technical and operational challenges to plugging into shore power for some ships," said Marvin, adding the agency is pleased alternatives are now available.

Unlike shore power, METS-1 is a mobile system mounted on a barge. It has an emissions control unit that connects to the ship's auxiliary generator through the smokestack. Positioned alongside a ship, METS-1 uses a crane to lower a flexible duct to the exhaust outlet of the auxiliary generator needed to power the onboard systems. Once the capture device is securely connected, the emissions control system engages to vacuum the exhaust.

METS-1 uses a catalytic ceramic filtration system to treat the exhaust. The system was developed by Tri-Mer Corp. Based in Owosso, Mich., Tri-Mer is the world's largest supplier of catalytic ceramic filter systems, which are used in many different industries.

The METS-1 unit runs on a diesel generator. While controlling and cleaning vessel emissions, it also captures and treats its own exhaust. "That feature is crucial," Garrett said. "Solutions by definition can't add to the problem."

Making Clean Air Gains

CARB approved METS-1 for use on container ships after tests showed the system successfully captured and treated more than 90 percent of diesel particulate matter (PM) and nitrogen oxides (NOx) from ships at berth. The results exceed the state's minimum requirement for shore power alternatives to reduce PM and NOx emissions by 81 percent.

In recent weeks, CARB approved a second alternative technology for reducing at-berth emissions from container ships, the Advanced Maritime Emissions Control Systems (AMECS) by Carson-based Advanced Cleanup Technologies Inc. (ACTI). Also a mobile barge-mounted system, AMECS is designed to capture vessel emissions from two auxiliary generators at the same time.

In 2008, the Port of Los Angeles contributed nearly \$150,000 to help fund early demonstration of AMECS through the San Pedro Bay ports' Technology Advancement Program. The system was reconfigured over time, and testing in San Pedro Bay over the last two years led to state approval of AMECS in mid October.

"We would not have been able to do that at any other port complex," said ACTI President Ruben Garcia. "The opportunity that exists at the LA/Long Beach ports, where we were able to demonstrate our technology at some of the nation's busiest and most modern terminals, makes the difference in creating technology that works."

Implementation of the at-berth regulation builds on dramatic clean air gains the San Pedro Bay ports have made under the 2006 Clean Air Action Plan (CAAP), with the first full year contributing to record clean air gains reflected in the Port of Los Angeles 2014 Inventory of Air Emissions. Ships remain the primary source of PM, NOx and sulfur oxides (SOx) from port-related operations, according to the latest results of air pollution reduction programs for the nation's busiest container port complex.

Meeting the shore power requirements during the initial year was not without challenges. Some of the largest vessels in the fleet experienced technical difficulties plugging in when their equipment did not line up with shore-based outlets. Other ships faced operational challenges berthing vessels on the side equipped to plug while navigating busy commercial seaports. Making the shore power connection within the state's mandatory three-hour window has involved new procedures that require more practice.

Statewide results have yet to be released, but CARB expects they will show important progress. "The vast majority of operators have made intensive efforts to comply," Marvin said.

Today, roughly half the ships subject to the regulation are built or retrofitted to plug into shore power. With more than \$180 million invested in shore power infrastructure at 24 berths, the Port of Los Angeles has the most shore power berths of any port in the world. Still, alternatives to plugging in are expected to play an increasingly important role in meeting future targets, including the Port's own aggressive pollution reduction goals.

From design to approval, the first METS-1 unit was an \$11 million investment. CAEM paid for the lion's share with \$8 million, the Port supported the project with \$1.5 million from its Technology Advancement Program, and TraPac contributed \$1 million. Subsequent units will cost less, reflecting METS-1's transition from prototype to market-ready technology.

"We expect to add three barges in the next six months, and we're in serious discussions with several shipping lines about producing more," said CAEM Principal Nick Tonsich. "We're also developing other versions of this technology."

Additionally, METS-1 captures boiler emissions, which shore power does not. The system also has an add-on module that captures SOx emissions, Tonsich said.

The importance of alternatives to shore power cannot be overstated, Garrett said. It is a giant step toward advancing a larger menu of commercially viable clean air solutions for the global maritime industry, he added.

"These systems expand the universe of vessels that can be treated beyond those subject to regulation. As mobile solutions, they also can be deployed at ports around the globe."