



**2019 AAPA Environmental Improvement Awards:  
Mitigation of Greenhouse Gas Emissions and Several Criteria Pollutants while Increasing  
Operations at Tenth Avenue Marine Terminal**

**Summary of Mitigation Program**

Enhancing the economic competitiveness of a marine-terminal facility, while minimizing environmental impacts to neighboring communities, is a challenge for ports throughout the country. Ports are under increasing pressure to upgrade aging infrastructure, decrease intra-terminal transfer times, and improve operational efficiencies to stay globally competitive while championing the environment. At the same time, ports are often located in highly urbanized areas with residential and commercial interests that are sensitive to increased terminal activity or possible environmental impacts to the community. The Port of San Diego's (Port) Tenth Avenue Marine Terminal (TAMT) is an example of this circumstance.

**The TAMT Final EIR includes a series of mitigation measures that address a variety of environmental resource areas but perhaps most ambitiously, target the reduction of greenhouse gas (GHG) emissions and several criteria pollutants.** The Final Environmental Impact Report for the Tenth Avenue Marine Terminal Redevelopment Plan (TAMT Final EIR) has provided the foundation to mitigate environmental impacts, resulting in 9 pieces of electric cargo handling equipment, implementation of a vessel speed reduction program, funding for an advanced maritime emission control system or bonnet to capture and treat emissions while hoteling, and installation of a renewable energy microgrid in an effort to reduce emissions and improve air quality. These mitigation measures will reduce GHG emissions and improve air quality in the local communities.

**Goals and Objectives**

The Port is committed to upgrading the TAMT facility to provide a clean, green, and modern terminal that attracts new businesses, increases cargo throughput, and reduces environmental impacts, particularly the reduction of emissions to improve local air quality. The

TAMT Final EIR identifies environmental performance measures that seek to reduce environmental impacts associated with increased cargo growth to the maximum extent practicable and, where possible, improve environmental conditions above existing baseline levels. The TAMT Final EIR seeks to phase-in environmental projects and programs commensurate with terminal needs and market opportunities to 2035.

## **Background**

TAMT is a 96-acre facility located along the northeast shoreline of San Diego Bay, south



of downtown San Diego and east of the Barrio Logan neighborhood. In May 2013, the Port hired consulting firm Vickerman & Associates to assess and forecast market conditions, and to identify physical improvements and new market opportunities for TAMT to create a long-term redevelopment plan.

In January 2015, the Port began working with environmental consulting firm ICF to evaluate the environmental impacts associated with the long-term redevelopment plan and determined that the rise in annual cargo throughput at TAMT would significantly increase emissions due to the expanded inventory of vessel, truck, and CHE activity required to transport the additional throughput. Based on the environmental review process, the Port identified performance standards (or significant thresholds) for air quality and GHG emissions (in addition to other resource areas), and short- and long-term mitigation measures that would meet those performance standards, thereby reducing environmental impacts of the redevelopment plan. The Port conducted extensive outreach with state and local agencies, environmental advocacy groups, the Barrio Logan Community Planning Group, and other local area residents. As part of



these outreach efforts, the Port prepared an EIR that included stringent environmental mitigation measures, projects, and long-term performance standards.

On December 13, 2016, the Board of Port Commissioner’s certified the TAMT Final EIR and adopted the redevelopment plan’s Sustainable Terminal Capacity (STC) Alternative. TAMT handled approximately 1 million metric tons (MT) of cargo throughput in fiscal year 2014, whereas the STC Alternative contemplates approximately 4.6 million MT of cargo throughput by 2035.

<b>Table 1: TAMT Cargo Throughput Comparisons in Metric Tons</b>		
<b>Node</b>	<b>Existing Conditions – July 2013 to June 2014</b>	<b>Redevelopment Plan Sustainable Terminal Capacity (STC) Alternative</b>
Dry Bulk	289,864	1,987,500
Refrigerated Containers	637,931	1,716,000
Multi-purpose General Cargo	85,131	733,050
Liquid Bulk <sup>1</sup>	31,520	239,017
<b>Total</b>	<b>1,044,446</b>	<b>4,675,567</b>
<i>Source: Data taken from TAMT Final EIR – Part 1 (December 2016)</i>		
<i>Notes:</i>		
<sup>1</sup> No improvements or capacity enhancements were identified to the liquid bulk node.		

Since the certification of the EIR, the Port has worked hard to implement the mitigation measures identified in the TAMT Final EIR to reduce the terminal’s environmental impacts and help meet the performance standards identified for year 2035. **This application focuses on the implementation of four mitigation measures** currently underway that were ratified in the TAMT Final EIR to reduce GHG emissions and criteria pollutants. A brief summary of each measure is provided below. The contribution towards attaining the long-term 2035 performance standards is identified in the Objectives and Methodology section.

**1. Replace diesel-burning cargo handling equipment with electric equivalents**

The objective of this mitigation measure is to reduce diesel particulate matter (DPM) by replacing old in-operation diesel CHE used at TAMT with new electric CHE. The measure is divided into three phases: the first phase requires three unspecified diesel CHE to be replaced

by electric CHE prior to 2020; the second phase requires 20 diesel yard trucks to be replaced by 20 electric yard trucks by 2025; and finally, the third phase requires three diesel reach stackers



and 10 diesel forklifts to be replaced by their electric equivalents by 2030. The Port is ahead of schedule in implementing this measure: **by the end of 2019 the Port anticipates 9 pieces of electric CHE will be in operation at TAMT** (four yard trucks, four drayage trucks, and one reach

stacker). This equipment was acquired from the \$5 million grant awarded to the Port Tenants Association from the California Energy Commission in 2017. Port staff is actively working with TAMT tenants to obtain grant funds to assist procuring the remaining CHE.

## ***2. Implement Vessel Speed Reduction Program at TAMT***

The objective of this mitigation measure is to target emissions associated with vessels while in transit because when speeds are reduced, less power is required to propel the vessels, and in turn, lowers emissions. The Port has had a voluntary Vessel Speed Reduction (VSR) Program since 2013 that recommends cruise vessels reduce their speeds to 15 knots and cargo vessels reduce their speeds to 12 knots within 20 nautical miles of Point Loma (the mouth of San Diego Bay). This mitigation measure makes the Program mandatory for all vessels calling to TAMT and identifies a compliance standard of 80%. Following certification of the TAMT Final EIR, compliance with VSR for cargo ships was 94% in 2017 and 88% in 2018 within the VSR zone; the data shows ships are on track to have similar compliance rates in 2019.<sup>1</sup>

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<sup>1</sup> These compliance percentages are calculated based on the average speed of all cargo ships within 20 nautical miles of Point Loma; this includes ships that berth at the Port's two marine terminals (TAMT and National City Marine Terminal).

**3. *Implement an Advanced Maritime Emissions Control System (AMECS, or Bonnet) to reduce vessel emissions while hoteling***

This mitigation measure will employ a barge-based Advanced Marine Emissions Control System (AMECS or Bonnet) project to capture and control vessel hoteling emissions while at berth. The AMECS will serve non-container vessels calling at TAMT, since all container ships that call at TAMT already utilize shore power. These vessel types typically operate on an inducement basis, are not likely to be shore power equipped, and are currently not required to achieve any emission reductions under California's At-berth (Shore Power) Regulation.

Capturing emissions from these vessels will dramatically reduce the negative health effects to nearby residents and allow TAMT to handle

additional cargo while minimizing air quality impacts to surrounding areas. The Board of Port Commissioners accepted a \$5 million grant from the California Transportation Commission to partially fund the AMECS; the Port anticipates

having a service agreement in place by early 2020.



**4. *Construct a renewable energy microgrid at TAMT, which includes a solar photovoltaic power system, battery storage, and energy controller technology***

This mitigation measure will bring renewable, reliable, and resilient power to TAMT, which is needed to meet both the operational and sustainability goals of the Port: the microgrid will support the increased electrification of operations while reducing GHG emissions. The renewable microgrid includes the installation of a 700 kW of solar PV renewable energy system, 280,000 kWh in energy efficiency through site lighting upgrades, a 700-kW energy battery storage system, and a microgrid controller that will increase the Port's energy security and resiliency at TAMT. The renewable microgrid not only provides cost savings through demand

response and peak shaving of the Port's energy loads, it also increases the Port's resiliency by



providing back-up power to security infrastructure, site lighting, and the existing jet fuel storage system, which services the San Diego International Airport. In addition, this includes a

Knowledge Transfer program intended to ensure that lessons learned throughout the implementation of the project can benefit other ports and create repeatable applications for microgrids and energy storage projects. In 2018, the Board of Port Commissioners accepted a \$5 million grant from the California Energy Commission; construction is currently underway and the microgrid is scheduled to be operational in Summer 2020. The sustained emission reduction from the microgrid is 361 CO<sub>2</sub>e annually.

**Objectives and Methodology**

The TAMT Final EIR identified potentially significant environmental impacts associated with increasing cargo throughput from a baseline of approximately 1 million MT in fiscal year 2014, to approximately 4.6 million MT of cargo throughput in year 2035. This included identifying the additional vessels, trucks, and CHE necessary to quadruple cargo throughput at the terminal, then forecasting the amount of emissions that would occur on a daily and annual basis.

Once the total amounts of emissions were known, the TAMT Final EIR identified a series of projects and programs that would be implemented as mitigation measures over the long-term to reduce criteria pollutants and GHG emissions associated with increased terminal activity.



The TAMT Final EIR establishes these reduction targets as performance standards that the Port will need to meet by the 2035 build-out year. Below is a high-level summary of the performance standards that are identified in the TAMT Final EIR for improving air quality and reducing GHG.

**Improve Air Quality**

Assuming 4.6 million MT of cargo throughput is handled at TAMT in 2035 and that all of the air quality mitigation measures are implemented<sup>2</sup>, the TAMT Final EIR effectively establishes performance standards for the following criteria pollutants:

<b>Table 2: Criteria Pollutants –Sustainable Terminal Capacity Alternative Compared to 2014 Baseline Conditions (lbs./day)</b>			
	<b>NOX</b>	<b>PM10</b>	<b>PM2.5</b>
FY 2014 Baseline Conditions	6,627	1,054	384
2035 STC Build-out Performance Standard	6,534	728	300
Difference	<b>-93</b>	<b>-326</b>	<b>-84</b>
<i>Source: Data taken from TAMT Final EIR – Part 1 (December 2016)</i>			

Table 2 above shows that the **maximum daily emission levels for NOX, PM10**

Table 2 above shows that **the maximum daily emission levels for NOX, PM10, and PM2.5 in year 2035 would be less than baseline levels, despite quadrupling cargo throughput.**

**Reduce Greenhouse Gas Emissions**

Furthermore, the additional activity at TAMT would generate approximately 64,679 additional MT of CO<sub>2</sub>e. However, by implementing the mitigation measures identified in the TAMT Final EIR, the total CO<sub>2</sub>e emissions at TAMT would be 27,779 MT of CO<sub>2</sub>e. This represents a 36,900 MT reduction in CO<sub>2</sub>e emissions, or rather, a **57% reduction in GHG emissions.**

While several of the air quality mitigation measures will help attain the overall reduction target, the TAMT Final EIR requires implementation of renewable energy projects and/or the

<sup>2</sup> Including electrification of cargo handling equipment, enhanced vessel speed reduction program, and the AMECS, but also implementing construction BMPs and diesel emission reduction measures, compliance with the Port’s Climate Action Plan, and installation of a dry bulk conveyor system.



purchase of GHG offsets from a California Air Resources Board approved registry throughout the life of the plan, to meet the renewable energy offset reduction targets identified below:

<b>Table 3: Greenhouse Gas Emission Reductions - Sustainable Terminal Capacity Alternative (annual)</b>		
	<b>MT CO<sub>2</sub>e</b>	<b>MW hours</b>
2035 Renewable Energy GHG Reduction Target at TAMT	18,206	86,172
<i>Source: Data taken from TAMT Final EIR – Part 1 (December 2016)</i>		

The installation of the Renewable Microgrid at TAMT is estimated to result in a reduction of 361 MT of CO<sub>2</sub>e annually, which would fulfill approximately 2% of the TAMT Final EIR’s requirement for the 2035 build-out year. However, if solar panels are installed on the remaining bays of Warehouse B in conjunction with the microgrid system, 1,785.48 MT of CO<sub>2</sub>e reduction could be attained, fulfilling approximately 10% of renewable energy requirement established in the TAMT Final EIR.

**Fulfilment of Awards Criteria**

***1. The level and nature of the benefits to environmental quality, beautification, or community involvement***

The TAMT Final EIR includes a robust mitigation program that mitigates air quality impacts to the local community as well as reduces global GHG emissions. Taken together, the four mitigation projects are estimated to result in 11.15 pounds of reduction in DPM, 452.16 pounds in NOx, and 883 MT of CO<sub>2</sub>e on an annual basis. In addition to establishing several long-term, site specific performance standards, it has enabled the Port to develop relationships and build trust with the Barrio Logan neighborhood and provide a foundation for tenants and terminal operators to pursue innovative equipment and technology that has a lower environmental impact and establish partnerships with other agencies.

***2. The level of independent involvement and effort by the Port***

The Port is the lead agency that voluntarily prepared the TAMT Redevelopment Plan, and the TAMT Final EIR ensures that TAMT will be a green, clean, and modern terminal facility that



mitigates impacts to the environment, particularly to air quality and GHG emissions. Several outside professional consultants were used to conduct technical analyses, assess the feasibility of various ideas and concepts, and to compile the TAMT Final EIR project document. The Port conducted all of the outreach to stakeholders and to nearby community residents. Based on these public engagement efforts, the Port utilized independent judgment to recommend the STC Alternative and the inclusion of several stringent mitigation measures to reduce air quality impacts. On December 13, 2016, the Board of Port Commissioner's voted unanimously to certify the TAMT Final EIR and adopt the STC Alternative, which was enthusiastically supported by community residents, stakeholders, tenants, and terminal operators alike.

### ***3. The creativity of the solution or programs***

Developing a mitigation program that emphasizes the promise of new, innovative technologies and programs to reduce emissions to that maritime business can grow is a creative solution. The highlighted mitigation measures are innovative solutions to reduce emissions that are not broadly adopted by ports nationwide; the electric CHE and the microgrid are both demonstration projects and the AMECS is a new clean air technology not yet certified for non-container vessels. The Port's VSR program is another strategy that has not been broadly adopted by ports nationwide. The Port is optimistic that these four mitigation measures will reduce emissions, demonstrate the effectiveness of public/private partnerships with implementing reduction technologies, and help achieve widespread market acceptance that can be replicated at other ports nationwide.

### ***4. Whether the project or program results are apparent***

Based on estimates calculated through the environmental review process, the below tables and bullet points identify the anticipated annual emission reductions that are either currently being realized or will be realized in the near future.

Electric CHE:

**Table 4. Total Annual Emission Reductions Achieved by the Electric CHE Upgrades**

Condition	Tons			Metric tons
	ROG	NOx	DPM	CO <sub>2</sub> e
<b>Emissions reduction from 9 pieces of CHE<sup>3</sup></b>	<b>0.21</b>	<b>5.76</b>	<b>0.15</b>	<b>507</b>

Source: ICF, Matt McFalls, April 22, 2019

VSR:

Based on the number of vessels calling to TAMT in 2016, the emission reductions associated with an 80% compliance rate is provided below. Although specific emission reductions were not estimated in 2017 and 2018, compliance with VSR exceeded the 80% target; VSR compliance for cargo ships was 94% in 2017 and 88% in 2018. These emission reduction tables provide an approximation of the emission reduction benefit achieved at TAMT thus far.

**Table 5. Total Emission Reductions with 80% VSR Compliance within 20-nm of Point Loma (Tons/Year)**

Vessel Type	NOx	DPM	ROG	CO <sub>2</sub> e
<b>Bulk Carrier</b>	0.4	0.0	0.0	15
<b>Container Ship</b>	15.0	0.4	1.1	643
<b>General Cargo</b>	2.3	0.1	0.2	92
<b>Total Reductions</b>	17.7	0.5	1.3	750

Source: ICF, Matt McFalls, October 12, 2018

AMECS:

Once implemented, preliminary research suggests that bulk carrier vessels and general cargo vessel's NOx emissions will be reduced by 77% and DPM will be reduced by 80%.

Assuming the Port has the same number of vessel calls in 2020 as in 2016, the AMECS will result in:

<sup>3</sup> This is a rough estimate and assumes the new electric CHE is operated at the same number of hours as the diesel CHE it replaced, which may or may not be the case.

**Table 7. AMECS – Estimated Pounds of Emissions Reduced Annually per Call**

Vessel Type	Number of Vessel Calls (2016)	Total Number of Calls	NOx	DPM
Bulk Carrier	9	58	446	11
General Cargo	49			

Source: Port of San Diego 2016 Maritime Air Emissions Inventory

Microgrid:

Similarly, when the microgrid is operational in 2020, it is estimated that TAMT will result in the following sustained emission reductions:

- **858,000 kWh Reduction** (Solar 700 kW/ 2,500 kWh)
- **280,000 kWh Reduction** (Energy Efficient Site Lighting Retrofits)
- **361 Metric Tons of CO<sub>2</sub>e Estimated Reduction<sup>4</sup>**

Source: Data taken from TAMT Final EIR – Part 1 (December 2016)

The long-term benefits of these mitigation measures will become more apparent over time to both workers and residents of the Barrio Logan community as the local air quality continues to improve as mitigation measures continue to be implemented at TAMT.

**5. The cost effectiveness of the activity or the program**

The TAMT Final EIR has substantially reduced the time and cost of obtaining project approvals by providing Port staff with the ability to “tier off” of the programmatic analysis. For example, the microgrid mitigation measure tiered off the TAMT Final EIR allowing for an expedited environmental review process. Additionally, the TAMT Final EIR has allowed the Port and its tenants to receive approximately \$15 million in grant awards to demonstrate technology that is not yet commercially available.

<sup>4</sup> CO<sub>2</sub>e reductions are calculated by estimating the number of kilowatt hours that would be reduced, based on the overall composition of the electrical grid that was identified in the TAMT Final EIR’s baseline analysis. Therefore, the 361 MTCO<sub>2</sub>e reduction assumed in this analysis is based on the SDG&E electrical grid composition that was in place during the Final EIR’s baseline, which averaged the 2013 renewable portfolio standard of 24% with the 2014 renewable portfolio standard of 32.2%. This yields an estimate of approximately 28.1% renewable resources, with a conversion rate of 699.5 pounds per megawatt hour. The Microgrid reductions are attributed to the use of 100% renewable energy and battery storage which provide a net annual energy reduction of approximately 858,000 kWh (272.23 MT CO<sub>2</sub>e) and reduction in energy consumption through lighting energy efficiency measures of approximately 280,000 kWh (88.84 tons of CO<sub>2</sub>e).



#### ***6. The transferability of the technology or idea to the port industry***

Developing an upfront, long-term mitigation program that reduces air quality and greenhouse gas emission impacts while expanding business, is transferable to any port anywhere in the country. Lessons learned throughout the implementation of the project can benefit other ports and create repeatable applications for emission reduction projects.

#### **Conclusion**

The TAMT Final EIR established broad strategies to mitigate emissions and creates a foundation to develop near- and long-term projects that reduce criteria pollutants and GHG emissions. This application emphasized four technologies that are being implemented at TAMT to mitigate emissions. The Port's objective is to be at the forefront of innovative measures, strategies, and projects that reduce criteria pollutants and GHG emissions. As the Port continues to implement these mitigation measures, it will continue to do so in a manner that promotes the maritime industry and business opportunities for the region. On June 18, 2019, the Board of Port Commissioners took further action to improve air quality in the region by adopting a resolution to improve air quality and reduce greenhouse gas; see the attached presentation for reference.