Cascade Energy®

Port Pilot Final Report

Port District Specialized Energy Efficiency Pilot

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1 Executive Summary

SDG&E released a Request for Offer on November 2, 2020 for the Port District Specialized Energy Efficiency Pilot ("Port Pilot" or "Pilot"). The purpose of the Pilot was to explore energy efficiency measures on temporary, portable, and leased ("TPL") equipment, primarily at the Port's shipbuilding sites. TPL equipment measures are typically not eligible for incentives in the State of California and the Pilot was to show the depth of opportunities available.

SDG&E contracted with an Implementer, Cascade Energy ("Cascade") and an Evaluator, IES. Cascade identified opportunities at participating sites, including opportunities with vendor equipment brought on site, generally for abrasive blasting. Cascade also worked with site participants on prioritizing and executing projects, and sent incentive checks once project savings were verified by IES.

Energy saving opportunities fell in two categories:

1. Specialized Measures ("SMs"). These are projects which could be implemented on site on existing TPL equipment whether owned by contractors or the Port Tenant participant. SMs could be in low-cost operations and maintenance measures or in capital projects. One large challenge to completing SMs in the Port Pilot was the long lead times for new equipment stemming from covid 19 caused supply chain issues. The Pilot was extended from it's original 1-year timeframe which would have ended July 31, 2022 to December 31, 2022 to accommodate those long lead times. A great deal more opportunity was found than could be completed in the timeframe of the Pilot.

2. Emerging Technology Demonstration Projects ("ETs"). ETs assessed performance and energy impacts of new energy efficiency technologies on TPL equipment. Assessments were on technologies that had not yet achieved sufficient market share to be considered self-sustaining or commercially viable. Five ETs were demonstrated during the Port Pilot. Both [redacted] and [redacted] participated in the demonstrations. Cascade planned and organized the demonstrations while IES performed the evaluation. Cascade also coordinated with the US Department of Energy on their Industrial Technology Validation Pilot. Data and results from all five ETs were sent to the ITV Pilot for consideration of further validation.

Three shipbuilding sites and two of their contractors participated in the Pilot at some level. [redacted] and [redacted] were very active along with one of their contractors, [redacted] who performed the hydroblasting ETs.

Overall savings opportunities identified in SMs were estimated at almost 22,000,000 kWh/year and 24,400 therms/yr. Realized savings in the Pilot were 1,746,337 kWh and 7,320 therm/yr, just short of the 2,000,000 kWh/yr and 12,000 therm/yr Pilot goals. Beyond available future SMs, there is further efficiency to be gained with implementation of ET technologies, especially the most efficient abrasive blasting nozzle demonstrated, manual hydroblasting, and robotic hydroblasting.

Cascade's recommendation is to create workpapers around the successful ET demonstrations, and work to have custom projects on TPL equipment eligible for incentives that would encourage their implementation. Another strategy would be to encourage sites throughout SDG&E territory with large amounts of TPL equipment to enroll in upcoming SEM programs, where savings from TPL equipment could be verified and claimed through that program.

This report contains further recommendations and describes extensive lessons learned over the course of the Pilot.

2 Participating Customers

2.1 Participants

The Pilot acquired four core participants (three signed enrollment agreements, one unsigned) over the course of the Pilot (Table 1).

Table 1 Port Pilot participation overview

Site	Location	Energy Champion	Participation	Total Savings	Total Incentives
[redacted]	[redacted]	[redacted]	Participated extensively. Held Treasure Hunt, hosted five ET Demonstrations, installed one SM.	180,154 kWh	$18,015.40
[redacted]	[redacted]	[redacted]	Held a Treasure Hunt and pursued one project, ultimately deciding not to install it because of poor payback.	0	$0
[redacted]	[redacted]	[redacted]	Participated extensively. Held Treasure Hunt and regular meetings with Cascade, hosted two ET Demonstrations and installed five SMs.	1,566,183 kWh 7,320 Therms	$315,469
[redacted]	[redacted]	[redacted]	Was very active in support of [redacted] ET Demonstrations, providing equipment and time to test the two hydroblasting technologies. Also wanted to replace air compressors with VFD compressors, but lead times were too long for the program.	0	$0

In addition to participants listed above, [redacted] a [redacted] and [redacted] contractor, participated in Treasure Hunts and considered some SMs.

2.2 Participant Satisfaction

Upon sending incentive checks to participants, Cascade sent participants a survey to gauge satisfaction with the Pilot. Participants were asked to rate the level to which they agreed with a series of statements on a scale from one to five, with five being the highest. There were four responses to the survey. Results are shown below.

Question	Average Score (out of 5)
I was satisfied working with the program implementer on this project.	4.75
The implementer understood my systems and made good recommendations.	4.25
The implementer helped get the project done quickly.	4.25
My incentive check arrived promptly.	3.50
The implementer was communicative throughout the project.	4.50
Overall, how satisfied were you with this project?	4.25

The survey then asked participants "For items rated 3 or lower, how can we do better?" Participants gave the following responses:

- The speed of incentive check delivery was not prompt but that was not an issue.
- I was happy with how the Pilot program supported [redacted] team and our operations. The improvement that comes to mind is to better communicate simple names for what stage of the Pilot each of our projects is in (data collection, savings calculations, implementation), remind us of what the deadline is (maybe set deadlines throughout the year for each stage), and give us specific items needed from [redacted] in order to meet the deadlines. We were slow on some tasks (such as data required for the cutting torch savings estimate and incentive offer) because we didn't fully grasp the tight schedule or for what the information was needed. Near the end of the program I went back to the presentations to remind myself of the project progression but the team could have benefited from periodic reviews throughout the year.

The appendix shows full survey results by respondent.

3 Implementation Process

3.1 IES Collaboration

Cascade and IES worked together extensively during the Pilot. Cascade shared files on SharePoint including post-Treasure Hunt lists of potential projects. These project lists, along with expected ET Demonstrations formed the basis for IES' M&V Plan. Once that M&V Plan was approved by SDG&E and the CPUC, Cascade and IES collaborated on savings estimates for projects and project implementation plans. As dictated by the M&V Plan, IES performed pre-M&V prior to installation of projects and post-M&V after. They analyzed savings and gave input to Cascade in developing final incentives. IES also provided ET M&V and in one case, determined the M&V pathway for one ET measure that became an incentivized SM. Cascade and IES mutually reviewed reports and gave each other feedback.

3.2 Recruitment

Cascade received assistance from the Port Tenants Association and the SDG&E Account Executive (AE) in recruiting.

Specific elements of Cascade's customer recruitment strategy included:

- A focus on shipyards as the primary users of TPL equipment at the Port
- A focus on major contractors at Port shipyards who supply blasting, compressed air, ventilation fans, welding, and other services
- Direct outreach to Port Tenants
- Information shared through the Port Tenants Association
- Presentation to the Shipbuilders' Association
- Identification of customers and technologies for the ET Demonstration Projects
- Use of PipeDrive CRM for recruitment tracking

3.3 Specialized Measures (SMs)

A key component of the Pilot was the identification of SMs. For each site, Cascade held targeted Treasure Hunts, and identified additional measures. Five SMs were completed.

Cascade helped participants decide which measures to implement by estimating savings, judging ease of implementation, and ability to be completed in the short timeline of the Pilot. Participating sites indicated which measures they wanted to pursue, and IES gathered data on those measures (11 total) to establish appropriate baselines and refine savings estimates.

For each SM, the participants were supported by Cascade's technical energy coaches to help overcome barriers to project implementation. Once implemented, Cascade assisted IES with final savings determinations. Participants signed incentive offers and Cascade paid the incentives after SDG&E review.

3.4 Emerging Technologies

Five ET Demonstrations provided an opportunity to test new technologies at a small scale and gain understanding of the cost/benefit analysis. Four of the five Demonstrations provided clear savings opportunities. The successful Demonstrations were:

- Venturi blast nozzles
- Oxy-fuel cutting torches
- Manual hydroblasting
- Robotic hydroblasting

3.5 Workshops

All workshops were held via Microsoft Teams. SDG&E, IES, and Participants were invited as Cascade led the group through Pilot updates, technical training, and savings opportunities.

- Workshop 1: Friday, October 22nd, 2021
- Workshop 2: Wednesday, March 16th, 2022
- Workshop 3: Monday, August 1st, 2022

3.6 Close-out

The Pilot was extended until December 31, 2022. Completed projects were evaluated by IES, approved by SDG&E, had incentives paid and customer satisfaction surveys completed. This report completes the Port Pilot.

4 Specialized Measure Projects

4.1 Overview of Installed Measures

SMs focused on TPL equipment at the Port. Both [redacted] and [redacted] installed SMs. Five SMs were installed over the course of the Pilot (Table 2). Note that [redacted] installed four SMs and [redacted] installed one. [redacted] came into the Pilot with an established Energy Team from participating in SDG&E's SEM program for the previous three years. This seemed to help the site team to provide adequate resources and the right people throughout the Pilot.

SMs were prioritized with the participant teams by discussing the savings potential and ease of installation for each measure. Each SM was then rated on a scale of 0-3, with 3 being the most interested in pursuing. The SMs were then rated by Cascade based on savings potential. From this, a combined prioritization number was created. The top prioritized projects for each site were focused on and pursued.

[redacted] cutting torches were originally studied as an ET and resulted in creating a streamlined capital incentive per torch for [redacted] This created a spillover of ET activity into SM. The Port budget was adjusted to account for this. Furthermore, it is recommended that the welder measure be a future deemed measure.

Table 2 Overview of Completed Port Pilot Specialized Measures (SMs)

Site	Project Name	Project Type	Estimated Savings per unit (kWh/year) or (therms/year)	Total Qty Onsite	Qty Installed	Total Verified Savings (kWh/year)	Total Incentive ($)
[redacted]	Add scheduled timer to ventilation blowers to shut off between 2nd and 1st shifts	BRO	13,858 kWh	65	13	180,154	$ 18,015.40
[redacted]	Replace transformer rectifier welders with inverter type	Streamlined Capital	5,937 kWh	900	262	1,555,494	$ 314,400.00
[redacted]	Add controls to exterior stringer lighting	BRO	255 kWh	5,000	10	2547	$ 254.70
[redacted]	Replace Victor Cutting Torches with Harris Torches	Streamlined Capital	49 Therms	500	150	7,320 (therms)	$ 15,372.00
[redacted]	Add controls to Batman lights - Ways 4	BRO	626	500	13	8,142	$ 814.20
Totals						**1,746,337 kWh 7,320 therms**	**$ 348,856.30**

4.2 Overview of Measures Investigated but Not Installed

In addition to the five measures shown in the table above, another 19 measures were identified and investigated, but were installed during the Pilot for a variety of reasons. This included six projects on contractor equipment ([redacted] Table 3. The total remaining estimated savings of these projects is almost [redacted] kWh/year.

Table 3 Port Pilot Specialized Measures (SMs) investigated. Those with some installed are shaded gray.

Equipment Owner	Project Name	Estimated Savings per unit (kWh/yr or Therms/yr)	Total Qty Onsite	Qty Installed	Remaining Savings Available
[redacted]	Add scheduled timer to ventilation blowers to shut off between 2nd and 1st shifts	13,858	65	13	720,616
[redacted]	Replace transformer rectifier welders with inverter type	5,937	900	262	3,787,806
	Add controls to exterior stringer lighting	327	5,000	10	1,631,730
	Replace Victor Cutting Torches with Harris Torches	49 therms	500	150	17,080 therms
	Add controls to Batman lights - Ways 4	907	500	13	729,300
[redacted]	Upgrade dust collector pulsing from timed to differential pressure control	4,837	8		38,696
	Install temperature control on cooling tower fans	1,469	8		11,752
	[redacted] Purchase new VFD air compressor	36,000	2		72,000
	[redacted] Stage air compressors	0	3		0
	[redacted] Investigate if compressed air discharge pressures can be reduced	7,311	1		7,311
	Purchase and utilize track welders instead of manual welding	0	20		
	Replace 4' T8 stringer fixtures with LED lamps (2 lamps per fixture)	?	2,000		
	Replace air powered diaphragm pumps with electric pumps	4,809	50		240,429
	Retrofit 6-lamp T5 HO Pole lights w/LEDs	6,307	120		756,864

Continued

Table 3 (continued)

Equipment Owner	Project Name	Estimated Savings per unit (kWh/yr or Therms/yr)	Total Qty Onsite	Qty Installed	Remaining Savings Available
[redacted]	Add scheduled timers to ventilation blowers to shut off between 2nd and 1st shifts	11,803	380		4,485,140
	Add return air ducting to temporary AC units - Berth 5	63,700	2		127,400
	Develop SOP for replacing blast nozzles and replace sooner	30,930	16		494,884
	[redacted] Develop SOP for replacing blast nozzles and replace sooner	11,883	20		237,661
	[redacted] Determine if humidity control can be utilized to cycle dehumidifiers	18,000	1		18,000
	[redacted] Upgrade dust collector pulsing from timed to differential pressure control	1,485	1		1,485
	BRS - replace comp air powered vacs with electric	12,139	4		48,555
	Test if VFDs can be added to ventilation blowers	18,423	380		7,000,679
	Optimize flushing rig pump speed and temperature to balance power	?	6		
	Upgrade flushing rig controls to monitor filter cleanliness to reduce pump runtime	7,552	5		37,759
Total					**19,727,451**

4.3 Lessons Learned

Savings Realization

Not all potential savings were realized during the Pilot. This was partly by program design. The Pilot goal was to identify opportunity and leave some of the savings to be accomplished and claimed in future programs. Other reasons for unrealized savings include:

- The M&V approach of pre- and post- data logging for the capital and BRO projects was very challenging for TPL equipment due to equipment moving and changing operation frequently. The streamlined capital approach (similar to approach for deemed measures) was therefore more effective for TPL equipment because it didn't require pre- and post-datalogging.
- TPL equipment upgrades raised safety concerns at times and were therefore not implemented. For example, on participant refrained from installing timers on ventilation blowers for fear the timers could be enacted in spaces that require 24/7 ventilation.
- TPL equipment can be moved and serve different purposes which changes savings potential. This causes issues with extended M&V plans. Post-install M&V conditions may differ from pre-install M&V conditions and could skew savings or make data logging challenging or impossible. For example, in a two-week span, an air compressor system configuration for blasting operations on one ship was changed three times. Therefore, measure persistence for TPL equipment is a challenge. With the amount the equipment is moved, adjusted, and replaced, it will be hard to ensure that energy efficient upgrades or operations are maintained.
- Staging TPL air compressors properly would be a complex challenge since the air compressors frequently move and operate differently depending on the work scope at that time. The controls would need to be mobile, robust, and easy to install.
- Some projects would have been more feasible in an SEM program with top-down measurement and verification.
    - Reduce compressed air discharge pressure
    - Optimize flushing rig pump speed and temperature to balance power

Subcontractor Specialized Measures

No subcontractors implemented in the Pilot. Some thoughts on why this was:

- The equipment subcontractors could upgrade had long lead times which did not fit within the one-year pilot. For example, one of the subcontractors wanted to purchase several variable frequency drive air compressors but the lead time was 42-52 weeks after order.
- Subcontractors had limited availability to support the investigation of energy efficiency measures. For example, [redacted] was initially engaged and completed a Treasure Hunt with our

team, then they got too busy and did not want to proceed. By the time they showed interest again, they no longer had eligible TPL equipment onsite.

- Some subcontractors showed a lack of interest in the program.

Measure-Specific Challenges

Various SMs had specific challenges. These individual challenges were:

- A contractor custom made a compressed air manifold on site. The manifold used sharp bends and directed pairs of lines to collide head-on in the manifold which can create a large pressure drop. The contractor reported that they had improved the design for future, but we got no further information. Port Tenants will likely have to watch for inefficiencies like this and instruct contractors to improve them.

- [redacted] blower timers were difficult to install in the Pilot's timeframe because they had to remove blowers with cranes, add the timers, and crane them back in place.

- Staging TPL air compressors properly will be a complex challenge in the future since compressors frequently move and operate differently depending on the work scope at that time. The controls would need to be mobile, robust, and easy to install, and should be paired with contractor and site training. There are very large potential savings from staging compressors better.

5 Emerging Technology (ET) Demonstration Projects

5.1 Overview

ET Demonstrations assessed the performance and energy impacts of new energy efficiency technologies and systems that were promoted as having significant energy savings potential but had not yet achieved sufficient market share (for a variety of reasons) to be considered self-sustaining or commercially viable. The Demonstrations assessed performance of specific ETs as a first step towards potential inclusion in PDSEEP or other IOU incentive programs. Five ET Demonstrations were completed over the course of the Pilot. Four showed savings with potential for greater savings when fully implemented (see *Table 4*).

Table 4 Port Pilot Emerging Technology (ET) Demonstration overview

ET #	Description/Result	Incentive Received	Savings
1	Engineered grit, compared to incumbent grit for abrasive blasting. This material was suggested as an ET study by a blasting contractor at the Port. The Demonstration failed, as described below.	$0.00	N/A
2	Venturi nozzles, different lengths and structures compared. The hypothesis that a longer Venturi nozzle would yield better blast efficiency is a common assumption. Cascade had proposed this Demonstration from the beginning. The surprising result was that one of the shorter nozzles outperformed all others.	$0.00	There was a range of savings for the 4 nozzles tested: 1. Worse case 2. 17% savings 3. 17% savings 4. 35% savings
3	Natural gas injector cutting torch compared to equal pressure torch. One of the participating sites in the Pilot, [redacted] suggested this project. They suspected that the new torch type would be faster but hadn't been able to quantify the difference. This Demonstration was a success and became a SM within the Pilot.	$0.00	Natural gas was reduced by 31% on straight cuts and 16% overall. Oxygen usage was reduced by 37% during gouging and 11.5% overall.
4	Manual hydroblasting compared to manual abrasive blasting. One of [redacted] contractors, [redacted] was a great partner in this Demonstration. Manual hydroblasting was shown to out-perform manual abrasive blasting.	$0.00	Manual hydroblasting used 61% of the energy in 73% of the time of manual abrasive blasting.

ET #	Description/Result	Incentive Received	Savings
5	Robotic hydroblasting compared to manual abrasive blasting. [redacted] partnered in this Demonstration as well. Results showed that robotic hydroblasting was more energy efficient than either manual abrasive blasting or manual hydroblasting.	$0.00	Robotic hydroblasting used 25% of the energy in 33% of the time of manual abrasive blasting. Reductions in cleaning time are also an advantage.

5.2 Summary of Emerging Technology Assessments

Engineered Abrasive for Industrial Paint Removal

This Demonstration was designed to determine the energy savings potential of a specific engineered abrasive compared to the incumbent abrasive, natural garnet, at [redacted] at the [redacted]

In the end, the abrasive size selected by the vendor did not compare favorably to the incumbent in three ways:

- Blasting time was longer with the ET abrasive than the incumbent.
- Compressed air usage was higher with the ET abrasive than the incumbent (partly as a result of the longer blasting time).
- The surface quality after blasting was smoother than with the incumbent, which site participants deemed to be less desirable than the incumbent.

After the test, the vendor hypothesized that a larger abrasive size for the Demonstration would have yielded more favorable results.

Potential benefits of the ET abrasive include reduced energy in dust collection, which wasn't measured in this assessment and is likely small.

Blasting Nozzles

This Demonstration was designed to determine the energy savings potential of longer Venturi blast nozzles compared to incumbent Venturi blast nozzles at [redacted] and [redacted] The unexpected result was that the [redacted] incumbent nozzle was the fastest of all.

Alternate nozzle designs have the potential to improve blasting productivity which in turn can reduce energy consumption. The ET Demonstration and analysis had these results:

- The incumbent nozzle used at [redacted] had the fastest cleaning rate of all nozzles tested. The nozzle was 35% faster than the incumbent nozzle used at [redacted]

- The [redacted] incumbent had a different nozzle geometry which employed a more gradual inlet taper to the throat. It is believed that this results in less resistance as the air and abrasive pass through the nozzle aiding its performance increase.
- The extra-long Venturi nozzle and the extra-extra-long Venturi nozzle had similar performance. Both proved to be 17% faster than the incumbent nozzle used at [redacted]
- Finish quality was identical with all nozzles.

For general blasting in an industrial setting, extra-long Venturi nozzles will provide increased performance over long Venturi nozzles, while enhanced nozzle design (like the [redacted] incumbent) can provide superior blasting performance and reduced energy costs.

Natural Gas Cutting Torch

This Demonstration was designed to determine the energy savings potential of an injector torch compared to the incumbent equal pressure torch at [redacted]

Injector torches operate at lower pressures which translate into lower natural gas flowrates. Since cutting times were comparable to the incumbent torch, energy savings were realized. The ET study had the following results:

- The ET torch reduced natural gas consumption by 31% on straight cuts and 16% overall.
- The ET torch reduced oxygen usage by 37% during gouging and 11.5% overall.
- The difference in speed of cutting between the two torch types was negligible.
- The cut quality was identical.
- The ET cutting torch is expected to be similar in durability and longevity to the incumbent torch.
- Potential exists for oxygen savings if oxygen were regulated on straight and bevel cuts.

For general cutting of plate steel using natural gas, an injector torch will provide similar performance with less fuel consumption than an equal pressure torch.

Manual Hydroblasting

Traditional abrasive blasting is typically used in shipyards and is a primary user of compressed air, a large driver of Port Tenant electricity consumption. Alternatives to traditional abrasive blasting have the potential to increase productivity and reduce energy consumption. Manual hydroblasting is one such alternative that is currently underutilized at Port of San Diego facilities. This assessment compared the performance of traditional abrasive blasting to manual hydroblasting. This Demonstration was conducted at [redacted]

The manual hydroblasting ET had the following results:

- Manual hydroblasting proved to blast 27% faster and used 39% less energy than traditional abrasive blasting.
- Manual hydroblasting achieved a surface profile well within the required specifications.

For general blasting in an industrial setting, manual hydroblasting will save energy and increase production.

Robotic Hydroblasting

This assessment compared the performance of traditional abrasive blasting to robotic hydroblasting. This Demonstration was conducted at [redacted]

The robotic hydroblasting ET had the following results:

- Robotic hydroblasting required 25% the time and 33% of the energy of traditional abrasive blasting.
- Robotic hydroblasting achieved a surface profile well within the required specifications.
- Robotic hydroblasting is relatively clean compared to traditional abrasive blasting which allows other trades to work near the blast area while hydroblasting is in progress.
- Robotic hydroblasting cleans the work surface as it traverses, saving labor costs relating to post blast clean-up.

For general blasting in an industrial setting, robotic hydroblasting will save energy, increase production, and make clean-up easier.

5.3 Lessons Learned

Participating sites were excited about new technologies and generally enthusiastic about providing the opportunity for testing and verification. The data Cascade was able to provide through ET Demonstrations was very well received. Other lessons learned include:

- Video recording was required for verification of some ETs. This was a challenge for both sites participating in the ETs because of information security policies. In the future, this should be outlined in advance.
- The nozzles were tested at two different sites, with different operators who had different blasting technique. When the potential result was a surprise (one incumbent appeared to be much more efficient than the other) Cascade needed to re-run the test for a head-to-head comparison of the two incumbents. If Cascade had foreseen the possible result, all four nozzles could have been tested at both sites and saved the participant some time and effort.

- Involving vendors in the ET test design and initial planning sessions proved to be very beneficial. The vendors brought a depth of knowledge to the planning process that we otherwise would have missed out on. For example, when exploring an engineered abrasive, the vendor had hands on experience and knowledge of different types of blasting equipment and what we needed to be concerned about with each system. In addition, the vendor had performed tests similar to what we were proposing and offered good input based on his experience.
- At least two of the completed ETs, torches and nozzles, are good candidates for deemed measures in the future. While the two types of hydroblasting studies provided good results, the processes are better suited to the custom process or SEM top-down M&V.

6 Lessons Learned for Future Implementation

There is immense potential for TPL energy savings at Port Tenant (and especially shipbuilding) sites in SDG&E territory. The Pilot only scratched the surface of that potential. Limited savings harvesting in the Pilot was partly by design, with a goal to determine potential for implementation in future programs such as SMART Industrials. Savings were also diminished by the nature of TPL installations, timing with Port Tenant contractors, and long equipment lead times resulting from the pandemic. A longer horizon for project completions, such as with SMART Industrials' 4-year design, will give adequate time for project completion.

Overall Lessons

- Some equipment had long lead times that were not feasible with the short program timeline (VFD air compressor 42-52 week lead time)
- Some Port contractors were more willing to participate in the program than others. Neither of the major shipbuilders currently have energy efficiency as a requirement for their contractors.
- There is variability in savings depending on installation of non-permanent equipment. This proves difficult to measure over the long term. It is possible that a top-down M&V approach will yield the clearest results, though it's likely that shipbuilders are poorly suited to top-down models (due to ever-changing work on vessels that can be in the yard for two years).
- The leased air compressors observed on participant sites were not energy efficient. It could be cost-effective for sites to increase capacity of Port Tenant permanent systems and provide connections for contractors on site. This approach should be examined for shipbuilders and considered along with efficiency upgrades to their existing systems, including VFDs and air leak maintenance, and reducing pressure to local requirements.
- Contractor schedules were a challenge with the short duration of the Pilot. For example, Cascade identified hydroblasting as a possible ET early in the program and had a contractor,

[redacted] who agreed to perform the test. The challenge was that they weren't performing work at the Port until the last days of the program period.

- Site access was sometimes a challenge for Cascade/IES; policies and application procedures were different between the two sites.
- A one-year program timeline to implement projects at these types of facilities was extremely challenging and resulted in the timeline requiring four months of extension to close out all projects. As noted by one of the participant team members, the short timeline and generous incentives did seem to spur action to happen faster than it may have with a longer potential timeline.
- [redacted] and [redacted] were excellent participants. [redacted] reports that the ETs have gotten employees really excited. The thorough M&V by IES was also valued highly, and led to more eagerness to complete projects.

7 Conclusion

7.1 Recommendations

- Cascade recommends that Port Tenants write efficiency into all future contracts for energy-consuming activities with contractors; this will give Port Tenants more input on methods used by the contractors. Energy efficiency performance by contractors could be rated by sites, with the ability to use these ratings as criteria for contractor selection.

- The State should develop a way to incentivize sites to reduce energy use in TPL applications. The Pilot has shown huge savings potential. Hydroblasting, for example, has huge potential for energy reductions compared to manual blasting, and Port Tenants (and potentially inland sites) should really be making this switch.

- Port Tenants should be encouraged to join upcoming SEM programs. Many O&M adjustments to TPL equipment can be claimed and incentivized through SEM.

- One SM (welder replacement) and two ETs (cutting torches and blast nozzles) should be moved forward to the workpaper stage for consideration as deemed measures. The DOE's Industrial Technology Validation (ITV) pilot analysis should provide some additional support for the two ETs.

8 Appendix

8.1 Full Participant Survey Results

Participant	Company	I was satisfied working with Cascade on this project.	Cascade understood my systems and made good recommend-dations.	Cascade helped get the project done quickly.	My incentive check arrived promptly.	Cascade was communi-cative throughout the project.	For items rated 3 or lower, how can Cascade do better?	Overall, how satisfied were you with this project?
[redacted]	[redacted]	5	5	5	4	5	-	5
[redacted]	[redacted]	4	2	3	2	4		3
Anony-mous		5	5	5	3	5	The speed of incentive check delivery was not prompts but that was not an issue.	5
Sierra [redacted]	[redacted]	5	5	4	5	4	I was happy with how the Pilot program supported [redacted] team and our operations. The improvement that comes to mind is to better communicate simple names for what stage of the Pilot each of our projects in in (data collection, savings calculations, implementation), remind us of what the deadline is (maybe set deadlines throughout the year for each state), and give us specific items needed from [redacted] in order to	4

							meet the deadlines. We were slow on some tasks (such as data required for the cutting torch savings estimate and incentive offer) because we didn't fully grasp the tight schedule or for what the information was needed. Near the end of the program I went back to the presentations to remind myself of the project progression but the team could have benefited from periodic reviews throughout the year.	