Streamlined Technical Analysis Study Assessment

Submitted to

Energy Trust of Oregon
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ENERGY • WATER • EFFICIENCY

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Executive Summary

Background

In third quarter of 2018, Energy Trust's Production Efficiency program introduced the streamlined Technical Analysis Study (TAS) process as an alternative to the standard TAS process for smaller, less complex industrial energy efficiency projects. Energy Trust hired SBW Consulting, Inc. to review the current streamlined TAS process and recommend program modifications including potentially increasing the current energy savings limits to allow larger projects to use the streamlined TAS process.

Methodology and Findings

This assessment examined the program dataset and project files, and interviewed program staff and implementation contractors, as follows:

- **Dataset Sample Review**. We reviewed the 26 streamlined TAS sites with verified energy savings as of October 2019 and sampled a representative subset of 10 projects for deeper review.
- **Program Staff and PDC Interviews**. We interviewed two Energy Trust Production Efficiency (PE) program staff members and four staff at the three custom program delivery contractors (PDCs). Both groups provided thoughtful insights on their experience with streamlined TAS, what is working well, and where improvements might be made. Energy Trust and PDC staff favorably viewed streamlined TAS, as well as the prospect of expanding it to a broader set of projects in the future.
- **Sample Project File Reviews**. We conducted engineering desk reviews of the 10 sampled projects. In all but three cases, the review results fully confirmed the program savings values. The effect of the three cases where we revised the analysis results was small: reviewed electric savings remained at 100% of the program estimate, and reviewed gas savings was slightly higher, at 113% of the program estimate. The three site calculation errors were all minor in nature and should not constitute a systemic concern for streamlined TAS. With few exceptions, the evaluability was good for all sample project analysis workbooks, savings verification reports, and related files.
- **Conduct Site Visits and Interviews**. Given the high standard of project evaluability, good project documentation, savings analyses and verification reports, our review team concluded that customer interviews or site visits were not necessary to adequately assess the sample projects. However, our reviewers contacted PDC staff to clarify certain aspects of the savings calculations for four projects.

Conclusions and Recommendations

Overall, the streamlined TAS process gets high marks from all stakeholders. Our review found that it is achieving its goal of simplifying efficiency project development, while producing rigorous, defensible estimates of energy savings. Based on this assessment, we find that Energy

Trust expansion of streamlined TAS is cost-efficient and helpful to participants and conclude that ample reason exists to expand the streamlined TAS process to cover larger projects. The five recommendations we offer below provide suggestions in two areas: expanding the reach of the process and improving the functionality and organization of project files.

Raise streamlined TAS savings caps

- **Recommendation 1**: Raise streamlined TAS project estimated energy savings limits to 300,000 kWh and 10,000 therms, provided the projects meet the criteria for non-complex measures. These are measures limited to stand-alone systems where savings come from one major component where savings can be determined with a simple algorithm or model. As more streamlined TAS projects are implemented, the PE team can reevaluate whether to raise or lower this cap accordingly.
- **Recommendation 2**: Raising streamlined TAS energy saving caps could result in more rigorous M&V requirements, such as interval metering. PDCs claim that such metering increases their delivery costs considerably. In those instances, Energy Trust might consider increasing PDC compensation by some mechanism, such compensation tiers.

Modify the TAS analysis workbook and supporting file organization

- **Recommendation 3**: In the Background worksheet in the streamlined TAS workbook, list the source for each of the key assumptions, either in a separate column in the key assumptions table or in the Baseline or EEM summary narrative boxes in that worksheet. This should help with both PDC internal project review and Production Efficiency team review. It will also improve program evaluability.
- **Recommendation 4**: Where analysis factors are not transparently calculated directly in the streamlined TAS workbook, list the calculator from which the savings were derived in the Key Assumptions or Analysis worksheets and include the calculator in a separate folder in the PDC Analysis folder.
- **Recommendation 5**: Allow supplemental information to be placed in an Appendix or Supporting Documentation folder within the file folder containing the streamlined TAS workbook. A numbering system should map documents in the file folder to a list in the Appendix worksheet. Alternatively, the program could allow PDCs to embed the file into the analysis workbook's appendix.

Memo

To: Board of Directors

From: Erika Kociolek, Evaluation Sr. Project Manager
Adam Bartini, Industrial & Agriculture Sr. Program Manager
Eric Braddock, Industrial & Agriculture Sr. Technical Manager

Date: March 31, 2020

Re: Staff Response to Streamlined TAS Assessment

Energy Trust's Production Efficiency program uses technical analysis studies (TAS) to estimate energy savings for custom projects. In 2018, the program introduced streamlined TAS for certain custom projects—specifically those with estimated energy savings of up to 100,000 kWh and/or 4,000 therms and that are less complex and involve stand-alone equipment. Key differences between standard TAS and streamlined TAS are the level of complexity of the analysis and the reporting requirements.

Energy Trust hired SBW Consulting to review the streamlined TAS process and make recommendations, including whether the estimated energy savings thresholds of 100,000 kWh and/or 4,000 therms should be increased. SBW conducted interviews with program staff and the three custom PDCs. SBW also selected a sample of 10 projects resulting from streamlined TAS, reviewed the project files, and performed engineering desk reviews.

The savings-weighted realization rates for the 10 sampled projects were 100% for electric and 113% for gas. SBW determined estimated savings for three of the 10 projects were not reasonable. SBW increased savings for one of the projects and decreased savings for two of the projects. The reasons for the adjustments to savings for these three projects were all different and did not have a common cause.

Given these findings, SBW recommended increasing the streamlined TAS estimated energy savings thresholds to 300,000 kWh and/or 10,000 therms, provided the projects are limited to stand-alone systems where savings come from one major component and can be determined with a simple algorithm or model. SBW also noted program staff needs to consider the implications of increasing the estimated energy savings thresholds on measurement and verification (M&V) requirements; if more rigorous M&V requirements (i.e., interval metering) are required, costs will be higher, and compensation provided to the custom PDCs may need to be adjusted.

Program staff plans to increase the estimated energy savings thresholds, likely to the thresholds recommended by SBW, and will pursue the recommended changes related to better documenting assumptions and organizing appendix information. Program staff is currently researching cost structure revisions to align with the increased energy savings thresholds.

1 Introduction

1.1 Background

In Q3 2018, Energy Trust's Production Efficiency program introduced the streamlined Technical Analysis Study (TAS) process as an alternative to the standard TAS process for smaller, less complex industrial energy efficiency projects. It aims to provide a simpler, more cost-efficient alternative for developing custom projects with estimated energy savings of up to 100,000 kWh and/or 4,000 therms. Third-party program delivery contractors (PDCs) develop these custom projects using the standard and streamlined TAS processes for Energy Trust and their customers.

The key factors that differentiate streamlined TAS from standard TAS are the level of technical complexity of the analysis and the project proposal presentation. Standard TAS requires a formal and lengthy project proposal for technically complex projects. Streamlined TAS uses an Excel workbook for projects with estimated energy savings of up to 100,000 kWh and/or 4,000 therms. These projects are less complex and usually involve stand-alone equipment. The streamlined TAS workbook concisely presents the proposed project summary, associated cost/benefit analysis, and the energy savings analysis.

Since its inception, streamlined TAS has been well received by stakeholders. Energy Trust hired SBW Consulting, Inc. to review the current streamlined TAS process and recommend program modifications including potentially increasing the current energy savings limits to allow larger savings projects to use the streamlined TAS process.

1.2 Goals

Key questions that this assessment addressed on behalf of Energy Trust are listed below:

- Are streamlined TAS savings reasonable?
- What factors make savings vary?
- Are projects evaluable?
- Are PDC analyses solid?
- How can the streamlined TAS template be improved?
- Will streamlined TAS work for larger projects?
- Where won't this work?

2 Methodology

Below we describe how we carried out the primary tasks for the streamlined TAS assessment.

2.1 Dataset Review

Energy Trust provided an Excel workbook with extensive data—containing 82 data columns for each project measure row—for 79 streamlined TAS measures. We narrowed the focus of the dataset review to the 26 streamlined TAS with verified energy savings. Energy Trust provided complete project files for these 26 sites.

There were nine general technology types within the sample. Three PDCs implemented these projects, which yielded electric savings ranging from 4,831 to 152,814 kWh/year. Some select program and sample characteristics are shown in Table 1. We reviewed the implemented streamlined TAS project files to prepare for our discussion at the kickoff meeting on selecting a sample of 10 implemented streamlined TAS projects for this study.

2.2 Sampling

We carefully selected a sample of 10 projects to represent the population of 26 implemented TAS studies. This sample reflects the mean and extreme savings results for both electric and gas saving projects. The sample also includes projects completed by each of the three PDCs to identify any variation between firms in documentation and project quality. A summary of the program and sample characteristics are shown below in Table 2. The sample was designed include these criteria:

- Large energy saving projects
- Representation of all PDCs
- Projects with gas savings

To date, streamlined TAS projects cover the nine general technology types listed below; our sample includes five of these technology types. The sample was intended to have similar averages and extrema for savings, a diverse selection across PDCs, and as a diverse selection of project technology types. The program and sample averages are shown in Table 2. The sample we drew also selected at least two projects for each PDC.

Table 1: Project Technology Types

Type	In Sample
Weatherization	Yes
Compressed Air	Yes
O&M	No
HVAC	Yes

Industrial Process	Yes
Refrigeration	No
Vacuum	No
Fans	Yes
Pumps	No

Table 2: Project Statistics

Group	Project Technology Types	Count	Fuel	Savings			
				Total	Average	Maximum	Minimum
All sites with savings	9	26	Electric (kWh)	1,095,082	45,628	152,814	4,831
			Gas (Therms)	17,840	4,460	9,561	409
Sample	5	10	Electric (kWh)	430,704	53,838	152,814	4,831
			Gas (Therms)	14,863	4,954	9,561	409

2.3 Interviews

We developed interview guides for two groups: Energy Trust PE program staff and staff at the three custom PDCs. Below are listed the topics areas in the interview guides for each of the two groups. Copies of the interview guides can be found in Appendix A.1.

Energy Trust Production Efficiency staff

- What are the key differences between streamlined TAS and standard TAS?
- What's working well with streamlined TAS and what could be improved?
- What are your thoughts on the expansion of streamlined TAS?
- Which project types are suitable for streamlined TAS?

Program Delivery Contractors

- What is your experience with streamlined TAS and its usefulness in the context of the larger PE program?
- How does the "conversion rate" compare between streamlined and standard TAS?
- What is the level of engineering rigor applied to streamlined TAS versus standard TAS?
- What is your impression on the customer's experience and satisfaction with streamlined TAS?
- What's working well with streamlined TAS and what could be improved?
- What types of projects are a good fit with streamlined TAS and the types of projects that would not be appropriate?

2.4 Project File Review

We developed a standardized project review workbook for use with each of the ten sampled projects. This enabled us to apply a systematic review framework and consistent approach for our project reviews. The key elements of the review process are listed in Table 3. During documentation review, we verified that (1) final savings matched savings claimed in Energy Trust's Project Tracking data, (2) projects had been completed with installations verified, and (3) the project descriptions matched tracking data. We also checked that calculation assumptions for baseline and efficient cases matched information from manufacturers' cut sheets and other documentation, and that savings algorithms met engineering best practices. After the initial file reviews, we determined which sites required follow-up, such as interviews or site visits. Reasons for follow-up included questions about savings calculation methods, installed equipment, and assumption documentation.

Table 3: Key Elements of the Project Review Workbook

Worksheet	Purpose
Evaluation Objectives	Research objectives and reviewer tasks.
File Review	Measure description, baseline and installed equipment, savings model type and key savings determinant descriptions.
Document Quality	Assess if the savings calculations are provided in a way that allows reviewer to access, investigate, and duplicate the calculations.
Savings Model Review	Investigate the savings algorithm and inputs as documented in the project files. Savings algorithm is defined as the key determinants and how they are mathematically combined. Inputs are defined as the numerical value or condition of the key determinant.
Savings Calculation	Reviewer's savings calculation (if needed).
Findings	Final evaluation savings and explanation if different from program savings.
Summary	Overall summary of evaluation outcome and recommendations.

3 Findings

The streamlined TAS assessment consisted of the four primary tasks listed below. Below is a summary of our findings for each.

3.1 Dataset and Sample Review

Dataset Review

We reviewed the streamlined TAS project dataset provided by Energy Trust and found it to be comprehensive and complete. Individual project files were well-organized and thorough. Prior to the kickoff meeting, we reviewed the 26 implemented streamlined TAS project files to inform our discussion on selecting a sample of 10 implemented streamlined TAS projects for this assessment.

Sample Selection Summary

We presented a sample of ten projects representing the population of 26 implemented TAS studies to the Energy Trust team. After Energy Trust's review and a couple of modifications to the sample, we reached a consensus that the final sample selection produced a balanced representation of the population of 26 sites with implemented streamlined TAS projects. The final sample was selected based on the following criteria:

- **Large energy savings**: Two projects with the largest energy savings were selected.
- **Program Delivery Contractors**: For each of the three current custom PDCs, two projects were randomly selected; six projects total.
- **Projects with gas savings**: To balance out the sample, two projects with gas savings were added to the sample.

One of the large energy savings projects with about 300,000 kWh savings was dropped from the sample and population at the request of Energy Trust because the savings were higher than originally anticipated and had been changed to a standard TAS. A second project with large energy savings was added to the sample.

Table 4 below shows the final sample, associated kWh and therm savings, and the ratio of each project's savings relative to the population.

Table 4: Final Sample

Project Reference	Selected for	ProjectType	Savings kWh	Savings Therms	% of cohort kWh savings	% of cohort Therm savings
PE15804	Size Sites	Fans	90,835	-	8.3%	0.0%
PE14935		Fans	152,814	9,561	14.0%	53.6%
PE15604	PDC Sites (#1)*	HVAC	11,999	-	1.1%	0.0%
PE15205		Compressed Air	41,237	-	3.8%	0.0%

Project Reference	Selected for	ProjectType	Savings kWh	Savings Therms	% of cohort kWh savings	% of cohort Therm savings
PE15928	PDC Sites (#2)*	Weatherization	4,831	-	0.4%	0.0%
PE15212		Industrial Process	58,200	-	5.3%	0.0%
PE15922	PDC Sites (#3, #4)**	Compressed Air	17,545	-	1.6%	0.0%
PE15927		HVAC	53,243	-	4.9%	0.0%
PE16070	Add-on Gas Project	Weatherization	-	409	0.0%	2.3%
PE15932		HVAC	-	4,893	0.0%	27.4%
		Total Savings	430,704	14,863		
		% of Population	39%	83%		

* Specific PDCs are referenced by number rather than name.

** PDC #3 is no longer a custom PDC; PDC #4 took over responsibility.

3.2 Program Staff and PDC Interviews

Energy Trust provided an interviewee list that included two Energy Trust PE program staff members and four staff from the three PDCs. The interviews were conducted between December 3, 2019 and December 11, 2019. The PDC interviewees were informed that their comments are confidential and would not be attributed to either themselves or their firms.

Both Energy Trust PE program staff and PDC staff viewed favorably the current streamlined TAS process, as well as the prospect of expanding it to a broader set of projects in the future. Below is a high-level summary of comments by each group to the topics presented in the interview guides. A detailed compilation of individual comments from the interview notes can be found in Appendix A.2.

Energy Trust PE Program Staff

The PE team endorsed streamlined TAS as a practical solution for providing a cost-effective means for processing smaller-savings projects with less technical complexity.

- Compared with standard TAS, streamlined TAS projects are much quicker to review in the Excel format. The analyses tend to be straightforward with clearly stated assumptions and less narrative.
- The PE team's expectations for engineering rigor do not vary much between streamlined TAS and standard TAS. One point of difference is that for less complex projects in streamlined TAS, M&V may consist of one-time measurements. By contrast, interval metering is usually required for standard TAS.

- One problem area for Energy Trust reviewers is that PDCs occasionally use other tools, such separate calculators or their own macros, to support their analysis. The issue arises when these tools are not included in the streamlined TAS analysis workbook.
- Streamlined TAS has been working well. Staff wants to expand it by raising the current savings caps of 100,000 kWh and 4,000 therms. However, they state that streamlined TAS is not suitable for complex projects with fluctuating loads, and/or that affect multiple pieces of equipment. For instance, a single system with chillers, cooling towers, and pumps would be a poor fit, because interactive systems require complex modeling, which is outside of the scope of streamlined TAS.
- Energy Trust encourages PDCs to expand the diversity of the customers they serve, e.g., develop projects with small and medium industrial customers and customers in rural areas. The streamlined TAS program delivery method is intended to help serve this customer segment.

Program Delivery Contractors

Like the Production Efficiency team, all PDCs interviewed were enthusiastic supporters of streamlined TAS and its suitability for less complex projects.

- Streamlined TAS projects are much faster to produce and are an excellent alternative to standard TAS. Energy Trust did a good job designing streamlined TAS and it is great to have in the toolkit.
- The level of engineering rigor is comparable to standard TAS, with the understanding that the less complex projects usually require less complicated M&V – for instance, spot measurements rather than time-interval data logging.
- The strength of streamlined TAS is that PDCs can provide the complexity of analysis that is appropriate to the project without the added burden of standard TAS reporting requirements.
- When asked about their thoughts on increasing the energy savings caps for streamlined TAS projects, all PDCs interviewed agreed that increasing savings caps was a good idea. When asked for their recommendations on what the new savings caps should be, the PDCs' recommendations ranged from 200,000 kWh to 400,000 kWh and 7,000 therms to 14,000 therms.
- We asked PDCs for their perspective on the TAS "conversion rate" or the percentage of implemented TAS measures between standard TAS and streamlined TAS. The PDCs we interviewed did not have input on this question, possibly because streamlined TAS is a relatively new program offering.
- Several PDCs reported that most customers do not pay very much attention to TAS process. For the few customers who understand the processes for both the streamlined and standard tracks, they appreciate the faster turnaround of the streamlined process. This applies particularly if they are waiting to order equipment.

- When the new streamlined TAS energy savings caps are in place, PDCs speculated that Production Efficiency staff could require more rigorous M&V requirements for larger savings projects. PDCs report that their costs go up considerably for time-series metering M&V. If this scenario develops as the revised streamlined TAS rules are implemented, Energy Trust may consider establishing PDC funding tiers for new, more time-intensive M&V requirements.

3.3 Sample Project File Reviews

Table 5 presents the energy savings results from the engineering desk review of the ten sampled streamlined TAS projects. In all but three cases, the review results fully confirmed the program savings values. The effect of the three cases where we revised the analysis results was small: reviewed electric savings remained at 100% of the program estimate, and reviewed gas savings was slightly higher, at 113% of the program estimate. Although project PE15928 has a 0.48 kWh savings realization rate, the evaluated savings for that project are about 1% of the total sample savings, consequently the project's impact on the overall realization rate is well under 1%.

Table 5: File Review Results

		Program-Reported		SBW-Reviewed				
Project Reference	Project Type	Savings kWh	Savings Therms	Savings kWh	Savings Therms	kWh Realization Rate	Therm Realization Rate	Savings Reasonable?
PE15804	Blower Upgrade	90,835	-	90,835	-	1.00	-	Yes
PE14935	HVAC VFD Upgrades	152,814	9,561	152,814	9,561	1.00	1.00	Yes
PE15604	HVAC Upgrades	11,999	-	11,999	-	1.00	-	Yes
PE15205	Compressed Air	41,237	-	41,237	-	1.00	-	Yes**
PE15928	Tank Insulation	4,831	-	2,336	-	0.48	-	No*
PE15212	Vacuum Kiln	58,200	-	58,200	-	1.00	-	Yes
PE15922	Compressed Air	17,545	-	17,545	-	1.00	-	Yes
PE15927	Upgrade Diffusion Pump	53,243	-	53,243	-	1.00	-	Yes
PE16070	Feedwater Tank Insulation	-	409		285	-	0.70	No*
PE15932	Heating Setback Controls	-	4,893	4,598	6,983	-	1.43	No*

	Program-Reported		SBW-Reviewed			
Total* **	430,704	14,863	432,807	16,829	1.00	1.13

* Savings revised by SBW.

** For this project and the three with SBW-revised savings, SBW reviewers contacted each PDC to discuss their analysis.

*** Realization rate totals are savings-weighted but not extrapolated to the population.

Where our review results varied from the savings in the PDC analysis workbooks and savings verification reports, we looked for underlying factors that could inform our assessment of the streamlined TAS processes. Our reviewers did not consider three of the PDC-verified project savings to be reasonable. Our findings on these projects are discussed below.

PE15932 – Heating Controls Setback

This project used an eQUEST model to estimate the effects of installing programmable thermostats on three gas furnaces in an RV production facility with a 10°F heating setback during unoccupied hours. The PDC model did not change the baseline fan schedule for the EEM version of the model. Our reviewer created a second version of the EEM model with the setback version of the fan schedule that resulted in increased gas therm savings and added electrical kWh savings.

PE15928 – Tank Insulation

This measure in a hard cider production facility added insulation to a chilled fermentation tank used for crash cooling. Our reviewer added a coefficient of performance to the glycol refrigeration system's efficiency estimate. This adjustment roughly halved savings.

PE16070 – Feedwater Tank Insulation

This project added insulation to a stainless-steel boiler feedwater tank at a brewery. A feedwater tank holds return condensate and city water before being fed back through the boiler. Our reviewer found an incorrect surface area calculation for the tank. The revision reduced the surface area of the tank by over half, and consequently, gas savings were reduced proportionally.

File Review Summary

For the three sites above, the realization rates varied from 0.48 to 1.43, so the individual variances are significant although the associated magnitude of energy savings are relatively small. There may be a correlation between small savings projects and errors in savings calculations as two of the three sites with errors were at the small-saver end of the sample's site savings range. It is possible that small-saver projects may get a light pass by PDC reviewers. There is no connection between these three projects with respect to the reasons for the errors.

Our revised savings estimates resulted in a net 3% increase in combined energy (Btu) savings for the sampled projects; both electrical and gas savings increased. The three project calculation errors are all minor in nature and should not constitute a systemic concern for streamlined TAS.

With few exceptions, the evaluability was good for all sample project analysis workbooks, savings verification reports, and related files.

3.4 Conduct Site Visits and Interviews

Given the high standard of project evaluability, good project documentation, savings analyses and verification reports, our review team concluded that customer interviews or site visits were not necessary to adequately assess the sample projects. However, we needed to clarify certain aspects of the savings calculations with the PDCs for four projects. Coordinating with Energy Trust staff, our reviewers contacted the PDCs to discuss their analyses to better understand their methodological approach.

Below are summaries of those discussions.

PE15927 - Upgrade Diffusion Pump

This project involved the installation of a diffusion heat pump with proportional, integral, derivative (PID) controls. The PID controls are intended to increase the precision for controlling the oil heater temperature instead of running continuously and then using a chiller to remove waste heat. Our reviewer contacted the PDC to clarify their understanding of the difference between baseline waste heat and that of the new EEM pumps. Our conclusion was that surplus heat requiring cooling could not be separated from necessary process heat without substantially more logging, so the PDC's methodology was considered acceptable.

PE15928 - Tank Insulation

This project provided insulation for a steel crash cooling tank chilled by a glycol refrigerant loop in a cider production facility. Savings results from reducing the electrical energy needed to run the glycol chiller. Our reviewer requested clarification of the coefficient of performance (COP) applied to the chiller, so the PDC analyst provided a table of efficiencies for the refrigeration compressor. They agreed to maintain the same cycle efficiency from what was originally proposed to reflect compressor motor efficiencies and power supply irregularities. As a revision, both engineers agreed that factoring in a chiller COP was appropriate. Our reviewer selected a condenser temperature of 45°C (approximately 25 degrees higher than the condenser temperature) and an evaporator temperature at -5°C from the chiller performance tables (COP of 1.9). Our reviewer then added a pump energy of 100 watts at the end of the cooling energy calculation, instead of considering it a part of the chiller efficiency.

PE16070 - Insulate Feedwater Tank

This measure added insulation to a stainless-steel boiler feedwater tank at a brewery. A feedwater tank holds return condensate and city water before being fed back through the boiler. Our reviewer found what was thought to be an incorrect surface area calculation for the tank and discussed this with the PDC to confirm this was the case.

PE15205 - Compressed Air

This project involved the installation of new compressed air lines to reduce system leaks. Our reviewer needed clarification on whether the leak load in the PDC calculation was for the entire system or only the four new lines to be installed. The PDC clarified that the 40 CFM leak load assumption was determined through data logging and represented the leaks that would be eliminated with new air lines.

Discussions with PDCs for these four projects clarified our understanding of their methodological approaches and satisfactorily resolved our questions on these projects.

4 Conclusions and Recommendations

Overall, the streamlined TAS process gets high marks from all stakeholders. Our review found that it is achieving its goal of simplifying custom project development, while producing rigorous, defensible estimates of energy savings. Based on this assessment, we believe Energy Trust expansion of streamlined TAS is cost-efficient and helpful to participants and conclude that ample reason exists to expand the streamlined TAS process to cover larger projects.

Discussions with Energy Trust PE program staff and custom PDCs, as well as findings from our file reviews, led to two general areas for modifications to the streamlined TAS process. Below are conclusions and recommendations that build on this early success to make refinements to the program.

Raise streamlined TAS savings caps

When we asked the PDCs to suggest a new streamlined TAS energy savings cap, we received a range from 200,000 to 400,000 kWh/year and 7,000 to 14,000 therms. Broad consensus thus exists that the current 100,000 kWh/year cap should, at a minimum, be doubled, and that the basic criteria for streamlined TAS projects remain confined to relatively simple stand-alone systems where savings primarily comes from one major component, and can be determined with a simple algorithm.

Recommendation 1: *Raise streamlined TAS project energy savings limits to 300,000 kWh and 10,000 therms, provided the projects meet the criteria for non-complex measures. These are measures limited to stand-alone systems where savings come from one major component where savings can be determined with a simple algorithm or model. As more streamlined TAS projects are implemented, the PE team can reevaluate whether to raise or lower this cap accordingly.*

Recommendation 2*: Raising streamlined TAS energy saving caps could result in more rigorous M&V requirements, such as interval metering. PDCs claim that such metering increases their delivery costs considerably. In those instances, Energy Trust might consider increasing PDC compensation by some mechanism, such compensation tiers.*

Modify the TAS analysis workbook and supporting file organization

In our project reviews, we had some difficulty determining the source of key assumptions. For instance, it was sometimes unclear whether key assumption values were derived from an engineering calculation, on-site observation, data logging, manufacturer specification, or other source.

Recommendation 3*: In the Background worksheet in the streamlined TAS workbook, list the source for each of the key assumptions, either in a separate column in the key assumptions table or in the Baseline or EEM summary narrative boxes in that worksheet. This should help with both PDC internal project review and Production Efficiency team review. It will also improve program evaluability.*

Our file reviewers noticed, and PE staff mentioned, that some PDCs' analyses rely on factors derived from calculators that are not included in the analysis workbook.

> ***Recommendation 4****: Where analysis factors are not transparently calculated directly in the streamlined TAS workbook, list the calculator from which the savings were derived in the Key Assumptions or Analysis worksheets and include the calculator in a separate folder in the PDC Analysis folder.*

PDCs noted that it was time-consuming to format documentation—such as manufacturer specifications and cost quotes--into the appendix worksheet of the streamlined TAS workbook,

> ***Recommendation 5****: Allow supplemental information to be placed in an Appendix or Supporting Documentation folder within the file folder containing the streamlined TAS workbook. A numbering system should map documents in the file folder to a list in the Appendix worksheet. Alternatively, the program could allow PDCs to embed the file into the analysis workbook's appendix.*

Appendices

This section contains verbatim interview guides, summaries of the interviews, and excerpts from the project review workbooks.

A.1 Interview Guides

Energy Trust Staff

Energy Trust Staff Interview Guide

Introduction: Thank interviewee for their time; this will be brief, one-half hour max. Ask if it's okay for me to email them if there are any follow-up questions and, likewise, if anything else comes to mind after our talk, please call or send me an email.

[*The first-level bullet is the question, the second-level bullets are prompts, if needed, to keep the dialogue going*]

- What is your involvement in streamlined TAS?
- What are the key differences between streamlined TAS and standard TAS?
  - Aside from the Excel template for streamlined TAS and Word template for standard TAS, what are the main differences between the two? Are there differences in Energy Trust's expectations for engineering rigor or M&V practices between streamlined TAS and standard TAS?
  - About one-third of streamlined TAS participants go on to complete the project and 50% for standard TAS. Can you think of factors that might contribute to the difference between the two?
  - The streamlined TAS customer report consists of PDFs from the three customer-facing pages from the analysis workbook, while the standard TAS report is a more formal report presentation. Do you think the streamlined TAS is equally as effective as a standard TAS report in informing and motivating customers to implement the project?
- Have you gotten any feedback about streamlined TAS from customers? If so, what feedback?
- What's working well with streamlined TAS? What's not working well with streamlined TAS?
- Do you think the streamlined TAS process could be improved and, if so, how?
  - What, if anything, would you like to change regarding the streamlined TAS process and/or the Excel template for streamlined TAS?
  - Is streamlined TAS more time-efficient? If so, why?
  - Do you think the streamlined TAS is equally as effective as a standard TAS in informing and motivating customers to implement projects?
- What are your thoughts about expanding TAS? Do you have any concerns about expanding streamlined TAS to projects with more savings? If so, what are your concerns?
  - Are there barriers to using streamlined TAS for certain larger projects?
- Are there certain types of projects that seem to be a better fit for streamlined TAS than standard TAS?
  - Do any types of projects come to mind that would not be appropriate for streamlined TAS?

Program Delivery Contractors

Program Delivery Contractor Interview Guide

Introduction: *Thank interviewee for their time and we'll be as brief as possible. Explain SBW's role as an Energy Trust contractor and the general purpose of the study being Energy Trust's interest in expanding streamlined TAS; their input as a PDC is critical to this task. Ask if it's okay to email them if there are any follow-up questions and, likewise, if anything else comes to mind after we talk, please call or email me. We are interviewing all current PDCs and that your statements will not be attributed to individuals or companies.*

[*The first-level bullet is the question, the second level bullets are prompts, if needed, to keep the dialogue going*]

- How long have you been working with Energy Trust's Production Efficiency program?
- How long have you been working with streamlined TAS? About how many streamlined TAS projects have you completed or have in progress? About how many people in your organization have worked on streamlined TAS?
- Has streamlined TAS been a useful option for your Energy Trust Production Efficiency projects?
- Over the past year, my information may not be completely current, your company implemented:
  - Energy 350: 18 out of 49 streamlined TAS, or about 37%
  - Cascade/PGE: 5 out of 21 streamlined TAS, or about 24%
  - RHT Energy: 4 out of 8 streamlined TAS, or about 50%
  - How does that compare with your implementation rate with standard TAS and/or other industrial programs?
- Do you think the engineering rigor or M&V practices between streamlined TAS and standard TAS are different?
- Have you gotten any feedback about streamlined TAS from customers? If so, what feedback?
- What's working well about streamlined TAS? What's not working well with streamlined TAS? Do you think the streamlined TAS process could be improved and, if so, how?
  - What, if anything, would you like to change regarding the streamlined TAS process and/or the Excel template for streamlined TAS?
  - Is streamlined TAS more time-efficient? If so, why?
- Do you think the presence or absence of the more formal TAS report makes a difference in the customer implementing the project?

  What percent of customers do you think read the standard TAS report? Are some sections of the standard TAS report read more than others, and if so, which ones?
- What are your thoughts about expanding TAS? Do you have any concerns about expanding streamlined TAS to projects with more savings? If so, what are your concerns?
  - Are there barriers to using streamlined TAS for certain larger projects?
- Are there certain types of projects that seem to be a better fit for streamlined TAS than standard TAS?
  - Do any types of projects come to mind that would not be appropriate for streamlined TAS?

A.2 Interview Summaries

Energy Trust PE Program Staff

Two members of Energy Trust's PE program were interviewed.

- Key differences between standard TAS and streamlined TAS
  - The project proposal review time for a streamlined TAS project requires considerably less time than a standard TAS project. The analysis for a streamlined TAS project, given the Excel format of the analysis workbook format, contributes to the overall transparency of the analysis and the shorter time for their review. In a standard TAS proposal, PDCs present analysis screen shots and PDFs to support their analysis.
  - Streamlined TAS reports have less narrative and the assumptions are generally stated more succinctly than in the standard TAS reports.
  - Engineering rigor expectations do not vary much between streamlined and standard TAS although with the less complex projects going through streamlined TAS, M&V may consist of one-time measurements for streamlined TAS as compared to using interval metering, which is more often the case with standard TAS.
- What's working well with streamlined TAS and what needs improvement?
  - Streamlined TAS saves everyone time and money.
  - Increasing streamlined TAS energy savings limits would be an improvement to the PE program.
  - Streamlined TAS analysis factors can be difficult to review when PDCs use use other tools, such separate calculators or their own macros, that are not included in the analysis.
- What are the characteristics of projects that are or are not appropriate for streamlined TAS?
  - Streamlined TAS is not suitable for complex projects, such as those with fluctuating loads, or that affect multiple pieces of equipment – for instance, a single system with chillers, cooling towers, and pumps.
- Other observations
  - PE program staff try to avoid being categorical with the PDCs and want to encourage flexibility. At the onset of a project the PDCs submit a one-page proposal, which is the stage at which the two parties agree on the approach, including whether to use streamlined or standard TAS.
  - Energy Trust is encouraging PDCs to expand the diversity of the customers they serve, e.g., develop projects with small and medium industrial customers and the rural customer base. The streamlined TAS program delivery method is intended to help serve this customer base.

Program Development Contractors

Four individuals were interviewed from the three firms currently serving as custom PDCs. Our observation was that all the interviewees were appreciative of being consulted on future modifications to streamlined TAS and were forthright in their comments. Below are responses from the interviewees. Responses are grouped by topic and, because in some cases we're reporting individual responses, sometimes offer differing perspectives on the same topic.

- On the usefulness of streamlined TAS in the Production Efficiency program:
  - All the PDCs profess to be big fans of streamlined TAS because, for relatively simple measures, it's a very time-efficient process. In particular, it eliminates the time-consuming front-end work that goes into a standard TAS project and is relatively quick to assemble and review.
  - Energy Trust really did well on streamlined TAS in its first iteration and it is great to have in their toolkit. Streamlined TAS gives allows more time to find savings opportunities at each site.
- Do you think the engineering rigor or M&V practices between streamlined TAS and standard TAS are different?
  - The strength of streamlined TAS is that you maintain the overall complexity of analysis that's needed, without the added burden of standard TAS reporting requirements.
  - There's probably a bit less rigor due to the subset of project types represented in streamlined TAS.
  - There is no difference with the level of rigor applied; they bring the same rigor to all projects.
- How does streamlined TAS impact the customer's experience?
  - There isn't much effect on the customers because they try to insulate them from the TAS process. One benefit is that with streamlined TAS, a customer waiting to order equipment has a shorter wait, usually by several weeks, than with standard TAS.
  - A small percentage of customers actually read a standard TAS report. Customers who have had exposure to both standard and streamlined TAS seem to appreciate the 'cut to the chase' aspect of streamlined TAS. Standard TAS reports could be overhauled to be more readable.
  - Streamlined TAS customers who are new to the program seem fine with the abbreviated report. One customer who is experienced with energy projects with the standard TAS report format also liked the streamlined TAS format.
- What's working well with streamlined TAS and what needs improvement?
  - Streamlined TAS is one-stop shopping, cleaner, easier to edit and reduces the chance of errors. There's lots of flexibility compared to standard TAS.

- Streamlined TAS is great as-is, although it would be nice not to have all the written narrative even in the streamlined TAS workbook - just present the analysis.
- The cement-like streamlined TAS rule on kWh or therms maximum can be an obstacle. For instance, you can have a big savings project that is a simple measure from an analysis standpoint. They would like more flexibility from Energy Trust in this regard.
- A minor point is that the streamlined TAS template can be problematic with formatting PDF information in the Appendix.
- Raise the savings limit to about 200,000 kWh. They really like the analysis workbook but it would be helpful for Energy Trust to unlock the workbook. They encounter minor glitches that could probably be resolved if they had access to the unlocked workbook.
- One negative is integrating PDF files; clunky conversion of Excel to PDFs with appendices and other customer information sections. Formatting from Excel to PDF for customers can be tricky

- Comparisons between standard TAS reports and streamlined TAS reports.
  - Not sure any customers read the TAS report. Customers rely on PDCs to summarize the findings. Also depends on who you're working with at a company.
  - For the majority of customers, it doesn't make much difference; not often does that documents get read. In certain cases, the formal report is needed, but that's the exception.
  - Maybe 20% of the customers give the TAS report a thorough review.
  - Streamlined TAS presentation is fine; if the report has a lot of content, they can (and have) opted for a standard TAS in lieu of streamlined TAS.
  - Streamlined TAS workbook is more revealing – better for everyone including evaluability.
- Thoughts about streamlined TAS expansion
  - Projects with more complexity are more costly to implement.
  - Labor hours burden – it would be good to consider adding some flexibility to the PDC fee based on how many hours are spent on the analysis. The time invested in analysis may not be a great proxy for the magnitude of kWh savings.
  - For example, with a 400,000 kWh ceiling, a fixed fee is okay if it's a simple process but flexibility in funding in lieu of a flat fee would be nice. Could establish funding tiers based on complexity. If the project requires data logging could be a criteria to establish a project as more complex, therefore qualifying for a higher PDC fee.
  - 250,000 kWh should capture a much larger share of potential streamlined TAS projects.

- A 200,000 to 300,000 kWh cap for streamlined TAS seems about right. Once you begin the analysis, if it turns out to be more complex than anticipated, you can always go back the standard TAS.
- Datalogging is the big differentiator on increased costs and complexity.

A.3 Evaluation Workbook Excerpts

Below are excerpts from our engineering desk review workbooks for the three projects we identified as not having savings estimates that aligned with our review.

PE15932 – Heating Controls Setback

Based on your review of the Program Documentation (i.e. the File Review), please provide an overall summary description of the project.	Project involved the installation of (3) programmable thermostats and the implementation of a heating setpoint setback for (3) existing gas furnaces.
Were there any post-installation changes to a key determinant (e.g. changes to operating hours)? If so, describe (qualitatively) the impact on energy savings?	Yes. The EEM run was unintentionally using baseline fan schedule. Adjusting it to the setback fan schedule increased both electric and gas savings significantly.
Briefly describe the methodology you used to calculate savings (i.e what type of model and where did you get the input values).	Savings were calculated in eQUEST. Input values were provided by the PDC.
Please provide a summary of your evaluation findings. Explain why the evalution savings are different than the program estimates (in cases where there are differences).	The documentation was clear and complete except that the verification eQUEST model was not included and, as cited above, the baseline fan schedule was mistakenly used for the EEM run. While the initial gas savings estimates were reasonable, the error in the eQUEST model inputs resulted in reduced gas savings and no electric savings. A revised eQUEST model increased electric savings by 4,598 kWh and gas savings by 2,090 therms.
Please provide specific recommendations regarding analysis approaches, assumptions, and customer behavior and/or decision-making that may be of value to the Energy Trust in developing, implementing and evaluating future program cycles.	No specific recommendations. The eQUEST error is an understandable omission that is easily made. This does not have systemic implications for the program.

PE15928 – Tank Insulation

Based on your review of the Program Documentation (i.e. the File Review), please provide an overall summary description of the project.	An uninsulated steel crash cooling tank is chilled with a glycol refrigerant loop at 25F 6,048 hours per year. The tank was insulated with reflective polyethylene bubble wrap to reduce heat gains into the tank. The savings are from the electrical energy needed to run an 80% efficient glycol chiller.
Did you discover/learn anything else interesting during the site visit (or phone call)? If so, describe here.	The PDC technical analyst provided a table of efficiencies that were representative of the existing refrigeration compressor. After some discussion, it was decided to keep the same cycle efficiency and to use the system COP at a condenser temperature of 45C (approximately 25 degrees higher than the condenser temperature) and an evaporator temperature at (-5) (COP of 1.9). The pump energy of 100 watts would then be added at the end.
Briefly describe the methodology you used to calculate savings (i.e what type of model and where did you get the input values).	Same model with the following changes: • The COP was multiplied with the system efficiency • The estimated pump power of 100 Watts was added to the required chiller energy.
Please provide a summary of your evaluation findings. Explain why the evalution savings are different than the program estimates (in cases where there are differences).	The reviewer recommends multiplying the cycle efficiency by the chiller coefficient of performance which would cause a reduction in savings. The evaluation savings are lower than the claimed savings. This is mostly a result of applying a coefficient of performance to the chilling energy.
Please provide specific recommendations regarding analysis approaches, assumptions, and customer behavior and/or decision-making that may be of value to the Energy Trust in developing, implementing and evaluating future program cycles.	Not including a coefficient of performance is a math error in the energy efficiency calculation, which could be a result of using an estimated efficiency instead of finding one from a cutsheet or calculating an efficiency from first principals to match the analysis. Recommend requiring a cutsheet describing efficiency, or a first principle efficiency calculation when efficiency is considered a key assumption.

PE16070 – Feedwater Tank Insulation

Based on your review of the Program Documentation (i.e. the File Review), please provide an overall summary description of the project.	Steel cylindrical (5 ft. tall, 2 ft. OD) 170 F process feedwater tank is was uninsulated in a 75 F ambient environment. Fiberglass insulation jacket added.
Did you discover/learn anything else interesting during the site visit (or phone call)? If so, describe here.	Verified the incorrect tank surface area which was discovered during file review
Briefly describe the methodology you used to calculate savings (i.e what type of model and where did you get the input values).	Original calculations were intended to use the area of a cylinder for calculation. The formula for the area of a sphere was used at either end (instead of a circle). The correct cylinder surface area formula was used for evaluation.
Please provide a summary of your evaluation findings. Explain why the evalution savings are different than the program estimates (in cases where there are differences).	The calculations appeared correct except for the surface area error. The actual area was 66% of what the calculated area was. The final savings was also 66% of the original savings.
Please provide specific recommendations regarding analysis approaches, assumptions, and customer behavior and/or decision-making that may be of value to the Energy Trust in developing, implementing and evaluating future program cycles.	The tank area and tank dimensions were not listed on the key assumptions on the background sheet. These are key assumptions and the error might have been caught were they listed. Some other key assumptions were not as explicitly laid out (ambient temperature, insulation value of fiberglass) but did not appear to lead to math errors.