



Keeping PACE in Texas PACE in a Box Technical Standards Working Group 2020 Feedback and Improvement Process

Submit comments to charlene.heydinger@keeppace.org by Monday, August 31, 2020.

Next Meeting: September 10, 2020 at 11:00 am CDT. [Register Here](#)

Document contains:

1. Meeting notes 7/23/2020
2. Meeting notes 6/19/2020
3. Current Technical Standards reference standards
4. Technical Standards comments submitted by Scott West

1. NOTES: Meeting No. 2, July 23, 2020

Attendees:

Eddy Trevino, SECO – Chair
Peter Aguirre, AMERESCO
Marina Badoian-Kriticos, HARC
James Cargas, New Energy, LLC
Melvin Glass, EMC Engineers
Holly Green, Daikin
Charlene Heydinger, Keeping PACE in Texas
Todd McAllister, SPEER
Lee McCormick, Lone Star PACE
Tracy Philips, CO
Keith Reihl, Reihl Engineering
Danny Specia, AACOG
Glen Sylva, Lone Star PACE
Dub Taylor, TPA
Scott West, HFA

Items for Discussion:

Chair requested feedback on current standards used in chart on TSM p9:

https://www.keepingpaceintexas.org/wp-content/uploads/2018/12/KPT_Technical-Standards-Manual-2.1-2018-12-10.pdf

- American Society for Testing and Materials (ASTM) E2797-11, Building Energy Performance Assessment (BEPA) Standard (data collection and baseline calculations for the energy audit, building asset data);

- International Performance Measurement and Verification Protocol (IPMVP) (latest edition);
- American National Standards Institute/Building Owners and Managers Association (ANSI/BOMA) Z65.3-2009 (gross floor area measurement);
- ASHRAE Guideline 14-2002 (measurement of energy and demand savings);
- ASHRAE Procedures for Commercial Building Energy Audits (latest edition);
- National Institute of Standards and Technology (NIST) Life-Cycle Costing Manual, NIST Handbook 135 (latest edition);
- ASHRAE Standard 202, Commissioning Process for Buildings and Systems (latest edition);
- ASHRAE Guideline 4, Preparation of Operating and Maintenance Documentation for Building Systems (latest edition);
- ASHRAE Guideline 1.4, The Systems Manual for Facilities; (latest edition);
- ASHRAE Handbook-2011, Fundamentals, Chapter 39 (Codes and Standards); and
- ASHRAE Guideline 14, Whole Building Performance Path (2002 edition).
- ICP EPP - Standard Commercial (Baselining – Core Requirements, Rate Analysis, Demand, Load Profile, Interval Data)
- ICP EPP - Large Commercial (Baselining – Core Requirements, Rate Analysis, Demand, Load Profile, Interval Data)
- IPMVP Concepts and Practices for Determining Energy Savings in Renewable Energy Technologies Applications (Pages 4-6)
- IPMVP Concepts and Options for Determining Energy and Water Savings, 2012 (Section 4)

Other acknowledged resources that may be considered are:

- The Alliance for Water Efficiency (AWE) Conservation Tracking Tool; and
 - EPA WaterSense Product Guide.
- Feedback comments from Scott West (also emailed detailed comments to TSM), Keith Reihl, Peter Aguirre; Tracy Philips
 - ASHRAE 211/ISO 500001 standard for Audits: TSM can be updated and simplified with ASHRAE ISO 50,0001 (but Green Guide references still useful – so keep these)
 - ICP: Still relevant?
 - Not sure how offered or the cost after transfer to USGBC / Philips provided current contact info for ICP
 - Texas engineering community more familiar with ASHRAE (Does being required to learn ICP slow progress/discourage participation?)

Chair requested feedback on the chart of standards by Property Type - TSM p9

Request for Feedback: Should the chart list properties separately since standards for most of these properties are the same?

- Feedback provided from Aguirre, Philips – presentation should be simplified as much as possible / ICP status should be explored
- Industrial using ISO 500001? In DFW, using for Dallas Green Build ordinance or internal requirements; standards for industrial would be good

ITPR Requirements

Charlene Heydinger asked if the current ITPR certifications reflect best practices? – TSM p 7

Feedback discussed by the Chair, Heydinger, Marina Badoian-Kriticos, Melvin Glass

- Chair asked if 5 years of experience is required. Feedback: clean energy experience is listed as an alternative to certifications on p 7, but not the requirement of 5 years' experience as SECO requires
- 5 years appears to be standard experience required for certification tests (BOMA as an example)
- Glass recommended that ITPR certification for activities under ASHRAE 211 should require most current 211 training
- Heydinger noted the need to balance desired certifications with the availability of the required skill sets in rural Texas.
- Aguirre noted that a "plug and play" format for the information provided to the ITPR (baseline and projected savings) and similar structure for ITPR report would better enable accessible service in rural areas and provide simplification and easier, more standardized review

Ability to review ITPR reports

Chair asked if there are troublesome areas regarding the review of ITPR reports (reports that support the spreadsheet all ITPRs must fill out for a project). Feedback discussed by Badoian-Kriticos, Aguirre

- Badoian-Kriticos acknowledged that the standards options were vague the need for template to standardize the presentation of information from initial contractor template and similar ITPR template so that the report explaining the ITPR spreadsheets (How the SIR is calculated) all have uniformity, consistency and clear expectations
- Chair recognized need for standardization of presentation and expressed concern for not over proscribing the standards themselves since each project will be different
- Aguirre discussed concern about calculating SIR (discussed as next item)

Calculating Savings

Aguirre noted SIR issue for older buildings: Baselines from 50 – 60- years ago don't achieve real savings and if use 2015 standards, can't get multiple measure projects to meet SIR. Comments provided by the Chair, Holly Green, West, Heydinger

- Aguirre requested ability to include operational savings in SIR calculation
- SECO's LoanSTAR program requires 50% actual energy and water savings
- PACE Act based on governmental benefit of energy and water savings – need to be significant part of project to reflect statutory intent
- SIR discussion in TPA Program Guide discusses this issue, but language is not included in TSM (SIR is an Underwriting Working Group requirement; but TSM needs to clearly lay out how it is to be calculated)
 - Assessment transfers to new owner - concern expressed that operational savings must provide value to next owner, not just be reassignment of employees to other tasks; Clearly document operational savings that purchaser will continue to receive (better building is the desired result)
- Operational savings should be hard cost savings
- Challenges in satisfying SIR were acknowledged
- Suggestion made that SIR calculations take into account increases in building value as well as increases in net operating income
- Chair asked rather than define each element, is it better to list considerations for a clear understanding?
 - What qualifies/should there be limits?

- Is eliminated position enough O&M to include in SIR calculation?

Chair's Summary of items for review:

- Baseline calculations
 - Which code to use for vacant building
 - Which codes to use for repurposed buildings
- Savings from energy and water
- Savings from operations (limits and qualify)

Possible templates

- Develop report guide template
- Review methodologies to create guidelines
- Review use of ICP as Roadmap guide as the template
 - Uses ASHRAE standards as a reference guide

2. Notes from Technical Standards Working Group meeting, 6/19/220
Chaired by Eddy Trevino
Notes taken by Sarah Silberman

Summary of goals – Eddy Trevino summarized the goals of the Working Group

What do we think needs to be updated?

- - Keith Reihl **when I do the site visits, I take pictures and submit it for initial PACE review.** This can also be compared to pictures after, further documentation from a professional standpoint how everything goes together. This is only a few pictures (what does the overall building look like, lighting, etc). **Representing what the condition on the site is, is the intent. For myself I take a lot of pictures, but I only submit half a dozen at the most to TPA. For improvement specifics and of the overall building. This seems to help from a review standpoint.** Some sites have been demoed out if the building has been abandoned, but you can at least document that too.
- - Taylor: I think that makes sense. And you're talking about the technical study or the ITPR report or both?
- - Reihl: Well if you're putting the calculations together then it's part of that, if it's been done with the previous study maybe you use those pictures. There's a site visit before but that's by you or a comrade or a professional colleague, and sometimes in order to expedite things or honestly if there's not much to take pictures of I'll have the contractor take pictures for me or Facetime me just so I can understand what it looks like before. The idea is that you have a before and an after of what's there, if there is stuff there.
- - Yebra: I second taking pictures as a good idea. Pictures are always much better than describing things in what condition they are. I attended this morning's underwriting meeting and one of the things we were talking about was how we could get a better picture of the energy savings analysis that goes into the technical aspect of the technical report.
- Yebra **How do we accommodate rate escalation, inflation, and those things -- do we need to take a look at the technical analysis standards here and make modifications?**
- - Reihl: As far as rate escalation, if I ask about electricity increasing over the next 20 years, I like the **standard 3% increase.**
- - Taylor: Safety degradation? - Keith: I don't necessarily have a degradation, but **some people have half a percent to one percent degradation for a year, it's just going to start giving you a lot more problems. I like to build in safety to that.** Hopefully certain things won't degrade severely over the course of time. Certain things last for longer, but we need to take into account and be more conservative with giving people an understanding of life expectancy.
- - Chair: On the denominator for the investment, what do you include in that?
- - Reihl: Obviously you have the pieces of equipment and the costs of installation. The soft costs may also be an engineer or design professionals, with PACE obviously any ITPR calculations fees and any of the loan fees can be built into that as well.
- - Chair: Do you build in the interest cost?

- - Reihl: So I don't put in the cost of the measure but I try to caption that in the savings analysis for the investment ratio, so it's spread over everything rather than attributed to one.
- - Chair: I meant from an SIR overall rather than a by measure
- - Reihl: Yeah, well I look at it at an overall SIR. There are potential tax savings, cost to capital savings. Things you can look at. Oftentimes PACE loans are more competitive than other loans.
- - Chair: There's no reference to the SIR other than one line. Do we need to put in a section defining SIR and its components?
- - Reihl: I run this SIR two ways. **First what is the major cost without the insurance expense and then what is the savings to get the SIR. Second adding in the insurance expense and looking at any other economic benefits.** Then I submit it to TPA based on those two numbers. I would look to other places to make sure our definitions are concurrent, and I'd appreciate keeping it standard across the board nationally. Would be good to hear from people working in other states. **One thing is that other people in other states will add in things for resiliency. Houston has a resiliency plan in place with Harvey and then Imelda, and Florida has some other things.** We've talked about having that be fundable by PACE in the future. If people can invest in their property to make it more robust that would be good.
- - Abby Johnson: We in VA have run base, resiliency on our PACE bill and how that would justify the measures. We don't have an SIR in VA but we have to be careful in how we qualify these projects. VA is working on this in the next few months and would be happy to share if it is of any help to you all.

- Chair: In the standards that are referenced in the technical guidelines, does anyone use (ICP?) for their savings calculations?

- - Reihl: No, I've done enough energy conservation projects that I don't use that. It could be compliant for that or not.
- - Chair: What I was getting at is that if there are references that aren't being used that we could consider replacing that with more standard industry references (ex: level one and two for ASHRAE, etc). Any feedback on that?
- - Reihl: **Some of the standards have probably changed since we first introduced legislation. We should probably review those, and we could certainly circulate that to this group for if we want to use it or not**
- - Johnson: I haven't seen it being used much on the East Coast
- - Chair: **At the beginning of the doc is a list of references. We can send that to everybody along with an additional list. I have to see if they are relevant and should be included or should not.**
- - Reihl: I think that'd be great.
- - Chair: There's also a reference in the current technical standards that talks about industrial projects and facility energy efficiency and process energy efficiency. That's broken up for industrial and agricultural, and I was wondering if we need to break that up necessarily.
- - Reihl: Dub have we done a lot of more industrial type projects?
- - Taylor: The majority have been commercial, multifamily -- it's difficult to standardize how industrial assessments are done. There are common practices for this but nothing so standard as ASHRAE.
- - Chair: What I've heard of is ??? for industrial and I have not found any standard for agriculture that has so many things fall under it in the marketplace.

- - Chair: Do you even use the technical guidelines?
- - Keith: **I may inadvertently use them, but for the most part I've done it enough that it's just become my way of doing things. I don't have the guideline open to check but I do a lot with ASHRAE.**
- - Chair: We need to send a copy of the guidelines via email and a list of standards and a possible other list of standards. The purpose of this is to find out if the document is relevant and how we can make it more relevant. Also looking at stuff that someone new can follow easily, through a flow chart or a simplified process to use so that they know they're on the right path. Do people know where to look for the guidelines?
- - Melvin Glass: When I go to the KPT website they are there to be found, though they could be more easily accessed
- - Chair: Charlene do you know if people are visiting the website to download that?
- - Heydinger: I do not know if people are downloading from the KPT downloading. TPA has attached them to the back of the program guide and they are available in Spanish, so I'd be surprised if people were having a hard time finding them, but it would be helpful to know if that is the case
- - Chair: **I am thinking that people reviewed the guide initially and then developed their own processes, so what I don't want to do is make up dates to the guide that conflict with their processes that already work and impose additional requirements to them.** What seems to be the biggest point of discussion seems to be how are they getting used if they are getting used. Is there anything else we need to do with the document to facilitate them being more successful when they use the document initially?
- - Heydinger: Great question. We've thought that perhaps if there were flowcharts that would make it easier for people to know when to do certain aspects. We want to promote standardization without being too strict. The ITPR needs to be as cost efficient as possible, so that would be helpful to have some standardization there to make it generally and financially efficient.
- - Glass: One of the other things you might think about is if someone new was coming into this, maybe there could be a training session video walking them through the process. What's involved and how to do it, work with the books, the flow chart, so they can get a feeling.
- - Heydinger: Jonathan Blackburn has a training module for this, Dub has done two webinars on this. The information is there, so it would be good for people to review these and let us know what to add.
- - Reihl: Do you want the ITPR to be less?
- - Heydinger: Not less but generally more efficient. How much extra work do you need to do if people are unaware of all of the components?
- - Aguirre: We've written the scope, and it could be good to have people write their own scopes. The big work is examining inputs to make sure that's good so that the output can be good. I have not looked at Johnathan's information, but I will do that and will be quiet until I do so, because it's possible the information is there and I just don't know it.
- - Heydinger: A lot of our communities want to ensure that PACE is there for smaller businesses and underserved communities -- efficiencies are extremely important so that this can be possible
- - Peter: Smaller projects tend to be retrofits and the ITPR for that tends to be easy, and those smaller loans under 500k have easy ITPR because it's essentially a plug and play. The information is readily available -- would you agree, other ITPR on the call?
- - Reihl: Kind of! When it gets to HVAC then it can get more complicated. I tend to do more excel sheets than energy modules. The problem is knowing how to do it. You need

a site visit before and after and depending on location that's a day or two, and then you have to pay for that and all so that's why I suggested having a colleague take pictures to save on that time and money.

- - Aguirre: Seconded that sounds like an excellent solution.
- - Chair: Let's change gears. Has anybody created ITPRs for lookback refinancing projects?
- - Aguirre: I've done a couple
- - Chair: What are the tricky parts of that? Any way we can give heads up to people for what they should look out for?
- - Aguirre: Explained the situations in which people may want to do lookback refinancing. **What we do is immediately get with Marina or Charlene or Dub to explain what's going on, what we're gonna do, how we're gonna do it, and when we put the information forward will it all fall into place. Go to the authority, make them aware of what is going on, go to the ITPR, get everything together, so that if we get everything will it work?**
- - Chair: Is this relevant to include in the technical standards?
- - Aguirre: **Needs to be addressed for people entering the program.**, SIR in the statute just in the PIAB
- - Aguirre: Do not want to get rid of SIR, the only issue I have is where you're doing an adaptive reuse of a property and the baseline is not what it turns out to be. I would think that energy engineers are not going to create a false baseline to get an SIR that would and could be accessible. TL;DR **Sometimes SIR does not actually match up with the reality of the situation in certain circumstances. We need to give new people to the program an understanding of this, in situations where it goes from an office building to a hotel or similar situations in which it's difficult to calculate that ratio.**
- - Glass: there's another way I think of this too. If you do a 179, based off of ASHRAE in 2007 or 2008, maybe you can use that as a baseline. This facility under those standards
- - Eddy: We can use that as finding the baseline in some of these other projects, for the exception projects
- - Aguirre: I totally agree with any and all of that as long as it's what we do, and we always do it that way. You need to get with Marina or Dub and get it OK'ed ahead of time so long as we all do it the same way so that it doesn't drive the Admin crazy

Summary of what people feel should be included in the technical standards:

- - **Including photos in the project application, to give a better understanding of the state of the building pre-construction**
- - **What happens when the SIR does not match up with the reality of the situation?**
- **How does one go about lookback refinancing? (Note: This topic is being reviewed by the Underwriting working group)**
- - **A flowchart of guidelines, to make it easy to understand for newcomers to the program**
- - **Should PACE consider adding a resiliency? (note: this would require a change in statute except where resiliency is an ancillary benefit to a project's energy and water savings)**

3. PACE Technical Standards Link:

<https://www.keepingpaceintexas.org/library/document-library/>

Current Reference Standards

- American Society for Testing and Materials (ASTM) E2797-11, Building Energy Performance Assessment (BEPA) Standard (data collection and baseline calculations for the energy audit, building asset data);
- International Performance Measurement and Verification Protocol (IPMVP) (latest edition);
- American National Standards Institute/Building Owners and Managers Association (ANSI/BOMA) Z65.3-2009 (gross floor area measurement);
- ASHRAE Guideline 14-2002 (measurement of energy and demand savings);
- ASHRAE Procedures for Commercial Building Energy Audits (latest edition);
- National Institute of Standards and Technology (NIST) Life-Cycle Costing Manual, NIST Handbook 135 (latest edition);
- ASHRAE Standard 202, Commissioning Process for Buildings and Systems (latest edition);
- ASHRAE Guideline 4, Preparation of Operating and Maintenance Documentation for Building Systems (latest edition);
- ASHRAE Guideline 1.4, The Systems Manual for Facilities; (latest edition);
- ASHRAE Handbook-2011, Fundamentals, Chapter 39 (Codes and Standards); and
- ASHRAE Guideline 14, Whole Building Performance Path (2002 edition).
- ICP EPP - Standard Commercial (Baselining – Core Requirements, Rate Analysis, Demand, Load Profile, Interval Data)
- ICP EPP - Large Commercial (Baselining – Core Requirements, Rate Analysis, Demand, Load Profile, Interval Data)
- IPMVP Concepts and Practices for Determining Energy Savings in Renewable Energy Technologies Applications (Pages 4-6)
- IPMVP Concepts and Options for Determining Energy and Water Savings, 2012 (Section 4)

Other acknowledged resources that may be considered are:

- The Alliance for Water Efficiency (AWE) Conservation Tracking Tool; and
- EPA WaterSense Product Guide.



TECHNICAL STANDARDS MANUAL

VERSION 2.1

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OVERVIEW

For any PACE program to succeed, its property owners, lenders, and community leaders must be able to confidently and objectively evaluate projected energy and water utility savings. The purpose of this technical standards manual is to outline the technical requirements necessary to qualify a project for the **PACE in a Box** program.

Once a project satisfies all underwriting requirements of **PACE in a Box**,¹ it must meet three technical requirements outlined in this manual. **First**, the property's current water and energy use is measured so that a baseline for comparison is established. **Second**, each potential energy or water conserving measure is evaluated to determine projected savings compared to the baseline in a technically sound, consistent and transparent manner. Findings from these two steps together are compiled in a document referred to as an energy /water assessment report. PACE law requires that each report is evaluated by an independent third party reviewer (ITPR). **Third**, after the project retrofit activities are completed, the project must be reviewed by the ITPR to ensure that the project meets the intent of the energy/water assessment report, is properly completed, and is operating as intended.

On their own initiative, property owners are encouraged to maintain the retrofits to ensure they receive the ongoing and full benefit of the improvements over time. Best practices are discussed further in the PACE Technical Standards Best Practices Guide for Property Owners.²



¹ See **PACE in a Box** Section 6.

² See **PACE in a Box** Section 8

Reference Materials

Accepted methods for data collection, measurement, and savings calculations should be used on proposed projects. This manual references several technical documents which will assist in determining pre-retrofit energy and water consumption, predicting retrofit energy and water savings, and verifying whether an installed measure or group of measures is performing as intended.

The technical methodology incorporated into the review process relies primarily upon the PACE in a Box (Section 6 – Guide to PACE Project Underwriting and Technical Standards) guidelines and the Investor Confidence Project (ICP) - Energy Performance Protocols (EPP) for Standard and Large Commercial Facilities.³ Should there be a condition where the guidelines and the protocols are in conflict, the guidelines should be followed.

The ICP EPP contain processes that form a framework for bringing together all aspects of project implementation from establishing a baseline and audit, through M&V. They have been created by a large stakeholder community of industry experts and are continuously reviewed and improved. PACE in a Box relies on the EPP because they are the result of a nationwide effort to standardize the technical review of energy efficiency projects to bring uniformity and reliability on a national scale. The EPP help ensure that conservation measures are evaluated consistently throughout the state and create a national standard for lender review of PACE projects.

The EPP technical processes are based on nationally accepted standards. The technical standards in EPP relating to baseline determination/calculation, performing energy assessments, and guidelines for performance measurement and verification of energy and water conservation measures respectively are:

- American Society for Testing and Materials (ASTM) E2797-11, Building Energy Performance Assessment (BEPA) Standard (data collection and baseline calculations for the energy audit, building asset data);
- International Performance Measurement and Verification Protocol (IPMVP) (latest edition);
- American National Standards Institute/Building Owners and Managers Association (ANSI/BOMA) Z65.3-2009 (gross floor area measurement);
- ASHRAE Guideline 14-2002 (measurement of energy and demand savings);
- ASHRAE Procedures for Commercial Building Energy Audits (latest edition);
- National Institute of Standards and Technology (NIST) Life-Cycle Costing Manual, NIST Handbook 135 (latest edition);
- ASHRAE Standard 202, Commissioning Process for Buildings and Systems (latest edition);
- ASHRAE Guideline 4, Preparation of Operating and Maintenance Documentation for Building Systems (latest edition);
- ASHRAE Guideline 1.4, The Systems Manual for Facilities; (latest edition);
- ASHRAE Handbook-2011, Fundamentals, Chapter 39 (Codes and Standards); and

³ <http://www.eepformance.org>

2015 is the most recent version

It might be good to keep this one generic since there are several guidelines that could be useful

2018 is the most recent version

2014 is the latest version of Guideline 14, however a revision is currently being developed and is targeting early 2021 for publication

1995 is the most recent version still, but worth mentioning that the "Energy Price Indices and Discount Factors for Life-Cycle Cost Analysis" get published each year as an annual supplement

Still on the 2nd edition from 2011, although an update is in the works

2019 is the most recent version of Guideline 4 which is now titled "Preparation of Operations and Maintenance Documentation for HVAC&R Systems"

2019 is the most recent version of Guideline 1.4 which is now titled "Preparing Systems Manuals for Facilities"

2018 is the most recent version of Standard 202

2017 is the most recent version of the Fundamentals Handbook and the "Codes and Standards" section is now Chapter 40

- ASHRAE Guideline 14, Whole Building Performance Path (2002 edition).

Do we need this listed here again?

Other acknowledged resources that may be considered are:

- The Alliance for Water Efficiency (AWE) Conservation Tracking Tool; and
- EPA WaterSense Product Guide.

ASHRAE Standard 211-2018: Standard for Commercial Building Energy Audits

Note: This standard was not around previously and it more clearly defines the Level 1, 2 and 3 energy audit procedures. I highly recommend adding this as a reference but also leaving the older ASHRAE Procedures for Commercial Building Energy Audit manual which still has a lot of useful content.

IPMVP Concepts and Practices for Determining Energy Savings in Renewable Energy Technologies Applications, Volume III, 2003 (Pages 4-6)

IPMVP Concepts and Options for Determining Energy and Water Savings, Volume I, 2012 (Section 4)

FEMP M&V Guidelines V3.0: Measurement and Verification for Federal Energy Projects, Version 3.0, 2008

Note: This resource is mentioned already on page 9 of this document

INDEPENDENT THIRD PARTY MONITORING

The Texas PACE law requires an independent third party review the water or energy baseline conditions and the projected water or energy savings for each proposed qualified project. It is the responsibility of the Independent Third Party Reviewer (ITPR) to validate projected future energy or water savings. Additionally, after a qualified project is completed, the ITPR must verify that the qualified project was properly completed and is operating as intended.⁴ This requirement provides assurances to the [PACE in a Box](#) program, the property owner, and the lender that due diligence has been executed, that a standard of consistency has been applied throughout the PACE process, and that a professional licensed engineer has validated the expected energy and water savings from the proposed project.

Third Party Review Process

Site Visit 1 / Reviewer's Certification

Once an engineer, contractor or installer has prepared an energy/water assessment report, a qualified ITPR selected by the property owner makes a site visit and reviews the energy/water assessment report using the EPP to determine if the report complies with [PACE in a Box](#) guidelines. When the project is deemed compliant with EPP/Pace in a Box guidelines, the ITPR prepares a Reviewer's Certification to the PACE program.

The Reviewer's Certification shall include:

- A statement that the ITPR has no financial interest in the project.
- A letter stating the savings (energy, demand, water, and cost) expected project life, and cost are reasonable, are in compliance with [PACE in a Box](#) program guidelines, and follow the EPP protocols.
- A Texas Professional Engineer signature and engineering seal.

An application for PACE financing will not be considered complete until Reviewer's Certification is submitted.

Site Visit 2 / Statement of Compliance

Once the project retrofit activities have been completed, the ITPR must revisit the site to confirm that the improvements were properly installed, meet EPP guidelines, and are operating as intended. The reviewer must submit a Statement of Compliance to the PACE program indicating that the project was properly completed and is operating in accordance with the [PACE in a Box](#) guidelines.

The Statement of Compliance shall include:

- A statement that the ITPR has no financial interest in the project;

⁴ Texas Local Government Code Chapter 399.011

- A project documentation review letter that covers the PACE Project Report, detailed engineering drawings, designs, and specifications, copies of mechanical, electrical, plumbing, and building permits, and copies of equipment test and balance commissioning reports as well as any change orders; and
- A Texas Professional Engineer signature and engineering seal.

Retainage funding for the qualified project will not be provided for progress beyond the construction phase, if applicable, until the Statement of Compliance is received by the PACE program.

The process described above is required by [PACE in a Box](#). The PACE program does not guarantee projected savings, and it is the responsibility of the property owner to exercise best practices to protect his interests through a contract with the engineer, contractor or installer responsible for the project's success as recommended in the energy/water assessment report.⁵

Independent Third Party Reviewer Qualifications

To be of value, the work of the ITPR must be both professionally qualified and without conflict or relationship to the project they are reviewing. An ITPR must be a licensed Professional Engineer with energy/water efficiency experience. Preferably, the Professional Engineer should have one of the following certifications:

- American Society of Heating, Refrigeration, and Air-Conditioning Engineers (ASHRAE)
 - Building Energy Assessment Professional (BEAP)
 - Building Energy Modeling Professional (BEMP)
- Association of Energy Engineers (AEE)
 - Certified Energy Manager (CEM)
 - Certified Measurement and Verification Professional (CMVP)
 - Certified Energy Auditor (CEA)
- Building Commissioning Association
 - Certified Commissioning Professional (CCP)

Ideally, the same ITPR should follow a project from initial review to project completion.

⁵ See **PACE in a Box** Technical Best Practices Guide in Section 8

FULL ASSESSMENT PROTOCOL

A project satisfying the underwriting requirements in [PACE in a Box](#) must also satisfy the Technical Standards required in this manual. This section establishes the basic protocol for complying with [PACE in a Box](#) technical standards. A proposed project qualifying for a FAST TRACK Protocol established in Section IV, shall use the technical standards in that section.

The Full Assessment Protocol divides an energy/water conservation project into four basic tasks:

1. Establish a Baseline. Establish energy and water baseline conditions (collecting utility provider information, consumption and cost data);
2. Prepare an Energy and Water Assessment. Create an Energy/Water Assessment Report (projecting savings of proposed projects when measured against the baseline data);
3. Implement the Project (installation of energy conservation measures (ECM) and/or water conservation measures (WCM)); and
4. Verify Completion and Operation. Verification that the qualified project was properly completed and is operating as intended.

Projects can range from installation of a single ECM or WCM, such as a new high efficiency boiler, installation of low-flow toilets, or a renewable energy system, to a whole building energy and water upgrade involving multiple, interactive ECMs and WCMs. Many projects will also achieve both energy and water savings, such as an energy efficiency measure that reduces heat load, thereby also reducing cooling tower water use.

Establish a Baseline

A sound energy and water usage baseline consists of collecting the utility provider information and establishing the critical starting point for accurate projection of potential savings and measurement after implementing ECMs/WCMs. The baseline establishes how much fuel, electricity, and/or water a facility used over the previous 12-month period. It also factors in the impact of independent variables such as weather, occupancy, and operating hours on the property's energy/water use.

For the majority of energy projects, the requirements for establishing a baseline are outlined in the ICP EPP. These protocols currently target energy measures in commercial facilities, but are readily adapted to other projects including applicable areas of industrial and agricultural energy as well as water conservation. The EPP provide a roadmap for key elements in performing a successful energy/water retrofit project.

For water conservation projects, the requirements for establishing a baseline are outlined in Federal Energy Management Program’s M&V Guidelines: *Measurement and Verification for Federal Energy Projects*, Version 2.2/3.0. The M&V Guidelines provide applied methodologies for baseline accomplishment. At this time, these protocols do not provide a high level of detail for baselining water efficiency projects. As future nationally recognized protocols are developed, the PACE Technical Standards will be updated for water projects.

The following table outlines which protocols should be used for establishing a baseline based on facility, project type, and scope.

Facility Type	Full Assessment Requirements
Standard Commercial / Multifamily	Energy: ICP EPP - Standard Commercial (Baselining – Core Requirements, Rate Analysis, Demand, Load Profile, Interval Data) Water: M&V Guidelines v2.2 (Sec VII, p203)*
Large Commercial / Multifamily	Energy: ICP EPP - Large Commercial (Baselining – Core Requirements, Rate Analysis, Demand, Load Profile, Interval Data) Water: M&V Guidelines v2.2 (Sec VII, p203)*
Industrial (Facility)	Energy: ICP EPP - Large Commercial (Baselining – Core Requirements, Rate Analysis, Demand, Load Profile, Interval Data) Water: ICP EPP - Large Commercial (Baselining – Core Requirements, Rate Analysis, Demand, Load Profile, Interval Data)
Agricultural (Facility)	Energy: ICP EPP - Standard Commercial , ICP EPP - Large Commercial (Baselining – Core Requirements, Rate Analysis, Demand, Load Profile, Interval Data) Water: ICP EPP - Standard Commercial , ICP EPP - Large Commercial (Baselining – Core Requirements, Rate Analysis, Demand, Load Profile, Interval Data)
Distributed Generation ⁶	Energy: IPMVP Concepts and Practices for Determining Energy Savings in Renewable Energy Technologies Applications (Pages 4-6) Water: IPMVP Concepts and Options for Determining Energy and Water Savings , 2012 (Section 4)

*M&V Guidelines: Measurement and Verification for Federal Energy Projects Version 2.2; Sec VII M&V for Water Projects.

⁶ For purposes of the **PACE in a Box** Technical Standards, the Term “Distributed Generation” includes energy generation technologies such as CHP, co-generation, small wind, solar, and biomass systems that generate electricity on the customer’s side of the retail electric meter and technologies such as solar water heating and geothermal heat pumps that utilize renewable energy resources to reduce electricity consumption and demand.

The protocols listed above are intended as minimum requirements for an energy and water assessment report to be considered for funding.

Energy and Water Audit

The EPP rely upon industry accepted ASHRAE Procedures for Commercial Building Energy Assessment as a technical basis. These procedures define the level of effort for energy audits and provide best practices for auditors and associated project deliverables. ASHRAE also provides necessary sample audit forms and templates for data collection during the audit process.

The level of audit selected is contingent on the complexity of the facility and its installed systems and components, as well as the number and types of anticipated energy and/or water saving opportunities. Information collected during the energy/water audit is integral in determining the facility energy/water baseline conditions. The auditor will also identify energy and water savings opportunities which meet threshold investment requirements and provide verifiable energy and water savings while conducting the audit.

We might want to change this reference to ASHRAE Standard 211-2018 regarding the definitions of Levels 1, 2 and 3 audits

Industrial and Agricultural Projects

For industrial and agricultural projects, an ECM/WCM may affect the facility, a process or equipment used within the facility, or a distinct area outside the facility. Depending on the project, a different protocol shall be used. See Exhibit A for Industrial Protocols and Exhibit B for Agricultural Protocols.

Distributed Generation (DG)

DG projects have no pre-retrofit conditions as typically encountered in an energy conservation project. Since DG delivers energy rather than conserves or reduces energy, establishing a pre-retrofit baseline is not a strict project requirement. Metering of delivered energy without a baseline is often recommended in the M&V approach.

DG protocol requirements can be found in IPMVP Concepts and Practices for Determining Energy Savings in Renewable Energy Technologies Applications Volume III; August 2003. Other specific information relevant to DG measurement and verification can be found in IPMVP Concepts and Options for Determining Energy and Water Savings Volume I, January 2012.

Prior Audit

A prior ASHRAE Level II or Level III energy/water audit may be used provided that it was completed within the last three (3) years and that:

- Specific ECMs/WCMs were detailed in the audit and are still viable;
- Energy / water savings were projected for each proposed ECM/WCM;
- Any major facility renovations and/or building additions that occurred after the last audit do not negate relevant findings of the prior audit; and
- Changes in facility equipment and/or facility end-use do not negate findings of the prior audit.

The level of effort associated with updating the project baseline is dependent on the date of prior audit. If the audit is older than six months, additional energy/water use data will be available, and must be included in the updated audit.

In the case where a previous audit was completed in the last six months, savings calculations may be taken directly from the report if applicable. For older energy/water audits, still within the three year allowable time frame, the following items must be verified and accounted for in updated savings calculations:

- Any change in energy/water and/or demand rates or billing structure;
- Any change to existing facility, system, or project area that significantly affects savings; and
- Any change in building use and/or occupancy that significantly affects savings.

Projected Savings

EPP provide processes that should be used in projecting energy and water conservation savings. Models, spreadsheets, and similar tools must be based on “open book” methodology with sufficient explanation and documentation that savings calculations are transparent and results are readily verifiable. The use of “closed book” calculation methods or proprietary software is prohibited unless all methodologies associated with their use are well documented by transparent savings calculations and readily verifiable results.

The following table outlines the protocols that should be used to determine projected savings.

Facility Type	Full Assessment Requirements
Standard Commercial / Multifamily	Energy: ICP EPP - Standard Commercial (Savings Calculation) Water: M&V Guidelines v3.0 (Sec 11.6)*
Large Commercial / Multifamily	Energy: ICP EPP - Large Commercial (Savings Calculation) Water: M&V Guidelines v3.0 (Sec 11.6)*
Industrial (Facility)	Energy: ICP EPP - Large Commercial (Savings Calculation) Water: M&V Guidelines v3.0 (Sec 11.6)*
Agricultural (Facility)	Energy: ICP EPP - Standard Commercial , ICP EPP - Large Commercial Water: M&V Guidelines v3.0 (Sec 11.6)*

Distributed Generation	<p>Energy: IPMVP Concepts and Practices for Determining Energy Savings in Renewable Energy Technologies Applications (Page 5, Examples pgs. 9-17)</p> <p>Water: IPMVP Concepts and Options for Determining Energy and Water Savings, 2012 (Section 4)</p>
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*M&V Guidelines: Measurement and Verification for Federal Energy Projects Version 3.0.

The protocols listed above are intended as minimum requirements for an energy assessment report to be considered for funding.

Verifying Completion and Operation

The Texas PACE law states, “After a qualified project is completed, the local government shall obtain verification that the qualified project was properly completed and is operating as intended.”⁷ The following table outlines the protocols that should be used for verifying proper project completion and operation.

Facility Type	Full Assessment Requirements
Standard Commercial / Multifamily	<p>Energy: ICP EPP - Standard Commercial (Operations, Maintenance, and Monitoring, Measurement and Verification)</p> <p>Water: M&V Guidelines v3.0 (Sec 11.6)*</p>
Large Commercial / Multifamily	<p>Energy: ICP EPP - Large Commercial (Operations, Maintenance, and Monitoring, Measurement and Verification)</p> <p>Water: M&V Guidelines v3.0 (Sec 11.6)*</p>
Industrial (Facility)	<p>Energy: ICP EPP - Large Commercial (Operations, Maintenance, and Monitoring, Measurement and Verification)</p> <p>Water: M&V Guidelines v3.0 (Sec 11.6)*</p>
Agricultural (Facility)	<p>Energy: ICP EPP - Standard Commercial(pgs. 19-22), ICP EPP - Large Commercial (Operations, Maintenance, and Monitoring, Measurement and Verification)</p> <p>Water: M&V Guidelines v3.0 (Sec 11.6)*</p>
Distributed Generation	<p>Energy: IPMVP Concepts and Practices for Determining Energy Savings in Renewable Energy Technologies Applications (Page 5, Examples pages 9-17)</p> <p>Water: IPMVP Concepts and Options for Determining Energy and Water Savings, 2012 (Section 4)</p>

*M&V Guidelines: Measurement and Verification for Federal Energy Projects Version 3.0

⁷ Texas Local Government Code chapter §399.011(b)

FAST TRACK APPROACH

The FAST TRACK approach allows for faster implementation of projects. These projects must meet specific eligibility criteria in order to utilize the FAST TRACK process. The FAST TRACK approach reduces project expenses associated with audit costs and, in some cases, the time required to review the proposed project. The property owner and contractor must decide whether the project qualifies for the FAST TRACK approach and whether this approach is applicable. For those projects that do not qualify under the FAST TRACK eligibility criteria, the FULL ASSESSMENT protocols are required. The qualifications for an ITPR under the FAST TRACK approach are the same as qualifications for a FULL ASSESSMENT.

The FAST TRACK approach is deemed relevant and appropriate for the three (3) project types specified below. The required procedures and documentation are unique to each project.

Type 1 – Like-for-Like Replacement. The FAST TRACK approach may be used for a project that involves like-for-like replacement of energy/water inefficient equipment with more energy/water efficient equipment. Examples may include a lighting retrofit or A/C unit upgrade.

Type 2 – Single-Measure Efficiency Projects. The FAST TRACK approach may be used for projects that install single efficiency measures such as window film, additional insulation, or reflective roof coating.

Type 3 - Distributed Renewable Generation. The FAST TRACK approach may be used for a project that involves only the installation of an industry accepted renewable energy system such as solar photovoltaic (PV).

Projects that fall within the above criteria do not qualify for the FAST TRACK approach if the project value to building appraisal ratio exceeds 0.10 (10%).

Establishing a Baseline

The following information is required to establish a baseline for a FAST TRACK approach project.

Site Visit

- Confirm building characteristics and major components
- Records collection (equipment, systems, utilities)
- Staff/occupant interviews
- Walk-through inspection (written and photo documentation)
- Verification of all collected information by a third party reviewer

Records/Data Collection

- Building construction data
- Equipment data – HVAC, etc.
- Building operating data
- Energy consumption data
- Water consumption data
- Weather data
- Previous audit reports

Note: Not all items listed will be applicable. Data collected is at the discretion of the professional performing the baseline work and subject to third party review.

Pertinent Interviews (optional)

- Concerning general building characteristics
- Operations of major building systems/components
- Past building operational history (service call logs)

Note: Verification of all collected information is required as part of the Site Visit to determine if there has been significant change; if verified, it is not necessary to conduct repeat interviews.

Review/Analysis of Collected Materials

- Data conversion and normalization
- Determine building energy and water consumption metrics
- Perform modeling and simulation as applicable
- Determine renewable energy system production as applicable

Preparation of Final Assessment Report

- Includes building energy/ water cost and performance
- Energy and use by area (HVAC, lighting), fuel (gas, electric), indoor v. outdoor water usage

If a unit of energy or water using equipment is beyond its useful service life, the work associated with the baseline analysis can be considerably reduced. Document the building's age, condition, operating parameters, and expected useful life based on manufacturer's warranty data or ASHRAE guidelines. If the project is a distributed renewable generation project, collect and document information on building structure and orientation relevant to installation, production and maintenance. For WCMs not all baseline data collection and analysis apply.

Projected Savings

The requirements in this section are derived in part from the EPP for commercial facilities and are applicable to multifamily units. For single component/system ECMs or WCMs, the contractor should provide appropriate annotations to assist in determining whether a listed requirement is necessary.

The following are considered the minimum requirements in determining savings from energy and water conservation measures under a FAST TRACK approach:

- Use of “open book” methodology, spreadsheet or software used in savings calculations;
- Detailed outline for savings calculation methodology; should be transparent and easily replicated by independent third party reviewer;
- Reasonable comparison of energy/water pre-retrofit estimates to historical end use data (for single measure/single component retrofits, use only necessary data set for calibration);
- Consideration of interactive effects of related loads or systems and potential for additional ECMs/WCMs which would affect the appropriate capacity or cost-effectiveness of equipment being replaced;
- Validation of return on investment (ROI) figures based on previous audit or newly incorporated data sets;
- Validation of ECM/WCM implementation costs including labor and materials estimates; and
- Validation of savings.

The following items are the minimum that must be verified and accounted for in savings calculations for projects that propose the installation of an industry accepted renewable energy system, e.g., solar photovoltaic (PV), approved for interconnection by local utility:

- Current energy and demand rates;
- Applicability of incentives, rebates, and local utility requirements;
- Current distributed renewable generation component pricing, including design and installation of systems;
- Current electrical and/or building code requirements; and
- Current zoning and emissions requirements as they impact the project.

Verifying Completion and Operation

The Texas PACE law states, “After a qualified project is completed, the local government shall obtain verification that the qualified project was properly completed and is operating as intended.”⁸

The requirements in this section follow M&V as referenced in the EPP for standard and large commercial facilities in conjunction with *IPMVP Concepts and Options for Determining Energy and Water Savings Volume I, January 2012*. The requirements support projects with a single component replacement or multiple ECMs/WCMs or distributed renewable generation system, qualifying as a FAST TRACK project.

For single component/system conservation measures, the following are the minimum requirements in verifying completion and operation of installed measures under the FAST TRACK method:

- ITPR review of the installation of the required number and type of ECMs/WCMs as specified in the audit and project design/construction documents; and
- ITPR review of the proper installation and operation of all ECMs/WCMs as specified in the audit and project design/construction documents:
 - Ensure that operation and function meet design intent of the project;
 - Determine that installed ECMs/WCMs will provide savings as estimated in original audit findings and commensurate with baseline analysis; and
 - Determine that installed ECMs/WCMs will meet or exceed service life estimates based on observed operation.

For distributed renewable generation projects, the following are the minimum requirements in verifying completion and operation of installed measures under the FAST TRACK method:

- ITPR review of the installation of the required number and type of system components as specified in the audit and project design/construction documents; and
- ITPR review of the proper installation and operation of all components as specified in the audit and project design/construction documents:
 - Ensure that operation and function meet design intent of the project;
 - Determine that the installed system will provide savings as estimated in original audit findings and commensurate with baseline analysis; and
 - Determine that the installed system will meet or exceed service life estimates based on observed operation.

⁸ Texas Local Government Code chapter §399.011(b)

REPORTING

The property owner is required to provide a post-construction Annual Savings Reports to the PACE administrator to measure impact of the PACE program. This report shall be submitted during the term of the assessment or through a term negotiated between the PACE Program Administrator and the property owner. Information required within the post-construction Annual Savings Reports shall be determined between the PACE Program Administrator and the property owner. These Annual Savings Reports shall be submitted by the property owner. Section 5 of [PACE in a Box](#) outlines the reporting requirements of individual PACE projects.

EXHIBITS A & B

Exhibit A INDUSTRIAL PROTOCOL

Industrial energy/water conservation projects can impact 1) the facility, 2) a process inside the facility, or 3) a combination of the facility and process inside the facility. It will be necessary to determine the affected area of the facility or the site before moving forward with the auditing and baseline determination process. This protocol serves as a general guideline for the facility owner.

Industrial Energy/Water Protocol (Facility)

For ECMs/WCMs considered to affect, conserve or reduce energy/water resources in the facility and are not directly linked to any process application, the EPP for Standard and Large Commercial will be followed as applicable. The sections below reference the appropriate EPP and indicate the minimum procedures and documentation required. Since all targeted measures or combination of measures are not known at this time, applicable portions of the EPP will be followed as necessary.

Establishing a Baseline

1. Document	2. Section Reference
3. ICP EPP Standard Commercial	4. Baseline – Core Requirements, Rate Analysis, Demand, Load Profile, Interval Data
5. ICP EPP Large Commercial	6. Baseline – Core Requirements, Rate Analysis, Demand, Load Profile, Interval Data

Savings Calculation

7. Document	8. Section Reference
9. ICP EPP Standard Commercial	10. Savings Calculation
11. ICP EPP Large Commercial	12. Savings Calculation

Verifying Completion and Operation

13. Document	14. Section Reference
15. ICP EPP Standard Commercial	16. Operations, Maintenance, and Monitoring, Measurement and Verification
17. ICP EPP Large Commercial	18. Operations, Maintenance, and Monitoring, Measurement and Verification

Industrial Energy/Water Protocol (Process)

For ECMs/WCMs considered to affect, conserve or reduce energy/water resources for a selected process in an industrial facility, it is expected that most measures will conform to appropriate *IPMVP Concepts and Options for Determining Energy and Water Savings Volume I, January 2012*. In particular, Option A – Retrofit Isolation: Key Parameter Measurement or Option B – Retrofit Isolation: All Parameter Measurement will provide the necessary requirements for savings verification, while other sections of the IPMVP document will be pertinent to establishing the baseline.

Establishing a Baseline

Document	Section Reference
ICP EPP Standard Commercial	Baselining – Core Requirements, Rate Analysis, Demand, Load Profile, Interval Data
ICP EPP Large Commercial	Baselining – Core Requirements, Rate Analysis, Demand, Load Profile, Interval Data

Savings Calculation

19. Document	20. Section Reference
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21. ICP EPP Standard Commercial	22. Savings Calculation
23. ICP EPP Large Commercial	24. Savings Calculation

Verifying Completion and Operation

25. Document	26. Section Reference
27. ICP EPP Standard Commercial	28. Operations, Maintenance, and Monitoring, Measurement and Verification
29. ICP EPP Large Commercial	30. Operations, Maintenance, and Monitoring, Measurement and Verification

Reporting

The property owner is required to provide a post-construction Annual Savings Reports to the PACE administrator to ensure the success of the PACE program. This report shall be submitted during the term of the assessment or through a negotiated duration between the PACE Program Administrator and the property owner. Information required within the post-construction Annual Savings Reports shall be determined between the PACE Program Administrator and the property owner. These Annual Savings Reports shall be submitted by the property owner. Section 5 of [PACE in a Box](#) outlines the reporting requirements of individual PACE projects.

Exhibit B AGRICULTURAL PROTOCOL

For agricultural conservation projects, it is necessary to determine the affected area of the facility, site, or property. In general, a proposed project for agricultural energy/water conservation may affect 1) a facility related to agricultural operations, 2) an isolated equipment component or system (pumps, motors, etc.), or 3) a distinct water use area (i.e., irrigation). This protocol serves as a general guideline to direct the facility owner towards actions which have a basis in proven engineering concepts.

Agricultural activities outside the facility differ from those normally encountered in commercial and/or industrial areas in that water use and the energy associated with delivery of water may account for a larger percentage of costs relative to the overall energy/water budget. This may be especially true in the farming sector including greenhouse operations.

Agricultural Energy Protocol (Facility)

For ECMs/WCMs considered to affect, conserve or reduce energy/water resources in an agricultural facility and that are not directly linked to agricultural irrigation or any process application outside the facility, the EPP for Standard and Large Commercial should be followed as applicable. The sections below reference the appropriate EPP and indicate the minimum required items as listed in the document. Since all targeted measures or combination of measures are not known at this time, applicable portions of the EPP should be followed as necessary.

Establishing a Baseline

Document	Section Reference
ICP EPP Standard Commercial	Baselining – Core Requirements, Rate Analysis, Demand, Load Profile, Interval Data
ICP EPP Large Commercial	Baselining – Core Requirements, Rate Analysis, Demand, Load Profile, Interval Data

Savings Calculation

Document	Section Reference
31. ICP EPP Standard Commercial	32. Savings Calculation
33. ICP EPP Large Commercial	34. Savings Calculation

Verifying Completion and Operation

Document	Section Reference
35. ICP EPP Standard Commercial	36. Operations, Maintenance, and Monitoring, Measurement and Verification
37. ICP EPP Large Commercial	38. Operations, Maintenance, and Monitoring, Measurement and Verification

Agricultural Energy Protocol (Equipment/Systems)

Implementing water-efficiency in the agricultural sector where the majority of water and energy are consumed in irrigation most often use IPMVP Option A (Retrofit Isolation: Key Parameter Measurement) although Option B (Retrofit Isolation: All Parameter Measurement) is also viable depending on the specific measure and the affected equipment or system. The sections below reference the appropriate IPMVP protocols and indicate the minimum required items as listed in the document. Since all targeted measures or combination of measures are not known at this time, applicable portions of the IPMVP should be followed as necessary.

Establishing a Baseline

Document	Reference
IPMVP Concepts and Options for Determining Energy and Water Savings Volume I	Chapter 4 (as applicable); selection criteria Fig. 4 p. 33 and Table 3 p. 34

Savings Calculation

39. Document	40. Reference
41. IPMVP Concepts and Options for Determining Energy and Water Savings Volume I	42. Chapter 4 (as applicable); selection criteria Fig. 4 p. 33 and Table 3 p. 34

Verifying Completion and Operation

43. Document	44. Reference
45. IPMVP Concepts and Options for Determining Energy and Water Savings Volume I	46. Chapter 4 (as applicable); selection criteria Fig. 4 p. 33 and Table 3 p. 34

Agricultural Water Protocol

Water conservation projects are intended to provide savings through reduced water consumption as a result of improved performance of water consuming equipment, fixtures, or controls. Savings can also result from reduced water supply charges, sewer charges, and/or energy costs depending on the conservation measure implemented. Energy savings are commonly achieved from reduced water heating, and additional savings may be realized for facilities that use pumps to boost water pressure or to irrigate with groundwater, or at facilities with on-site water treatment systems. The performance of many common water conservation projects can be accounted for through short-term measurements and usage factors can be estimated, water savings are most often verified using IPMVP Option A (Retrofit Isolation: Key Parameter Measurement).

Key issues related to water conservation projects which should be observed are:

- Determining equipment inventory for baseline and post-installation;
- Establishing existing equipment performance for each type of device/system;
- Determining usage characteristics of each type of device/system;
- Determining post-installation equipment performance for each type of device/system; and
- Accounting for any known or observed interactive effects.

The sections below reference the appropriate IPMVP protocols and indicate the minimum required items as listed in the document. Since all targeted measures or combination of measures are not known at this time, applicable portions of the IPMVP should be followed as necessary.

Establishing a Baseline

Document	Reference
IPMVP Concepts and Options for Determining Energy and Water Savings Volume I	Chapter 4 (as applicable); selection criteria Fig. 4 p. 33 and Table 3 p. 34

Savings Calculation

Document	Reference
IPMVP Concepts and Options for Determining Energy and Water Savings Volume I	Chapter 4 (as applicable); selection criteria Fig 4 pp. and Table 3 p. 34

Verifying Completion and Operation

Document	Reference
IPMVP Concepts and Options for Determining Energy and Water Savings Volume I	Chapter 4 (as applicable); selection criteria Fig. 4 p. 33 and Table 3 p. 34

Reporting

The property owner is required to provide a post-construction Annual Savings Reports to the PACE administrator to measure the impact of the PACE program. This report shall be submitted during the term of the assessment or through a term negotiated between the PACE Program Administrator and the property owner. Information required within the post-construction Annual Savings Reports shall be determined between the PACE Program Administrator and the property owner. These Annual Savings Reports shall be submitted by the property owner. Section 5 of [PACE in a Box](#) outlines the reporting requirements of individual PACE projects.